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IPMAT Indore 2022

The complete question paper with step-by-step solutions, topic and difficulty tagging for every question, official cut-offs and revision notes.

90	360	120	3
QUESTIONS	MARKS	MINUTES	SECTIONS

Reading it is step one. **Attempting it is what moves the score.**

Attempt this paper on the exam interface →

or create a free login and start practising →

HOW TO USE THIS PAPER

Don't read it. Attempt it.

A solved paper is only worth what you do with it. Here is the order that actually builds a score — and what is in this PDF to support each step.

1. **Attempt first, in one sitting.** 40 minutes per section, no pausing, no looking ahead. Mark every question you guessed.
2. **Then check, question by question.** Every question here carries its area, topic and a difficulty rating out of 10 — so a wrong answer points at a topic, not just a mistake.
3. **Read the solution even when you were right.** The step-by-step method matters more than the answer; a lucky guess at difficulty 7 is a gap you have not found yet.
4. **Convert the gaps into practice.** List the topics you lost marks in, then take a short timed test on each one until the accuracy holds.

Question text, numbering and option order follow the published reproductions of the official paper. Every solution and shortcut below is worked from first principles, and every answer was computed independently before being cross-checked against two independent free sources, which agree on every question they both key.

WHERE THIS PAPER NEEDS A CAVEAT

One defective question, flagged again at the question itself. Q26 (the matrix A^{2022}) cannot be answered as printed: the matrix given satisfies $A^2 = A$, so every power equals A itself, and that matrix is not among options 2, 3 or 4. Strictly, "None of these" is the only defensible answer. The published keys mark option 2, which corresponds to the question the setter almost certainly intended — with a 1, not a 0, in the bottom-right entry. This document keeps the published answer so that marks match, and works through both versions in the solution.

90

Every question solved

Full working for all 90 questions, not just an answer key.

T

Topic tagged

Area, topic and sub-topic on every question, so gaps are nameable.

Difficulty rated

A 1–10 rating per question — know what was fair to skip.

Cut-offs & notes

Official sectional cut-offs plus end-of-paper revision notes.

BEFORE YOU TURN THE PAGE

Attempt this exact paper, scored and ranked

The same paper is live on Scorebuddy as three sectional tests and one full test, on the real exam interface — with instant scoring and a question-wise analysis once you submit.

Open the paper →

Create a free login

THE PAPER

Pattern & cut-offs

IIM Indore · 2 July 2022 · 90 questions · 360 marks · 120 minutes

Exam pattern

Section	Questions	Type	Correct	Wrong	Time
Quantitative Ability — Short Answer	15	TITA	+4	0	40 min
Quantitative Ability — MCQ	30	MCQ (incl. a 5-question LR set)	+4	−1	40 min
Verbal Ability	45	MCQ (+ 5 TITA para jumbles)	+4	−1 / 0	40 min
Total	**90**		**360 marks**		**120 min**

Sections are **separately timed** — 40 minutes each, with no returning to a section once its time is over.

Cut-offs, category-wise

Minimum sectional marks, IPMAT Indore 2022. All three must be cleared, however high the total.

Category	QA (SA) /60	QA (MCQ) /120	VARC /180	Sum /360
General	20	43	112	175
EWS	8	29	86	123
NC-OBC	8	21	70	99

Read this before quoting the numbers. The three rows above are the only ones two independent sources agree on. For SC, ST and PwD the published figures differ between sources — and in one case between two tables on the same page — so they are deliberately left out rather than printed with false confidence. Check iimidr.ac.in for those.

A candidate must clear **all three** sectional minimums to be shortlisted, however high the total. The last column is simply the sum of the three sectional figures, not a separately published overall cut-off.

Year on year. The General cut-offs ran 20 / 43 / 112 in 2022, 12 / 39 / 125 in 2023, 24 / 35 / 113 in 2024 and 24 / 28 / 112 in 2025. Two things stand out for teaching: the QA (MCQ) bar has fallen every single year, from 43 to 28, and the QA (SA) bar collapsed to 12 in 2023 — the hardest short-answer paper in the exam's history — before recovering. **The quantitative sections have been getting steadily harder, not easier.**

🧭 Cut-offs, seat counts, fees and deadlines for every UG management exam, in one place. UG Guide

PAPER ANALYSIS

What IPMAT Indore 2022 actually asked

Every question in this PDF is tagged by area, topic and difficulty. Put together, the paper looks like this — and it is a fair map of what to prepare for.

40	5	45	5.2
QUANTITATIVE ABILITY	DATA INTERPRETATION	VERBAL & RC	AVERAGE DIFFICULTY / 10

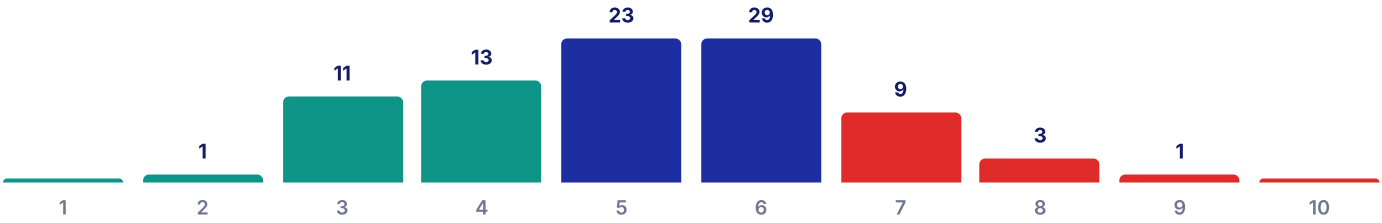
Quant & DI — where the marks sat



Verbal — where the marks sat



Difficulty spread across all 90 questions



Most of the paper sits at 5–7 out of 10. The paper is not won on the hardest questions — it is won by not dropping the ones rated 4 and below.

YOUR NEXT STEP

Turn this analysis into a study plan

Pick the topics that carry the most marks above, take a short timed test on each, and work down the list. Topic tests are built for exactly this.

Topic-wise tests →

Talk to a mentor

SECTION 1

QA-SA

Quantitative Ability — Short Answer

15	60	40 min	+4 / 0
QUESTIONS	MARKS	SECTIONAL LIMIT	MARKING

TITA

MOST ASKED HERE — Modern Maths **5** · Algebra **4** · Arithmetic **3** · Geometry And Mensuration **2** · Number System **1**

1 QA ALGEBRA LOGARITHMS ●●●●●○○○○○ 5 /10

If $\log_{x^2} y + \log_{y^2} x = 1$ and $y = x^2 - 30$, then the value of $x^2 + y^2$ is _____

ANSWER 72

SOLUTION

Step 1 — reduce both logs to one quantity. Put $L = \log_x y$. Using the change-of-base rule,

$$\log_{x^2} y = \frac{\log y}{2 \log x} = \frac{L}{2}, \qquad \log_{y^2} x = \frac{\log x}{2 \log y} = \frac{1}{2L}$$

Step 2 — solve the resulting equation.

$$\frac{L}{2} + \frac{1}{2L} = 1 \;\Rightarrow\; L^2 + 1 = 2L \;\Rightarrow\; (L-1)^2 = 0$$

So $L = 1$, a **repeated root** — which means $\log_x y = 1$, i.e. $y = x$

Step 3 — use the second condition.

$$x = x^2 - 30 \;\Rightarrow\; x^2 - x - 30 = 0 \;\Rightarrow\; (x-6)(x+5) = 0$$

The base of a logarithm must be positive and $\neq 1$, so $x = 6$ and $y = 6$.

Step 4 — evaluate.

$$x^2 + y^2 = 36 + 36 = 72$$

Answer: 72

Shortcut

Spot the AM–GM shape. For any positive L,

$$\frac{L}{2} + \frac{1}{2L} \geq 2\sqrt{\frac{L}{2} \cdot \frac{1}{2L}} = 1$$

with equality **only** when the two terms are equal, i.e. $L = 1$. So the equation "$= 1$" is the equality case of AM–GM, forcing $y = x$ instantly — no quadratic needed.

Then $x = x^2 - 30$ gives $x = 6$, and the answer is $2 \times 36 = \mathbf{72}$. **Whenever you see $\frac{t}{2} + \frac{1}{2t} = 1$ or $t + \frac{1}{t} = 2$, read off $t = 1$ immediately.**

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2 QA GEOMETRY AND MENSURATION COORDINATE GEOMETRY BASICS ●●●○○○○○○○ 3 /10

The area enclosed by $2|x| + 3|y| \leq 6$ is _____ sq. units.

ANSWER **12**

SOLUTION

Step 1 — put the inequality in intercept form. Divide through by 6:

$$\frac{|x|}{3} + \frac{|y|}{2} \leq 1$$

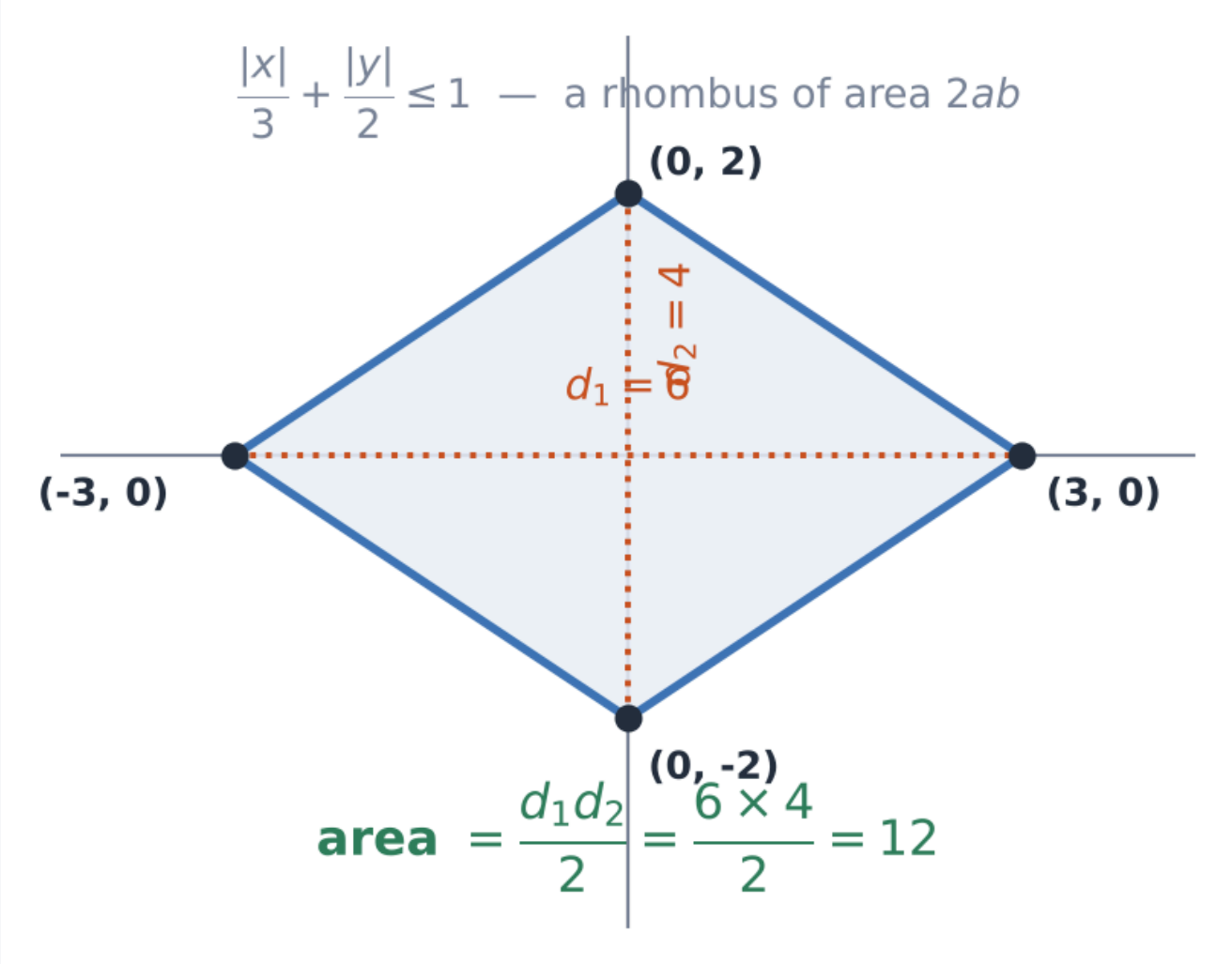
Step 2 — identify the shape. With both moduli present, the region is a **rhombus** centred at the origin with vertices on the axes at

$$(\pm 3,\ 0) \quad \text{and} \quad (0,\ \pm 2)$$

Step 3 — compute the area. The diagonals are $2 \times 3 = 6$ and $2 \times 2 = 4$, and for a rhombus

$$\text{Area} = \frac{d_1 d_2}{2} = \frac{6 \times 4}{2} = 12$$

Equivalently: the first-quadrant piece is a right triangle of legs 3 and 2, area 3, and there are four such pieces.



Answer: 12

Shortcut

Memorise the formula. The region $\frac{|x|}{a}+\frac{|y|}{b}\leq 1$ is a rhombus of area

$2ab$

Here $a=3$, $b=2$, so the area is $2\,(\,3\,)\,(\,2\,)\,=\mathbf{12}$ — one division and one product.

The common error is forgetting the moduli and computing the triangle in the first quadrant only, giving 3. The four-fold symmetry is the whole point of the absolute values.

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3 QA ARITHMETIC TIME SPEED AND DISTANCE 3 /10

When Geeta increases her speed from 12 km/hr to 20 km/hr, she takes one hour less than the usual time to cover the distance between her home and office. The distance between her home and office is _____ km.

ANSWER 30

SOLUTION

Step 1 — write both times. Let the distance be d km.

$$t_{12}=\frac{d}{12},\qquad t_{20}=\frac{d}{20}$$

Step 2 — use the one-hour saving.

$$\frac{d}{12}-\frac{d}{20}=1$$

Step 3 — combine the fractions. The lcm of 12 and 20 is 60:

$$\frac{5d-3d}{60}=1\;\Rightarrow\;\frac{2d}{60}=1\;\Rightarrow\;d=30$$

Check: $\frac{30}{12}=2.5$ hours and $\frac{30}{20}=1.5$ hours — a saving of exactly 1 hour ✔

Answer: 30 km

Shortcut

Use the product-over-difference shortcut. When the same distance is covered at speeds u and v with a time difference t,

$$d=\frac{uv}{v-u}\times t$$

Here $\frac{12\times 20}{20-12}\times 1=\frac{240}{8}=\mathbf{30}$. One line, no fractions to clear.

This is worth drilling — it turns a two-step equation into a single mental calculation, and the same formula handles "arrives late/early by" questions.

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4 QA MODERN MATHS PERMUTATION AND COMBINATION 4 /10

The number of triangles that can be formed by choosing points from 7 points on a line and 5 points on another parallel line is _____

ANSWER 175

SOLUTION

Step 1 — note what makes a triangle. Three points form a triangle only if they are **not collinear**. Since all 7 points lie on one line and all 5 on a parallel line, any three chosen from the *same* line are collinear and give no triangle.

So every valid triangle takes **2 points from one line and 1 from the other**.

Step 2 — count both cases.

- 2 from the line of 7, 1 from the line of 5:

$$\binom{7}{2} \times 5 = 21 \times 5 = 105$$

- 2 from the line of 5, 1 from the line of 7:

$$\binom{5}{2} \times 7 = 10 \times 7 = 70$$

Step 3 — add.

$105 + 70 = 175$

Answer: 175

Shortcut

Complement check, if you prefer it: total ways to pick 3 of the 12 points minus the collinear ones,

$$\binom{12}{3} - \binom{7}{3} - \binom{5}{3} = 220 - 35 - 10 = \mathbf{175}$$

Both routes are quick; the complement is safer when there are more than two lines, because you never have to enumerate the split.

The one thing to get right is that the two lines are parallel, so no three points can be collinear across lines — which is exactly why the $2 + 1$ split is always valid.

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5 QA ARITHMETIC PROFIT LOSS AND DISCOUNT 5 /10

Aruna purchases a certain number of apples for INR 20 each and a certain number of mangoes for INR 25 each. If she sells all the apples at 10% profit and all the mangoes at 20% loss, overall she makes neither profit nor loss. Instead, if she sells all the apples at 20% loss and all the mangoes at 10% profit, overall she makes a loss of INR 150. Then the number of apples purchased by Aruna is _____

ANSWER 50

SOLUTION

Step 1 — set up. Let a be the number of apples and m the number of mangoes. Then

$\text{cost of apples} = 20a, \qquad \text{cost of mangoes} = 25m$

Step 2 — first scenario (no net profit or loss). Profit on apples equals loss on mangoes:

$0.10\,(\,20a\,) = 0.20\,(\,25m\,) \;\Rightarrow\; 2a = 5m$

Step 3 — second scenario (net loss of 150). Loss on apples exceeds profit on mangoes by 150:

$0.20\,(\,20a\,) - 0.10\,(\,25m\,) = 150 \;\Rightarrow\; 4a - 2.5m = 150$

Step 4 — solve. From (1), $m = \frac{2a}{5}$. Substituting into (2):

$$4a - 2.5\left(\frac{2a}{5}\right) = 4a - a = 3a = 150 \;\Rightarrow\; a = 50$$

and $m = 20$.

Check: costs are $20\,(\,50\,) = 1000$ and $25\,(\,20\,) = 500$. Scenario 1: $+100$ on apples, -100 on mangoes — net zero ✔ Scenario 2: -200 on apples, $+50$ on mangoes — net -150 ✔

Answer: 50 apples

Shortcut

Work with the two cost totals, not the counts. Let $A = 20a$ and $M = 25m$ be the money spent on each. The conditions become

$0.1A = 0.2M \quad\Rightarrow\quad A = 2M, \qquad 0.2A - 0.1M = 150$

Substituting: $0.4M - 0.1M = 0.3M = 150 \Rightarrow M = 500$, so $A = 1000$ and the apple count is $1000/20 = \mathbf{50}$.

This re-framing is the real shortcut — percentages act on amounts of money, so putting the money (not the fruit) at the centre removes the unit prices from the algebra until the very last division.

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6 QA ALGEBRA INEQUALITIES AND MODULUS ●●●●●●○○○○ 6 /10

Given that $f\,(\,x\,) = |x| + 2|x-1| + |x-2| + |x-4| + |x-6| + 2|x-10|$, $x \in\,(\,-\infty, \infty\,)$, the minimum value of $f\,(\,x\,)$ is _____

ANSWER 26

SOLUTION

Step 1 — recognise the structure. This is a **weighted sum of distances** from x to the points $0, 1, 2, 4, 6, 10$, with weights

point	0	1	2	4	6	10
weight	1	2	1	1	1	2

Total weight $= 1+2+1+1+1+2 = 8$.

Step 2 — use the weighted-median rule. A sum $\sum w_i|x - a_i|$ is minimised at the **weighted median** — the point where the running total of weights first reaches half the total, here 4.

point	0	1	2	4	6	10
cumulative weight	1	3	**4**	5	6	8

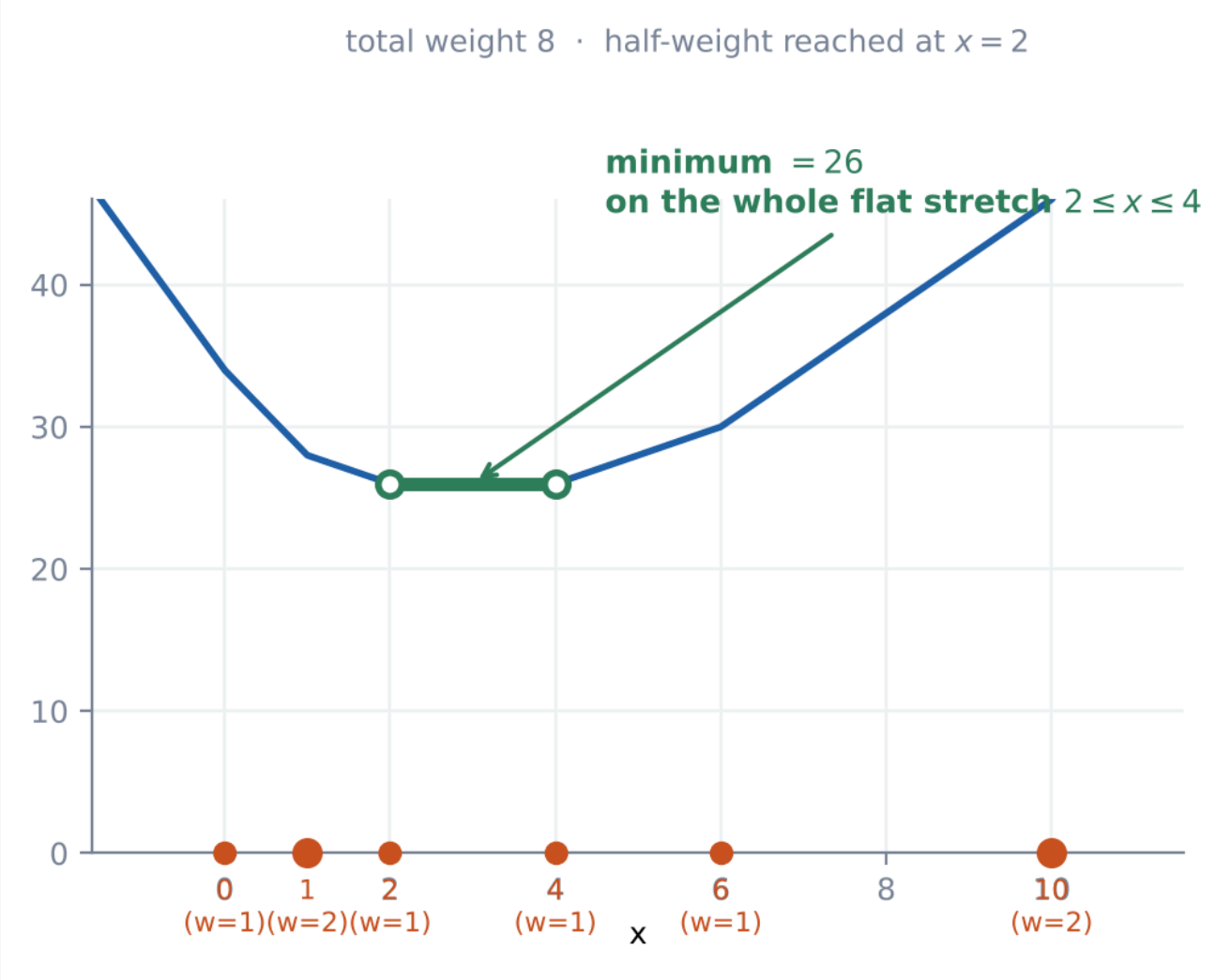
The cumulative weight reaches 4 at $x = 2$.

Step 3 — evaluate there.

$f\,(\,2\,) = |2| + 2|1| + |0| + |-2| + |-4| + 2|-8|$

$= 2 + 2 + 0 + 2 + 4 + 16 = 26$

Step 4 — confirm it is the minimum. Just left of $x = 2$ the slope is $1 + 2 - 1 - 1 - 1 - 2 = -2 < 0$ (decreasing); just right of it the slope is $1 + 2 + 1 - 1 - 1 - 2 = 0$. So the function stops decreasing at $x = 2$ — and a numerical sweep confirms 26 as the least value. The graph shows the minimum is attained along the whole flat stretch $2 \le x \le 4$.



Answer: 26

Shortcut

Never differentiate a sum of moduli — find the weighted median. Count weights from the left until you pass half the total (4 of 8 here); you land on $x = 2$.

A useful cross-check is the **slope test**: at any point, slope = (weight to the left) − (weight to the right). The minimum is wherever that changes sign. Here left-weight becomes 4 and right-weight 4 at $x = 2$, so the slope hits zero — and a flat stretch means every $x \in [2, 4]$ gives the same value 26.

Treat a repeated term like $2|x - 1|$ as a point of weight 2, not as a separate point. That is the only subtlety in the question.

7 QA MODERN MATHS MATRICES AND DETERMINANTS 6 /10

If $A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix}$, then the absolute value of the determinant of $\left(A^9 + A^6 + A^3 + A \right)$ is _____

ANSWER 32

SOLUTION

Step 1 — see what A does. A is a **permutation matrix**: it fixes the first coordinate and swaps the second and third. Swapping twice returns you to the start, so

$A^2 = I$

Step 2 — reduce every power. Because $A^2 = I$, powers alternate:

$A^9 = A^8 \cdot A = A, \qquad A^6 = I, \qquad A^3 = A^2 \cdot A = A$

Step 3 — add them up.

$A^9 + A^6 + A^3 + A = A + I + A + A = 3A + I$

Step 4 — write out the matrix.

$$3A + I = \begin{bmatrix} 3 & 0 & 0 \\ 0 & 0 & 3 \\ 0 & 3 & 0 \end{bmatrix} + \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} 4 & 0 & 0 \\ 0 & 1 & 3 \\ 0 & 3 & 1 \end{bmatrix}$$

Step 5 — take the determinant. Expanding along the first row:

$\det = 4\,(\,1 \cdot 1 - 3 \cdot 3\,) = 4\,(\,1 - 9\,) = -32$

$|\det| = 32$

Answer: 32

Shortcut

Check A^2 first — always. For a permutation matrix built from a single swap, $A^2 = I$, and the whole sum collapses to $3A + I$ in one line.

Then exploit the **block structure**: the matrix is 4 in the top-left corner and the 2×2 block $\begin{bmatrix} 1 & 3 \\ 3 & 1 \end{bmatrix}$ below it, so

$\det = 4\left(1^2 - 3^2\right) = -32$

A matrix that is its own inverse turns any polynomial in A into just $\alpha A + \beta I$ — worth recognising, because it reduces a ninth power to arithmetic.

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8 QA MODERN MATHS BINOMIAL THEOREM 3 /10

The sum of the coefficients of all the terms in the expansion of $(\,5x - 9\,)^4$ is _____

ANSWER 256

SOLUTION

The principle. For any polynomial $P(\,x\,)$, the sum of all its coefficients is simply $P(\,1\,)$ — substituting $x = 1$ turns every power of x into 1, leaving just the coefficients added together.

Apply it.

$P(1) = (5\cdot 1 - 9)^4 = (-4)^4 = 256$

Why this works, written out. Expanding,

$$(5x-9)^4 = \sum_{r=0}^{4} \binom{4}{r} (5x)^{4-r}(-9)^r = \sum_{r=0}^{4} \underbrace{\binom{4}{r} 5^{4-r}(-9)^r}_{\text{the coefficients}} x^{4-r}$$

and setting $x = 1$ adds exactly those coefficients.

Answer: 256

Shortcut

Substitute $x = 1$. That is the entire question.

$(5-9)^4 = (-4)^4 = \mathbf{256}$

Two companions worth memorising alongside it:

- **Sum of all coefficients** $= P(1)$
- **Sum of coefficients of even powers minus odd powers** $= P(-1)$

So the even-power coefficients sum to $\frac{P(1)+P(-1)}{2}$. Note also that the answer is positive because the exponent 4 is even — a sign slip here gives -256, which is the trap.

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9 QA NUMBER SYSTEM SEQUENCES AND COUNTING ●●●●●○○○○○ 5 /10

A new sequence is obtained from the sequence of positive integers $(1, 2, 3, \ldots)$ by deleting all the perfect squares. Then the 2022^{nd} term of the new sequence is _____

ANSWER **2067**

SOLUTION

Step 1 — relate position to value. If the new sequence's 2022^{nd} term is the integer N, then among $1, 2, \ldots, N$ exactly 2022 numbers survive. The ones removed are the perfect squares up to N, and there are $\lfloor \sqrt{N} \rfloor$ of them. So

$N - \lfloor \sqrt{N} \rfloor = 2022$

Step 2 — estimate. $\sqrt{2022} \approx 44.97$, so N is roughly $2022 + 45 = 2067$.

Step 3 — verify $N = 2067$.

$45^2 = 2025 \le 2067 < 2116 = 46^2 \Rightarrow \lfloor \sqrt{2067} \rfloor = 45$

$2067 - 45 = 2022$ ✓

Step 4 — check N itself is not a square. 2067 lies strictly between $45^2 = 2025$ and $46^2 = 2116$, so it is not a perfect square and therefore really is in the sequence.

Answer: 2067

Shortcut

The rule of thumb: the nth non-square is about $n + \sqrt{n}$. Compute $\sqrt{2022} \approx 45$, add, and you have 2067 immediately.

Then do the two checks that make it rigorous, both of which take seconds:

1. $2067 - \lfloor \sqrt{2067} \rfloor = 2067 - 45 = 2022$ ✔

2. 2067 is not itself a square ✔

The trap is forgetting check 2. If the estimate lands exactly on a perfect square, that number has been deleted and you must move up by one.

Want this paper scored, ranked and analysed? Attempt it on the exam interface. Take the test

10 QA GEOMETRY AND MENSURATION TRIGONOMETRY 6 /10

If $\sin\alpha+\sin\beta=\frac{\sqrt{2}}{\sqrt{3}}$ and $\cos\alpha+\cos\beta=\frac{1}{\sqrt{3}}$, then the value of $\left(20\cos\frac{\alpha-\beta}{2}\right)^2$ is _____

ANSWER 100

SOLUTION

Step 1 — square and add. This is the standard move whenever a sine sum and a cosine sum are both given.

$$(\sin\alpha+\sin\beta)^2+(\cos\alpha+\cos\beta)^2=\frac{2}{3}+\frac{1}{3}=1$$

Step 2 — expand the left side.

$$\underbrace{\sin^2\alpha+\cos^2\alpha}_{1}+\underbrace{\sin^2\beta+\cos^2\beta}_{1}+2\underbrace{(\sin\alpha\sin\beta+\cos\alpha\cos\beta)}_{\cos(\alpha-\beta)}$$

$$=2+2\cos(\alpha-\beta)$$

Step 3 — solve for the difference.

$$2+2\cos(\alpha-\beta)=1\Rightarrow\cos(\alpha-\beta)=-\frac{1}{2}$$

Step 4 — halve the angle. Using $\cos2\theta=2\cos^2\theta-1$ with $\theta=\frac{\alpha-\beta}{2}$:

$$\cos^2\frac{\alpha-\beta}{2}=\frac{1+\cos(\alpha-\beta)}{2}=\frac{1-\frac{1}{2}}{2}=\frac{1}{4}$$

Step 5 — finish.

$$\left(20\cos\frac{\alpha-\beta}{2}\right)^2=400\times\frac{1}{4}=100$$

Answer: 100

Shortcut

"Square and add" is the reflex whenever you are handed $\sin\alpha+\sin\beta$ and $\cos\alpha+\cos\beta$. It always produces $2+2\cos(\alpha-\beta)=(\text{sum of the two squares})$

Here that is 1, so $\cos(\alpha-\beta)=-\frac{1}{2}$ and $\cos^2\frac{\alpha-\beta}{2}=\frac{1}{4}$.

Note the question asks for the square, so the sign of $\cos\frac{\alpha-\beta}{2}$ never matters — a deliberate kindness that lets you skip any quadrant discussion. Answer $400\times\frac{1}{4}=\mathbf{100}$.

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11 QA ALGEBRA PROGRESSIONS 7 /10

The 3^{rd}, 14^{th} and 69^{th} terms of an arithmetic progression form three distinct and consecutive terms of a geometric progression. If the next term of the geometric progression is the n^{th} term of the arithmetic progression, then n equals _____

ANSWER 344

SOLUTION

Step 1 — name the AP. Let the first term be a and the common difference d. The three terms are

$T_3 = a + 2d, \qquad T_{14} = a + 13d, \qquad T_{69} = a + 68d$

Step 2 — impose the GP condition. Three terms are in GP when the middle one squared equals the product of the outer two:

$(a + 13d)^2 = (a + 2d)(a + 68d)$

Step 3 — expand and simplify.

$a^2 + 26ad + 169d^2 = a^2 + 70ad + 136d^2$

$33d^2 = 44ad \Rightarrow 3d = 4a \quad (d \neq 0, \text{ since the terms are distinct})$

So $a = \frac{3d}{4}$.

Step 4 — write the three GP terms.

$T_3 = \frac{3d}{4} + 2d = \frac{11d}{4}, \quad T_{14} = \frac{3d}{4} + 13d = \frac{55d}{4}, \quad T_{69} = \frac{3d}{4} + 68d = \frac{275d}{4}$

The common ratio is $\frac{55}{11} = 5$ ✔ (and $\frac{275}{55} = 5$ ✔).

Step 5 — find the next GP term and locate it in the AP.

$\text{next} = \frac{275d}{4} \times 5 = \frac{1375d}{4}$

Setting this equal to $a + (n-1)d$:

$\frac{3d}{4} + (n-1)d = \frac{1375d}{4} \Rightarrow \frac{3}{4} + n - 1 = \frac{1375}{4}$

$n = \frac{1375}{4} + \frac{1}{4} = \frac{1376}{4} = 344$

Answer: 344

Shortcut

Scale $d = 4$ and the fractions vanish. Then $a = 3$ and the AP is $3, 7, 11, \ldots$ with the three terms

$T_3 = 11, \qquad T_{14} = 55, \qquad T_{69} = 275$

— visibly a GP of ratio 5. The next GP term is $275 \times 5 = 1375$, and

$3 + (n-1)4 = 1375 \Rightarrow n - 1 = 343 \Rightarrow n = \mathbf{344}$

Choosing a convenient d is legitimate because the answer n is a position, not a value, so it cannot depend on the scale. Note the neat $343 = 7^3$ at the end — a sign you have it right.

12 QA MODERN MATHS SET THEORY 4 /10

Let $P(X)$ denote the power set of a set X. If A is the null set, then the number of elements in $P(P(P(P(A))))$ is _____

ANSWER 16

SOLUTION

The rule. For a finite set X with $|X| = k$, the power set has

$|P(X)| = 2^k$

Build up one layer at a time, starting from $A = \varnothing$ with $|A| = 0$:

Set	Size
A	0
$P(A)$	$2^0 = 1$
$P(P(A))$	$2^1 = 2$
$P(P(P(A)))$	$2^2 = 4$
$P(P(P(P(A))))$	$2^4 = \mathbf{16}$

Worth seeing concretely at the start: $P(\varnothing) = \{\varnothing\}$ — the empty set has exactly one subset, namely itself — so the first layer has size 1, not 0. That single step is where the question is won or lost.

Answer: 16

Shortcut

The sizes go $0 \to 1 \to 2 \to 4 \to 16$**,** each being 2 raised to the previous one. Note the jump at the end: $2^4 = 16$, not $2^3 = 8$ — the exponent is the *previous size*, which was already 4.

The one trap is the first step. $|P(\varnothing)| = 1$, because $\varnothing$ is a subset of itself. Starting from 0 and writing $2^0 = 1$ handles it automatically; starting by "there are no subsets" gives 0 and derails everything after.

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13 QA ALGEBRA EXPONENTS AND INDICES 5 /10

The numbers -16, $2^{x+3} - 2^{2x-1} - 16$, $2^{2x-1} + 16$ are in an arithmetic progression. Then x equals _____

ANSWER 3

SOLUTION

Step 1 — apply the AP condition. Three numbers are in AP when twice the middle equals the sum of the outer two:

$2\left(2^{x+3} - 2^{2x-1} - 16\right) = -16 + \left(2^{2x-1} + 16\right) = 2^{2x-1}$

Step 2 — expand the left side.

$2^{x+4} - 2^{2x} - 32 = 2^{2x-1}$

Step 3 — substitute $t = 2^x$ (so $2^{x+4} = 16t$, $2^{2x} = t^2$, $2^{2x-1} = \frac{t^2}{2}$):

$$16t - t^2 - 32 = \frac{t^2}{2}$$

Step 4 — clear the fraction and solve. Multiply by 2:

$$32t - 2t^2 - 64 = t^2 \;\Rightarrow\; 3t^2 - 32t + 64 = 0$$

$$t = \frac{32 \pm \sqrt{1024 - 768}}{6} = \frac{32 \pm 16}{6} \;\Rightarrow\; t = 8 \text{ or } t = \frac{8}{3}$$

Step 5 — return to x**.** We need $2^x = t$ with x a real number; the question expects an integer answer, and only

$$2^x = 8 \;\Rightarrow\; x = 3$$

gives one. ($t = \frac{8}{3}$ gives $x = \log_2 \frac{8}{3}$, not a clean value.)

Check at $x = 3$**:** the three terms are -16, $2^6 - 2^5 - 16 = 64 - 32 - 16 = 16$, and $2^5 + 16 = 48$. Differences: $16 - (-16) = 32$ and $48 - 16 = 32$ ✔

Answer: 3

Shortcut

Substitute $t = 2^x$ **before doing anything else.** Every term is a power of 2, and the substitution turns the condition into the plain quadratic

$$3t^2 - 32t + 64 = 0 \;\Rightarrow\; (t-8)(3t-8) = 0$$

Then keep only the root that is a power of 2, giving $x = \mathbf{3}$.

Watch the exponent arithmetic: $2^{2x-1} = \frac{1}{2}(2^x)^2$, not $(2^x)^2 - 1$. Mishandling that half is the commonest slip in this question.

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14 QA MODERN MATHS PERMUTATION AND COMBINATION ●●●●●●○○○○ 6 /10

Mrs and Mr Sharma, and Mrs and Mr Ahuja along with four other persons are to be seated at a round table for dinner. If Mrs and Mr Sharma are to be seated next to each other, and Mrs and Mr Ahuja are not to be seated next to each other, then the total number of seating arrangements is _____

ANSWER **960**

SOLUTION

Step 1 — count arrangements with the Sharmas together. Glue the Sharmas into a single block. That leaves $8 - 2 + 1 = 7$ entities around a round table:

$$(7-1)! = 6! = 720$$

and the Sharmas can sit within their block in $2! = 2$ orders:

$$720 \times 2 = 1440$$

Step 2 — count arrangements with *both* couples together. Glue both couples, leaving $8 - 4 + 2 = 6$ entities:

$$(6-1)! = 5! = 120$$

each couple internally arrangeable in 2 ways:

$$120 \times 2 \times 2 = 480$$

Step 3 — subtract. "Sharmas together **and** Ahujas apart" is "Sharmas together" minus "both together":

$$1440 - 480 = 960$$

Answer: 960

Shortcut

Glue, then subtract — never try to place the Ahujas apart directly.

$$\underbrace{6! \times 2}_{\text{Sharmas together}} - \underbrace{5! \times 2 \times 2}_{\text{both couples together}} = 1440 - 480 = \mathbf{960}$$

The circular-table rule is where marks are lost: n entities around a round table give $(n-1)!$ arrangements, not $n!$, because rotations are identical. Count your entities *after* gluing — 7 in the first case, 6 in the second.

A quick sanity check: the answer must be less than 1440 and a clear majority of it, since gluing a second specific couple is restrictive. $960 = \frac{2}{3} \times 1440$ sits exactly where you would expect.

---

15 QA ARITHMETIC AVERAGES ●●●●●●●●○○ 8 /10

Let 50 distinct positive integers be chosen such that the highest among them is 100, and the average of the largest 25 integers among them exceeds the average of the remaining integers by 50. Then the maximum possible value of the sum of all the 50 integers is _____

ANSWER 3150

SOLUTION

Step 1 — turn the average condition into a sum condition. Let S_H be the sum of the largest 25 and S_L the sum of the smallest 25. The averages differ by 50:

$$\frac{S_H}{25} - \frac{S_L}{25} = 50 \Rightarrow S_H - S_L = 1250$$

Step 2 — write what is to be maximised.

$\text{Total} = S_H + S_L$

Using (1), $S_L = S_H - 1250$, so

$\text{Total} = 2S_H - 1250$

Maximising the total therefore means maximising S_H — nothing else matters.

Step 3 — maximise S_H. The 50 integers are distinct and the largest is 100, so the top 25 are at most $100, 99, 98, \ldots, 76$:

$$S_H \le 100 + 99 + \cdots + 76 = \frac{(100+76) \times 25}{2} = 2200$$

Step 4 — check the bottom half can accommodate it. With $S_H = 2200$, equation (1) gives

$S_L = 2200 - 1250 = 950$

We need 25 distinct positive integers summing to 950, all **below 76** (the smallest of the top group). The range available is

- minimum possible: $1 + 2 + \cdots + 25 = 325$
- maximum possible: $51 + 52 + \cdots + 75 = \frac{(51+75) \times 25}{2} = 1575$

Since $325 \le 950 \le 1575$, such a set exists ✔

Step 5 — compute the total.

$2200 + 950 = 3150$

Answer: 3150

Shortcut

Reduce to one variable first. The difference $S_H - S_L = 1250$ is fixed, so

$\text{Total} = 2S_H - 1250$

and the problem becomes “make the top 25 as large as possible” — a one-line consecutive-block sum, 100 down to 76, giving 2200.

Then do the feasibility check, which is what separates a correct answer from a lucky one: the bottom 25 must sum to 950 using distinct values under 76, and $325 \leq 950 \leq 1575$ confirms it.

Total $= 2\,(\,2200\,) - 1250 = \mathbf{3150}$**.** The general lesson: when a *difference* is fixed, maximising a *sum* reduces to maximising one side alone.

ATTEMPT THIS SECTION

Type the answer, like the real thing

Short-answer questions give no options to work backwards from and carry no negative marking — the only way to build that reflex is to practise on the same interface. Attempt this paper section by section, timed, and get an instant score with a question-wise analysis.

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SECTION 2

QA-MCQ

Quantitative Ability — MCQ

30	120	40 min	+4 / −1
QUESTIONS	MARKS	SECTIONAL LIMIT	MARKING

MCQ (incl. a 5-question LR set)

MOST ASKED HERE — Algebra **7** · Modern Maths **6** · Geometry And Mensuration **5** · Logical Reasoning **5** · Arithmetic **4**

16 QA ALGEBRA LOGARITHMS — 6 /10

The set of real values of x for which the inequality $\log_{27} 8 \leq \log_3 x < 9^{\frac{1}{\log_2 3}}$ holds is

(A) $[2, 81)$

(B) $(2, 27)$

(C) $[2, 81]$

(D) $(2, 27]$

ANSWER **(a)** $[2, 81)$

SOLUTION

Step 1 — simplify the left bound.

$$\log_{27} 8 = \frac{\log 8}{\log 27} = \frac{3 \log 2}{3 \log 3} = \log_3 2$$

So the left inequality is $\log_3 2 \leq \log_3 x$, i.e. $x \geq 2$ — and since the bound is **not strict**, $x = 2$ is included.

Step 2 — simplify the right bound. Use $\frac{1}{\log_2 3} = \log_3 2$:

$$9^{\frac{1}{\log_2 3}} = 9^{\log_3 2} = \left(3^2\right)^{\log_3 2} = \left(3^{\log_3 2}\right)^2 = 2^2 = 4$$

So the right inequality is $\log_3 x < 4$, i.e. $x < 3^4 = 81$ — **strict**, so 81 is excluded.

Step 3 — combine.

$2 \leq x < 81 \Rightarrow x \in [2, 81)$

(The domain condition $x > 0$ is already implied.)

Answer: (a) — $[2, 81)$

Shortcut

Two standard simplifications end this before any inequality work:

- $\log_{27} 8 = \log_{3^3} 2^3 = \log_3 2$ — matching exponents on base and argument cancel.
- $\frac{1}{\log_2 3} = \log_3 2$, so $9^{\log_3 2} = 2^2 = 4$.

Then read the bracket types straight off the inequality signs: $\leq$ gives a closed left end, $<$ an open right end — so $[2, 81)$.

All four options have the same shape, differing only in endpoints and brackets. That is a signal to be careful about $\leq$ versus $<$ rather than to redo the algebra.

---

17 QA ALGEBRA FUNCTIONS 6 /10

The set of all possible values of $f(x)$ for which $(81)^x + (81)^{f(x)} = 3$ is

(A) $(0.25, 3)$

(B) $(-\infty, 4)$

(C) $(-\infty, 0.25)$

(D) $(3, 4)$

ANSWER **(c)** $(-\infty, 0.25)$

SOLUTION

Step 1 — isolate the term containing $f(x)$.

$81^{f(x)} = 3 - 81^x$

Step 2 — find the range of the right-hand side. For real x, $81^x > 0$ and takes every positive value. So

$3 - 81^x \in (-\infty, 3)$

Step 3 — impose positivity. The left side $81^{f(x)}$ is an exponential, so it must be **strictly positive**:

$0 < 3 - 81^x < 3$

Step 4 — solve for $f(x)$. Taking $\log_{81}$ across $0 < 81^{f(x)} < 3$:

$f(x) < \log_{81} 3$

and $\log_{81} 3 = \frac{\log 3}{\log 81} = \frac{\log 3}{4 \log 3} = \frac{1}{4} = 0.25.$

There is no lower bound: as $81^x \to 3^-$, the right side tends to 0 and $f(x) \to -\infty$.

$f(x) \in (-\infty, 0.25)$

Answer: (c) — $(-\infty, 0.25)$

Shortcut

The whole question is one observation: an exponential is strictly positive and here strictly below 3.

$0 < 81^{f(x)} < 3 \Rightarrow -\infty < f(x) < \log_{81} 3 = \frac{1}{4}$

The number to spot is $\log_{81} 3 = \frac{1}{4}$, because $81 = 3^4$. Seeing 0.25 in two of the options tells you that is the bound being tested.

Then pick the interval that is open at the top and unbounded below — only option (c). Option (a) wrongly imposes a lower bound; the exponential can be arbitrarily close to 0, so $f(x)$ runs to $-\infty$.

---

18 QA ALGEBRA LINEAR EQUATIONS 3 /10

The value of k for which the following lines

$x - y - 1 = 0$
$2x + 3y - 12 = 0$
$2x - 3y + k = 0$

are concurrent is

(A) 1
(B) -1
(C) 0
(D) 12

ANSWER **(c)** 0

SOLUTION

Concurrent means all three lines pass through one common point. So find where the first two meet, then force the third through that point.

Step 1 — intersect the first two lines.

$x - y = 1 \quad \text{and} \quad 2x + 3y = 12$

From the first, $x = y + 1$. Substituting:

$2(y+1) + 3y = 12 \Rightarrow 5y = 10 \Rightarrow y = 2, \quad x = 3$

The point of intersection is $(3, 2)$.

Step 2 — make the third line pass through it.

$2(3) - 3(2) + k = 0 \Rightarrow 6 - 6 + k = 0 \Rightarrow k = 0$

Check: with $k = 0$ the third line is $2x = 3y$, and $(3,2)$ gives $6 = 6$ ✔

Answer: (c) — 0

Shortcut

Solve two, substitute into the third — never set up the 3×3 determinant. The determinant condition

$$\begin{vmatrix} 1 & -1 & -1 \\ 2 & 3 & -12 \\ 2 & -3 & k \end{vmatrix} = 0$$

is correct but slower and far more error-prone than finding $(3,2)$ and plugging in.

Here the arithmetic is especially kind: at $(3,2)$ the first two terms of the third line are 6 and -6, which cancel, so $k = 0$ on sight.

19 QA GEOMETRY AND MENSURATION TRIANGLES 3 /10

The lengths of the sides of a triangle are x, 21 and 40, where x is the shortest side. A possible value of x is

(A) 18 (B) 20

(C) 19 (D) 16

ANSWER **(b)** 20

SOLUTION

Step 1 — apply the triangle inequality. The sum of any two sides must exceed the third. The binding condition is

$x + 21 > 40 \Rightarrow x > 19$

(The other two inequalities, $x + 40 > 21$ and $21 + 40 > x$, are satisfied by any sensible x.)

Step 2 — apply the "shortest side" condition. We are told x is the shortest, so

$x \leq 21$

Step 3 — combine.

$19 < x \leq 21$

Step 4 — test the options.

Option	x	$x > 19$?	shortest?
(a)	18	✘	—
(b)	**20**	✔	✔
(c)	19	✘ (equality fails)	—
(d)	16	✘	—

Only $x = 20$ works: $20 + 21 = 41 > 40$ ✔

Answer: (b) — 20

Shortcut

One inequality decides everything: $x > 40 - 21 = 19$. Three of the four options are at or below 19 and die immediately.

Option (c) $x = 19$ **is the designed trap** — it gives $19 + 21 = 40$, exactly equal to the third side, which makes the "triangle" degenerate (a straight line, zero area). **The triangle inequality is strict.**

Remember the general bound: for sides a and b, the third side lies in $(\,|a - b|,\ a + b\,)$ — here $(\,19, 61\,)$, with the extra condition that x be the smallest.

20 QA GEOMETRY AND MENSURATION TRIANGLES 3 /10

In a right-angled triangle ABC, the hypotenuse AC is of length 13 cm. A line drawn connecting the midpoints D and E of sides AB and AC is found to be 6 cm in length. The length of BC is

(A) 12 cm
(B) 5 cm
(C) $2\sqrt{3}$ cm
(D) 8 cm

ANSWER (a) 12 cm

SOLUTION

Step 1 — identify the midsegment. D is the midpoint of AB and E the midpoint of AC, so DE joins the midpoints of two sides of triangle ABC. By the **midpoint theorem**, DE is parallel to the third side BC and half its length:

$$DE = \frac{BC}{2}$$

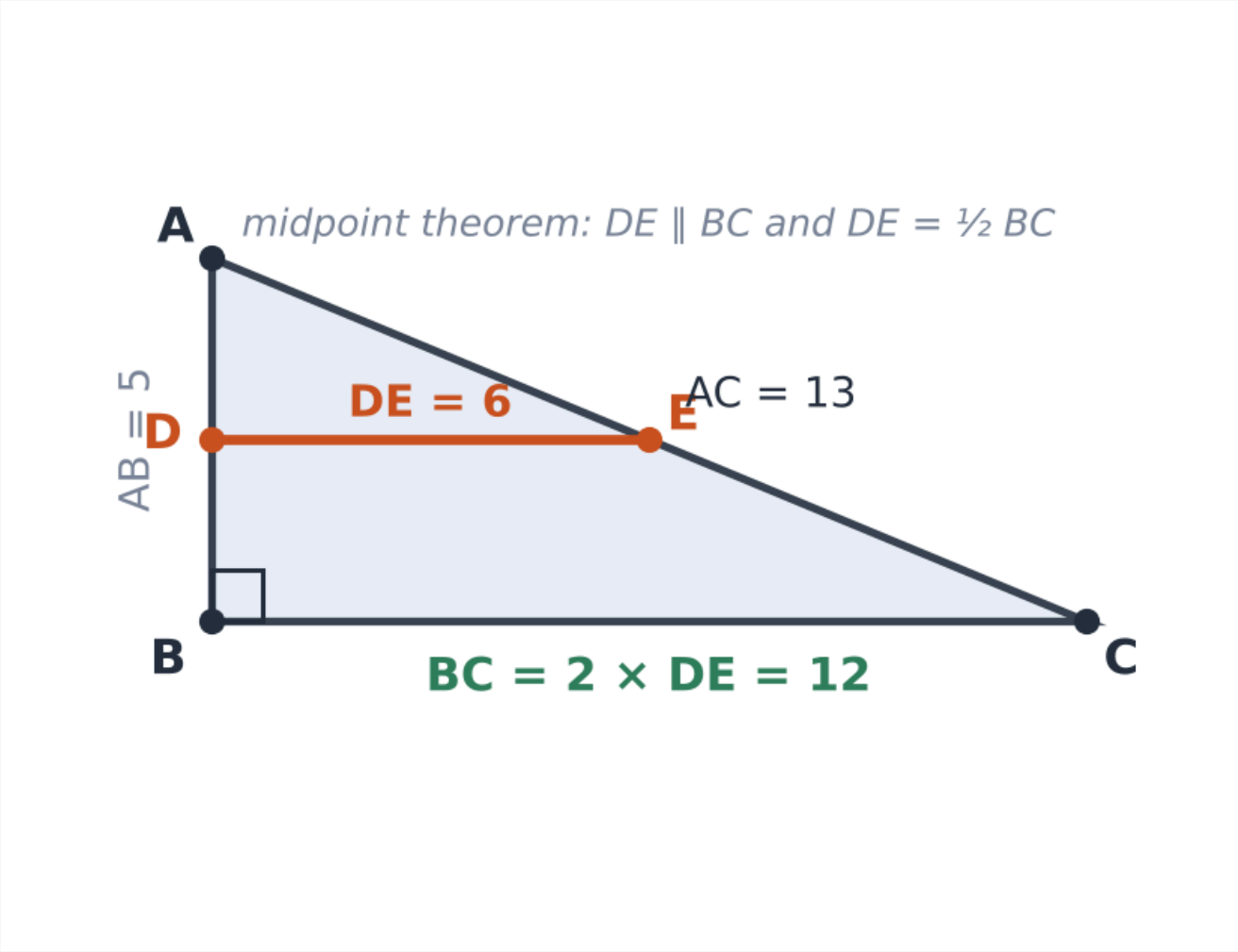
Step 2 — solve for BC.

$$6 = \frac{BC}{2} \Rightarrow BC = 12$$

Step 3 — sanity-check against the right angle. The triangle is right-angled with hypotenuse $AC = 13$, so

$$AB = \sqrt{13^2 - 12^2} = \sqrt{169 - 144} = \sqrt{25} = 5$$

giving the familiar 5–12–13 triple ✔ Everything is consistent.



Answer: (a) — 12 cm

Shortcut

The midpoint theorem answers this in one step: $BC = 2 \times DE = 12$**.** The hypotenuse length is not even needed — it is there to let you confirm the 5–12–13 triple, and to tempt you into Pythagoras first.

Option (b) 5 cm is the trap: it is the *other* leg, which you get if you use the right angle instead of the midsegment.

Recognise the three small Pythagorean triples on sight — 3–4–5, 5–12–13, 8–15–17. Seeing 13 with a leg of 12 should immediately suggest 5, which is the consistency check that confirms the answer.

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21 QA NUMBER SYSTEM DIVISIBILITY ●●●●●○○○○○ 5 /10

If the five-digit number $a\bar{bcde}$ is divisible by 6, then which of the following numbers is not necessarily divisible by 6?

A $ed\bar{cba}$

B $e\bar{ee}$

C $bbad\bar{cacede}$

D $cd\bar{bae}$

ANSWER **(a)** $ed\bar{cba}$

SOLUTION

Step 1 — recall what divisibility by 6 requires. A number is divisible by 6 exactly when it is divisible by **both 2 and 3**:

- by **3**: the digit sum is a multiple of 3 — this depends only on *which* digits appear, not their order;
- by **2**: the **last digit** is even — this depends entirely on position.

Step 2 — see what rearranging preserves. Any rearrangement of a, b, c, d, e keeps the digit sum, so **divisibility by 3 always survives**. Only the last-digit condition can break.

Given $a\bar{bcde}$ is divisible by 6, we know e is even and $a + b + c + d + e \equiv 0 \pmod 3$.

Step 3 — test each option's last digit.

- **(a)** $ed\bar{cba}$ — ends in a. Nothing forces a to be even. ✘ **This is the answer.**
- **(b)** $e\bar{ee}$ — ends in e, which is even ✔; digit sum $3e$ is a multiple of 3 ✔. Always divisible by 6.
- **(c)** $bbad\bar{cacede}$ — ends in e, even ✔; its digit sum is $2(a + b + c + d + e) + (c + e)$ … more simply, it ends in e and we can check the sum is a multiple of 3: the ten digits are $b, b, a, d, c, a, c, e, d, e$, i.e. $2(a + b + c + d + e)$, which is a multiple of 3 ✔.
- **(d)** $cd\bar{bae}$ — ends in e, even ✔; same digits, same sum ✔.

Concrete counterexample for (a). Take $a\bar{bcde} = 12354$: digit sum 15 ✔ and last digit 4 is even ✔, so it is divisible by 6. Reversed, $ed\bar{cba} = 45321$, which is odd — not divisible by 2, hence not by 6.

Answer: (a) — $ed\bar{cba}$

Shortcut

Only the last digit can go wrong. Every option is a rearrangement of the same digits, so the digit sum — and with it divisibility by 3 — is automatic. Scan the options for the one that does **not** end in e:

Option	last digit	safe?
(a)	a	**no**
(b), (c), (d)	e	yes

Answer (a), found in about five seconds. The transferable idea: when a question rearranges digits, split the divisibility rule into a *position-free* part (digit sum) and a *position-dependent* part (final digits), and test only the second.

---

22 QA MODERN MATHS PERMUTATION AND COMBINATION ●●●●●●○○○ 6 /10

In how many ways can the letters of the word MANAGEMENT be arranged such that no two vowels appear together?

(A) 75600 (B) 25200

(C) 37800 (D) 21600

ANSWER **(c)** 37800

SOLUTION

Step 1 — inventory the letters. MANAGEMENT has 10 letters:

- **Consonants (6):** M, N, G, M, N, T — with M twice and N twice
- **Vowels (4):** A, A, E, E — with A twice and E twice

Step 2 — arrange the consonants first.

$$\frac{6!}{2!\,2!} = \frac{720}{4} = 180$$

Step 3 — choose the gaps for the vowels. Six consonants in a row create **7 gaps** (including the two ends):

$$_\,C\,_\,C\,_\,C\,_\,C\,_\,C\,_\,C\,_$$

Placing at most one vowel per gap guarantees no two vowels are adjacent. Choose 4 of the 7 gaps and arrange the vowels (which have repeats):

$$\binom{7}{4} \times \frac{4!}{2!\,2!} = 35 \times 6 = 210$$

Step 4 — multiply.

$$180 \times 210 = 37800$$

Answer: (c) — 37800

Shortcut

Gap method, and divide by the repeats on both halves.

$$\underbrace{\frac{6!}{2!2!}}_{\text{consonants}} \times \underbrace{\binom{7}{4}\frac{4!}{2!2!}}_{\text{vowels into gaps}} = 180 \times 210 = \mathbf{37800}$$

Two slips to avoid, each of which matches a wrong option:

- Forgetting the vowel repeats gives $180 \times 35 \times 24 = 151200$;
- Using n gaps instead of $n+1$ (6 rather than 7) gives $180 \times 15 \times 6 = 16200$.

Six letters in a row give seven gaps — count the ends. That is the single most common error in "no two together" questions.

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23 QA ARITHMETIC AVERAGES ●●●●○○○○○○ 4 /10

In a room, there are n persons whose average height is 160 cm. If m more persons, whose average height is 172 cm, enter the room, then the average height of all persons in the room becomes 164 cm. Then $m:n$ is

(A) $1:2$ (B) $1:3$

(C) $3:1$ (D) $2:1$

ANSWER (a) $1:2$

SOLUTION

Step 1 — write the combined average.

$$\frac{160n+172m}{n+m}=164$$

Step 2 — clear the denominator.

$160n+172m=164n+164m$

$8m=4n \Rightarrow \frac{m}{n}=\frac{4}{8}=\frac{1}{2}$

$m:n=1:2$

Check: take $n=2$, $m=1$. Total height $=2(160)+172=492$ over 3 people $=164$ ✔

Answer: (a) — $1:2$

Shortcut

Alligation gives this in one line. Place the two group averages either side of the combined average:

$$\begin{array}{ccc} 160 & & 172 \\ & 164 & \end{array}$$

The distances are $164-160=4$ and $172-164=8$, and the groups are in the **inverse** ratio of those distances:

$n:m=8:4=2:1 \Rightarrow m:n=\mathbf{1:2}$

The trap is the order. The question asks for $m:n$, not $n:m$ — and $2:1$ is sitting there as option (d). **Read which ratio is wanted before you write the answer**; alligation naturally produces the ratio of the *group sizes* in the order you set up the diagram.

---

24 QA ALGEBRA PROGRESSIONS ●●●●●○○○○○ 5 /10

The sum of the first 15 terms in an arithmetic progression is 200, while the sum of the next 15 terms is 350. Then the common difference is

(A) $\frac{7}{9}$ (B) $\frac{2}{3}$

(C) $\frac{4}{9}$ (D) $\frac{1}{3}$

ANSWER (b) $\frac{2}{3}$

SOLUTION

Step 1 — use the block property of an AP. Pair each term of the second block with the corresponding term of the first: term 16 with term 1, term 17 with term 2, and so on. Each pair differs by exactly $15d$, because

$T_{16} - T_1 = 15d, \quad T_{17} - T_2 = 15d, \quad \ldots$

Step 2 — sum those 15 differences.

$(\text{ sum of next } 15) - (\text{ sum of first } 15) = 15 \times 15d = 225d$

Step 3 — substitute the given sums.

$$350 - 200 = 150 = 225d \Rightarrow d = \frac{150}{225} = \frac{2}{3}$$

Answer: (b) — $\frac{2}{3}$

Shortcut

Memorise the block rule: for an AP, consecutive blocks of k terms differ by $k^2 d$.

Here $k = 15$, so the gap between the two blocks is $225d$, and

$$d = \frac{350 - 200}{225} = \frac{150}{225} = \mathbf{\frac{2}{3}}$$

This avoids the standard route entirely — no need to set up $\frac{15}{2}(2a + 14d) = 200$ and a second equation for 30 terms, then eliminate a. The block rule is one subtraction and one division, and it generalises: three consecutive blocks of k terms are themselves in AP with common difference $k^2 d$.

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25 QA MODERN MATHS MATRICES AND DETERMINANTS 7 /10

Suppose a, b and c are integers such that $a > b > c > 0$, and $A = \begin{bmatrix} a & b & c \\ b & c & a \\ c & a & b \end{bmatrix}$. Then the value of the determinant of A

(A) can be positive or negative

(B) is positve

(C) **is negative**

(D) is zero

ANSWER (c) is negative

SOLUTION

Step 1 — expand the determinant. For this cyclic matrix the standard result is

$$\det A = 3abc - a^3 - b^3 - c^3$$
$$= -\left(a^3 + b^3 + c^3 - 3abc\right)$$

Step 2 — factorise the bracket. The classic identity:

$$a^3 + b^3 + c^3 - 3abc = (a + b + c)\left(a^2 + b^2 + c^2 - ab - bc - ca\right)$$

and the second factor can be rewritten as

$$\frac{1}{2}\left[(a-b)^2 + (b-c)^2 + (c-a)^2\right]$$

Step 3 — determine the sign. Since $a > b > c > 0$:

- $a+b+c > 0$ ✔
- the bracket of squares is **strictly positive**, because a, b, c are distinct, so at least one square is non-zero ✔

Therefore $a^3+b^3+c^3-3abc > 0$, and

$$\det A = -(\text{positive}) < 0$$

Step 4 — confirm numerically. Take $a=3$, $b=2$, $c=1$:

$$\det = 3(6) - 27 - 8 - 1 = 18 - 36 = -18 < 0 \checkmark$$

Answer: (c) — is negative

Shortcut

Test one triple and trust the structure. With $a, b, c = 3, 2, 1$ the determinant is -18. Since the conditions $a > b > c > 0$ fix a single ordering pattern, the sign cannot flip — which rules out option (a) at once.

If you want the reason rather than the example: $\det A = -\left(a^3+b^3+c^3-3abc\right)$, and the bracket equals

$$\frac{1}{2}(a+b+c)\left[(a-b)^2+(b-c)^2+(c-a)^2\right] > 0$$

for distinct positive a, b, c. **The distinctness is what forces "negative" rather than "zero"** — if $a=b=c$ the determinant would vanish, which is why option (d) is offered.

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26 QA MODERN MATHS MATRICES AND DETERMINANTS ●●●●●●●●○○ 8 /10

If $A = \begin{bmatrix} 1 & 0 \\ \frac{1}{2} & 0 \end{bmatrix}$ then A^{2022} is

(A) None of these

(B) $\begin{bmatrix} 1 & 0 \\ 1011 & 0 \end{bmatrix}$

(C) $\begin{bmatrix} 1 & 0 \\ 2022 & 0 \end{bmatrix}$

(D) $\begin{bmatrix} 1 & 0 \\ \frac{1}{2^{2022}} & 0 \end{bmatrix}$

ANSWER (b) $\begin{bmatrix} 1 & 0 \\ 1011 & 0 \end{bmatrix}$

SOLUTION

This question is defective and was discarded. The working below shows why, and what was almost certainly intended.

Step 1 — compute A^2 from the matrix as printed.

$$A^2 = \begin{bmatrix} 1 & 0 \\ \frac{1}{2} & 0 \end{bmatrix}\begin{bmatrix} 1 & 0 \\ \frac{1}{2} & 0 \end{bmatrix} = \begin{bmatrix} 1\cdot 1 + 0\cdot\frac{1}{2} & 0 \\ \frac{1}{2}\cdot 1 + 0\cdot\frac{1}{2} & 0 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ \frac{1}{2} & 0 \end{bmatrix} = A$$

So A **is idempotent**: $A^2 = A$, and therefore

$$A^n = A \quad \text{for every } n \geq 1 \;\Rightarrow\; A^{2022} = \begin{bmatrix} 1 & 0 \\ \frac{1}{2} & 0 \end{bmatrix}$$

Step 2 — compare with the options. That matrix is **not** option 2, 3 or 4. Taken exactly as printed, the only defensible answer is **option (a), "None of these"**.

Step 3 — what was intended. Replace the bottom-right 0 with 1:

$$B = \begin{bmatrix} 1 & 0 \\ \frac{1}{2} & 1 \end{bmatrix} \Rightarrow B^n = \begin{bmatrix} 1 & 0 \\ \frac{n}{2} & 1 \end{bmatrix}$$

(a shear, proved in one line by induction). Then $B^{2022} = \begin{bmatrix} 1 & 0 \\ 1011 & 1 \end{bmatrix}$ — and $1011 = \frac{2022}{2}$ is exactly the entry in option 2, which carries a 0 where it should carry a 1. So the misprint is in both the question and the key.

Answer: (b) is the published answer and the one that scores. Mathematically, the printed matrix gives "None of these".

Shortcut

Treat this as a free mark and move on. It appears in the published keys as option 2, so mark that; but note for teaching that the printed matrix satisfies $A^2 = A$, which makes every power equal to A itself.

The genuine skill being tested is worth keeping, because the intended version is a standard result:

$$\begin{bmatrix} 1 & 0 \\ k & 1 \end{bmatrix}^n = \begin{bmatrix} 1 & 0 \\ nk & 1 \end{bmatrix}$$

A unipotent 2×2 shear simply multiplies its off-diagonal entry by n. With $k = \frac{1}{2}$ and $n = 2022$ that gives 1011.

And the broader habit: always compute A^2 first. It instantly tells you whether a matrix is idempotent ($A^2 = A$), involutory ($A^2 = I$) or nilpotent ($A^2 = 0$) — each of which collapses a huge power to something trivial.

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27 QA GEOMETRY AND MENSURATION TRIGONOMETRY ●●●●●●●●●○ 9 /10

For $0 < \theta < \frac{\pi}{4}$, let $a = (\sin\theta)^{\sin\theta\left(\log_2 \cos\theta\right)}$, $b = (\cos\theta)^{\sin\theta\left(\log_2 \sin\theta\right)}$, $c = (\sin\theta)^{\cos\theta\left(\log_2 \cos\theta\right)}$ and $d = (\sin\theta)^{\sin\theta\left(\log_2 \sin\theta\right)}$. Then, the median value in the sequence a, b, c, d is

(A) $\frac{a+b}{2}$ (B) $\frac{a+d}{2}$

(C) $\frac{b+c}{2}$ (D) $\frac{c+d}{2}$

ANSWER (b) $\frac{a+d}{2}$

SOLUTION

Step 1 — fix the signs and sizes on $0 < \theta < \frac{\pi}{4}$. On this interval

$0 < \sin\theta < \cos\theta < 1$

Consequently both logarithms are **negative** (logs of numbers below 1), and since $\sin\theta < \cos\theta$,

$\log_2 \sin\theta < \log_2 \cos\theta < 0$

Both exponential factors $(\sin\theta)^{\sin\theta}$ and $(\cos\theta)^{\sin\theta}$ are **positive**, and because $\sin\theta < \cos\theta$ with a common positive exponent,

$(\sin\theta)^{\sin\theta} < (\cos\theta)^{\sin\theta}$

Also, raising a number **less than 1** to a **larger** power makes it smaller, and $\cos\theta > \sin\theta$, so

$(\sin\theta)^{\cos\theta} < (\sin\theta)^{\sin\theta}$

Step 2 — order the four quantities. Write $P = \log_2 \cos\theta$ and $Q = \log_2 \sin\theta$, both negative with $Q < P$.

- $a = (\sin\theta)^{\sin\theta P}$
- $c = (\sin\theta)^{\cos\theta P}$
- $d = (\sin\theta)^{\sin\theta Q}$
- $b = (\cos\theta)^{\sin\theta Q}$

Since P is negative, multiplying by a **smaller** positive number gives a **larger** (less negative) result, so $c > a$. Since Q is negative and $(\cos\theta)^{\sin\theta} > (\sin\theta)^{\sin\theta}$, we get $b < d$. And comparing a with d: same positive factor, and $P > Q$, so $a > d$.

Putting it together:

$b < d < a < c$

Step 3 — take the median. With four values, the median is the average of the middle two, d and a:

$$\text{median} = \frac{a+d}{2}$$

Numerical check at $\theta = 30^\circ$ ($\sin = 0.5,\ \cos \approx 0.866$):

$a \approx 0.707\,(-0.2075) = -0.147, \quad b \approx 0.931\,(-1) = -0.931,$

$c \approx 0.5456\,(-0.2075) = -0.113, \quad d \approx 0.707\,(-1) = -0.707$

Order: $b < d < a < c$ ✔ median $= \frac{a+d}{2}$ ✔

Answer: (b) — $\frac{a+d}{2}$

Shortcut

Don't reason symbolically — substitute $\theta = 30^\circ$**.** All four expressions become concrete numbers in under a minute, and the ordering $b < d < a < c$ is immediate.

The substitution is safe because the question asks which *pair* forms the median, and the ordering of a, b, c, d is the same throughout $0 < \theta < \frac{\pi}{4}$ (no crossings occur).

If you prefer the structure: every term is (positive) × (negative log), so all four are negative, and the comparison reduces to two facts — $\sin\theta < \cos\theta$, and x^p decreases in p when $0 < x < 1$. **Answer** $\frac{a+d}{2}$**.**

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28 QA MODERN MATHS PROBABILITY ●●●●●○○○○○ 5 /10

Let $A = \{1, 2, 3\}$ and $B = \{a, b\}$. Assuming all relations from set A to set B are equally likely, what is the probability that a relation from A to B is also a function?

A $\frac{1}{8}$

B $\frac{1}{2}$

C 1

D $\frac{3^2}{2^6}$

ANSWER (a) $\frac{1}{8}$

SOLUTION

Step 1 — count the relations. A relation from A to B is **any subset** of $A \times B$. Since

$|A \times B| = 3 \times 2 = 6$

the number of relations is

$2^6 = 64$

Step 2 — count the functions. A function assigns to **each** element of A exactly one element of B. With 3 elements in A and 2 choices each:

$2^3 = 8$

Step 3 — divide.

$$P = \frac{8}{64} = \frac{1}{8}$$

Answer: (a) — $\frac{1}{8}$

Shortcut

Two formulas, both worth knowing cold:

relations $A \to B = 2^{|A||B|}$, functions $A \to B = |B|^{|A|}$

So the probability is

$$\frac{|B|^{|A|}}{2^{|A||B|}} = \frac{2^3}{2^6} = \frac{1}{2^3} = \mathbf{\frac{1}{8}}$$

Option (d) $\frac{3^2}{2^6}$ is the trap: it swaps the roles of $|A|$ and $|B|$ in the numerator, giving 3^2 instead of 2^3. **The base is the size of the *codomain*** — each element of A independently picks one of $|B|$ targets.

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29 QA ARITHMETIC TIME SPEED AND DISTANCE ●●●●●●○○○○ 6 /10

In a 400-metre race, Ashok beats Bipin and Chandan respectively by 15 seconds and 25 seconds. If Ashok beats Bipin by 150 metres, by how many metres does Bipin beat Chandan in the race?

(A) 80 (B) 100

(C) 150 (D) 50

ANSWER **(a)** 80

SOLUTION

Step 1 — use the Bipin information to get his speed. When Ashok finishes, Bipin is 150 m short, and he covers that 150 m in the 15 seconds by which he loses. So

$$\text{Bipin's speed} = \frac{150}{15} = 10 \text{ m/s}$$

Step 2 — find Bipin's total time.

$$t_B = \frac{400}{10} = 40 \text{ s}$$

Step 3 — find Ashok's and Chandan's times. Ashok beats Bipin by 15 s:

$t_A = 40 - 15 = 25$ s

Ashok beats Chandan by 25 s:

$t_C = 25 + 25 = 50$ s

Step 4 — find Chandan's speed.

$$\text{Chandan's speed} = \frac{400}{50} = 8 \text{ m/s}$$

Step 5 — compare Bipin and Chandan. Bipin finishes at $t = 40$ s. In 40 seconds Chandan covers

$8 \times 40 = 320$ m

so he is $400 - 320 = 80$ m behind.

Answer: (a) — 80 metres

Shortcut

Convert "beats by x metres and y seconds" into a speed immediately: the loser's speed is $\frac{x}{y}$. Here Bipin runs at $\frac{150}{15} = 10$ m/s, which unlocks every other time in the question.

From there the times fall out as 40, 25 and 50 seconds, and the final gap is

$400 - 8 \times 40 = \mathbf{80}$ m

The trap is option (c) 150 m — reusing the margin given in the question. The gaps are not additive or transferable between pairs of runners; you must go through the speeds.

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30 QA ARITHMETIC MIXTURES AND ALLIGATION ●●●●●○○○○○ 5 /10

In a bowl containing 60 ml orange juice, 40 ml of water is poured. Thereafter, 100 ml of apple juice is poured to make a fruit punch. Madhu drinks 50 ml of this fruit punch and comments that the proportion of orange juice needs to be higher for better taste. How much orange juice should be poured into the fruit punch that remained, in order to bring up the level of orange juice to 50 percentage?

(A) 100 ml
(B) 40 ml
(C) 80 ml
(D) **60 ml**

ANSWER **(d) 60 ml**

SOLUTION

Step 1 — compose the punch.

$60\ (\text{orange}) + 40\ (\text{water}) + 100\ (\text{apple}) = 200\ \text{ml}$

The orange fraction is $\frac{60}{200} = 30\%$.

Step 2 — remove 50 ml. Madhu drinks a well-mixed 50 ml, i.e. one quarter of the punch. Every component is reduced by a quarter, leaving three quarters of each:

$$\text{orange} = \frac{3}{4}(\,60\,) = 45\ \text{ml}, \qquad \text{total} = 150\ \text{ml}$$

Step 3 — add x ml of orange juice and require 50%. After adding, the orange is $45 + x$ and the total is $150 + x$:

$$\frac{45 + x}{150 + x} = \frac{1}{2}$$

Step 4 — solve.

$$2\,(\,45 + x\,) = 150 + x \;\Rightarrow\; 90 + 2x = 150 + x \;\Rightarrow\; x = 60$$

Check: orange $= 105$, total $= 210$, and $\frac{105}{210} = 50\%$ ✔

Answer: (d) — 60 ml

Shortcut

Track the non-orange part — it never changes once drinking stops. After Madhu drinks a quarter, the non-orange liquid is $\frac{3}{4}(\,140\,) = 105$ ml, and adding orange juice leaves it untouched.

For the mixture to be 50% orange, the orange must simply **equal** the non-orange:

$$\text{orange needed} = 105, \qquad \text{already present} = 45 \;\Rightarrow\; x = \mathbf{60}$$

This "hold the other component fixed" trick turns every "raise the concentration to 50%" question into a subtraction. For a target of $\frac{1}{3}$ or $\frac{1}{4}$ instead, scale the fixed part accordingly — it is still one line.

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31 QA GEOMETRY AND MENSURATION CONIC SECTIONS 8 /10

The curve represented by the equation $\frac{x^2}{\sin\sqrt{2}-\sin\sqrt{3}}+\frac{y^2}{\cos\sqrt{2}-\cos\sqrt{3}}=1$ is

(A) an ellipse with the foci on the y-axis

(B) an ellipse with the foci on the x-axis

(C) a hyperbola with the foci on the x-axis

(D) a hyperbola with the foci on the y-axis

ANSWER (a) an ellipse with the foci on the y-axis

SOLUTION

Everything turns on the **signs and relative sizes** of the two denominators. Note $\sqrt{2}\approx 1.414$ and $\sqrt{3}\approx 1.732$ radians — both in the second quadrant region $\left(\frac{\pi}{2}\approx 1.571\right)$? Let us be careful: $\sqrt{2}<\frac{\pi}{2}<\sqrt{3}$, so $\sqrt{2}$ is in the **first** quadrant and $\sqrt{3}$ in the **second**.

Step 1 — the x^2 denominator. Sine increases on $\left(0,\frac{\pi}{2}\right)$ and decreases on $\left(\frac{\pi}{2},\pi\right)$. Use the sum-to-product form instead, which is safer:

$$\sin\sqrt{2}-\sin\sqrt{3}=2\cos\left(\frac{\sqrt{2}+\sqrt{3}}{2}\right)\sin\left(\frac{\sqrt{2}-\sqrt{3}}{2}\right)$$

Here $\frac{\sqrt{2}+\sqrt{3}}{2}\approx 1.573>\frac{\pi}{2}$, so the cosine is **negative**; and $\frac{\sqrt{2}-\sqrt{3}}{2}\approx -0.159$, so the sine is **negative**. Negative × negative gives

$$\sin\sqrt{2}-\sin\sqrt{3}>0$$

Numerically: $\sin(1.414)\approx 0.9878$, $\sin(1.732)\approx 0.9870$, difference $\approx +0.0008$ — positive but **tiny**.

Step 2 — the y^2 denominator. Cosine is strictly decreasing on $(0,\pi)$ and $\sqrt{2}<\sqrt{3}$, so

$$\cos\sqrt{2}>\cos\sqrt{3}\ \Rightarrow\ \cos\sqrt{2}-\cos\sqrt{3}>0$$

Numerically: $\cos(1.414)\approx 0.1559$, $\cos(1.732)\approx -0.1609$, difference $\approx +0.3168$.

Step 3 — classify. Both denominators are positive, so the curve is an **ellipse**.

Step 4 — locate the foci. For $\frac{x^2}{A}+\frac{y^2}{B}=1$ with $A,B>0$, the foci lie on the axis belonging to the **larger** denominator. Since

$$B\approx 0.3168\ \gg\ A\approx 0.0008$$

the major axis is vertical and the **foci lie on the y-axis**.

Answer: (a) — an ellipse with the foci on the y-axis

Shortcut

Two sign checks decide everything, and neither needs a calculator.

- **Cosine is decreasing on** $(0,\pi)$, and $\sqrt{2}<\sqrt{3}$, so $\cos\sqrt{2}-\cos\sqrt{3}>0$ immediately.
- Both $\sqrt{2}$ and $\sqrt{3}$ sit very close to $\frac{\pi}{2}\approx 1.571$, where sine is at its **maximum and nearly flat**. So $\sin\sqrt{2}$ and $\sin\sqrt{3}$ are both ≈ 0.987 and their difference is **positive but minuscule**.

Both denominators positive $\Rightarrow$ **ellipse**, which kills (c) and (d). And the y denominator is hundreds of times larger $\Rightarrow$ **foci on the y-axis**.

The design of the question is the flatness of sine near its peak — that is what makes one denominator tiny and settles the orientation without any precise computation.

32 QA ALGEBRA FUNCTIONS 2 /10

A set of all possible values the function $f(x) = \frac{x}{|x|}$, where $x \neq 0$, takes is

(A) $\{1\}$

(B) $\{1, -1\}$

(C) $\{1, 0\}$

(D) $\{1, 0, -1\}$

ANSWER **(b)** $\{1, -1\}$

SOLUTION

Step 1 — split on the sign of x. The definition of $|x|$ gives two cases.

If $x > 0$: $|x| = x$, so

$$f(x) = \frac{x}{x} = 1$$

If $x < 0$: $|x| = -x$, so

$$f(x) = \frac{x}{-x} = -1$$

Step 2 — note the excluded point. $x = 0$ is explicitly removed from the domain (the expression would be $\frac{0}{0}$), so 0 is **not** in the range.

Step 3 — collect. The function takes exactly two values:

$\{1, -1\}$

This is the **signum function**, $sgn(x)$, restricted to $x \neq 0$.

Answer: (b) — $\{1, -1\}$

Shortcut

Recognise $\frac{x}{|x|}$ as the sign of x. It reports $+1$ for positives and -1 for negatives, and nothing else.

The only trap is whether 0 belongs. It does not: the question states $x \neq 0$, so options (c) and (d) are out. And since negative x is permitted, (a) is incomplete.

A useful related fact: $\frac{|x|}{x}$ gives the same set, and $x = |x| sgn(x)$ for all x — worth having when a question mixes moduli and signs.

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33 QA NUMBER SYSTEM HCF AND LCM 4 /10

When the square of the difference of two natural numbers is subtracted from the square of the sum of the same two numbers and the result is divided by four, we get

(A) **the product of the LCM and HCF of the two numbers**

(B) the HCF of the two numbers

(C) the LCM of the two numbers

(D) the square of the product of the two numbers

ANSWER **(a) the product of the LCM and HCF of the two numbers**

SOLUTION

Step 1 — translate the words into algebra. Let the two natural numbers be a and b. The description says:

$$\frac{(a+b)^2 - (a-b)^2}{4}$$

Step 2 — simplify. Expanding,

$(a+b)^2-(a-b)^2=\left(a^2+2ab+b^2\right)-\left(a^2-2ab+b^2\right)=4ab$

so the whole expression equals

$\frac{4ab}{4}=ab$

Step 3 — express ab in the language of the options. The fundamental identity relating two numbers to their HCF and LCM:

$HCF(a,b)\times LCM(a,b)=ab$

So the result is the **product of the LCM and HCF**.

Check with $a=6$, $b=4$: $\frac{100-4}{4}=24$, and $HCF=2$, $LCM=12$, product $=24$ ✔

Answer: (a) — the product of the LCM and HCF of the two numbers

Shortcut

The identity $(a+b)^2-(a-b)^2=4ab$ is the whole question — divide by 4 and you have ab.

Then recall $HCF\times LCM=ab$, which holds for **any two positive integers**.

Test the options with one example if you want certainty fast: $a=6$, $b=4$ gives 24. The HCF alone is 2, the LCM alone is 12, and $(ab)^2=576$ — so only option (a) matches. **One numerical example separates all four options here**, which is usually the quickest route when the options are verbal descriptions.

🎯 Not sure which topic is costing you marks? A topic-wise test tells you in 15 minutes. Find the gap

34 QA ARITHMETIC RATIO AND PROPORTION ●●●○○○○○○○ 3 /10

The cost of a piece of jewellery is proportional to the square of its weight. A piece of jewellery weighing 10 grams is INR 3600. The cost of a piece of jewellery of the same kind weighing 4 grams is

(A) INR 1220
(B) INR 600
(C) INR 576
(D) INR 1440

ANSWER (c) INR 576

SOLUTION

Step 1 — write the proportionality.

$C=kw^2$

Step 2 — find k from the given piece.

$3600=k(10)^2=100k\Rightarrow k=36$

Step 3 — apply it at 4 grams.

$C=36\times4^2=36\times16=576$

Answer: (c) — INR 576

Shortcut

Use the ratio directly and skip the constant. Because cost scales with the square of weight,

$$\frac{C_2}{C_1} = \left(\frac{w_2}{w_1}\right)^2 = \left(\frac{4}{10}\right)^2 = \frac{16}{100}$$

$$C_2 = 3600 \times \frac{16}{100} = 36 \times 16 = \mathbf{576}$$

Option (d) INR 1440 is the trap — it is what you get from a *linear* scaling, $3600 \times \frac{4}{10}$. Whenever a quantity varies as a square, the ratio must be squared too; checking that the answer falls much faster than the weight is a quick sanity test.

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35 QA ALGEBRA INEQUALITIES AND MODULUS ●●●●●●○○○○ 6 /10

The sum of the squares of all the roots of the equation $x^2 + |x+4| + |x-4| - 35 = 0$ is

(A) 74 (B) 175

(C) 50 (D) 148

ANSWER **(c)** 50

SOLUTION

Step 1 — split on the critical points $x = -4$ and $x = 4$.

Case A: $|x| \geq 4$. Then $|x+4| + |x-4| = 2|x|$, so the equation becomes

$x^2 + 2|x| - 35 = 0$

Put $t = |x| \geq 4$: $t^2 + 2t - 35 = 0 \Rightarrow (t+7)(t-5) = 0 \Rightarrow t = 5$ (rejecting $t = -7$).

Since $5 \geq 4$ ✔, this gives $x = \pm 5$.

Case B: $-4 < x < 4$. Then $|x+4| = x+4$ and $|x-4| = 4-x$, which sum to 8. The equation becomes

$x^2 + 8 - 35 = 0 \Rightarrow x^2 = 27 \Rightarrow x = \pm 3\sqrt{3} \approx \pm 5.196$

But $|\pm 5.196| > 4$, which **contradicts** the assumption $|x| < 4$. So Case B yields **no roots**.

Step 2 — collect the roots and square them. The roots are $x = 5$ and $x = -5$:

$5^2 + (-5)^2 = 25 + 25 = 50$

Answer: (c) — 50

Shortcut

Learn the identity for this shape:

$$|x+a| + |x-a| = \begin{cases} 2|x|, & |x| \geq a \\ 2a, & |x| \leq a \end{cases}$$

It converts the equation into two clean quadratics with no sign bookkeeping.

The essential discipline is checking each case against its own interval. Case B produces $x = \pm 3\sqrt{3} \approx \pm 5.2$, which lies *outside* $(-4, 4)$ and must be discarded — and it is exactly those discarded values that generate the wrong option (a) $74 = 25 + 49$ and (d) 148.

Answer $25 + 25 = \mathbf{50}$.

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36 QA MODERN MATHS SET THEORY 5 /10

Let A and B be two sets such that the Cartesian product $A \times B$ consists of four elements. If two elements of $A \times B$ are $(1,4)$ and $(4,1)$, then

(A) None of these

(B) $A \times B \neq B \times A$

(C) $\varnothing \in A \times B$

(D) $A \times B = B \times A$

ANSWER **(d)** $A \times B = B \times A$

SOLUTION

Step 1 — pin down A and B. From $(1,4) \in A \times B$ we get $1 \in A$ and $4 \in B$. From $(4,1) \in A \times B$ we get $4 \in A$ and $1 \in B$. So

$$\{1,4\} \subseteq A \quad \text{and} \quad \{1,4\} \subseteq B$$

Step 2 — use the size constraint. We are told $|A \times B| = 4$, and $|A \times B| = |A|\,|B|$. Since both A and B already contain at least two elements,

$$|A| \geq 2, \quad |B| \geq 2, \quad |A||B| = 4 \;\Rightarrow\; |A| = |B| = 2$$

Therefore

$$A = B = \{1,4\}$$

Step 3 — evaluate the options. Since A and B are the *same* set,

$$A \times B = B \times A = \{(1,1), (1,4), (4,1), (4,4)\}$$

- **(d)** $A \times B = B \times A$ ✔ — true, because $A = B$.
- **(b)** $A \times B \neq B \times A$ ✘ — the opposite.
- **(c)** $\varnothing \in A \times B$ ✘ — the elements of $A \times B$ are ordered pairs; the empty set is a *subset*, not a member.
- **(a)** None of these ✘ — (d) is true.

Answer: (d) — $A \times B = B \times A$

Shortcut

The size condition does all the work. Both sets must contain 1 and 4, so each has at least 2 elements; and $|A||B| = 4$ forces both to have *exactly* 2. Hence $A = B = \{1,4\}$, and once the sets are equal the products are trivially equal.

Note the general fact being tested: $A \times B = B \times A$ holds **only** when $A = B$ (or one of them is empty). The question engineers that equality through the counting constraint.

Option (c) is a type error worth flagging to students — confusing $\in$ with $\subseteq$. The empty set is a subset of every set but an element of almost none.

37 QA ALGEBRA FUNCTIONS 7 /10

If $f\left(x^2+f(y)\right)=xf(x)+y$ for all non-negative integers x and y, then the value of $[f(0)]^2+f(0)$ equals

(A) 2

(B) 0

(C) 6

(D) 1

ANSWER **(b)** 0

SOLUTION

Step 1 — substitute $x=0$. The functional equation becomes

$f(f(y))=0\cdot f(0)+y=y$

So f is its own inverse — in particular f is a **bijection** on the non-negative integers.

Step 2 — substitute $y=0$.

$f(x^2+f(0))=xf(x)$

Step 3 — put $x=0$ into (2).

$f(f(0))=0$

But from (1) with $y=0$ we also have $f(f(0))=0$ — consistent, no new information yet.

Step 4 — show $f(0)=0$. Let $c=f(0)$. Applying f to both sides of $f(c)=0$ and using (1):

$f(f(c))=c \Rightarrow f(0)=c$

again consistent. Now use (2) with $x=1$:

$f(1+c)=f(1)$

Since f is injective (from (1)), $1+c=1$, hence

$c=f(0)=0$

Step 5 — evaluate the requested expression.

$[f(0)]^2+f(0)=0^2+0=0$

(For completeness, the function satisfying the equation is $f(x)=x$, which indeed gives $f(x^2+y)=x\cdot x+y$ ✔.)

Answer: (b) — 0

Shortcut

Substitute $x=0$ first — it is almost always the most productive move in a functional equation. It yields $f(f(y))=y$ immediately, which tells you f is a bijection and its own inverse.

Injectivity is then the tool that pins $f(0)$: from $f(1+f(0))=f(1)$ you may cancel f, giving $f(0)=0$.

A legitimate shortcut under exam pressure: guess the obvious candidate $f(x)=x$, verify it satisfies $f(x^2+y)=xf(x)+y$, and read off $f(0)=0$. Then $[f(0)]^2+f(0)=\mathbf{0}$. Note that the expression t^2+t vanishes only at $t=0$ or $t=-1$, and f maps into non-negative integers — so 0 is the only possible answer among the options.

38 QA MODERN MATHS PROBABILITY 5 /10

If one of the factors of the number $3^7 2^8 17^3$ is randomly chosen, then the probability that the chosen factor will be a perfect square is

A $\frac{5}{36}$

B $\frac{1}{12}$

C $\frac{3}{40}$

D $\frac{5}{32}$

ANSWER (a) $\frac{5}{36}$

SOLUTION

Step 1 — count all factors. For $N = 3^7 2^8 17^3$, a divisor is $3^p 2^q 17^r$ with

$0 \le p \le 7, \qquad 0 \le q \le 8, \qquad 0 \le r \le 3$

$\text{total} = (7+1)(8+1)(3+1) = 8 \times 9 \times 4 = 288$

Step 2 — count the perfect-square factors. A divisor is a perfect square exactly when **every exponent is even**:

- $p \in \{0, 2, 4, 6\}$ — 4 choices
- $q \in \{0, 2, 4, 6, 8\}$ — 5 choices
- $r \in \{0, 2\}$ — 2 choices

$\text{squares} = 4 \times 5 \times 2 = 40$

Step 3 — divide.

$$P = \frac{40}{288} = \frac{5}{36}$$

Answer: (a) — $\frac{5}{36}$

Shortcut

Two parallel counts, then one fraction.

$$\text{all factors} = \prod (a_i + 1), \qquad \text{square factors} = \prod \left(\left\lfloor \frac{a_i}{2} \right\rfloor + 1 \right)$$

Here $8 \cdot 9 \cdot 4 = 288$ against $4 \cdot 5 \cdot 2 = 40$, giving $\frac{40}{288} = \frac{5}{36}$.

The even-exponent count is where errors creep in: for an exponent of 7 the even choices are $0, 2, 4, 6$ — that is $\lfloor 7/2 \rfloor + 1 = 4$, not 3. Counting 0 as an even exponent is essential, since $3^0 = 1$ is a perfectly good square factor.

A quick check on the answer's size: roughly one factor in seven should be a square here, and $\frac{5}{36} \approx 0.14$ sits right.

39 QA NUMBER SYSTEM DIVISIBILITY 4 /10

The number of four-digit integers which are greater than 1000 and divisible by both 2 and 3, but not by 5, is

(A) 1333 (B) 1666

(C) 1200 (D) 1500

ANSWER **(c)** 1200

SOLUTION

Step 1 — reduce the two conditions to one. Divisible by both 2 and 3 means divisible by $lcm\ (\ 2, 3\ )\ = 6$.

Step 2 — count multiples of 6 in range. The integers are four-digit and strictly greater than 1000, so they run from 1001 to 9999. The multiples of 6 in that range are $1002, 1008, \ldots, 9996$:

$$\frac{9996 - 1002}{6} + 1 = \frac{8994}{6} + 1 = 1499 + 1 = 1500$$

Step 3 — remove those also divisible by 5. A multiple of 6 that is also a multiple of 5 is a multiple of $lcm\ (\ 6, 5\ )\ = 30$. In range these are $1020, 1050, \ldots, 9990$:

$$\frac{9990 - 1020}{30} + 1 = \frac{8970}{30} + 1 = 299 + 1 = 300$$

Step 4 — subtract.

$1500 - 300 = 1200$

Answer: (c) — 1200

Shortcut

Combine, count, then subtract the overlap. "Divisible by 2 and 3" is "divisible by 6"; "also by 5" is "divisible by 30".

$$\underbrace{1500}_{\text{multiples of } 6} - \underbrace{300}_{\text{multiples of } 30} = \mathbf{1200}$$

A faster route worth knowing: among multiples of 6, exactly one in five is also a multiple of 5, so the survivors are $\frac{4}{5}$ of them — $\frac{4}{5} \times 1500 = 1200$ directly.

Option (d) 1500 is the trap for anyone who forgets the "not by 5" clause, and it is also the count you get if you misread the range. Note that "greater than 1000" and "four-digit" happen to agree here, so the boundary costs nothing.

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40 QA GEOMETRY AND MENSURATION HEIGHTS AND DISTANCES 5 /10

Ayesha is standing atop a vertical tower 200 m high and observes a car moving away from the tower on a straight, horizontal road from the foot of the tower. At 11:00 AM, she observes the angle of depression of the car to be 45°. At 11:02 AM, she observes the angle of depression of the car to be 30°. The speed at which the car is moving is approximately

(A) 6.3 km per hour (B) 8.45 km per hour

(C) 10.6 km per hour (D) **4.39 km per hour**

ANSWER **(d) 4.39 km per hour**

SOLUTION

Step 1 — set up. Let A be Ayesha's position atop the tower, B the foot of the tower, and C, D the car's positions at 11:00 and 11:02. The tower height is $AB = 200$ m.

Step 2 — use the 45° observation. The angle of depression equals the angle of elevation from the car, so in triangle ABC:

$$\tan 45^\circ = 1 = \frac{AB}{BC} \;\Rightarrow\; BC = 200 \text{ m}$$

Step 3 — use the 30° observation.

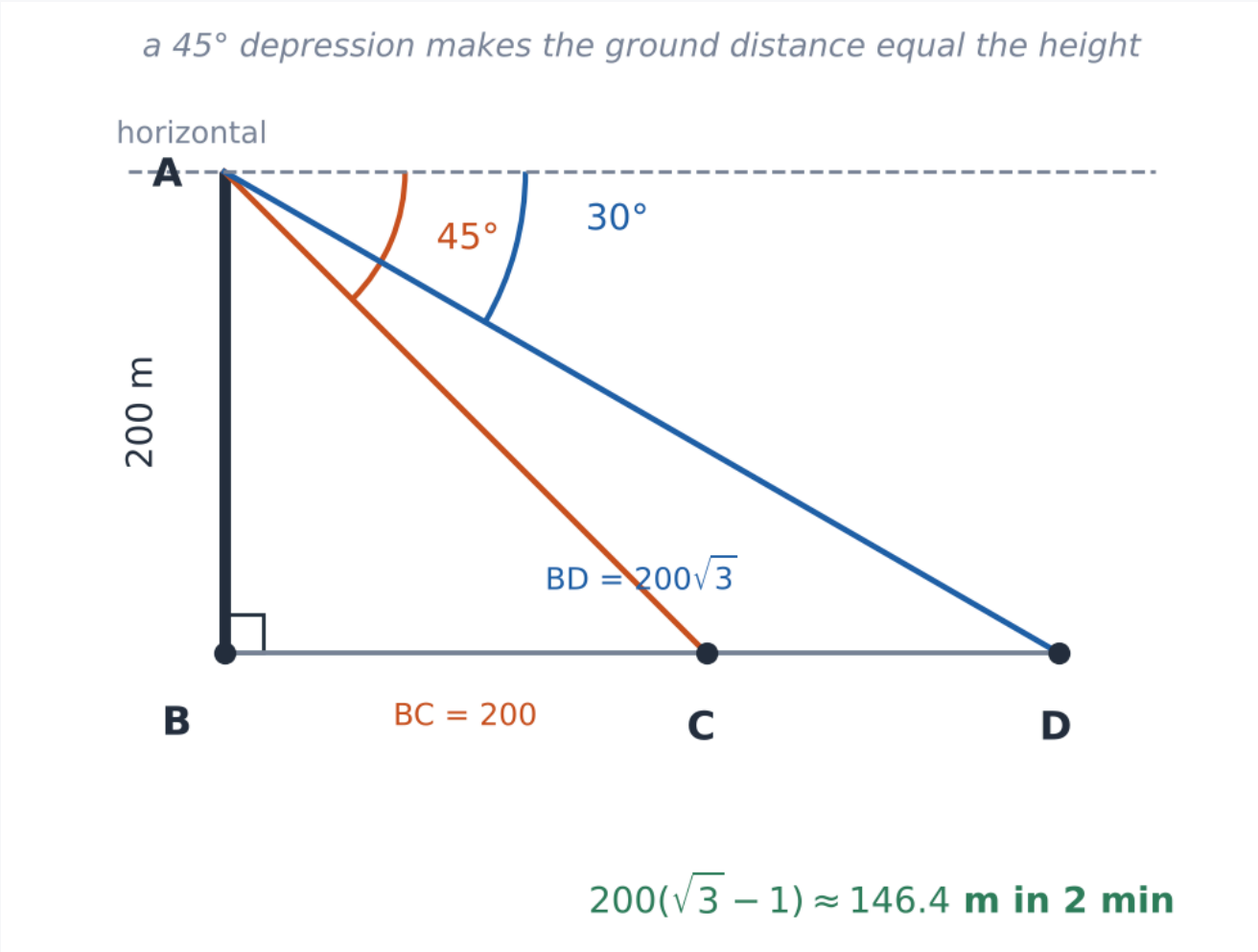
$$\tan 30^\circ = \frac{1}{\sqrt{3}} = \frac{AB}{BD} \;\Rightarrow\; BD = 200\sqrt{3} \text{ m}$$

Step 4 — find the distance travelled.

$$CD = BD - BC = 200\sqrt{3} - 200 = 200\left(\sqrt{3} - 1\right) \approx 200\,(0.732) = 146.4 \text{ m}$$

Step 5 — convert to speed. That distance was covered in 2 minutes:

$$v = \frac{0.1464 \text{ km}}{\frac{2}{60} \text{ h}} = 0.1464 \times 30 = 4.392 \text{ km/h}$$



Answer: (d) — approximately 4.39 km per hour

Shortcut

The 45° reading hands you the first distance free: a depression of 45° means the horizontal distance **equals** the tower height, 200 m. No trigonometry needed for that step.

Then the gap is $200\,(\sqrt{3} - 1) \approx 146.4$ m in 2 minutes, and multiplying by 30 converts m-per-2-minutes into km/h in one step:

$0.1464 \times 30 = 4.39$ km/h

Sanity-check the magnitude before computing precisely. Roughly 150 m in 2 minutes is about 4.5 km/h — a brisk walk. Only one option is anywhere near that, so the question can be answered on estimation alone.

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41 DILR LOGICAL REASONING ARRANGEMENT AND DISTRIBUTION ●●●●●●●○○ 7 /10

Number of days Bhabha and Cathy work together in a week is

(A) 0
(B) 1
(C) 3
(D) **2**

ANSWER **(d) 2**

SOLUTION

Build the roster once and all five questions are read off it.

Step 0 — check the arithmetic. Six days need two staff and Sunday needs three:

$6 \times 2 + 3 = 15 = 5 \text{ employees} \times 3 \text{ days each}$

Every slot is accounted for, so nobody has spare capacity — a useful rigidity.

Step 0a — how "consecutive" is meant. The showroom runs "on all seven days of the week **throughout the year**", so the week is a repeating cycle and **Sunday and Monday are consecutive days**. This matters: read as a flat Monday-to-Sunday list the puzzle has a *different* unique answer, and the published answers follow the cyclical reading. Treat the seven days as a circle.

Step 1 — place Alex. Alex works Tuesday and Wednesday (given), which is his consecutive pair. His third day must not be adjacent to either, so it cannot be Monday or Thursday. That leaves **Friday, Saturday or Sunday**.

Step 2 — place Cathy. Cathy works neither Saturday nor Monday, and never alongside Alex — so she avoids Tuesday and Wednesday too. That leaves only

$\text{Thursday, Friday, Sunday}$

which is exactly three days, so Cathy takes all of them. Check the pattern: Thursday–Friday are consecutive, and Sunday is adjacent to Saturday and Monday — neither of which she works ✔

Step 3 — Alex's third day. Alex cannot share a day with Cathy, who now holds Friday and Sunday. So Alex's third day is **Saturday**:

$\text{Alex} = \{\text{Tue, Wed, Sat}\}$

Step 4 — Dilip's third day. Dilip works Tuesday and Wednesday with Alex, and his third day must *differ* from Alex's, so it is not Saturday. It also cannot be Monday or Thursday (adjacent to his pair). That leaves Friday or Sunday.

Step 5 — count Monday. Monday needs two staff. Alex, Cathy and Dilip are all unavailable on Monday, so Monday must be **Bhabha and Ethan**.

Step 6 — finish Bhabha and Ethan. Bhabha never works with Alex, so he avoids Tuesday, Wednesday and Saturday. With Monday fixed, his remaining options are Thursday, Friday and Sunday. His pattern needs exactly one consecutive pair including Monday's neighbour Sunday — so Bhabha takes **Sunday** (adjacent to Monday) plus one isolated day, which must be **Thursday** (Friday would sit next to Saturday? no — Friday is adjacent to Thursday and Saturday, neither held, but Friday and Sunday are not adjacent, so both remain possible at this stage; the day counts settle it below).

Ethan must cover Saturday's second slot (Alex is the only other Saturday worker) and so takes **Friday–Saturday** as his consecutive pair, with **Monday** isolated.

Step 7 — balance the days. Working through the remaining counts:

Day	Required	Workers
Monday	2	Bhabha, Ethan
Tuesday	2	Alex, Dilip
Wednesday	2	Alex, Dilip
Thursday	2	Bhabha, Cathy
Friday	2	Cathy, Ethan
Saturday	2	Alex, Ethan
Sunday	**3**	**Bhabha, Cathy, Dilip**

The completed roster.

Employee	Days	Consecutive pair	Isolated day
Alex	Tue, Wed, Sat	Tue–Wed	Sat
Bhabha	Mon, Thu, Sun	Sun–Mon	Thu
Cathy	Thu, Fri, Sun	Thu–Fri	Sun
Dilip	Tue, Wed, Sun	Tue–Wed	Sun
Ethan	Mon, Fri, Sat	Fri–Sat	Mon

Every condition checks out: each employee works three days with exactly one consecutive pair ✔; every day has the right headcount ✔; Alex and Dilip share Tuesday and Wednesday with different third days (Sat vs Sun) ✔; neither Bhabha nor Cathy ever shares a day with Alex ✔; Cathy avoids Saturday and Monday ✔

An exhaustive search over all valid patterns confirms this roster is the **only** one consistent with the constraints.

Reading off Bhabha and Cathy.

$$\text{Bhabha} = \{\text{Mon, Thu, Sun}\}, \qquad \text{Cathy} = \{\text{Thu, Fri, Sun}\}$$

They overlap on **Thursday** and **Sunday** — two days.

Answer: (d) — 2

Shortcut

Do this question last, not first. It asks for an overlap, which needs the full roster; the other four questions each turn on a single deduction.

Once the grid is built, the count is immediate: Bhabha and Cathy share **Thursday and Sunday**.

A partial shortcut if you are short of time: Cathy's three days are forced early (Thu, Fri, Sun — she is barred from Sat, Mon, and from Alex's Tue and Wed), and Sunday needs three people. Since Alex is never with Cathy and Ethan ends up on Saturday, Bhabha is almost certainly on Sunday with her — pointing to at least one shared day, which already eliminates option (a).

Refers to the LR set above.

42 DILR LOGICAL REASONING ARRANGEMENT AND DISTRIBUTION 7 /10

Which among the following employees do not work together on any of the days?

(A) Bhabha and Dilip
(B) Bhabha and Ethan
(C) Cathy and Dilip
(D) **Dilip and Ethan**

ANSWER **(d) Dilip and Ethan**

SOLUTION

Build the roster once and all five questions are read off it.

Step 0 — check the arithmetic. Six days need two staff and Sunday needs three:

$$6 \times 2 + 3 = 15 = 5 \text{ employees} \times 3 \text{ days each}$$

Every slot is accounted for, so nobody has spare capacity — a useful rigidity.

Step 0a — how "consecutive" is meant. The showroom runs "on all seven days of the week **throughout the year**", so the week is a repeating cycle and **Sunday and Monday are consecutive days**. This matters: read as a flat Monday-to-Sunday list the puzzle has a *different* unique answer, and the published answers follow the cyclical reading. Treat the seven days as a circle.

Step 1 — place Alex. Alex works Tuesday and Wednesday (given), which is his consecutive pair. His third day must not be adjacent to either, so it cannot be Monday or Thursday. That leaves **Friday, Saturday or Sunday**.

Step 2 — place Cathy. Cathy works neither Saturday nor Monday, and never alongside Alex — so she avoids Tuesday and Wednesday too. That leaves only

$$\text{Thursday, Friday, Sunday}$$

which is exactly three days, so Cathy takes all of them. Check the pattern: Thursday–Friday are consecutive, and Sunday is adjacent to Saturday and Monday — neither of which she works ✔

Step 3 — Alex's third day. Alex cannot share a day with Cathy, who now holds Friday and Sunday. So Alex's third day is **Saturday**:

$$\text{Alex} = \{\text{Tue, Wed, Sat}\}$$

Step 4 — Dilip's third day. Dilip works Tuesday and Wednesday with Alex, and his third day must *differ* from Alex's, so it is not Saturday. It also cannot be Monday or Thursday (adjacent to his pair). That leaves Friday or Sunday.

Step 5 — count Monday. Monday needs two staff. Alex, Cathy and Dilip are all unavailable on Monday, so Monday must be **Bhabha and Ethan**.

Step 6 — finish Bhabha and Ethan. Bhabha never works with Alex, so he avoids Tuesday, Wednesday and Saturday. With Monday fixed, his remaining options are Thursday, Friday and Sunday. His pattern needs exactly one consecutive pair including Monday's neighbour Sunday — so Bhabha takes **Sunday** (adjacent to Monday) plus one isolated day, which must be **Thursday** (Friday would sit next to Saturday? no — Friday is adjacent to Thursday and Saturday, neither held, but Friday and Sunday are not adjacent, so both remain possible at this stage; the day counts settle it below).

Ethan must cover Saturday's second slot (Alex is the only other Saturday worker) and so takes **Friday–Saturday** as his consecutive pair, with **Monday** isolated.

Step 7 — balance the days. Working through the remaining counts:

Day	Required	Workers
Monday	2	Bhabha, Ethan
Tuesday	2	Alex, Dilip
Wednesday	2	Alex, Dilip
Thursday	2	Bhabha, Cathy
Friday	2	Cathy, Ethan
Saturday	2	Alex, Ethan
Sunday	**3**	**Bhabha, Cathy, Dilip**

The completed roster.

Employee	Days	Consecutive pair	Isolated day
Alex	Tue, Wed, Sat	Tue–Wed	Sat
Bhabha	Mon, Thu, Sun	Sun–Mon	Thu
Cathy	Thu, Fri, Sun	Thu–Fri	Sun
Dilip	Tue, Wed, Sun	Tue–Wed	Sun
Ethan	Mon, Fri, Sat	Fri–Sat	Mon

Every condition checks out: each employee works three days with exactly one consecutive pair ✔; every day has the right headcount ✔; Alex and Dilip share Tuesday and Wednesday with different third days (Sat vs Sun) ✔; neither Bhabha nor Cathy ever shares a day with Alex ✔; Cathy avoids Saturday and Monday ✔

An exhaustive search over all valid patterns confirms this roster is the **only** one consistent with the constraints.

Check each pair against the roster.

Pair	Days in common
Bhabha {Mon, Thu, Sun} & Dilip {Tue, Wed, Sun}	**Sunday**
Bhabha {Mon, Thu, Sun} & Ethan {Mon, Fri, Sat}	**Monday**
Cathy {Thu, Fri, Sun} & Dilip {Tue, Wed, Sun}	**Sunday**
Dilip {Tue, Wed, Sun} & Ethan {Mon, Fri, Sat}	**none**

Dilip and Ethan never overlap.

(For completeness, the full list of non-overlapping pairs is Alex–Bhabha, Alex–Cathy and Dilip–Ethan; only the last appears among the options.)

Answer: (d) — Dilip and Ethan

Shortcut

Sunday eliminates two options at once. Three people work Sunday — Bhabha, Cathy and Dilip — so any pair drawn from those three *does* work together. That removes “Bhabha and Dilip” (a) and “Cathy and Dilip” (c) immediately.

Between the survivors, Bhabha and Ethan both cover **Monday**, which leaves **Dilip and Ethan**.

The general tactic: find the busiest day and use it as an eliminator. In any scheduling set the day with the largest headcount rules out the most pairings for the least work.

Refers to the LR set above.

📖 Reading comprehension improves with daily practice, not last-minute revision. Start Daily Reads

43 DILR LOGICAL REASONING ARRANGEMENT AND DISTRIBUTION ●●●●●●●○○ 7 /10

One of the days Alex works on is

(A) Monday
(B) Friday
(C) Sunday
(D) **Saturday**

ANSWER **(d) Saturday**

SOLUTION

Build the roster once and all five questions are read off it.

Step 0 — check the arithmetic. Six days need two staff and Sunday needs three:

$$6 \times 2 + 3 = 15 = 5 \text{ employees} \times 3 \text{ days each}$$

Every slot is accounted for, so nobody has spare capacity — a useful rigidity.

Step 0a — how "consecutive" is meant. The showroom runs "on all seven days of the week **throughout the year**", so the week is a repeating cycle and **Sunday and Monday are consecutive days**. This matters: read as a flat Monday-to-Sunday list the puzzle has a *different* unique answer, and the published answers follow the cyclical reading. Treat the seven days as a circle.

Step 1 — place Alex. Alex works Tuesday and Wednesday (given), which is his consecutive pair. His third day must not be adjacent to either, so it cannot be Monday or Thursday. That leaves **Friday, Saturday or Sunday**.

Step 2 — place Cathy. Cathy works neither Saturday nor Monday, and never alongside Alex — so she avoids Tuesday and Wednesday too. That leaves only

$$\text{Thursday, Friday, Sunday}$$

which is exactly three days, so Cathy takes all of them. Check the pattern: Thursday–Friday are consecutive, and Sunday is adjacent to Saturday and Monday — neither of which she works ✔

Step 3 — Alex's third day. Alex cannot share a day with Cathy, who now holds Friday and Sunday. So Alex's third day is **Saturday**:

$$\text{Alex} = \{\text{Tue, Wed, Sat}\}$$

Step 4 — Dilip's third day. Dilip works Tuesday and Wednesday with Alex, and his third day must *differ* from Alex's, so it is not Saturday. It also cannot be Monday or Thursday (adjacent to his pair). That leaves Friday or Sunday.

Step 5 — count Monday. Monday needs two staff. Alex, Cathy and Dilip are all unavailable on Monday, so Monday must be **Bhabha and Ethan**.

Step 6 — finish Bhabha and Ethan. Bhabha never works with Alex, so he avoids Tuesday, Wednesday and Saturday. With Monday fixed, his remaining options are Thursday, Friday and Sunday. His pattern needs exactly one consecutive pair including Monday's neighbour Sunday — so Bhabha takes **Sunday** (adjacent to Monday) plus one isolated day, which must be **Thursday** (Friday would sit next to Saturday? no — Friday is adjacent to Thursday and Saturday, neither held, but Friday and Sunday are not adjacent, so both remain possible at this stage; the day counts settle it below).

Ethan must cover Saturday's second slot (Alex is the only other Saturday worker) and so takes **Friday–Saturday** as his consecutive pair, with **Monday** isolated.

Step 7 — balance the days. Working through the remaining counts:

Day	Required	Workers
Monday	2	Bhabha, Ethan
Tuesday	2	Alex, Dilip
Wednesday	2	Alex, Dilip
Thursday	2	Bhabha, Cathy
Friday	2	Cathy, Ethan
Saturday	2	Alex, Ethan
Sunday	**3**	**Bhabha, Cathy, Dilip**

The completed roster.

Employee	Days	Consecutive pair	Isolated day
Alex	Tue, Wed, Sat	Tue–Wed	Sat
Bhabha	Mon, Thu, Sun	Sun–Mon	Thu
Cathy	Thu, Fri, Sun	Thu–Fri	Sun
Dilip	Tue, Wed, Sun	Tue–Wed	Sun
Ethan	Mon, Fri, Sat	Fri–Sat	Mon

Every condition checks out: each employee works three days with exactly one consecutive pair ✔; every day has the right headcount ✔; Alex and Dilip share Tuesday and Wednesday with different third days (Sat vs Sun) ✔; neither Bhabha nor Cathy ever shares a day with Alex ✔; Cathy avoids Saturday and Monday ✔

An exhaustive search over all valid patterns confirms this roster is the **only** one consistent with the constraints.

Reading off Alex.

$$\text{Alex} = \{\text{Tue}, \text{Wed}, \text{Sat}\}$$

Of the four options, only **Saturday** appears.

The direct argument, without the full grid. Alex works Tuesday and Wednesday, so his third day cannot be Monday or Thursday (both adjacent to that pair). That leaves Friday, Saturday or Sunday. Now:

- Cathy is barred from Saturday and Monday, and cannot work with Alex, so her three days must be **Thursday, Friday and Sunday**.
- Alex cannot share a day with Cathy, which rules out Friday and Sunday.

Therefore Alex's third day is **Saturday**.

Answer: (d) — Saturday

Shortcut

Two of the options die on the adjacency rule alone. Alex's consecutive pair is Tuesday–Wednesday, so his third day must be isolated — Monday (a) and Thursday are both adjacent and impossible. That removes option (a) at once.

Then pin Cathy: barred from Saturday, Monday, and from Alex's Tuesday and Wednesday, she has **exactly three** days left (Thu, Fri, Sun) and must take all of them. Since Alex never works with Cathy, Friday (b) and Sunday (c) are gone.

Saturday by elimination — and this is the question to solve *first* in the set, because forcing Cathy's row is the key that unlocks everything else.

Refers to the LR set above.

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44 DILR LOGICAL REASONING ARRANGEMENT AND DISTRIBUTION ●●●●●●●○○ 7 /10

The consecutive days on which Ethan works are

(A) Thursday and Friday
(B) Saturday and Sunday
(C) **Friday and Saturday**
(D) Sunday and Monday

ANSWER **(c) Friday and Saturday**

SOLUTION

Build the roster once and all five questions are read off it.

Step 0 — check the arithmetic. Six days need two staff and Sunday needs three:

$$6 \times 2 + 3 = 15 = 5 \text{ employees} \times 3 \text{ days each}$$

Every slot is accounted for, so nobody has spare capacity — a useful rigidity.

Step 0a — how "consecutive" is meant. The showroom runs "on all seven days of the week **throughout the year**", so the week is a repeating cycle and **Sunday and Monday are consecutive days**. This matters: read as a flat Monday-to-Sunday list the puzzle has a *different* unique answer, and the published answers follow the cyclical reading. Treat the seven days as a circle.

Step 1 — place Alex. Alex works Tuesday and Wednesday (given), which is his consecutive pair. His third day must not be adjacent to either, so it cannot be Monday or Thursday. That leaves **Friday, Saturday or Sunday**.

Step 2 — place Cathy. Cathy works neither Saturday nor Monday, and never alongside Alex — so she avoids Tuesday and Wednesday too. That leaves only

$$\text{Thursday, Friday, Sunday}$$

which is exactly three days, so Cathy takes all of them. Check the pattern: Thursday–Friday are consecutive, and Sunday is adjacent to Saturday and Monday — neither of which she works ✔

Step 3 — Alex's third day. Alex cannot share a day with Cathy, who now holds Friday and Sunday. So Alex's third day is **Saturday**:

$$\text{Alex} = \{\text{Tue, Wed, Sat}\}$$

Step 4 — Dilip's third day. Dilip works Tuesday and Wednesday with Alex, and his third day must *differ* from Alex's, so it is not Saturday. It also cannot be Monday or Thursday (adjacent to his pair). That leaves Friday or Sunday.

Step 5 — count Monday. Monday needs two staff. Alex, Cathy and Dilip are all unavailable on Monday, so Monday must be **Bhabha and Ethan**.

Step 6 — finish Bhabha and Ethan. Bhabha never works with Alex, so he avoids Tuesday, Wednesday and Saturday. With Monday fixed, his remaining options are Thursday, Friday and Sunday. His pattern needs exactly one consecutive pair including Monday's neighbour Sunday — so Bhabha takes **Sunday** (adjacent to Monday) plus one isolated day, which must be **Thursday** (Friday would sit next to Saturday? no — Friday is adjacent to Thursday and Saturday, neither held, but Friday and Sunday are not adjacent, so both remain possible at this stage; the day counts settle it below).

Ethan must cover Saturday's second slot (Alex is the only other Saturday worker) and so takes **Friday–Saturday** as his consecutive pair, with **Monday** isolated.

Step 7 — balance the days. Working through the remaining counts:

Day	Required	Workers
Monday	2	Bhabha, Ethan
Tuesday	2	Alex, Dilip
Wednesday	2	Alex, Dilip
Thursday	2	Bhabha, Cathy
Friday	2	Cathy, Ethan
Saturday	2	Alex, Ethan
Sunday	**3**	**Bhabha, Cathy, Dilip**

The completed roster.

Employee	Days	Consecutive pair	Isolated day
Alex	Tue, Wed, Sat	Tue–Wed	Sat
Bhabha	Mon, Thu, Sun	Sun–Mon	Thu
Cathy	Thu, Fri, Sun	Thu–Fri	Sun
Dilip	Tue, Wed, Sun	Tue–Wed	Sun
Ethan	Mon, Fri, Sat	Fri–Sat	Mon

Every condition checks out: each employee works three days with exactly one consecutive pair ✔; every day has the right headcount ✔; Alex and Dilip share Tuesday and Wednesday with different third days (Sat vs Sun) ✔; neither Bhabha nor Cathy ever shares a day with Alex ✔; Cathy avoids Saturday and Monday ✔

An exhaustive search over all valid patterns confirms this roster is the **only** one consistent with the constraints.

Reading off Ethan.

$$\text{Ethan} = \{\text{Mon},\ \text{Fri},\ \text{Sat}\}$$

His consecutive pair is **Friday and Saturday**, with Monday as the isolated day.

Why it is forced. Saturday needs two workers. Alex is one of them, and Alex never works with Bhabha or Cathy — and Cathy is explicitly barred from Saturday anyway. Dilip's third day differs from Alex's, so Dilip is not on Saturday. That leaves only **Ethan** for Saturday's second slot.

Ethan's consecutive pair must therefore include Saturday, so it is Friday–Saturday or Saturday–Sunday. Sunday already has its three workers (Bhabha, Cathy, Dilip), so the pair is **Friday–Saturday**.

Why the others fail:

- **(a) Thursday and Friday** — Thursday is taken by Bhabha and Cathy, filling it.
- **(b) Saturday and Sunday** — Sunday's three slots are already filled.
- **(d) Sunday and Monday** — same problem with Sunday, and it would leave Saturday a worker short.

Answer: (c) — Friday and Saturday

Shortcut

Saturday is the bottleneck. Alex holds one of its two slots, and Bhabha, Cathy and Dilip are each excluded from the other — so **Ethan must work Saturday**.

That single deduction cuts the options to (b) and (c). Sunday is already full with three names, so Ethan's pair must be **Friday–Saturday**.

In scheduling sets, always look for the day with the fewest eligible people. Here Saturday has only one candidate left after the exclusions, which forces Ethan's whole row in one step.

Refers to the LR set above.

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45 DILR LOGICAL REASONING ARRANGEMENT AND DISTRIBUTION ●●●●●●●○○ 7 /10

Employees who work on Sunday are

(A) **Bhabha, Cathy and Dilip**
(B) Bhabha, Cathy and Ethan
(C) Alex, Dilip and Ethan
(D) Cathy, Dilip and Ethan

ANSWER **(a) Bhabha, Cathy and Dilip**

SOLUTION

Build the roster once and all five questions are read off it.

Step 0 — check the arithmetic. Six days need two staff and Sunday needs three:

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Every slot is accounted for, so nobody has spare capacity — a useful rigidity.

Step 0a — how "consecutive" is meant. The showroom runs "on all seven days of the week **throughout the year**", so the week is a repeating cycle and **Sunday and Monday are consecutive days**. This matters: read as a flat Monday-to-Sunday list the puzzle has a *different* unique answer, and the published answers follow the cyclical reading. Treat the seven days as a circle.

Step 1 — place Alex. Alex works Tuesday and Wednesday (given), which is his consecutive pair. His third day must not be adjacent to either, so it cannot be Monday or Thursday. That leaves **Friday, Saturday or Sunday**.

Step 2 — place Cathy. Cathy works neither Saturday nor Monday, and never alongside Alex — so she avoids Tuesday and Wednesday too. That leaves only

Thursday, Friday, Sunday

which is exactly three days, so Cathy takes all of them. Check the pattern: Thursday–Friday are consecutive, and Sunday is adjacent to Saturday and Monday — neither of which she works ✔

Step 3 — Alex's third day. Alex cannot share a day with Cathy, who now holds Friday and Sunday. So Alex's third day is **Saturday**:

$$\text{Alex} = \{\text{Tue, Wed, Sat}\}$$

Step 4 — Dilip's third day. Dilip works Tuesday and Wednesday with Alex, and his third day must *differ* from Alex's, so it is not Saturday. It also cannot be Monday or Thursday (adjacent to his pair). That leaves Friday or Sunday.

Step 5 — count Monday. Monday needs two staff. Alex, Cathy and Dilip are all unavailable on Monday, so Monday must be **Bhabha and Ethan**.

Step 6 — finish Bhabha and Ethan. Bhabha never works with Alex, so he avoids Tuesday, Wednesday and Saturday. With Monday fixed, his remaining options are Thursday, Friday and Sunday. His pattern needs exactly one consecutive pair including Monday's neighbour Sunday — so Bhabha takes **Sunday** (adjacent to Monday) plus one isolated day, which must be **Thursday** (Friday would sit next to Saturday? no — Friday is adjacent to Thursday and Saturday, neither held, but Friday and Sunday are not adjacent, so both remain possible at this stage; the day counts settle it below).

Ethan must cover Saturday's second slot (Alex is the only other Saturday worker) and so takes **Friday–Saturday** as his consecutive pair, with **Monday** isolated.

Step 7 — balance the days. Working through the remaining counts:

Day	Required	Workers
Monday	2	Bhabha, Ethan
Tuesday	2	Alex, Dilip
Wednesday	2	Alex, Dilip
Thursday	2	Bhabha, Cathy
Friday	2	Cathy, Ethan
Saturday	2	Alex, Ethan
Sunday	**3**	**Bhabha, Cathy, Dilip**

The completed roster.

Employee	Days	Consecutive pair	Isolated day
Alex	Tue, Wed, Sat	Tue–Wed	Sat
Bhabha	Mon, Thu, Sun	Sun–Mon	Thu
Cathy	Thu, Fri, Sun	Thu–Fri	Sun
Dilip	Tue, Wed, Sun	Tue–Wed	Sun
Ethan	Mon, Fri, Sat	Fri–Sat	Mon

Every condition checks out: each employee works three days with exactly one consecutive pair ✔; every day has the right headcount ✔; Alex and Dilip share Tuesday and Wednesday with different third days (Sat vs Sun) ✔; neither Bhabha nor Cathy ever shares a day with Alex ✔; Cathy avoids Saturday and Monday ✔

An exhaustive search over all valid patterns confirms this roster is the **only** one consistent with the constraints.

Reading off Sunday. Sunday is the only three-person day, and the roster gives

$$\text{Sunday} = \{\text{Bhabha, Cathy, Dilip}\}$$

The direct argument.

- **Alex is out:** his days are Tuesday, Wednesday and Saturday.
- **Cathy is in:** her forced trio is Thursday, Friday and Sunday.
- **Ethan is out:** he must take Saturday (the only remaining candidate there), and his consecutive pair is Friday–Saturday with Monday isolated — no Sunday.
- That leaves **Bhabha and Dilip** to join Cathy, and both fit: Dilip's third day is Sunday (it differs from Alex's Saturday and is non-adjacent to Tue–Wed), and Bhabha's Sunday pairs with Monday around the week.

Answer: (a) — Bhabha, Cathy and Dilip

Shortcut

Alex settles it in one step. His three days are Tuesday, Wednesday and Saturday, so he is not on Sunday — which removes option (c).

Cathy is forced onto Sunday (her only possible trio is Thu, Fri, Sun), so any option omitting her is wrong — but all three survivors contain her. The discriminator is **Ethan versus Dilip**, and Ethan is pinned to Saturday, making Friday–Saturday his pair.

Hence Bhabha, Cathy and Dilip.

Note how the five questions interlock: Q43 forces Cathy's row, Q44 forces Ethan's, and together they determine Sunday. **Solve a scheduling set in the order the constraints bite, not the order the questions are printed.**

COMMON DATA SET

Showroom staffing – five employees across seven days

A showroom is open on all seven days of the week throughout the year. There are five employees Alex, Bhabha, Cathy, Dilip and Ethan who work in the showroom. Every day except Sunday, two employees are required while on Sunday three employees need to work. Every employee works for three days in a week. Some additional information is also provided:

- Every employee works on two consecutive days while the third day is not consecutive.
- Alex and Dilip work together on Tuesday and Wednesday while the other working day differs for them.
- Neither Bhabha nor Cathy works with Alex on any day.
- Cathy does not work either on Saturday or on Monday.

FIX THE WEAK AREA

One weak topic at a time

Algebra alone carries the largest share of the quant in this paper. Instead of re-attempting whole mocks, pick a single topic, take a short timed test on it, and watch the accuracy move.

Topic-wise tests →

All IPMAT practice

SECTION 3

VARC

Verbal Ability and Reading Comprehension

45	180	40 min	+4 / −1 / 0
QUESTIONS	MARKS	SECTIONAL LIMIT	MARKING

MCQ (+ 5 TITA para jumbles)

MOST ASKED HERE Verbal Ability **33** | Reading Comprehension - Question Types **12**

46 VARC | READING COMPREHENSION - QUESTION TYPES | RC MAIN IDEA QUESTIONS ●●●●●●○○○○ 6 /10

The main point the writer makes is that fruit-bearing plants

(A) of all kinds need to be studied, not just those consumed by humans.

(B) and other plant species' propagation cannot be studied accurately.

(C) are better protected than other plant species and can propagate easily.

(D) **have the same problems in propagation as other plants.**

ANSWER **(d) have the same problems in propagation as other plants.**

SOLUTION

Where the passage says it. Paragraph 2 states the governing idea:

"Fruits, they observe, exist to solve a problem faced by **all plants** — how best to spread their progeny around."

So fruit-bearing plants face the same propagation problem as every other plant; fruit is simply their particular solution to it. That is option (d).

Why the others fail:

- **(a)** True as a *recommendation*, but it is the passage's closing suggestion for future work ("The next step... should be the analysis of wild fruits"), not its main point. A final recommendation is not the thesis.
- **(b)** Over-negative. The passage reports a study that *did* produce "a suggestively strong correlation"; it notes a limitation, it does not declare the subject unstudiable.
- **(c)** Unsupported. Nothing claims fruit-bearing plants are better protected or propagate more easily — only that they recruit animals to do the distributing.

Answer: (d)

Shortcut

Look for the sentence containing a universal quantifier. "A problem faced by **all plants**" is the writer framing fruit within a general botanical challenge — and only option (d) echoes that universality.

Option (a) is the designed trap, because it restates the passage's genuine final sentence. **A recommendation for further research is almost never the main point**; it is what the passage arrives at *after* making its point. Ask instead what the passage spends its middle paragraphs establishing.

Refers to the RC set above.

47

VARC | READING COMPREHENSION - QUESTION TYPES | RC DETAIL AND FACT BASED QUESTIONS

6 /10

The study has been based on

(A) **fruits that are consumed by humans.**

(B) fruits available at the University of Tokyo.

(C) wild fruits consumed by animals.

(D) fruits sourced by greengrocers.

ANSWER **(a) fruits that are consumed by humans.**

SOLUTION

Where the passage says it. The final paragraph states the study's limitation outright:

"The main limitation of their work is that they **looked at fruits eaten by people**."

Why the others fail:

- **(b)** The University of Tokyo is where the two biologists work, not where the fruit came from. The passage never describes a local collection.
- **(c)** The exact opposite. Wild fruits are what the passage says should be studied **next** — "The next step, therefore, should be the analysis of wild fruits." They were *not* the basis of this study.
- **(d)** Greengrocers appear in paragraph 1 only to explain why climacterism matters commercially. They are not the source of the sample.

Answer: (a)

Shortcut

Options (a) and (c) are a direct opposition pair — fruits eaten by people versus wild fruits — and in a detail question one of a contradictory pair is usually the answer. Locate the single sentence that settles it: "looked at fruits eaten by people."

The trap in (c) is tense. Wild fruits belong to the passage's *future* ("the next step should be"), not its method. **Whenever an option paraphrases a recommendation, check whether the passage puts it in the past or the future.**

Refers to the RC set above.

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48 VARC READING COMPREHENSION - QUESTION TYPES

RC VOCABULARY IN CONTEXT QUESTIONS

6 /10

Which one of the following options means "arboreal" and "camouflage"?

(A) **tree-dwelling and disguised**

(B) ground-dwelling and hidden

(C) protected and fortified

(D) covered and variegated

ANSWER **(a) tree-dwelling and disguised**

SOLUTION

Both words can be worked out from the passage itself, without a dictionary.

"Arboreal". Paragraph 2 contrasts two kinds of distributor:

"If **ground-dwelling** animals are the main distributors... If, by contrast, those distributors are **arboreal or aerial**, and so can **feed on unfallen fruit**..."

The contrast with *ground-dwelling*, plus the ability to reach fruit still on the plant, gives **tree-dwelling**. (The Latin root *arbor* = tree.)

"Camouflage". Paragraph 4:

"non-climacteric fruits tend to have **vivid colours**... This may help them to **stand out** amid the foliage... Climacteric fruits are generally better **camouflaged**. That makes them **harder to spot**."

Camouflaged is the opposite of standing out — i.e. **disguised**.

Why the others fail:

- **(b)** "Ground-dwelling" is precisely what *arboreal* contrasts with — a reversal.
- **(c)** "Protected and fortified" imports a defensive idea the passage never raises; camouflage here is about visibility, not protection.
- **(d)** "Covered" is close but weaker than disguised, and *variegated* means multi-coloured — the opposite of blending in.

Answer: (a)

Shortcut

Vocabulary-in-context questions are answered from the contrast, not from memory. The passage sets *arboreal* directly against *ground-dwelling*, so option (b) — which offers "ground-dwelling" as the meaning — is a guaranteed reversal and can go first.

Then *camouflaged* is explained in the very next sentence: "harder to spot". Match that to **disguised**.

Note that (d) contains a self-contradiction: *variegated* means showing several colours, which is what the passage attributes to the **non**-camouflaged fruits. An option whose two halves pull in opposite directions is rarely correct.

Refers to the RC set above.

49 VARC READING COMPREHENSION - QUESTION TYPES

RC DETAIL AND FACT BASED QUESTIONS

6 /10

The origins of the distinguishing characteristics between the two types of fruits, climacteric and non-climacteric are

(A) **nebulous in spite of research.**

(B) clear now as a result of this research.

(C) trivial at this stage.

(D) dependent on researcher observation.

ANSWER **(a) nebulous in spite of research.**

SOLUTION

Step 1 — find the statement about origins. Paragraph 1 closes:

"But how those differences **originally came about remains unclear**."

Nebulous means vague or unclear — a direct match.

Step 2 — check that the research does not settle it. The study produces only "a **suggestively** strong correlation", the hypothesis is "fortified by other evidence" rather than proved, and the final paragraph concedes the sample is "probably **contaminated**". The passage is careful never to claim the question is closed.

Why the others fail:

- **(b)** "Clear now" overstates every hedge in the passage. A correlation on a contaminated sample is not a settled origin.
- **(c)** "Trivial" contradicts paragraph 1, which says the difference "**matters** to fruit growers and greengrocers."
- **(d)** Shifts the issue to researcher subjectivity, which the passage never raises. Its stated limitation is the *sample*, not the observers.

Answer: (a)

Shortcut

The phrase "remains unclear" sits in the first paragraph and is never retracted. Scan for a synonym among the options — *nebulous* — and you are done.

Weigh the hedges before choosing (b). The passage uses *propose*, *suggestively*, *may help*, *probably contaminated* — a chain of qualifications. **A passage that hedges this heavily never supports an option containing "clear now".**

And note the concession in the stem: "in spite of research" tells you the answer must acknowledge that research happened *and* that the matter is still open — which only (a) does.

Refers to the RC set above.

50 VARC READING COMPREHENSION - QUESTION TYPES RC INFERENCE QUESTIONS 6 /10

According to the passage, the interest in the difference between climacteric and non-climacteric fruits is in the

(A) commercial context.
(B) environmental context.
(C) gastronomical context.
(D) public health context.

ANSWER (a) commercial context.

SOLUTION

Where the passage says it. Paragraph 1 names exactly who cares and why:

"The difference... matters to **fruit growers and greengrocers**, who must make sure their **wares** are in **tip-top condition** when they arrive at the **marketplace**."

Growers, greengrocers, wares, marketplace — four commercial markers in a single sentence.

Why the others fail:

- **(b) Environmental** — the passage discusses seed dispersal as *biology*, not as an environmental concern, and no ecological stake is raised.
- **(c) Gastronomical** — the "tasty meal" in paragraph 2 is bait for **animals**, part of the dispersal mechanism, not a comment on human cuisine.
- **(d) Public health** — nothing in the passage touches health at all.

Answer: (a)

Shortcut

Ask who the passage says is interested, not what the passage is about. The question is about *the interest*, and paragraph 1 answers it directly: growers and greengrocers getting goods to market.

That vocabulary — *wares*, *marketplace* — is unambiguously commercial, so option (a) is secure without weighing the others.

Option (c) is the near-miss worth noticing: the passage really does mention a "tasty meal", but for animals and as part of the plant's strategy. **Check whose experience a detail describes before letting it drive your answer.**

Refers to the RC set above.

51 VARC READING COMPREHENSION - QUESTION TYPES

RC STRUCTURE AND ORGANISATION QUESTIONS

6 /10

Consider the following two Findings:

i. Non-climacteric fruits tend to have vivid colours.

ii. Thirty-six varieties of climacteric and non-climacteric fruits were eaten predominantly either by ground-dwellers, or by arboreal or aerial animals respectively.

According to the passage,

(A) Finding (i) provides main evidence and Finding (ii) provides supplementary evidence confirming the hypothesis of the biologists.

(B) Both Findings (i) and (ii) provide supplementary evidence confirming the hypothesis of the biologists.

(C) Both Findings (i) and (ii) provide main evidence confirming the hypothesis of the biologists.

(D) Finding (i) provides supplementary evidence and Finding (ii) provides main evidence confirming the hypothesis of the biologists.

ANSWER **(d) Finding (i) provides supplementary evidence and Finding (ii) provides main evidence confirming the hypothesis of the biologists.**

SOLUTION

Step 1 — identify each Finding in the passage.

Finding (ii) is the study itself, in paragraph 3:

"15 of the 19 varieties eaten principally by ground-dwellers were climacteric, while 21 of the 26 fed on by arboreal or aerial animals were non-climacteric."

Note $15 + 21 = 36$ — exactly the "thirty-six varieties" the Finding describes. This is the **test the researchers designed**, and paragraph 4 opens by calling it "a suggestively strong correlation."

Finding (i) is the colour observation, in paragraph 4:

"And the authors' hypothesis is **fortified by other evidence**. They point out that non-climacteric fruits tend to have vivid colours..."

Step 2 — read the passage's own labelling. The phrase "**fortified by other evidence**" explicitly marks the colour point as *additional* support — i.e. supplementary — arriving **after** the main correlation has been reported.

So Finding (ii) is the main evidence and Finding (i) is supplementary.

Answer: (d)

Shortcut

One phrase in paragraph 4 decides the whole question: "fortified by *other* evidence". Whatever follows that phrase is supplementary by the passage's own account — and what follows is the colour observation, Finding (i).

So (i) is supplementary, (ii) is main — option (d).

Two structural cues confirm it without any reading of content:

1. The designed study comes first and is called "suggestively strong"; the colour point comes second and is introduced as reinforcement.
2. The number 36 in Finding (ii) matches $15 + 21$ from paragraph 3, tying it to the study proper.

All four options use the same two labels in different pairings, so the task is purely to rank the two pieces of evidence — do that from the connectives, not from the biology.

READING PASSAGE

Passage 1 – Why some fruits keep ripening after picking

Read the following passage and choose the answer that is closest to each of the questions that are based on the passage.

Bananas, apples, and avocados continue to ripen after they are picked. Cherries, blackberries, and grapes do not. The difference between climacteric fruits (the former) and non-climacteric fruits (the latter) matters to fruit growers and greengrocers, who must make sure their wares are in tip-top condition when they arrive at the marketplace. But how those differences originally came about remains unclear.

Two biologists of the University of Tokyo offer a suggestion. Fruits, they observe, exist to solve a problem faced by all plants-how best to spread their progeny around. Wrapping their seeds in a sugary pulp to provide a tasty meal serves as a way to get animals to do this for them. They do, however, need to make sure that their fruits favour the animals most likely to do the distributing. The biologists propose that climacterism, or its absence, is a way to achieve this. If ground-dwelling animals are the main distributors, then the continuing ripening of fallen fruit (i.e., climacterism) is beneficial. If, by contrast, those distributors are arboreal or aerial, and so can feed on unfallen fruit, then non-climacteric fruits will do well.

To test their idea, the two researchers studied 80 varieties of fruits, and noted which animals each depended on for its propagation. 35 of these fruits, eaten by both ground-dwelling animals and arboreal or aerial animals, were non-climacteric. Further, 15 of the 19 varieties eaten principally by ground-dwellers were climacteric, while 21 of the 26 fed on by arboreal or aerial animals were non-climacteric.

That is a suggestively strong correlation. And the authors' hypothesis is fortified by other evidence. They point out that non-climacteric fruits tend to have vivid colours, especially reds and purples. This may help them to stand out amid the foliage of their parent plants, advertising their presence. Climacteric fruits are generally better camouflaged. That makes them harder to spot until they have fallen to the ground.

The main limitation of their work is that they looked at fruits eaten by people. This has probably contaminated the sample, for thousands of years of selective breeding for traits that human beings find appealing may have blurred any signal optimised by natural selection. The next step, therefore, should be the analysis of wild fruits.

52 VARC READING COMPREHENSION - QUESTION TYPES

RC VOCABULARY IN CONTEXT QUESTIONS

6 /10

'Local reaction' refers to

(A) **adverse reaction caused by injections.**

(B) adverse comments and protests by people from that location.

(C) encouraging reaction from local doctors.

(D) encouraging reaction from the people of the locality.

ANSWER **(a) adverse reaction caused by injections.**

SOLUTION

Step 1 — read the sentence in context. Paragraph 4:

"The child was in a **run-down condition**, and the vaccine material might very well have provoked a rather **serious local reaction**. In a way, the fate of vaccination **hung in the balance** and good luck was in its favour."

Step 2 — note the two clues.

- The subject is the **child's physical state** ("run-down condition"), not public opinion.
- The outcome is framed as a danger narrowly avoided — "hung in the balance", "good luck" — so the reaction would have been **harmful**.

In medicine, a *local reaction* is an adverse response **at the site of an injection** (swelling, inflammation, ulceration), as opposed to a systemic one. That is option (a).

Why the others fail:

- **(b)** Reads *local* as geographical. But protests by local people would not depend on the child being run-down, and would not be averted by "good luck" in a clinical sense.
- **(c)** and **(d)** are **encouraging** reactions. The passage's whole framing is of a risk, so a positive reading contradicts "hung in the balance".

Answer: (a)

Shortcut

Split the options by polarity first. Two are adverse, two are encouraging — and "the fate of vaccination hung in the balance" is unambiguously about danger. That halves the field in one reading.

Between the two adverse options, the deciding word is in the previous clause: the **child** was run-down, so the reaction belongs to the child's body, not to the neighbourhood.

This is the standard method for vocabulary-in-context items: polarity first, then subject. You rarely need the word's technical definition.

Refers to the RC set above.

53 VARC READING COMPREHENSION - QUESTION TYPES

RC DETAIL AND FACT BASED QUESTIONS

6 /10

Jenner received a lot of recognition from medical bodies because

(A) fortunately, only a few colleagues were illogical enough to reject him.

(B) **most of his colleagues realised the effectiveness of his work.**

(C) Dr. Watt could not prove that vaccination caused measles.

(D) medical societies across Europe regularly engaged in tokenism.

ANSWER **(b) most of his colleagues realised the effectiveness of his work.**

SOLUTION

Where the passage says it. The final paragraph:

"**Fortunately, only a few colleagues were so illogical**, and an excellent idea of how much Jenner's discovery was **appreciated by his contemporaries** may be obtained from the number of honours, diplomas, addresses and communications... Most of the prominent medical and scientific societies of Europe elected him a member."

If only a few were illogical, the **majority recognised the work's value** — which is the cause of the honours. Option (b) states that cause.

Why option (a) is the subtle trap. It quotes the passage almost word for word, but it names the **absence of opposition** rather than the **presence of appreciation**. Few people objecting does not, by itself, generate honours and memberships; positive recognition does. The passage makes the appreciation explicit ("appreciated by his contemporaries"), and that is the operative reason.

Why the others fail:

- **(c)** Dr. Watt blamed the vaccine for measles deaths, but the passage never says he failed to prove it, nor links that to Jenner's honours.
- **(d)** "Tokenism" is a hostile reading. The passage lists the honours as evidence of genuine esteem; it even calls them "some special token of recognition" in a plainly positive sense.

Answer: (b)

Shortcut

When two options both echo the text, prefer the one that supplies a *cause*, not a *condition*. Option (a) describes the backdrop (few objectors); option (b) describes the engine (colleagues recognised the work).

Option (d) can be eliminated on tone alone. The last paragraph is wholly admiring — "excellent idea of how much Jenner's discovery was appreciated" — so an option attributing empty gestures to the societies contradicts the passage's own evaluation.

Refers to the RC set above.

54 VARC READING COMPREHENSION - QUESTION TYPES RC MAIN IDEA QUESTIONS 6 /10

According to the author, the main idea in the passage is

(A) scientific breakthroughs are more likely to happen in major urban centres.

(B) documentation is key for disseminating science.

(C) to explore the causes for vaccine hesitancy.

(D) **chance and risk play a part in the success of scientific experiments.**

ANSWER **(d) chance and risk play a part in the success of scientific experiments.**

SOLUTION

Step 1 — trace the arc. Jenner's first test works; he records 23 cases; he fails for three months in London; Cline's trial succeeds on a frail child who might easily have reacted badly; opposition forms; recognition eventually arrives.

Step 2 — find the author's own evaluative sentence. Paragraph 4:

"In a way, the **fate of vaccination hung in the balance** and **good luck was in its favour**."

That is the author stepping back to comment, and it names both **risk** and **chance** — exactly option (d).

Why the others fail:

- **(a)** London is where Jenner **failed** to find volunteers; the decisive trial happened through Cline afterwards. If anything the passage undercuts this.
- **(b)** Documentation appears (the 23 cases, the pamphlet), but as one episode. It is a detail, not the thread running through the whole passage.
- **(c)** Opposition is described in paragraph 5, but the passage reports it rather than exploring its *causes* — and that paragraph is one of six.

Answer: (d)

Shortcut

Find the one sentence where the narrator editorialises. The passage is otherwise plain reportage of dates, names and cases; "the fate of vaccination hung in the balance and good luck was in its favour" is the author's own judgement — and main-idea answers sit in exactly such sentences.

Then apply the scope test. Options (b) and (c) each cover a single paragraph; (a) misreads one. Only (d) describes something visible across the whole narrative — the risky boy, the risky frail child, the lucky outcome.

Refers to the RC set above.

✏ Para jumbles and para summary sets, timed or untimed, with full explanations. RC Practice

55 VARC READING COMPREHENSION - QUESTION TYPES

RC DETAIL AND FACT BASED QUESTIONS

6 /10

On returning from London, Dr. Jenner was disappointed because

(A) his friends responded negatively to the vaccine.

(B) **he was unsuccessful in replicating the experiment due to lack of volunteers.**

(C) his friends would not agree with his findings on the vaccine.

(D) the vaccine did not receive any recognition, rewards, or a patent.

ANSWER **(b) he was unsuccessful in replicating the experiment due to lack of volunteers.**

SOLUTION

Where the passage says it. Paragraph 3:

"He remained in London for nearly three months **without being able to find anyone who would submit to vaccination**. Jenner went back to Gloucestershire, **disappointed**."

The obstacle was the absence of **volunteers**, which prevented further trials — option (b).

Why the others fail:

- **(a)** and **(c)** both blame his *friends*. But the passage says the opposite: he "left the vaccine material **with his friends**", and it was through those friends that Cline obtained it. Friends who hold your material for you have not rejected your findings.
- **(d)** Recognition, rewards and patents are not mentioned at this point. Recognition does arrive, but in the final paragraph and much later; it is not the cause of this disappointment.

Answer: (b)

Shortcut

The cause sits in the sentence immediately before the word "disappointed". Read that one sentence and the answer is settled: nobody would submit to vaccination.

Two options can be dismissed by a single later fact: Jenner "left the vaccine material with his friends", and they passed it to Cline. That cooperation is incompatible with friends who responded negatively or disagreed — so (a) and (c) both fall.

Whenever a question asks *why* someone felt something, look for the adjacent sentence rather than searching the whole passage.

Refers to the RC set above.

Twenty-three cases were put on record with the objective to explain very clearly that

(A) **the cowpox vaccine protected the patients from another deadly disease.**

(B) Dr. Jenner was ready to go to any extent, even testing the vaccine on his own son.

(C) accidental contraction of cowpox happens among dairy workers.

(D) it is beneficial to immunity if we work with cows and horses.

ANSWER **(a) the cowpox vaccine protected the patients from another deadly disease.**

SOLUTION

Where the passage says it. Paragraph 2 states the purpose of the record explicitly:

"By 1798, Jenner had succeeded in **demonstrating the protective quality of the cowpox virus against smallpox**, by putting on record details of 23 cases... Jenner demonstrated **conclusively** that the cowpox protects the human constitution from the infection of smallpox."

The objective was to show that cowpox protects against smallpox — *another* disease. That is option (a).

Why the others fail:

- **(b)** His son's inoculation is one case among the 23, mentioned as a detail. The purpose of the record was scientific demonstration, not a display of personal commitment.
- **(c)** Accidental contraction among dairy workers describes **how sixteen of the cases arose** — the method of acquiring the sample, not the point being proved.
- **(d)** Reverses the logic. The protection comes from **cowpox infection**, not from the occupation; working with animals merely made accidental exposure likely.

Answer: (a)

Shortcut

The stem asks for an objective, so look for a purpose verb — "demonstrating", "to show", "to prove". The passage supplies two in the same paragraph, both saying the same thing: cowpox protects against smallpox.

Options (b) and (c) are both true statements lifted from the passage, which is what makes them dangerous. But a true detail is not an objective. **Separate *what the record contained* from *what it was meant to prove*** — only the latter answers this question.

Refers to the RC set above.

57 VARC READING COMPREHENSION - QUESTION TYPES

RC PHRASE AND SENTENCE MEANING QUESTIONS

6 /10

By calling the vaccine unjustifiable, Dr. Ingenhouz meant that vaccination

(A) **made people sick and failed to provide general immunity.**

(B) was an injustice against those on whom it was tested.

(C) was being carried out without any legal basis.

(D) actually spread the disease to a large population.

ANSWER **(a) made people sick and failed to provide general immunity.**

SOLUTION

Where the passage says it. Paragraph 5 gives Ingenhouz's charge in full:

"...proclaimed openly that it was a dangerous innovation, **absolutely unjustifiable, and communicated a disease without protecting against any other**."

The clause after "unjustifiable" explains it: vaccination **gives you a disease** (communicates one) **without protecting** against another. Option (a) restates both halves — "made people sick" and "failed to provide general immunity".

Why the others fail:

- **(b)** Reads *unjustifiable* as a moral wrong done to test subjects. The passage's own gloss is about **efficacy**, not ethics.
- **(c)** Reads it as a legal complaint. No law or legal basis is mentioned anywhere in the passage.
- **(d)** Overstates the scope. The charge is that vaccination communicated a disease **to the person vaccinated**, not that it spread an epidemic through a population.

Answer: (a)

Shortcut

The passage defines the word for you in the same sentence. Whenever a question asks what a quoted term "meant", read on to the clause immediately following — here "communicated a disease without protecting against any other".

Then match both halves to an option. Option (a) is the only one that covers **both** the harm and the failure to protect; (d) captures the harm but inflates it, and (b) and (c) import meanings of *unjustifiable* that the passage does not use.

Beware the dictionary instinct. *Unjustifiable* suggests ethics or legality in ordinary use, which is exactly why (b) and (c) are there — but context, not the dictionary, defines a word in RC.

58 VARC VERBAL ABILITY IDIOMS AND PHRASES 5 /10

Complete the following sentence by choosing the most appropriate word/phrase from the options given below.

Some of the best spies take the guise of innocuous secretaries or researchers and are able to send large amounts of information to their heads of espionage, as they are _____.

(A) **hiding in plain sight**
(B) hiding documents very craftily
(C) hiding from watchful eyes
(D) hiding within everyone's sight

ANSWER **(a) hiding in plain sight**

SOLUTION

The idiom. *To hide in plain sight* means **to remain unnoticed precisely because one is openly visible and appears ordinary**.

Why it fits. The spies "take the guise of **innocuous** secretaries or researchers" — they are not concealed at all; they are in full view, and their very ordinariness is the concealment. That paradox is exactly what the idiom names.

Why the others fail:

- **(b) hiding documents very craftily** — shifts the object. The sentence is about how the *spies* escape notice, not about where papers are kept.
- **(c) hiding from watchful eyes** — the ordinary sense of hiding, which **contradicts** "take the guise of" an open, visible role. If they were hiding from view, the disguise would be pointless.
- **(d) hiding within everyone's sight** — a near-miss that captures the idea but is not the fixed form. The idiom is *in plain sight*, not *within everyone's sight*.

Answer: (a)

Shortcut

The word *innocuous* is the signal. It tells you the concealment works through appearing harmless and visible, not through being out of view — which rules out (c) immediately, since it means the opposite.

Then (d) is the standard "right idea, wrong wording" distractor. **Idioms are fixed strings**: *in plain sight* cannot become *within everyone's sight* any more than *in the nick of time* can become *at the nick of time*.

A useful family to revise together: *hide in plain sight*, *an open secret*, *under one's nose*, *the elephant in the room* — all about things visible yet unremarked.

59 VARC VERBAL ABILITY VOCABULARY AND WORD USAGE 4 /10

Complete the following sentence by choosing the most appropriate word/phrase from the options given below.

Ever since Girish won the prestigious Infosys prize, he has been behaving _____.

(A) ambitiously
(B) **condescendingly**
(C) overly
(D) controversially

ANSWER **(b) condescendingly**

SOLUTION

Step 1 — read what the sentence implies. "**Ever since** he won... he **has been behaving** ___" signals a *change* in manner caused by the award. Winning a prestigious prize characteristically produces a superior attitude towards others.

Step 2 — test the options.

- **(b) condescendingly** ✓ — behaving as though superior to others; patronising. It is the natural consequence of sudden prestige and, crucially, it is an **adverb describing how one treats people**, which "behaving" requires.
- **(a) ambitiously** — ambition is a *drive*, not a manner of behaving towards others, and winning a prize does not obviously make someone more ambitious.
- **(c) overly** ✗ — grammatically impossible on its own. *Overly* is an intensifier and must modify an adjective or adverb (*overly cautious*, *overly polite*); it cannot stand alone after "behaving".
- **(d) controversially** — possible in isolation, but nothing in the sentence suggests controversy, and a prize does not imply it.

Answer: (b)

Shortcut

Option (c) dies on grammar before meaning. *Overly* never stands alone — "behaving overly" is incomplete, because the word exists only to intensify something else. **Run a part-of-speech check first; it costs nothing and often removes an option outright.**

Among the rest, ask what a *prize* plausibly changes. Prestige affects how one **treats others**, which is what *condescendingly* describes; ambition and controversy are not consequences the sentence prepares.

Worth knowing: *condescending* = talking down to people while appearing gracious. It is among the most frequently tested attitude words in these papers.

60 VARC VERBAL ABILITY IDIOMS AND PHRASES 3 /10

Complete the following sentence by choosing the most appropriate word/phrase from the options given below.

Flying this simple aeroplane is a _____ for the experienced pilot.

(A) left-handed game
(B) **piece of cake**
(C) left-handed sport
(D) slice of cake

ANSWER **(b) piece of cake**

SOLUTION

The idiom. *A piece of cake* means **something very easy to do**.

Why it fits. The sentence pairs a **simple** aeroplane with an **experienced** pilot — both cues point to the task being effortless.

Why the others fail:

- **(a) left-handed game** and **(c) left-handed sport** — neither exists in English. (The real phrase in that family is *a left-handed compliment*, meaning a remark that sounds like praise but insults; it has nothing to do with ease.)
- **(d) slice of cake** — a real noun phrase but **not** the idiom. Idioms do not accept synonym substitution: it is *a piece of cake*, never *a slice of cake*, just as it is *a piece of the action*, not *a slice of the action*.

Answer: (b)

Shortcut

Two of the four options are invented, and the fourth swaps one word of the real idiom — the standard construction for this question type.

The rule that catches (d): you cannot replace a word in a fixed idiom with a synonym, however natural it sounds. *Piece* is part of the expression.

Other "easy" idioms worth having ready, since the same idea is tested repeatedly: *a walk in the park*, *child's play*, *as easy as pie*, *plain sailing*, *a cinch*.

61 VARC VERBAL ABILITY VOCABULARY AND WORD USAGE 3 /10

Complete the following sentence by choosing the most appropriate word/phrase from the options given below.

For the past three decades, this chain of coffee shops has been committed to building a culture where everyone is welcome. They are an ally to the LGBTQ community, and this is just one instance of their _____.

(A) inclusivity and diversity
(B) mindfulness and objectivity
(C) discriminatory practices
(D) discretionary practices

ANSWER (a) inclusivity and diversity

SOLUTION

Step 1 — read the setup. The sentence states two things: the company builds "a culture where **everyone is welcome**", and it is "an **ally** to the LGBTQ community". The blank must name the quality those two facts exemplify.

Step 2 — match. Welcoming everyone and allying with a minority community is precisely **inclusivity and diversity**.

Why the others fail:

- **(b) mindfulness and objectivity** — mindfulness is about attention and presence; objectivity about impartiality. Neither follows from welcoming everyone.
- **(c) discriminatory practices ✘** — the **opposite**. Discrimination excludes; the sentence describes inclusion.
- **(d) discretionary practices** — *discretionary* means "left to one's own judgement" (as in *discretionary spending*). It has no connection to the sentence, and is placed here purely to be confused with *discriminatory*.

Answer: (a)

Shortcut

Check polarity first. The sentence is unambiguously positive — *welcome*, *ally*, *committed* — so any negative option is out, which removes (c) at once.

Then note the deliberate near-pair in (c) and (d). *Discriminatory* (treating people unfairly) and *discretionary* (at one's own discretion) differ by three letters and mean entirely different things; stacking both as options is a vocabulary trap, not a reasoning one.

The phrase "this is just one instance of" tells you the blank names a general policy, which "inclusivity and diversity" does and a single practice would not.

62 VARC VERBAL ABILITY IDIOMS AND PHRASES 4 /10

Complete the following sentence by choosing the most appropriate word/phrase from the options given below.

Leela is always nasty and inconsiderate with her colleagues; now that she has a rude superior, she is getting _____.

A a spoon of her own medicine

B **a taste of her own medicine**

C an unpleasant medicine dose

D a dose of bitter medicine

ANSWER **(b) a taste of her own medicine**

SOLUTION

The idiom. *To get a taste of one's own medicine* means **to receive the same unpleasant treatment one has been giving others**.

Why it fits. Leela is "nasty and inconsiderate with her colleagues", and now a **rude superior** is treating her the same way. The sentence is built to illustrate this idiom exactly.

Why the others fail:

- **(a) a spoon of her own medicine** — swaps *taste* for *spoon*. Not the idiom.
- **(c) an unpleasant medicine dose** — ordinary English, not an idiom, and it loses the crucial "her **own**" element that carries the sense of comeuppance.
- **(d) a dose of bitter medicine** — a real phrase, but it means **facing a harsh but necessary truth or measure** (as in a difficult economic policy). It lacks the reciprocity: the medicine is not *hers*.

Answer: (b)

Shortcut

The reciprocity is the point, and only "her own" carries it. The sentence sets up a mirror — she is nasty, now someone is nasty to her — so the idiom must say the treatment is *the same one she dispenses*.

Option (d) is the thoughtful trap, because *a dose of bitter medicine* is genuine English. But it describes something unpleasant yet necessary, with no sense of being repaid in kind. **When two real idioms compete, pick the one whose structure mirrors the sentence's structure.**

The fixed form is *a taste of one's own medicine* — *taste*, not *spoon* or *dose*.

63 VARC VERBAL ABILITY PHRASAL VERBS 3 /10

Complete the following sentence by choosing the most appropriate word/phrase from the options given below.

She _____ her classmates because she comes from a very rich, aristocratic family.

(A) looks up to
(B) looks towards
(C) looks away from
(D) **looks down on**

ANSWER **(d) looks down on**

SOLUTION

The phrasal verb. *To look down on* someone means **to regard them as inferior**.

Why it fits. The reason given is that she comes from a "very rich, **aristocratic** family" — a cause of social superiority. The attitude that follows is contempt for her classmates.

Why the others fail:

- **(a) looks up to** ✘ — the exact opposite: to admire or respect. Wealth and aristocratic origin would not cause her to admire classmates.
- **(b) looks towards** — means to face in a direction, or to anticipate (*look towards the future*). It expresses no attitude at all.
- **(c) looks away from** — to avert one's gaze; about avoidance, not judgement, and it does not follow from being wealthy.

Answer: (d)

Shortcut

The clause after *because* is the whole question. It gives the cause — wealth and aristocracy — so the blank must be the attitude that cause produces. Contempt, not admiration.

Options (a) and (d) are a deliberate opposite pair, which is itself a signal: in phrasal-verb questions, when two options are antonyms, one of them is almost always right. Decide between them by the direction of the causal clause.

The spatial logic helps you remember the pair: *up to* = respect, *down on* = contempt. Both need their preposition; dropping it changes the verb entirely.

🧭 Which colleges, what cut-offs, which deadlines? The UG guide maps the whole route. Open the guide

64 VARC VERBAL ABILITY IDIOMS AND PHRASES 3 /10

Complete the following sentence by choosing the most appropriate word/phrase from the options given below.

I still have two more difficult exams left, but I'm trying to _____; after these I won't have any more for a year!

(A) **look on the bright side**
(B) think upon the sunny side
(C) look forward to the bright side
(D) think about the sunny side

ANSWER **(a) look on the bright side**

SOLUTION

The idiom. *To look on the bright side* means **to focus on the positive aspect of a difficult situation**.

Why it fits. The structure is pure contrast: a hardship ("two more difficult exams") set against a consolation ("after these I won't have any more for a year"). Finding the consolation in a hardship *is* looking on the bright side.

Why the others fail. All three are corruptions of the fixed form:

- **(b) think upon the sunny side** — wrong verb and wrong adjective; *upon* is archaic here.
- **(c) look forward to the bright side** — grafts a second idiom (*look forward to*) onto this one. You look forward to an **event**, not to a perspective.
- **(d) think about the sunny side** — wrong verb and wrong adjective again.

The idiom is *look* (not think) *on* (not upon/about) the **bright** (not sunny) side.

Answer: (a)

Shortcut

Three of the four options change a word of a fixed phrase, which is the whole design. Fix the exact string in memory: **look on the bright side**.

Option (c) is worth studying because it blends two real idioms — a very common distractor technique. *Look forward to* takes a noun denoting an event (*look forward to the holidays*), so "look forward to the bright side" is a category error as well as a blend.

And note the sentence's own signal: "but". The contrast marker tells you the blank must introduce the positive counterweight, which confirms the meaning before you weigh the wordings.

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65 VARC VERBAL ABILITY GRAMMAR AND SENTENCE CORRECTION 4 /10

The following sentence contains an error. Choose the option that corrects it.

If I had known that you needed to go to the airport yesterday, I **could drive you there**.

(A) should have driven you there.
(B) **would have driven you there.**
(C) would drive you there.
(D) should drive you there.

ANSWER **(b) would have driven you there.**

SOLUTION

The error: a broken third conditional. The *if*-clause is

"If I **had known**..."

which is the past-perfect form that defines a **third conditional** — a hypothetical about the past that did not happen. Its main clause must take

$$\text{would have} + \text{past participle}$$

The original has "could drive", a present/future form, which clashes with "yesterday".

The fix. "...I **would have driven** you there."

Why the others fail:

- **(a) should have driven** — grammatically well-formed, but *should have* expresses **obligation or regret** ("I ought to have"), not the hypothetical consequence the conditional requires. The sentence is about what *would* have happened given knowledge, not about duty.
- **(c) would drive** — present conditional; mismatched with "had known" and "yesterday".
- **(d) should drive** — wrong tense **and** wrong modal.

Answer: (b)

Shortcut

Match the halves of the conditional and the question answers itself:

$$\text{If} + \text{had} + \text{V}_3 \ldots \text{would have} + \text{V}_3$$

"If I had known" demands "would have driven" — scan the options for that exact string.

The real discrimination is (a) versus (b), and it is about meaning, not form. *Would have* = the hypothetical outcome; *should have* = regret about an obligation. The sentence supplies a condition, so it needs the outcome.

Note that "yesterday" is doing real work — it fixes the time as past and eliminates both present-tense options at a glance.

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66 VARC VERBAL ABILITY GRAMMAR AND SENTENCE CORRECTION ●●●●○○○○○○ 4 /10

The following sentence contains an error. Choose the option that corrects it.

The Principal and professors are authorized to sanction leave to a student **provided she will have a good attendance record**.

(A) **provided she has a good attendance record.**
(B) provided she will have a good attendance record.
(C) provided she had a good attendance record.
(D) provided that a good attendance record is maintained by her.

ANSWER **(a) provided she has a good attendance record.**

SOLUTION

The error: a future tense in a conditional clause. *Provided* introduces a condition, and English conditional clauses take the **present tense** to refer to the future — never *will*. Compare:

*If it **rains** tomorrow...* (not *if it will rain*) *Provided she **has** a good record...* (not *provided she will have*)

The fix. "...provided she **has** a good attendance record."

Why the others fail:

- **(b)** Reproduces the original error.
- **(c) had** — past tense. The rule describes a standing policy applying whenever leave is requested, so the present is required; the past would make it a single completed condition.
- **(d)** Grammatically acceptable but stylistically poor: it switches to the **passive voice** ("is maintained by her") for no reason, making the sentence wordier and less direct. In a correction question, prefer the concise active form when both are grammatical.

Answer: (a)

Shortcut

The rule in one line: conditional clauses take the present for future meaning. After *if*, *when*, *unless*, *provided*, *as soon as*, *until* and *before*, use the present — never *will*.

That kills (b) at once, and the tense mismatch kills (c).

Between (a) and (d), prefer the active and the shorter. Both are grammatical, but sentence-correction questions reward economy and directness; a passive construction introduced where the active works is treated as the inferior answer.

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67 VARC VERBAL ABILITY GRAMMAR AND SENTENCE CORRECTION ●●●●○○○○○○ 4 /10

The following sentence contains an error. Choose the option that corrects it.

When all the words on the page got scrambled, she quickly pressed undo, after which the **document reverted back to its original state**.

(A) document reverted back to it's original state.
(B) document reverted back to original state.
(C) document reverted to it's original state.
(D) **document reverted to its original state.**

ANSWER **(d) document reverted to its original state.**

SOLUTION

The error: redundancy. *Revert* already means "to go **back** to a previous state" — the *re-* prefix carries the backward motion. So "reverted **back**" says the same thing twice. The correct form is simply **reverted to**.

The second issue: the apostrophe. The possessive of *it* is **its**, with no apostrophe. *It's* is only ever a contraction of *it is* or *it has* — and "the document reverted to **it is** original state" is obviously wrong.

Checking the options:

Option	*back* removed?	correct *its*?
(a)	✘	✘ (*it's*)
(b)	✘	— (drops the possessive entirely)
(c)	✔	✘ (*it's*)
(d)	✔	✔

Answer: (d)

Shortcut

Two independent filters, applied in either order:

1. **Drop the redundant *back*** — *revert* already means to go back. Removes (a) and (b).
2. **Use *its*, never *it's*, for possession.** Removes (a) and (c).

Only (d) survives both.

The *its / it's* test is foolproof: expand the apostrophe to *it is* and see whether the sentence still works. "It is original state" fails, so no apostrophe.

Other redundancies tested in the same family: *return back*, *repeat again*, *reply back*, *ascend up*, *merge together*, *free gift*. All carry their meaning in the verb already.

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68 VARC VERBAL ABILITY VOCABULARY AND WORD USAGE ●●●●●○○○○○ 5 /10

The following sentence contains an error. Choose the option that corrects it.

His talk on heritage sites has **picked up** my interest.

(A) aroused
(B) adopted
(C) caught
(D) brightened

ANSWER (a) aroused

SOLUTION

The error: a collocation failure. *Pick up* has several legitimate senses — to lift, to acquire a skill, to collect someone, to improve — but **it does not take *interest* as an object** in the sense required here. The idiomatic verbs for interest are *arouse*, *spark*, *pique*, *stir* or *kindle*.

Why *aroused* is right. *To arouse interest* is the standard collocation, meaning to awaken or stimulate it. "His talk... has **aroused** my interest" is natural and precise.

Why the others fail:

- **(b) adopted** — to take up and make one's own (*adopt a policy*, *adopt a child*). You cannot adopt someone else's interest in this construction.
- **(c) caught** — "caught my interest" is possible in casual usage, but the standard pairing is *caught my **attention***. *Attention* is momentary and can be caught; *interest* is sustained and is aroused.
- **(d) brightened** — means to make lighter or more cheerful. It collocates with *day*, *room*, *mood* — not with *interest*.

Answer: (a)

Shortcut

Build the collocation pairs; they are what this question tests, not grammar.

Noun	Verbs that fit
interest	arouse, spark, pique, stir, kindle
attention	catch, attract, draw, grab
curiosity	arouse, pique, satisfy

Option (c) is the near-miss precisely because it belongs to the *attention* row. **Ask which noun each verb normally partners, and the answer separates out immediately.**

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69 VARC VERBAL ABILITY GRAMMAR AND SENTENCE CORRECTION ●●●●●●○○○○ 6 /10

The following sentence contains an error. Choose the option that corrects it.

He was having a difficult time, but **never once he complained**.

(A) **not once did he complain.**
(B) not once did he give the complaint.
(C) not once any complaining happened.
(D) not once he complained.

ANSWER **(a) not once did he complain.**

SOLUTION

The error: a missing inversion. When a sentence **begins with a negative adverbial** — *never*, *not once*, *rarely*, *seldom*, *hardly*, *no sooner*, *under no circumstances* — English requires **subject–auxiliary inversion**, exactly as in a question.

So "never once **he complained**" must become "never once **did he complain**" — auxiliary before subject, and the main verb in its base form.

The fix. "...but **not once did he complain**."

Why the others fail:

- **(b) not once did he give the complaint** — the inversion is correct, but "give the complaint" is not idiomatic. One *makes* a complaint or simply *complains*; and the definite article is unexplained.
- **(c) not once any complaining happened** — no inversion (there is no auxiliary to invert), and the gerund construction is clumsy and impersonal.
- **(d) not once he complained** — repeats the original error: negative adverbial at the front with no inversion.

Answer: (a)

Shortcut

Spot the fronted negative and invert — that is the entire rule.

Never **have I** seen... · *Rarely* **does she** complain... · *No sooner* **had he** left...

Here: *not once* **did he** complain.

Note the form of the main verb after inversion. The auxiliary carries the tense, so the main verb goes into its **base** form: *did he complain*, never *did he complained*.

Two options keep the uninverted order (c, d) and one spoils the idiom (b), so the inversion test alone resolves the question — and it is tested in some form in almost every IPMAT paper.

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70 VARC VERBAL ABILITY PARA COMPLETION ●●●●○○○○○○ 4 /10

The paragraph given below has a sentence missing, indicated by a blank. From the choices given below, choose the most appropriate sentence to fill the blank.

This winter, I wish to go to the beaches for a holiday. I think I will go to Goa, India's most well-known beach holiday destination. It is about 600 km away from Mumbai, so reaching there is not a major problem. _____. The major Goan beaches are tourist attractions and have some good beach-view hotels and plenty of shops selling touristy things such as beach robes, hats, jewellery, bags, and more.

(A) **There are buses that ply at night, there are both day and night trains, and one can always hire a car and reach there in comfort in about 10 hours.**

(B) A great getaway place, it offers an interesting variety of food, sightseeing options, flea markets, and some wonderful Indo-Portuguese buildings.

(C) One of the great things about a holiday in Goa is that we can be as lazy as we want, relaxing all day, sunbathing, sipping juice, and trying out different Goan tidbits.

(D) Some major beaches are Baga, Bogmalo, Candolim, Calangute, and Dona Paula, where adventure sports activities like water skiing and scuba diving are organized.

ANSWER **(a) There are buses that ply at night, there are both day and night trains, and one can always hire a car and reach there in comfort in about 10 hours.**

SOLUTION

Step 1 — read the sentence immediately before the blank.

"It is about 600 km away from Mumbai, so **reaching there is not a major problem**."

That is a claim about **travel**, and it is asserted without support. The blank must **justify** it.

Step 2 — test option (a).

"There are **buses** that ply at night, there are both day and night **trains**, and one can always **hire a car** and reach there in comfort in about 10 hours."

Three modes of transport and a journey time — precisely the evidence the preceding claim needs. ✔

Step 3 — eliminate.

- **(b)** Food, sightseeing, flea markets and architecture — attractions, not access. It leaves "reaching there is not a major problem" unsupported.
- **(c)** How relaxing the holiday is — again about the stay, not the journey.
- **(d)** Names specific beaches and adventure sports. This is closest in topic to the *following* sentence ("The major Goan beaches are tourist attractions..."), which would make it **redundant** — and it still ignores the travel claim.

Answer: (a)

Shortcut

Find the unsupported assertion and support it. "Reaching there is not a major problem" is a claim about access, so the blank must be about transport. Only one option mentions buses, trains or cars.

You can answer this by keyword alone, in a few seconds, without reading the options in full.

Option (d) illustrates the redundancy trap: it talks about the major beaches, which is exactly what the sentence *after* the blank goes on to do. **An option that duplicates the following sentence is wrong even when it fits the topic.**

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71 VARC VERBAL ABILITY PARA COMPLETION ●●●●●○○○○○ 5 /10

The paragraph given below has a sentence missing, indicated by a blank. From the choices given below, choose the most appropriate sentence to fill the blank.

Nowadays, many teenagers and young adults around the world have to spend most of their time studying in order to get top grades, a university place, and a good job. _____. There are several causes for this situation, one of the main ones being exams. These are stressful experiences, and most students take a huge number of them during their school career.

(A) Therefore, studying while you are exhausted is unproductive.

(B) Therefore, it would be better to learn how to apply the knowledge gained.

(C) **For this reason, there is often little time left for hobbies or socializing.**

(D) For this reason, the education system has to change for the welfare of the students.

ANSWER **(c) For this reason, there is often little time left for hobbies or socializing.**

SOLUTION

Step 1 — note what the sentence after the blank requires.

"There are several causes for **this situation**..."

The pronoun *this situation* must point back to a **situation** described in the blank — and the causes given are exams and stress. So the blank must name a **problem** that heavy study creates.

Step 2 — test option (c).

"For this reason, there is often **little time left for hobbies or socializing**."

This follows directly from "spend most of their time studying" (the cause) and is itself a situation whose causes can then be discussed. ✔

Step 3 — eliminate.

- **(a)** "Studying while exhausted is unproductive" — a piece of advice about *how* to study. It is not a situation, so "There are several causes for this situation" would have nothing to attach to.
- **(b)** "Better to learn how to apply the knowledge" — a **recommendation**, and off-topic; the paragraph is about time pressure, not pedagogy.
- **(d)** "The education system has to change" — a **conclusion**, and much too strong for this position. It also pre-empts the paragraph: you cannot call for reform *before* the causes have been set out.

Answer: (c)

Shortcut

"This situation" is the anchor. A *situation* is a state of affairs, not advice and not a demand for reform — so (a), (b) and (d) are all the wrong kind of sentence, regardless of content.

Then check the causal direction. The blank follows a cause (spending most of their time studying) and precedes an explanation of causes — so it must state the **effect**. Little time for hobbies is exactly that.

A reliable rule: match the *type* of sentence the slot needs — fact, cause, effect, recommendation — before you judge the content. Here the type test alone answers it.

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72 VARC VERBAL ABILITY PARA COMPLETION ●●●●●●○○○○ 6 /10

The paragraph given below has a sentence missing, indicated by a blank. From the choices given below, choose the most appropriate sentence to fill the blank.

_____. In Southeast Asia, for example, climate and lifestyle factors mean that people spend much more time in shopping malls than Europeans do, who might go shopping once a fortnight. Then there are gender variations in the way we shop. As descendants of hunter-gatherers, accumulating is in our blood, but how you go about it depends on whether you are male or female.

(A) By and large, people enjoy shopping and comparing brands and prices.

(B) Retail stores constantly offer promotional discounts to entice shoppers.

(C) When it comes to shopping, men hunt, and women gather.

(D) **Culture plays an important role in shaping the shopping experience.**

ANSWER **(d) Culture plays an important role in shaping the shopping experience.**

SOLUTION

Step 1 — the blank is the opening sentence, so it must introduce the theme the rest develops.

Step 2 — see what follows. The second sentence begins "**In Southeast Asia, for example**" — an example requires a **general claim** to exemplify, and the example contrasts Southeast Asian with European shopping habits. That is a claim about **culture**.

Step 3 — test option (d).

"**Culture** plays an important role in shaping the shopping experience."

The Southeast Asia / Europe contrast is exactly an instance of culture shaping shopping. ✔ And the paragraph then moves on with "**Then** there are gender variations" — *then* signals a second factor being added to the first, confirming that the opener named a factor.

Step 4 — eliminate.

- **(a)** "People enjoy shopping and comparing brands" — a general statement, but the example that follows is about *how much time* different cultures spend, not about enjoyment or comparison.
- **(b)** Retail discounts — introduces promotions, which nothing in the paragraph picks up.
- **(c)** "Men hunt, women gather" — this belongs to the **gender** strand, which the paragraph explicitly introduces later with "Then there are gender variations". Putting it first would make that sentence redundant and would leave the Southeast Asia example unexplained.

Answer: (d)

Shortcut

"For example" in sentence two tells you the blank is a generalisation, and the example's content — one region compared with another — tells you it is about **culture**.

Option (c) is the strongest distractor and fails on position, not content. It is a genuine summary of the paragraph's closing idea, but the connective "**Then** there are gender variations" shows gender is the *second* factor. **An opener cannot be the paragraph's second theme.**

Two cues to carry forward: *for example* demands a preceding generalisation, and *then there are…* confirms the paragraph is listing factors in order — so the opener is factor one.

Prefer a structured plan with recorded classes and tests? Look at the self-prep courses. See courses

73 VARC VERBAL ABILITY PARA COMPLETION ●●●●●○○○○○ 5 /10

The paragraph given below has a sentence missing, indicated by a blank. From the choices given below, choose the most appropriate sentence to fill the blank.

The people of the Indus Valley civilization wrote with a script. So far scholars have been unable to decipher that script. Archaeologists who have been excavating newly discovered sites in Mesopotamia hope to find a text that has scripts from both the Indus valley and Mesopotamia, the second of which has already been deciphered. _____.

(A) **They will then be able to decode the Indus valley language.**

(B) They will then be able to decide which civilization was older.

(C) The nature of relationships between the two will come to light.

(D) They can then prove that there was trade between the two.

ANSWER **(a) They will then be able to decode the Indus valley language.**

SOLUTION

Step 1 — follow the logic the paragraph sets up. Three steps are given:

1. The Indus script exists but is **undeciphered**.
2. The Mesopotamian script **has** been deciphered.
3. Archaeologists hope to find a text containing **both**.

A text in two scripts, one already readable, is a **bilingual key** — the same principle by which the Rosetta Stone unlocked Egyptian hieroglyphs. The obvious conclusion is that the Indus script could then be read.

Step 2 — confirm with option (a).

"They will then be able to **decode the Indus valley language**."

This is precisely the payoff the preceding sentence promises, and it closes the loop opened by "scholars have been unable to decipher that script". ✔

Step 3 — eliminate.

- **(b)** Relative age — a bilingual text does not establish which civilisation is older, and age is never raised in the paragraph.
- **(c)** The nature of relationships — plausible as a side benefit, but vague, and it does not use the key fact that one script is **already deciphered**. That detail would be wasted.

- **(d)** Proving trade — again a possible by-product, but the paragraph's explicit problem is **decipherment**, not commerce.

Answer: (a)

Shortcut

Ask which option uses every fact the paragraph supplies. The detail that the Mesopotamian script is "already deciphered" is doing deliberate work — it is only useful if the aim is to read the *other* script.

Options (c) and (d) would be equally true of any joint text, deciphered or not, so they leave that detail idle. **The correct completion in a para-completion question almost always consumes the paragraph's most specific detail.**

The real-world parallel is worth telling students: this is the Rosetta Stone method — a known script beside an unknown one is how decipherment works.

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74 VARC VERBAL ABILITY FILL IN THE BLANKS ●●●●●○○○○○ 5 /10

Some of the words in the sentences below are missing. Choose the best option from those given below to complete them.

The beauty of _____ is that it poses thought-provoking questions and inspires us to think deeply about _____ and life in general. Further, _____ about the ideas and perspectives outlined by different thinkers can help us to gain a better _____ of the world we live in.

(A) **philosophy; ourselves; pondering; understanding**
(B) orthography; writing; speaking; perspective
(C) linguistics; language; cogitating; picture
(D) history; animals; mulling; acquaintance

ANSWER **(a) philosophy; ourselves; pondering; understanding**

SOLUTION

Blank 1 — which discipline poses thought-provoking questions about life? The sentence names "different **thinkers**" later, which points directly to **philosophy**.

- *orthography* (b) is the study of **spelling** — it poses no questions about life.
- *linguistics* (c) studies language scientifically; it does not inspire reflection on "life in general".
- *history* (d) is plausible in isolation, but its blank 2 partner is "animals", which makes no sense.

Blank 2 — think deeply about ___ and life in general. The phrase "and life in general" signals that the first item is **narrower and personal**, so **ourselves** fits exactly. "Think deeply about animals and life in general" (d) is incoherent.

Blank 3 — the activity. "___ about the ideas and perspectives" needs a verb of reflection that takes *about*:

- **pondering about** ✓ (and *pondering over*) — reflecting at length.
- *speaking about* (b) is grammatical but wrong in sense: the sentence is about private reflection leading to understanding, not conversation.
- *cogitating* (c) and *mulling* (d) both mean to think over, but *mull* takes **over**, not *about*, and *cogitate* is unnaturally formal here.

Blank 4 — the outcome. "A better ___ of the world we live in" wants **understanding** — the standard collocation and the natural end point of reflection. *Acquaintance with* the world (d) would need a different preposition, and *picture* (c) is weaker.

Consistent throughout: philosophy; ourselves; pondering; understanding.

Answer: (a)

Shortcut

Blank 1 alone settles it if you read ahead to "different thinkers". That phrase belongs to philosophy, not to spelling, linguistics or history.

Then use blank 2 as the confirmation, because it is the most absurd of the distractors: "think deeply about **animals** and life in general" is self-evidently wrong, which removes (d) without any vocabulary knowledge.

Vocabulary worth taking from this question: *orthography* (spelling), *cogitate* (to think deeply), *mull over* (to turn over in the mind — note the preposition), *ponder over/about*.

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75 VARC VERBAL ABILITY FILL IN THE BLANKS ●●●○○○○○○○ 4 /10

Some of the words in the sentences below are missing. Choose the best option from those given below to complete them.

Everyday more than 1 billion promotional messages are sent that are commercial and _____. Although _____ have used more technology to stop this, _____ find ways around it.

(A) **unsolicited; regulators; spammers**

(B) inescapable; governments; advertisers

(C) informative; authorities; promoters

(D) educational; firewalls; hackers

ANSWER **(a) unsolicited; regulators; spammers**

SOLUTION

Blank 1 — what kind of promotional messages? The sentence goes on to say that someone is trying to **stop** them, so the adjective must be negative — specifically, it must explain *why* they are unwanted:

- **unsolicited** ✔ — not asked for. This is the defining feature of spam and the precise reason it is blocked.
- *informative* (c) and *educational* (d) are **positive**; nobody deploys technology to stop informative messages.
- *inescapable* (b) is negative but describes the *result* rather than the nature of the messages, and it sits oddly beside "commercial and…".

Blank 2 — who tries to stop it? The slot needs an agent who "**used more technology to stop this**":

- **regulators** ✔ — the bodies that police unsolicited commercial messaging.
- *firewalls* (d) ✘ — a firewall is a **tool**, not an actor; and the sentence contrasts this party with the one that "finds ways around it", which requires people on both sides.

Blank 3 — who evades the controls?

- **spammers** ✔ — the senders of unsolicited messages, the natural counterpart to regulators.
- *advertisers* (b) and *promoters* (c) are neutral, legitimate roles; they would not be described as finding ways *around* controls.
- *hackers* (d) belong to a different domain — intrusion, not bulk messaging.

Consistent throughout: unsolicited; regulators; spammers.

Answer: (a)

Shortcut

Blank 1 is a pure polarity test. Something is being *stopped*, so the adjective must be negative — and *informative* and *educational* are positive. Options (c) and (d) go immediately.

Then blank 2 kills (d) a second time on a category error: a firewall is a piece of software, but the sentence needs an agent that *uses* technology. **Check that each option supplies the right kind of thing — actor, tool, action — before weighing nuance.**

The three blanks here form a single coherent story — unsolicited mail, regulators fighting it, spammers evading them. **In a multi-blank cloze, the right option reads as one story; the wrong ones mix registers or domains.**

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76 VARC VERBAL ABILITY FILL IN THE BLANKS ●●●●●●○○○○ 6 /10

Some of the words in the sentences below are missing. Choose the best option from those given below to complete them.

Visually strong, _____ films of the 1920s are _____ preserved and suffer from censorship cuts, leading to the _____ that they were primitive and barely watchable.

(A) classic; dispassionately; conclusion

(B) action-packed; badly; accusation

(C) monochrome; barely; observation

(D) **silent; poorly; misconception**

ANSWER **(d) silent; poorly; misconception**

SOLUTION

Blank 1 — which films of the 1920s? The decade is the clue: the 1920s were the era of **silent** film, and "**Visually strong**" is exactly how one describes cinema that had no dialogue to rely on. The two halves fit together precisely.

- *monochrome* (c) is true of the period but adds nothing to "visually strong", and it is not what makes 1920s film distinctive as a category.
- *classic* (a) and *action-packed* (b) are vague and unconnected to the visual emphasis.

Blank 2 — how are they preserved? The clause continues "**and suffer from** censorship cuts", so the preservation must be **bad**:

- **poorly** ✓
- *badly* (b) is equally negative in meaning and would fit — but its option fails on blanks 1 and 3.
- *dispassionately* (a) ✘ — describes manner, not quality, and makes no sense of "suffer from".
- *barely* (c) ✘ — "barely preserved" means scarcely preserved at all, which overstates and reads awkwardly.

Blank 3 — what does poor preservation lead to? Here is the key logical turn: the films are described as "**visually strong**", yet people think them "primitive and barely watchable". That belief is therefore **mistaken**, and caused by the damaged copies that survive:

misconception

- *conclusion* (a) and *observation* (c) treat the belief as **valid**, contradicting "visually strong".

- *accusation* (b) is the wrong register — nobody is being accused of anything.

Answer: (d)

Shortcut

Blank 3 carries the whole argument. The sentence opens by calling the films "visually strong" and ends with people thinking them "primitive and barely watchable" — a contradiction that can only be resolved if that belief is **wrong**. So the blank must mean *a false belief*: **misconception**.

Options offering *conclusion* or *observation* would endorse the belief and break the sentence's logic.

Then blank 1 confirms: 1920s + visually strong = **silent** film, which relied on images because it had no sound.

The habit worth building: locate the blank that resolves a tension in the sentence. It is usually the only one you need.

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77 VARC VERBAL ABILITY FILL IN THE BLANKS ●●●●●○○○○○ 5 /10

Some of the words in the sentences below are missing. Choose the best option from those given below to complete them.

Achieving spaceflight enabled humans to begin to explore the solar system and the rest of the _____, to understand the many objects and _____ that are better observed from a space perspective, and to use for human benefit the resources and attributes of the space environment. All of these activities - discovery, scientific understanding, and the _____ of that understanding to serve human purposes - are elements of space _____.

(A) configuration; elements; functioning; vastness
(B) galaxy; ideologies; enormity; visualisation
(C) cosmos; materials; principles; identification
(D) **universe; phenomena; application; exploration**

ANSWER **(d) universe; phenomena; application; exploration**

SOLUTION

Blank 4 is the decisive one. The sentence summarises three activities — "**discovery**, scientific understanding, and the ___ of that understanding" — and asks what they are elements of. The established term covering discovery and scientific understanding of space is

space exploration

- *space vastness* (a), *space visualisation* (b) and *space identification* (c) are not terms at all, let alone ones that encompass discovery.

Blank 3 — what do you do with understanding "to serve human purposes"? You **apply** it:

application

- *functioning* (a) and *identification* (c) do not take "of that understanding" meaningfully; *enormity* (b) is a noun of size (and strictly means great wickedness in careful usage).

Blank 1 — the solar system and the rest of the ___. The containing whole is the **universe**.

- *galaxy* (b) is too small a step up from the solar system to be "the rest", and the paragraph is about space generally.
- *configuration* (a) is meaningless here.

Blank 2 — "the many objects and ___ that are better observed from a space perspective". Paired with *objects*, the natural partner is **phenomena** — events and occurrences, as against things.

- *ideologies* (b) ✘ — absurd in an astronomical context.
- *materials* (c) and *elements* (a) are both kinds of **object**, so they would duplicate the first noun rather than complement it.

Answer: (d)

Shortcut

Start at blank 4: the phrase "space ___" has only one idiomatic completion among the options — exploration. That alone answers the question.

Blank 2 then confirms by the "objects and ___" pairing. When two nouns are joined by *and*, they should be **complementary, not overlapping** — *objects and phenomena* (things and events) works; *objects and materials* says the same thing twice.

Note the vocabulary trap in (b): *enormity* means great evil or moral outrage in careful usage, not great size — a distinction worth teaching, since it is widely misused.

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78 VARC VERBAL ABILITY FILL IN THE BLANKS ●●●●●○○○○○ 5 /10

Some of the words in the sentences below are missing. Choose the best option from those given below to complete them.

The investigators have _____ that he had leaked confidential _____ information about the acquisition, thereby allowing associates to profit _____ from the deal.

(A) discovered; internal; enormously
(B) **alleged; insider; illicitly**
(C) accused; important; dramatically
(D) announced; financial; treacherously

ANSWER **(b) alleged; insider; illicitly**

SOLUTION

Blank 1 — the grammar decides it. The blank is followed by "**that** he had leaked...", so the verb must take a *that*-clause.

- **alleged that** ✔ — standard, and correctly tentative for an investigation in progress.
- *discovered that* (a) is grammatical but asserts the leak as **established fact**, which sits awkwardly with "investigators have" — and it clashes with the tentative tone such sentences take.
- **accused** (c) ✘ — a **grammatical error**. One accuses a *person* **of** something: *accused him of leaking*. "Accused that" is not English. This is the decisive elimination.
- *announced that* (d) — investigators announce findings, but the register is wrong for an unproven leak.

Blank 2 — what kind of confidential information about an acquisition? The fixed term is

insider information

— non-public information about a company, whose misuse constitutes insider trading. *Internal* (a) and *financial* (d) are vaguer and miss the legal term the sentence is clearly reaching for.

Blank 3 — how did the associates profit? Given a leak of insider information, the profit was **unlawful**:

illicitly

- *enormously* (a) and *dramatically* (c) describe **size**, not legality, and the sentence's whole point is wrongdoing.
- *treacherously* (d) describes betrayal, which fits the leaker rather than the profiting associates.

Answer: (b)

Shortcut

Option (c) fails on pure grammar: *accuse* never takes a *that*-clause. You accuse someone **of** something. That is the cheapest elimination available and costs no comprehension.

Then blank 2 looks for a set phrase. *Insider information* is the established legal term for exactly this scenario; the alternatives are generic.

And blank 3 asks for the right dimension. The sentence is about a leak and its consequences, so the adverb must concern **legality**, not magnitude — *illicitly*, not *enormously*.

Three different tests — grammar, fixed phrase, dimension — each pointing to (b).

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79 VARC VERBAL ABILITY FILL IN THE BLANKS ●●●●●●○○○○ 6 /10

Some of the words in the sentences below are missing. Choose the best option from those given below to complete them.

In an anthropocentric _____, animals are no more than property to human beings. Therefore, the concepts of 'humane' treatment and 'necessary' _____ are economic in nature. The idea that killing animals is not a serious issue as long as animals are not made to suffer rests _____ on the widely accepted idea that animals do not have a right to life.

(A) belief; well-being; partially
(B) construct; comfort; somewhat
(C) universe; gain; entirely
(D) **worldview; suffering; explicitly**

ANSWER **(d) worldview; suffering; explicitly**

SOLUTION

Blank 1 — "in an anthropocentric ___". *Anthropocentric* means human-centred, and the phrase describes a **framework of thinking**:

- **worldview** ✓ — the standard collocation; one speaks of an anthropocentric *worldview*.
- *universe* (c) ✘ — a physical thing, not a way of seeing.
- *belief* (a) and *construct* (b) are possible but weaker; "in an anthropocentric belief" is not idiomatic.

Blank 2 — pair it with 'humane' treatment. The sentence puts two quoted concepts side by side: "'humane' treatment and 'necessary' ___". In animal-welfare debate the standard pairing is *humane treatment* and *necessary* **suffering** — the two notions used to justify what may be done to animals.

- *well-being* (a) ✘ — you would not speak of "necessary well-being"; the adjective *necessary* only makes sense of something undesirable.
- *comfort* (b) ✘ — same problem.
- *gain* (c) ✘ — unrelated to the humane-treatment framework.

Blank 3 — how does the idea rest on that premise? The final clause names a "**widely accepted idea**" that directly supports the claim:

- **explicitly** ✔ — the dependence is stated outright, not partial or hedged.
- *partially* (a) and *somewhat* (b) weaken the link, contradicting "widely accepted".
- *entirely* (c) is plausible in strength but belongs to an option already dead on blanks 1 and 2.

Answer: (d)

Shortcut

Blank 2 is the sharpest test: which noun can take "necessary"? *Necessary suffering* is a real and much-debated phrase; *necessary well-being* and *necessary comfort* are incoherent, because you would never describe something desirable as merely necessary in this frame.

That single check removes (a), (b) and (c).

Blank 1 confirms it by collocation — *anthropocentric worldview* is the established pairing.

The content is worth knowing too: this is the standard philosophical argument that treating animals as property makes welfare rules economic rather than moral. Recognising the debate makes the vocabulary fall into place.

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80 VARC VERBAL ABILITY VOCABULARY AND WORD USAGE ●●●●●○○○○○ 5 /10

One of the statements below contains a word used incorrectly. Choose the option which has the incorrect or inappropriate usage of the word.

(A) There was a scenic spot not very far from our cottage where we used to go for picnics.

(B) **Such a spot on his career was difficult to ignore when deciding promotions.**

(C) He was unsure if he could respond to the question asked; fortunately, his answer was spot on.

(D) She wanted to make a good impression but, at the last moment, she discovered a spot of ink on her collar.

ANSWER **(b) Such a spot on his career was difficult to ignore when deciding promotions.**

SOLUTION

The word being tested: *spot*, across its senses.

- **(a)** "a scenic **spot**" ✔ — a place or location.
- **(c)** "his answer was **spot on**" ✔ — the idiom meaning exactly right.
- **(d)** "a **spot** of ink on her collar" ✔ — a small mark or stain.
- **(b)** "Such a **spot** on his career..." ✘

Why (b) fails. A *spot* is a literal mark on a physical surface. For a **blemish on a reputation or record**, English uses **blot** — "a **blot** on his career", "a blot on his copybook". *Spot* is not used figuratively this way.

The intended sense is clearly a stain on his professional record, since it affected promotion decisions — so the word required is *blot*.

Answer: (b)

Shortcut

Ask which option uses the word figuratively, then check whether that figure exists. Here (b) is the only metaphorical use of *spot*, and the figurative term for a damaged record is **blot**, not spot.

The near-pair to fix: *spot* = a place, a mark, or "exactly right" (spot on); *blot* = a stain, literal or on a reputation.

Note that option (c) may look unfamiliar — *spot on* is British idiom for "precisely correct". As in other papers in this series, **an unfamiliar but genuine usage is placed deliberately to look like the error.** Verify by meaning, not by recognition.

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81 VARC VERBAL ABILITY VOCABULARY AND WORD USAGE ●●●●●●○○○○ 6 /10

One of the statements below contains a word used incorrectly. Choose the option which has the incorrect or inappropriate usage of the word.

(A) When the women were asked to join the protest, they refused to collaborate.

(B) Some treacherous relatives of Indian rulers collaborated with the British Empire.

(C) **She interviewed many teens to collaborate her thesis on their mental health issues.**

(D) The policeman collaborated with the film makers who were shooting a crime thriller.

ANSWER **(c) She interviewed many teens to collaborate her thesis on their mental health issues.**

SOLUTION

The word pair being tested: *collaborate* vs *corroborate*.

- **collaborate** — to work jointly **with** someone on a shared task (and, in a second sense, to cooperate traitorously with an occupying power).
- **corroborate** — to **confirm or support** a statement, theory or finding with evidence.

Checking each option:

- **(a)** "refused to **collaborate**" ✔ — declining to work with others on the protest.
- **(b)** "relatives… **collaborated with** the British Empire" ✔ — the traitorous sense, signalled by "treacherous".
- **(d)** "The policeman **collaborated with** the film makers" ✔ — working jointly on the shoot.
- **(c)** "interviewed many teens to **collaborate** her thesis" ✘ — interviewing people gathers **evidence to support** a thesis. That is **corroborating** it, not collaborating with it.

Note the grammatical tell as well: *collaborate* takes **with** a person; here the word is followed directly by a thing ("her thesis"), which is the pattern *corroborate* takes.

Answer: (c)

Shortcut

Use the preposition as the test. *Collaborate* is almost always followed by **with**; *corroborate* takes a **direct object**. Scan the four options:

Option	Pattern	Verdict
(a)	*collaborate* (with implied)	fine
(b)	collaborated **with**	fine
(d)	collaborated **with**	fine
(c)	collaborate **her thesis**	wrong verb

Answer (c), found by grammar alone — and the meaning confirms it, since evidence *corroborates* a claim.

Memory hook: co-labor**-ate = work together (labour); co-**robor**-ate = strengthen (Latin *robur*, strength).**

🧪 Vocabulary sticks when it is drilled in short bursts, not memorised in lists. Word Lab

82 VARC VERBAL ABILITY VOCABULARY AND WORD USAGE ●●●●●●○○○○ 6 /10

One of the statements below contains a word used incorrectly. Choose the option which has the incorrect or inappropriate usage of the word.

(A) It was a long journey by road, and they had yet to find a boat that would help them to cross the river.

(B) We were told that she had lived through tough times which made her cross and cranky as she grew older.

(C) The mistakes of his youth are the cross that he has to bear for the rest of his life.

(D) **Although he thinks he is the life of the party, his remarks are insensitive, and his jokes are vulgar, cross, and crude.**

ANSWER **(d) Although he thinks he is the life of the party, his remarks are insensitive, and his jokes are vulgar, cross, and crude.**

SOLUTION

The word being tested: *cross*, across its senses.

- **(a)** "**cross** the river" ✔ — the verb, to go across.
- **(b)** "made her **cross** and cranky" ✔ — the adjective meaning **annoyed or irritable**, pairing naturally with *cranky*.
- **(c)** "the **cross** that he has to bear" ✔ — the idiom for a burden one must endure.
- **(d)** "his jokes are vulgar, **cross**, and crude" ✘

Why (d) fails. The list describes **jokes**, and the other two adjectives — *vulgar* and *crude* — both mean coarse or offensive. *Cross* means **irritable**, which describes a **person's mood**, not the character of a joke. A joke cannot be bad-tempered.

The intended word is something like *coarse*, *crass* or *off-colour*. Note too that *crass* is one letter from *cross*, which is likely the source of the error.

Answer: (d)

Shortcut

When a word sits in a list, it must match the other items in kind. Here *vulgar* and *crude* both describe the **content** of jokes, while *cross* describes a **temperament**. The mismatch is visible without defining anything.

That list test is the fastest route — faster than working through the four senses of *cross*.

Option (c) is worth flagging for students: "the cross he has to bear" is a genuine idiom (from carrying a cross), meaning a lasting burden. It often reads as wrong to those who have not met it. **Unfamiliar is not incorrect.**

83 VARC VERBAL ABILITY VOCABULARY AND WORD USAGE 5 /10

One of the statements below contains a word used incorrectly. Choose the option which has the incorrect or inappropriate usage of the word.

(A) The orchestra decided to flout tradition and played their instruments wearing ordinary clothes.

(B) The problems caused by flouting rules are many, but some people do not care.

(C) **She flouted her designer wear and accessories in front of her classmates.**

(D) Her fault was that she flouted the dress code and refused to wear the uniform.

ANSWER **(c) She flouted her designer wear and accessories in front of her classmates.**

SOLUTION

The word pair being tested: *flout* vs *flaunt*.

- **flout** — to **openly disregard** a rule, convention or law.
- **flaunt** — to **display ostentatiously**, to show off.

Checking each option:

- **(a)** "**flout** tradition" ✔ — openly defying a convention.
- **(b)** "**flouting** rules" ✔ — the core usage.
- **(d)** "**flouted** the dress code" ✔ — disregarding a rule, confirmed by "refused to wear the uniform".
- **(c)** "**flouted** her designer wear and accessories in front of her classmates" ✘ — showing off possessions is **flaunting**, not flouting. The phrase "in front of her classmates" makes the display sense unmistakable.

Answer: (c)

Shortcut

Check the object of the verb — it separates these two words cleanly.

Verb	Takes as object
flout	rules, laws, conventions, authority, tradition
flaunt	wealth, beauty, possessions, success

Options (a), (b) and (d) all take rules or traditions. Option (c) takes **clothes and accessories** — possessions — so it needs *flaunt*.

This pair is among the most commonly confused in English, and the mnemonic is simple: **fl-ou-t** rhymes with *shout* — you shout down a rule; **fl-au-nt** rhymes with *vaunt*, which also means to boast.

84 VARC VERBAL ABILITY VOCABULARY AND WORD USAGE 4 /10

One of the statements below contains a word used incorrectly. Choose the option which has the incorrect or inappropriate usage of the word.

(A) The cricket match was heading for a draw, when the batsman hit a sixer and our team won.

(B) He was lucky enough to win the draw in the lottery, where the prize was a rare painting.

(C) **He used to keep all his important documents in the draw of his cupboard.**

(D) As he was very old, he didn't have the strength to draw water from the well near his house.

ANSWER **(c) He used to keep all his important documents in the draw of his cupboard.**

SOLUTION

The word pair being tested: *draw* vs *drawer*.

- **draw** — a verb (to pull, to sketch, to extract) or a noun meaning a **tie** in a game, or a **lottery selection**.
- **drawer** — a **sliding compartment** in a piece of furniture.

Checking each option:

- **(a)** "heading for a **draw**" ✔ — a tied result.
- **(b)** "win the **draw** in the lottery" ✔ — a random selection.
- **(d)** "**draw** water from the well" ✔ — the verb, to pull up.
- **(c)** "kept all his important documents in the **draw** of his cupboard" ✘ — a compartment in a cupboard is a **drawer**. "In the draw" is not English in this sense.

Answer: (c)

Shortcut

The preposition gives it away: "in the ___ of his cupboard" needs a container, and *draw* names an event or an action, never a thing you put papers inside.

The two words are pronounced almost identically in many Indian and British accents, which is exactly why the question works — it is testing spelling rather than meaning.

Note how wide the net is cast: a tie, a lottery, and the verb to pull. **Three different senses of one word, plus one homophone — the standard IPMAT construction** for this question type, seen also in Q82 (*cross*) and Q80 (*spot*).

85 VARC VERBAL ABILITY VOCABULARY AND WORD USAGE 5 /10

One of the statements below contains a word used incorrectly. Choose the option which has the incorrect or inappropriate usage of the word.

(A) **Her admirers considered her demeanour to be of great state and refinement, and most impressive.**

(B) Uttar Pradesh, being the most densely populated state in India, has the highest number of representatives in Parliament.

(C) The judicial magistrate asked the prosecuting lawyer to state the grounds on which the defendant had been arrested.

(D) The state of his grandfather's health was critical, but it was difficult for him to get in touch with all the members of the family.

ANSWER **(a) Her admirers considered her demeanour to be of great state and refinement, and most impressive.**

SOLUTION

The word being tested: *state*, across its senses.

- **(b)** "the most densely populated **state** in India" ✔ — a political region.
- **(c)** "asked the lawyer to **state** the grounds" ✔ — the verb, to declare formally.
- **(d)** "The **state** of his grandfather's health" ✔ — a condition.
- **(a)** "her demeanour to be of great **state** and refinement" ✘

Why (a) fails. The sentence praises someone's bearing, pairing the blank with *refinement*. The word required is **stature** — standing, distinction, dignity — or possibly *grace*. *State* does not mean dignity or elegance; "of great state" is not an English phrase.

The intended sense is clear from the company it keeps: *refinement* and *most impressive* both point to personal distinction, which is **stature**.

Answer: (a)

Shortcut

Use the list test again, as in Q82. The phrase is "of great ___ **and refinement**", so the missing word must be a quality of personal bearing. *Refinement* tells you the register; *state* does not belong to it.

The near-pair is *state / stature*, and *stature* is the word for standing or distinction.

A pattern across Q80–Q85 worth giving students directly: every one of these six is built on a word that is one or two letters from the right one — *spot/blot*, *collaborate/corroborate*, *cross/crass*, *flout/flaunt*, *draw/drawer*, *state/stature*. **When you find the tested word, ask what word it is nearly.**

86 VARC VERBAL ABILITY PARA JUMBLES 6 /10

The sentences given below, when properly sequenced, form a coherent paragraph. Each sentence is labelled with a number. Decide on the most logical order and enter the sequence of numbers in the space provided.

1. A sub-par monsoon cuts farm yields, output, and farm incomes, increasing the country's dependence on food imports.
2. A robust monsoon will help put a lid on food inflation by increasing domestic output of a variety of goods and commodities.
3. This is because half the Indian population depends upon farm-derived income.
4. The June-to-September rain-bearing system is often called the lifeblood of the country's economy.
5. Unfortunately, however, nearly 40% of India's net sown area does not have access to irrigation.

ANSWER 43512

SOLUTION

Step 1 — find the opener. Sentence **4** is the only one that names its subject in full — "The June-to-September rain-bearing system" — with no backward reference and no connective. Every other sentence depends on it: 3 begins "**This is because**", 5 begins "**Unfortunately, however**", and 1 and 2 both discuss monsoon quality without having introduced the monsoon.

Step 2 — the explanation. Sentence **3**: "**This is because** half the Indian population depends upon farm-derived income." The *This* refers to the lifeblood claim in 4, and the sentence justifies it. A **mandatory pair**: $4 \to 3$.

Step 3 — the complication. Sentence **5**: "Unfortunately, **however**, nearly 40% of India's net sown area does not have access to irrigation." The contrast marker turns the paragraph from the monsoon's importance to India's vulnerability — and it is this lack of irrigation that makes the monsoon decisive.

Step 4 — the consequences. With no irrigation, outcomes hinge entirely on the rains, so the paragraph sets out both directions:

- Sentence **1**: a **sub-par** monsoon cuts yields and raises import dependence.
- Sentence **2**: a **robust** monsoon curbs food inflation.

Bad case before good case, closing on the positive note.

The sequence:

$4 \to 3 \to 5 \to 1 \to 2$

Answer: 43512

Shortcut

Three of the five sentences are disqualified from opening by a connective or a pronoun — *This is because* (3), *Unfortunately, however* (5) — and 1 and 2 are a matched pair of outcomes that need a premise first. That leaves **4**.

Then the pair 4–3 is locked by "This is because", and the pair 1–2 is locked as the sub-par/robust contrast. The only question left is where 5 goes, and its *however* must introduce the vulnerability that makes both outcomes matter.

Look for matched pairs of sentences built on the same frame — here "A sub-par monsoon..." and "A robust monsoon...". Such twins almost always sit together, and usually at the end.

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87 VARC VERBAL ABILITY PARA JUMBLES ●●●●●○○○○○ 5 /10

The sentences given below, when properly sequenced, form a coherent paragraph. Each sentence is labelled with a number. Decide on the most logical order and enter the sequence of numbers in the space provided.

1. The popularity of these creations grew along with that of the tea ceremony in the 16th century.
2. However, savvy tourists find the best bargains for ceramics in Tokyo's Kitchen Town.
3. Modern shops in touristy spots display thousands of them, both hand crafted and factory made.
4. Japanese artisans have been making ceramics, known as Yakimono since prehistoric times.

ANSWER 4132

SOLUTION

Step 1 — find the opener. Sentence **4** introduces both the subject and its name: "Japanese artisans have been making **ceramics, known as Yakimono** since prehistoric times." It has no backward reference.

The others cannot open: 1 says "**these** creations", 3 says "**them**", and 2 begins "**However**".

Step 2 — follow the chronology. The paragraph moves forward in time:

- **4** — prehistoric times
- **1** — "The popularity of **these creations** grew... in the **16th century**"
- **3** — "**Modern** shops... display thousands of **them**"

Each step also carries a backward reference to the one before, confirming the order.

Step 3 — the closer. Sentence **2** begins "**However**, savvy tourists find the best bargains... in Tokyo's Kitchen Town." It qualifies sentence 3's touristy shops by pointing elsewhere, so it must follow 3 directly.

The sequence:

$4 \rightarrow 1 \rightarrow 3 \rightarrow 2$

Answer: 4132

Shortcut

This paragraph is ordered by time, and the time markers are explicit: prehistoric (4) → 16th century (1) → modern (3). Sorting on those three words gets you most of the way with no analysis.

Then *However* (2) must come last, because it contrasts with the modern tourist shops of 3.

A caution worth repeating: chronology is a reliable guide *here* because the paragraph is a straightforward history. In a paragraph that corrects a received view — like the 2023 Visakhapatnam jumble, which mentions 1857 before 1780 — the argument, not the calendar, sets the order. **Check which kind of paragraph you have before trusting the dates.**

---

88 VARC VERBAL ABILITY PARA JUMBLES 6 /10

The sentences given below, when properly sequenced, form a coherent paragraph. Each sentence is labelled with a number. Decide on the most logical order and enter the sequence of numbers in the space provided.

1. This means the brain receives less input over the course of a day.
2. Youthful eyes jiggle regularly to take in new or unfamiliar stimuli.
3. As the person attached to those eyes ages, the eye muscles grow slower and the pathways between the eye and the brain grow longer, more complex, or, in some cases, get damaged.
4. Our eyes quickly scan the surroundings and then send the data to the brain.
5. Human eyes perform jiggles, more formally called saccades, in response to a change in the field of vision.

ANSWER 54231

SOLUTION

Step 1 — find the opener. Sentence **5** defines the phenomenon and names it: "Human eyes perform **jiggles, more formally called saccades**, in response to a change in the field of vision." A sentence that introduces a technical term is almost always the opener.

The others all presuppose it: 1 begins "**This** means", 2 refers to "jiggle" as already known, 3 says "**those** eyes", and 4 describes the mechanism without having introduced it.

Step 2 — the mechanism. Sentence **4**: "Our eyes quickly scan the surroundings and then **send the data to the brain**." This explains what the jiggling accomplishes, and it introduces **the brain**, which the paragraph needs later.

Step 3 — the youthful case. Sentence **2**: "**Youthful** eyes jiggle regularly to take in new or unfamiliar stimuli." The baseline, against which ageing will be contrasted.

Step 4 — the ageing case. Sentence **3**: "As the person attached to **those eyes ages**..." The phrase *those eyes* points directly back to the youthful eyes of sentence 2 — a **mandatory pair**, $2 \to 3$.

Step 5 — the consequence. Sentence **1**: "**This** means the brain receives less input over the course of a day." *This* refers to the slowed muscles and damaged pathways of sentence 3, and it closes the paragraph by returning to the brain.

The sequence:

$5 \to 4 \to 2 \to 3 \to 1$

Answer: 54231

Shortcut

The sentence that defines a technical term opens the paragraph. "jiggles, more formally called saccades" is a definition, so 5 is first — before any other analysis.

Then the youth/age contrast is an unbreakable pair: "**those** eyes" in 3 has no referent except the "youthful eyes" of 2, so $2 \to 3$.

And "This means..." (1) is a consequence, which can only come after the cause it summarises.

Three structural facts — definition first, pronoun pair in the middle, consequence last — fix the whole order without reading for content.

89 VARC VERBAL ABILITY PARA JUMBLES 7 /10

The sentences given below, when properly sequenced, form a coherent paragraph. Each sentence is labelled with a number. Decide on the most logical order and enter the sequence of numbers in the space provided.

1. Located in the foothills of the Sion Fort, the lake is a Grade II-A heritage structure, dating back to the 17th century.
2. Once home to several marine creatures, the lake is now surrounded by high-rise residential buildings.
3. The Municipal Corporation is set to breathe life back into the city's Sion Talao (Lake) with the rejuvenation and beautification of the centuries-old lake.
4. Over the years, the lake has lost its prominence.
5. Earlier the talao was a known natural water tank with the Sion hillock expanding around it like an enclosing wall.

ANSWER 31542

SOLUTION

Step 1 — find the opener. Sentence **3** is the news hook: "The Municipal Corporation is set to breathe life back into **the city's Sion Talao (Lake)**." It introduces the lake by its full name and states the event the paragraph exists to report.

Note how the others depend on it: 1, 2 and 4 all say "**the** lake" with the definite article, and 5 says "**the** talao" — all requiring prior introduction.

Step 2 — the background. Sentence **1** describes what the lake *is*: its location, heritage status and age. This is the natural follow-up to naming it.

Step 3 — the past. Sentence **5**: "**Earlier** the talao was a known natural water tank..." The time marker takes the paragraph back before the present day.

Step 4 — the decline. Sentence **4**: "**Over the years**, the lake has lost its prominence." This moves forward from the earlier state and names the deterioration.

Step 5 — the present state. Sentence **2**: "**Once** home to several marine creatures, the lake is **now** surrounded by high-rise residential buildings." The then/now contrast gives the concrete picture of what the decline amounts to, closing the paragraph — and explaining why rejuvenation is needed.

The sequence:

$3 \to 1 \to 5 \to 4 \to 2$

Answer: 31542

Shortcut

The news sentence opens. Sentence 3 is the only one reporting an *event* — a civic body about to act — and it is the only one naming the lake in full. Everything else is background.

Then the time markers order the rest: *Earlier* (5) → *Over the years* (4) → *now* (2). Sort on those three phrases.

A general principle for this kind of paragraph: news first, then background, then the present situation that justifies the news. Journalistic paragraphs very often invert chronology this way, which is why the "earliest sentence first" instinct would fail here.

90 VARC VERBAL ABILITY PARA JUMBLES 5 /10

The sentences given below, when properly sequenced, form a coherent paragraph. Each sentence is labelled with a number. Decide on the most logical order and enter the sequence of numbers in the space provided.

1. The Central African Republic has approved Bitcoin as an official currency.
2. Experts foresee that this will damage the environment as well as the economy.
3. Others claim that this may make money laundering easy and also use up a lot of electricity.
4. Economists criticised this move as a potential risk to the financial stability of the nation.

ANSWER 1432

SOLUTION

Step 1 — find the opener. Sentence **1** states the fact that everything else reacts to: "The Central African Republic has approved Bitcoin as an official currency." It names the country and the decision, with no backward reference.

The others are all reactions: 4 says "**this move**", 3 says "**Others** claim", and 2 says "**this**".

Step 2 — the first reaction. Sentence **4**: "**Economists criticised this move**..." *This move* refers directly to the approval in sentence 1. A mandatory pair: $1 \to 4$.

Step 3 — the second reaction. Sentence **3**: "**Others** claim..." The word *Others* requires a first group to have spoken already — the economists of sentence 4. So $4 \to 3$.

Step 4 — the summary. Sentence **2**: "Experts foresee that this will damage **the environment as well as the economy**." This gathers both strands:

- the **economy** — the financial-stability risk from sentence 4;
- the **environment** — the heavy electricity use from sentence 3.

A sentence that combines the two preceding concerns must come last.

The sequence:
$1 \to 4 \to 3 \to 2$
Answer: 1432

Shortcut

"Others claim" is the single most useful word in this jumble. *Others* presupposes a first group, so sentence 3 can never be second — it must follow whichever sentence introduces the first set of critics, namely 4.

Then sentence 2 is identifiable as the closer by its scope: it names *both* the environment and the economy, the two concerns raised separately in 3 and 4. **A sentence that summarises two earlier strands belongs at the end.**

Across all five jumbles in this paper, the opener was found the same way: the sentence with no backward-pointing word. That one reflex places the first sentence correctly every time, and the pronouns usually chain the rest together.

Want this paper scored, ranked and analysed? Attempt it on the exam interface. Take the test

READING PASSAGE

Passage 2 – Edward Jenner and the first vaccinations

Read the following passage and choose the answer that is closest to each of the questions that are based on the passage.

On the 14th of May 1796, vaccine matter was taken from the hand of a dairy maid, Sarah Nelmes, and inserted by two superficial incisions in the arms of James Phipps, a healthy boy of about eight years of age. The boy went through an attack of cowpox as expected. After this, however, it was necessary to determine whether he was protected from smallpox. After waiting two months Jenner inoculated him with material from a smallpox patient. He was delighted to note that the boy was not affected by smallpox.

By 1798, Jenner had succeeded in demonstrating the protective quality of the cowpox virus against smallpox, by putting on record details of 23 cases, contracted either casually or by direct inoculation. Sixteen of these had occurred accidentally among dairy workers in the course of occupations connected with cows and horses; the rest were done under Jenner's direction. Among the persons inoculated was Jenner's own little second son, Robert Harding Jenner, an infant eleven months old. Jenner demonstrated conclusively that the cowpox protects the human constitution from the infection of smallpox.

After Dr. Jenner had made his tests, he prepared a pamphlet for publication. He also went to London, so that he might have the opportunity to introduce the subject personally to friends and demonstrate the truth of his assertion to them. He remained in London for nearly three months without being able to find anyone who would submit to vaccination. Jenner went back to Gloucestershire, disappointed. It happened, however, that soon after his return home, a distinguished London surgeon named Cline resolved to make a trial of the vaccine material which Jenner had left with his friends.

The patient was a child suffering from a form of chronic hip-joint disease. The vaccine material was inoculated, and the vaccine vehicle ran rather a normal course and healed fully. The little patient was afterward inoculated with smallpox virus and found to be incapable of acquiring that disease. This case attracted considerable attention. The child was in a run-down condition, and the vaccine material might very well have provoked a rather serious local reaction. In a way, the fate of vaccination hung in the balance and good luck was in its favour. Mr. Cline, however, after this, became a strong advocate of vaccination, and brought it very decidedly before the London physicians.

It was not long before the opposition to the practice of vaccination took definite form. One of the best-known London physicians of the time, Dr. Ingenhouz, became the leader of a strong faction of the medical profession of London, who not only would have nothing to do with vaccination, but proclaimed openly that it was a dangerous innovation, absolutely unjustifiable, and communicated a disease without protecting against any other. Dr. Watt from Glasgow blamed the vaccine for the increase in severe cases of measles and measles-related deaths among children.

Fortunately, only a few colleagues were so illogical, and an excellent idea of how much Jenner's discovery was appreciated by his contemporaries may be obtained from the number of honours, diplomas, addresses and communications from public bodies and distinguished individuals which he

received. Most of the prominent medical and scientific societies of Europe elected him a member or sent him some special token of recognition.

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APPENDIX

Topic notes

The concepts this paper leaned on, pulled out of the solutions and written as revision notes. Read them after you have attempted the paper, not before.

Number system

Counting with exclusions *(Q9)* — The nth number after deleting the perfect squares is about $n + \sqrt{n}$. Then run two checks: that $N - \lfloor \sqrt{N} \rfloor = n$, and that N is not itself a square. The second check is the one people skip.

Divisibility and digit rearrangement *(Q21)* — Split any divisibility rule into the part that ignores position (the **digit sum**, which governs 3 and 9) and the part that depends on it (the **last digits**, which govern 2, 4, 5, 8, 10). When a question shuffles digits, only the second part can fail — so look at the final digit of each option and nothing else.

Counting multiples *(Q39)* — "Divisible by 2 and 3" means divisible by 6; "also by 5" means by 30. Count the first set, subtract the second. Equivalently, $\frac{4}{5}$ of the multiples of 6 survive.

HCF and LCM *(Q33)* — The identity worth having instantly:

$HCF(a,b) \times LCM(a,b) = ab$

together with $(a+b)^2 - (a-b)^2 = 4ab$, which is what the question is really testing.

Arithmetic

Equal-distance speed problems *(Q3)* — For the same distance at speeds u and v with a time difference t:

$$d = \frac{uv}{v-u}t$$

One line, no fractions to clear.

Races *(Q29)* — "Beats by x metres **and** y seconds" gives the loser's speed directly as $\frac{x}{y}$. That single conversion unlocks every other time in the question. Gaps between pairs of runners are **not** additive — always go through the speeds.

Profit and loss across two scenarios *(Q5)* — Work with the **money spent on each category**, not the item counts. Percentages act on amounts, so putting the money at the centre removes the unit prices from the algebra until the final division.

Averages and alligation *(Q23)* — Place the two group averages either side of the combined average; the group sizes are in the **inverse** ratio of the distances. Then check carefully which ratio the question asked for — the reverse is always among the options.

Mixtures *(Q30)* — When a fraction of a well-mixed solution is removed, **every component** falls by that fraction. To raise one component to 50%, note that the *other* components are unchanged by the addition, so the target is simply to make the added component equal them.

Variation *(Q34)* — If $C \propto w^2$, then $\frac{C_2}{C_1} = \left(\frac{w_2}{w_1}\right)^2$. Use the ratio and never compute the constant. The linear answer will be one of the options.

Maximisation under a fixed difference *(Q15)* — If $S_H - S_L$ is fixed, then $S_H + S_L = 2S_H - \text{const}$, so maximising the total reduces to maximising **one side**. Then always check the other side is still achievable.

Algebra

Logarithms *(Q1, Q16)* — Two moves cover both questions:

$$\log_{a^k} b^k = \log_a b, \qquad \frac{1}{\log_a b} = \log_b a$$

So $\log_{27} 8 = \log_3 2$, and $9^{1/\log_2 3} = 9^{\log_3 2} = 4$. And recognise $\frac{L}{2} + \frac{1}{2L} = 1$ as the **AM–GM equality case**, forcing $L = 1$ with no quadratic.

Exponential ranges *(Q17)* — An exponential is **strictly positive**. From $81^{f(x)} = 3 - 81^x$ it follows that $0 < 81^{f(x)} < 3$, hence $f(x) < \log_{81} 3 = \frac{1}{4}$ with no lower bound.

Sums of moduli *(Q6)* — Never differentiate. $\sum w_i|x - a_i|$ is minimised at the **weighted median**: accumulate weights from the left until you pass half the total. Treat $2|x - 1|$ as a point of weight 2. If the cumulative weight lands exactly on half, the minimum is attained along a whole flat interval.

Modulus equations *(Q35)* — Learn the identity

$$|x + a| + |x - a| = \begin{cases} 2|x|, & |x| \geq a \\ 2a, & |x| \leq a \end{cases}$$

and **check each case against its own interval** — the discarded roots are exactly what generate the wrong options.

Progressions *(Q11, Q24)* — For an AP, consecutive blocks of k terms differ by $k^2 d$; here $225d = 150$. And when AP terms form a GP, apply $b^2 = ac$, then **scale the common difference** to clear fractions ($d = 4$ turns Q11 into the AP $3, 7, 11, \ldots$).

AP condition with powers *(Q13)* — Substitute $t = 2^x$ *before* anything else, and watch that $2^{2x-1} = \frac{1}{2}(2^x)^2$.

Functional equations *(Q37)* — Substitute $x = 0$ first; it is almost always the most productive move. Here it gives $f(f(y)) = y$, so f is a bijection and its own inverse, and injectivity then pins $f(0) = 0$. Verifying an obvious candidate such as $f(x) = x$ is a legitimate exam shortcut.

Signum *(Q32)* — $\frac{x}{|x|}$ is the sign of x: range $\{1, -1\}$, with 0 excluded because it is not in the domain.

Concurrent lines *(Q18)* — Solve two, substitute into the third. The 3×3 determinant condition is correct but slower and more error-prone.

Geometry, coordinate geometry and trigonometry

Modulus regions *(Q2)* — $\frac{|x|}{a} + \frac{|y|}{b} \leq 1$ is a rhombus of area $2ab$.

Triangle inequality *(Q19)* — The third side lies strictly in $(|a - b|, a + b)$. Equality gives a **degenerate** triangle, which is why an option sitting exactly on the boundary is always wrong.

Midpoint theorem *(Q20)* — A segment joining the midpoints of two sides is parallel to the third and **half** its length. Recognise 3–4–5, 5–12–13 and 8–15–17 on sight to cross-check.

Heights and distances *(Q40)* — A 45° angle of elevation or depression makes the horizontal distance **equal** the height — no trigonometry needed for that leg. To convert metres-per-2-minutes into km/h, multiply by 30.

Sum and difference of sines and cosines *(Q10)* — Given both $\sin\alpha + \sin\beta$ and $\cos\alpha + \cos\beta$, **square and add**:

$(\ldots)^2 + (\ldots)^2 = 2 + 2\cos(\alpha - \beta)$

Then halve with $\cos^2\theta = \frac{1 + \cos 2\theta}{2}$.

Conic classification *(Q31)* — For $\frac{x^2}{A} + \frac{y^2}{B} = 1$: both denominators positive gives an **ellipse** (foci on the axis of the **larger** denominator); opposite signs give a **hyperbola**. Two facts settle the 2022 question without a calculator —

cosine is decreasing on $(0, \pi)$, and sine is nearly flat at its peak, so $\sin\sqrt{2} - \sin\sqrt{3}$ is positive but tiny.

Ordering expressions *(Q27)* — When four messy expressions must be ranked, **substitute a convenient value** ($\theta = 30^\circ$) rather than reasoning symbolically. Remember that $\log$ of a number below 1 is negative, and that x^p **decreases** in p when $0 < x < 1$.

Modern maths

Counting triangles from collinear points *(Q4)* — Either split as $2 + 1$ across the two lines, or use the complement $\binom{12}{3} - \binom{7}{3} - \binom{5}{3}$.

Arrangements with repetition and the gap method *(Q22)* — Arrange the consonants ($\frac{6!}{2!2!}$), then slot vowels into the **gaps**: n letters in a row give $n + 1$ gaps. Divide by repeats on **both** halves.

Circular arrangements *(Q14)* — n entities around a round table give $(n-1)!$ arrangements. Glue a couple together and count entities **after** gluing; for "A together and B apart", compute "A together" minus "both together".

Power sets *(Q12)* — $|P(X)| = 2^{|X|}$, and crucially $|P(\varnothing)| = 1$. The chain runs $0 \to 1 \to 2 \to 4 \to 16$.

Relations and functions *(Q28)* — Relations $A \to B$ number $2^{|A||B|}$; functions number $|B|^{|A|}$. The **base is the codomain**.

Cartesian products *(Q36)* — $A \times B = B \times A$ only when $A = B$. Use $|A \times B| = |A||B|$ to force the sizes.

Divisor counting *(Q38)* — All divisors: $\prod (a_i + 1)$. Perfect-square divisors: $\prod (\lfloor a_i/2 \rfloor + 1)$ — and remember exponent 0 counts as even.

Matrices *(Q7, Q25, Q26)* — **Always compute A^2 first.** It reveals whether a matrix is involutory ($A^2 = I$, as in Q7, making every odd power A), idempotent ($A^2 = A$) or nilpotent. For the cyclic matrix of Q25, $\det = -\left(a^3 + b^3 + c^3 - 3abc\right)$, which is negative for distinct positive a, b, c. And the shear identity is worth memorising:

$$\begin{bmatrix} 1 & 0 \\ k & 1 \end{bmatrix}^n = \begin{bmatrix} 1 & 0 \\ nk & 1 \end{bmatrix}$$

Binomial theorem *(Q8)* — Sum of all coefficients $= P(1)$; sum of even minus odd $= P(-1)$.

Logical reasoning

Scheduling grids *(Q41–Q45)* — The staffing set is solved by one discipline: **find the slot with the fewest eligible people and fill it first.** Here Saturday had only one possible second worker, and Cathy had exactly three permissible days, so both rows were forced before any trial and error.

Three further habits:

1. **Check the slot arithmetic** before starting — $6 \times 2 + 3 = 15 = 5 \times 3$, so nobody has spare capacity and every exclusion bites.
2. **Read "consecutive" carefully.** A business open "throughout the year" runs on a **cyclical** week, so Sunday and Monday are adjacent. Reading the week as a flat Monday-to-Sunday list gives a different (and wrong) unique roster — this is the single most important decision in the set.
3. **Use the busiest day as an eliminator.** Sunday carries three people, so any pair drawn from those three must work together — which answers the "never together" question almost immediately.

Verbal ability

Reading comprehension *(Q46–Q57)* — Match the technique to the question type:

Type	What to do
Detail / fact	Find the question's verb in the passage; read only that sentence
Main idea	Count how many paragraphs each option covers — the winner covers all
Structure / evidence	Read the connectives; *fortified by other evidence* marks what is supplementary
Vocabulary in context	Sort options by **polarity** first, then by **subject**
Inference	State only the step the passage leaves unsaid
Phrase meaning	The passage usually defines the phrase in the same sentence — read on

Traps that recur in both 2022 passages:

1. **The recommendation mistaken for the thesis.** The fruit passage ends by proposing further study of wild fruits; that is its *next step*, not its main point (Q46).
2. **True details that do not answer the question asked.** Jenner's son and the dairy workers are both real, but neither is the *objective* of the 23-case record (Q56).
3. **Absence of opposition versus presence of appreciation.** Q53 turns entirely on that distinction.
4. **Dictionary meaning versus context.** *Unjustifiable* suggests ethics or legality, but the passage glosses it as *ineffective* in the very next clause (Q57).

Idioms and sentence completion *(Q58–Q64)* — From this paper: *hide in plain sight*, *a piece of cake*, *a taste of one's own medicine*, *look down on*, *look on the bright side*, *condescendingly*, *inclusivity and diversity*.

Two rules cover nearly every distractor:

- **Idioms are fixed strings.** No synonym substitution (*slice* for *piece*), no added prepositions (*go to the extra mile*), no blending of two idioms (*look forward to the bright side*).
- **Check the grammatical slot before the meaning.** *Overly* cannot stand alone after "behaving"; that eliminates an option with no vocabulary knowledge at all.

Grammar and sentence correction *(Q65–Q69)* — The points tested, each worth knowing as a frame:

- **Third conditional**: *If* + **had** + V_3 … **would have** + V_3. And distinguish *would have* (hypothetical outcome) from *should have* (regret or obligation).
- **Conditional clauses take the present for future meaning** after *if, when, unless, provided, until, as soon as* — never *will*.
- **Redundancy**: *revert back*, *return back*, *repeat again* all say it twice. And *its* is possessive; *it's* is only ever *it is* or *it has*.
- **Collocation**: you *arouse* interest but *catch* attention.
- **Negative inversion**: a fronted *never, not once, rarely, seldom, hardly, no sooner* forces subject–auxiliary inversion, with the main verb in its **base** form — *not once* ***did he complain***.

Para completion *(Q70–Q73)* — Four tests, in order of usefulness:

1. **Support the unsupported claim.** "Reaching there is not a major problem" demands transport.

2. **Match the sentence *type* the slot needs.** "There are several causes for this **situation**" requires the blank to be a situation — not advice, not a recommendation.
3. **Read the connectives in the neighbouring sentences.** *For example* demands a preceding generalisation; *Then there are…* shows the paragraph is listing factors in order.
4. **Prefer the option that consumes the paragraph's most specific detail.** In Q73 that detail is "already deciphered", which only the decoding option uses.

Cloze *(Q74–Q79)* — Work across the options column by column and start with whichever blank has the cleanest test:

- **polarity** — something being *stopped* must be negative (*unsolicited*, not *informative*);
- **category** — a firewall is a tool, not an actor;
- **grammar** — *accuse* never takes a *that*-clause;
- **collocation** — *anthropocentric worldview*, *insider information*, *necessary suffering*;
- **internal contradiction** — films called "visually strong" but thought primitive means the belief is a **misconception**.

Word usage *(Q80–Q85)* — Every one of these six turns on a word one or two letters from the right one:

Tested word	Should have been	Difference
spot	**blot**	a mark on a surface vs a stain on a reputation
collaborate	**corroborate**	work with someone vs confirm a claim
cross	**crass / coarse**	irritable (a mood) vs offensive (content)
flout	**flaunt**	disregard a rule vs show off a possession
draw	**drawer**	a tie or a lottery vs a sliding compartment
state	**stature**	a region or condition vs personal standing

Three habits settle almost all of them. Check the **part of speech** and the **preposition** (*collaborate **with*** a person; *corroborate* a claim). Check that a word in a **list** matches its neighbours in kind (*vulgar, cross, crude*). And remember that **unfamiliar is not incorrect** — *spot on* and *the cross he has to bear* are both genuine and are placed to look like errors.

Para jumbles *(Q86–Q90)* — Three moves, in order:

1. **Find the opener** — the only sentence with no backward-pointing word (*this, these, them, those, others*) and no connective (*However, Therefore, Unfortunately, Then*). In all five of this paper's jumbles that single test identified the first sentence.
2. **Lock the mandatory pairs** — *This is because* after the claim it explains; *Others claim* after the first group; *those eyes* after the eyes were introduced.
3. **Find the closer** — a sentence that summarises two earlier strands (the Bitcoin paragraph's "environment as well as the economy") or completes a mechanism.

Order by time only when the paragraph is a plain history. The ceramics jumble does run prehistoric → 16th century → modern, but the Sion Lake paragraph puts the *news* first and the background afterwards, which is how journalistic paragraphs normally work.

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