

Mathematical Reasoning

Answers & worked explanations

Free NSW selective practice paper | Breezy Squirrel | 35 answers

Matches the accompanying question PDF. The key and explanations below are taken from the published online paper, checked on 8 October 2026. This is our original practice material, not an official Department of Education paper.

Quick answer key

Mathematical Reasoning

1: A	2: E	3: E	4: A	5: E	6: D	7: C	8: B
9: D	10: E	11: D	12: B	13: A	14: A	15: D	16: C
17: A	18: D	19: C	20: D	21: A	22: B	23: E	24: B
25: C	26: E	27: B	28: D	29: B	30: C	31: C	32: E
33: C	34: C	35: D					

Worked explanations

Mathematical Reasoning

Question 1 - Answer A

A movie finishes at 12:35 (24-hour time). It ran for 5 hours 15 minutes. What time did it start (give your answer in 12-hour format)?

Correct answer: 7:20 am

Strategy. Work backwards from the end time, taking off the hours first and then the minutes.

End at 12:35 pm.

Subtract 5 hours: $12:35 \text{ pm} - 5 \text{ h} = 7:35 \text{ am}$.

Then subtract 15 minutes: $7:35 \text{ am} - 15 \text{ min} = 7:20 \text{ am}$.

Write the answer in 12-hour time: 7:20 am.

Check. Forward check: $7:20 \text{ am} + 5 \text{ h} + 15 \text{ min}$ returns to 12:35 pm.

Why the others are wrong

B. Added the duration instead of subtracting it.

C. Subtracted the hours but forgot to take off the 15 minutes.

E. Crossed midday but kept the wrong period (am vs pm).

D. Adding 5 h 15 min to 7:30 am gives 12:45 pm, not the 12:35 pm end time in the question.

Question 2 - Answer E

Mrs Rossi is tiling a border of two rows along the bottom of a wall. Both rows start at the same corner. The top row uses only tiles 35 cm long and the bottom row uses only tiles 20 cm long, laid end to end with no gaps. Mrs Rossi wants both rows to end at exactly the same point, and the border to be as short as possible. How many tiles are needed altogether?

Correct answer: 11

Strategy. Each row's length is a multiple of its tile length, so the shortest border where both rows end level is the lowest common multiple of 35 and 20.

The top row can end at 35, 70, 105, 140, ... cm. The bottom row can end at 20, 40, 60, 80, ... cm.

The first length in both lists is the lowest common multiple of 35 and 20. 35 and 20 share the factor 5, so multiply them and divide by 5 once. $35 \times 20 \div 5 = 140$.

Count the tiles in each row. $140 \div 35 = 4$ and $140 \div 20 = 7$.

Add the two rows. $4 + 7 = 11$.

Check. $4 \times 35 = 140 \text{ cm}$ and $7 \times 20 = 140 \text{ cm}$, so both rows end level. correct

Why the others are wrong

A. Thought both rows need the same number of tiles, so doubled the top row's $140 \div 35 = 4$: $4 \times 2 = 8$. The rows end level in length, not in number of tiles.

B. Thought both rows need the same number of tiles, so doubled the bottom row's $140 \div 20 = 7$: $7 \times 2 = 14$. The rows end level in length, not in number of tiles.

C. This counts only the top row ($140 \div 35 = 4$ tiles); the bottom row needs 7 more.

D. A border $35 \times 20 = 700 \text{ cm}$ long also makes the rows end level ($700 \div 35 + 700 \div 20 = 55$ tiles), but it is not the shortest: 35 and 20 share the factor 5, so 140 cm is enough.

Question 3 - Answer E

How many three-digit whole numbers can be divided exactly by both 9 and 8?

Correct answer: 12

Strategy. Count the three-digit multiples of the lowest common multiple, 72.

Numbers that divide exactly by 9 and by 8 are the multiples of their lowest common multiple, 72. $9 \times 8 = 72$.

Find the largest three-digit multiple of 72. $999 \div 72 = 13$ remainder 63, so $72 \times 13 = 936$.

Find the smallest three-digit multiple of 72. $99 \div 72 = 1$ remainder 27, so $72 \times 2 = 144$.

Count 72×2 up to 72×13 . $13 - 2 + 1 = 12$.

Check. From 144 to 936 in steps of 72: 12 numbers. correct

Why the others are wrong

A. Subtracted $13 - 2 = 11$ but did not add 1, so one end of the list from 144 to 936 was not counted.

B. Counted the three-digit multiples of 8 only: $124 - 12 = 112$; not all of them divide by 9.

C. Counted every multiple of 72 from 72 up to 936, including the 1 with fewer than three digits: that is 13 numbers, not 12.

D. Counted the three-digit multiples of 9 only: $111 - 11 = 100$; not all of them divide by 8.

Question 4 - Answer A

A square field has sides that are a 4-digit whole number of metres long. Its area in square metres is the side length multiplied by itself. What is the greatest number of digits the area could have?

Correct answer: 8

Strategy. Square the smallest and the largest possible side and count the digits.

The smallest 4-digit number is 1,000. $1,000 \times 1,000 = 1,000,000$.

The largest 4-digit number is 9,999. $9,999 \times 9,999 = 99,980,001$.

So the answer has at least 7 and at most 8 digits.

Check. 1,000,000 has 7 digits and 99,980,001 has 8 correct

Why the others are wrong

B. Used the smallest numbers instead of the largest: $1,000 \times 1,000$ is 1,000,000, which has 7 digits, the fewest the answer can have.

C. Multiplied the digit counts ($4 \times 4 = 16$) instead of thinking about the size of the answer.

D. Doubled the side instead of multiplying it by itself: $2 \times 9,999$ is 19,998, which has 5 digits.

E. Rounded the largest numbers up to 10,000 and 10,000: $10,000 \times 10,000$ is 100,000,000, which has 9 digits; but each of those has one digit too many.

Question 5 - Answer E

Aisha has \$75 in a money box. In week 1 she puts in \$35, in week 2 she takes out some money, and she keeps taking turns: putting in \$35 one week, then taking out the same amount as before the next week. At the end of week 7 there is \$167 in the money box. How much does she take out each time?

Correct answer: \$16

Strategy. Count how many forward and backward steps there were, then share out the missing amount.

In 7 weeks there are 4 forward steps of 35 and 3 backward steps. $4 \times 35 = 140$.

Without the backward steps it would reach $75 + 140 = 215$; it is at 167 instead. $215 - 167 = 48$.

That total was taken back in 3 equal steps. $48 \div 3 = 16$.

Check. $75 + 4 \times 35 - 3 \times 16 = 167$. correct

Why the others are wrong

A. Counted 4 weeks taking money out instead of 3: $(75 + 4 \times 35 - 167) \div 4 = \$12$.

B. Found the total taken back, $75 + 4 \times 35 - 167 = \$48$, but did not share it over the 3 weeks taking money out.

C. Counted 2 weeks taking money out instead of 3: $(75 + 4 \times 35 - 167) \div 2 = \$24$.

D. Worked out the change over each forward-and-back pair, $(167 - 75 - 35) \div 3 = \$19$, and gave that instead of the backward amount.

Question 6 - Answer D

Five runners recorded the following times in a 100-metre sprint (in seconds): Ava: 58.936 s; Isla: 59.05 s; Noah: 59.011 s; Mia: 58.935 s; Ben: 59.07 s. Who was the fastest (shortest time)?

Correct answer: Mia

Strategy. Write every time to the same number of decimal places, then pick the smallest value.

Write each time to 3 decimal places: Ava 58.936, Isla 59.050, Noah 59.011, Mia 58.935, Ben 59.070.

Trailing zeros do not change the value.

Order the times: $58.935 < 58.936 < 59.011 < 59.050 < 59.070$.

The smallest time is 58.935 s, run by Mia.

Check. Mia's 58.935 s is the smallest of the five times, so Mia is the fastest.

Why the others are wrong

A. Ava's 58.936 s is just slower than Mia's 58.935 s.

B. Isla's 59.050 s is bigger than Mia's 58.935 s.

C. Noah's 59.011 s is bigger than Mia's 58.935 s.

E. Ben's 59.070 s is bigger than Mia's 58.935 s.

Question 7 - Answer C

A flight leaves Los Angeles at 7:00 pm on Sunday and takes 14 hours to reach Sydney. Sydney is 18 hours ahead of Los Angeles. What is the local time in Sydney when the flight lands?

Correct answer: 3:00 am on Tuesday

Strategy. Add the flight length to the departure clock, then apply the time-zone offset and check the day.

Start at 7:00 pm on Sunday in Los Angeles.

Add the 14-hour flight: 7:00 pm Sunday + 14 h = 9:00 am Monday in Los Angeles time.

Sydney is 18 hours ahead of Los Angeles, so the offset is +18 hours.

Apply the offset: 9:00 am Monday + 18 h = 3:00 am on Tuesday.

Check. Adding flight + offset to the start lands on 3:00 am on Tuesday.

Why the others are wrong

- A. Got the right clock but the wrong day-of-week label.
- B. Off by a whole day - the date rolls forward to Tuesday.
- D. Stopped at the Los Angeles arrival and forgot to apply the offset.
- E. Applied the offset in the wrong direction.

Question 8 - Answer B

In a sequence, each term is obtained by multiplying the previous term by the same whole number. The 1st term is 9 and the 6th term is 288. What is the 2nd term?

Correct answer: 18

Strategy. Find the constant multiplier from the two given terms, then step forward to the 2nd term.

Start with the first term, 9.

Test whole-number multipliers: only 2 makes 9 grow to 288 by the 6th term.

Multiply by 2 to get the 2nd term: $9 \times 2 = 18$.

Check. 9, 18, 36, 72, 144, 288 - the 2nd term is 18, and the 6th term is 288.

Why the others are wrong

- A. Used an add-2 rule each step instead of multiply by 2.
- C. Multiplied by the rule one extra time (off by one step).
- D. Multiplied by the rule one fewer time (off by one step).
- E. 148 doesn't appear anywhere in the sequence 9, 18, 36, 72, 144, 288, so it can't be a term.

Question 9 - Answer D

Consider these three statements.

1) $\frac{5}{6} - \frac{3}{4} < \frac{1}{4}$

2) $\frac{3}{5} - \frac{2}{5} < \frac{1}{3}$

3) $\frac{1}{2} - \frac{1}{6} > 1$

Which of the statements are correct?

Correct answer: 1 and 2

Strategy. Test each statement, comparing with simple benchmarks such as $\frac{1}{2}$ or 1 wherever the exact answer would need fractions with unlike denominators, then pick the option that names exactly the true statements.

Statement 1: $\frac{3}{4} + \frac{1}{4} = 1$, and $\frac{5}{6}$ is less than 1. So $\frac{5}{6}$ is less than $\frac{3}{4} + \frac{1}{4}$, which means $\frac{5}{6} - \frac{3}{4}$ is less than $\frac{1}{4}$. True.

Statement 2: $\frac{3}{5} - \frac{2}{5} = \frac{1}{5}$, which is less than $\frac{1}{3}$. True.

Statement 3: $\frac{1}{2} = \frac{3}{6}$, so $\frac{1}{2} - \frac{1}{6} = \frac{3}{6} - \frac{1}{6} = \frac{2}{6} = \frac{1}{3}$, which is less than 1, not more. False.

The true statements are 1 and 2.

Check. Statement 3 comes to $\frac{1}{3}$, well short of 1, while statements 1 and 2 both hold. That matches '1 and 2'. correct

Why the others are wrong

- A. 2 only misses statement 1, which is true because $\frac{5}{6}$ is less than $\frac{3}{4} + \frac{1}{4}$.
- B. 1 only misses statement 2, which is true: $\frac{3}{5} - \frac{2}{5} = \frac{1}{5}$, less than $\frac{1}{3}$.

- C. 1, 2 and 3 includes statement 3, but $\frac{1}{2} - \frac{1}{6} = \frac{1}{3}$, which is less than 1.
 E. 3 only picks the one false statement and misses statements 1 and 2.

Question 10 - Answer E

The spinner shown has 5 equal sectors labelled 1 to 5. The spinner is spun twice. What is the probability that the two spins show the same number?

Correct answer: $\frac{1}{5}$

Strategy. Count every ordered pair of spins, then count the pairs where both spins match.

Each spin has 5 outcomes, so two spins give $5 \times 5 = 25$ ordered pairs.
 Pairs that match (both spins show the same number): there are 5 of them.
 Probability = matching pairs $\div$ total pairs = $\frac{5}{25} = \frac{1}{5}$.

Check. 5 winning pairs out of 25 ordered pairs equals $\frac{1}{5}$.

Why the others are wrong

- D. Divided by 5 instead of 25, forgetting the second spin doubles the outcome space.
 A. $\frac{2}{5}$ equals $\frac{10}{25}$, but only 5 of the 25 pairs match, not 10 - too high.
 B. $\frac{6}{25}$ would mean 6 of the 25 pairs match, but only 5 actually do - one too many.
 C. $\frac{4}{25}$ would mean 4 of the 25 pairs match, but there are 5 - one short.

Question 11 - Answer D

A book has some pages. On the first day Rina reads $\frac{3}{4}$ of the pages. On the second day she reads $\frac{1}{3}$ of the remaining pages. She has 40 pages left to read. How many pages does the book have?

Correct answer: 240 pages

Strategy. Work backwards one day at a time: from the 40 pages left, find the pages before day 2, then the whole book.

On day 2 Rina reads $\frac{1}{3}$ of the pages she had left, so $\frac{2}{3}$ of them remain.
 The 40 pages left are that $\frac{2}{3}$, so $\frac{1}{3}$ is $40 \div 2 = 20$ and before day 2 she had $20 \times 3 = 60$ pages.
 On day 1 she reads $\frac{3}{4}$ of the book, so $\frac{1}{4}$ of the book is left. Those 60 pages are $\frac{1}{4}$ of the book.
 So the whole book has $60 \times 4 = 240$ pages.

Check. From 240: day 1 reads $\frac{3}{4}$ of 240, which is 180 pages, leaving 60; day 2 reads $\frac{1}{3}$ of 60, which is 20 pages, leaving 40, matching the leftover.

Why the others are wrong

- A. Worked back with the fractions read instead of the fractions left: treated the 40 pages as the $\frac{1}{3}$ read on day 2 ($40 \times 3 = 120$ before day 2), then the 120 as the $\frac{3}{4}$ read on day 1 ($\frac{1}{4}$ is $120 \div 3 = 40$, so $40 \times 4 = 160$).
 C. Doubled the leftover ($40 \times 2 = 80$) instead of working back through both days - doubling would only undo reading half.
 B. 200 can't be right: day 1 would leave $\frac{1}{4}$ of $200 = 50$ pages, and $\frac{1}{3}$ of 50 is not a whole number of pages.
 E. 237 can't be right either: $\frac{1}{4}$ of 237 is not a whole number of pages.

Question 12 - Answer B

The balance scale shown is exactly level. The left pan holds 1 star and 3 pentagons; the right pan holds 4 diamonds. One pentagon weighs 80 g and one diamond weighs 100 g. What is the weight of one star?

Correct answer: 160 g

Strategy. Both pans weigh the same, so star + 3 pentagons = 4 diamonds; solve for the star.

Right pan: 4 diamonds at 100 g each = $4 \times 100 = 400$ g.

Three pentagons on the left: $3 \times 80 = 240$ g.

The pans balance, so star + 240 = 400, giving star = $400 - 240 = 160$ g.

Check. Left pan: $160 + 3 \times 80 = 400$ g; right pan: $4 \times 100 = 400$ g. The pans match.

Why the others are wrong

A. 106 g is smaller than the correct answer (160 g) - if you landed on it, re-check that every step used the numbers exactly as the question gives them.

C. Reported the given pentagon weight instead of the star weight.

D. 260 g is larger than the correct answer (160 g) - if you landed on it, re-check that every step used the numbers exactly as the question gives them.

E. Reported the given diamond weight instead of the star weight.

Question 13 - Answer A

A pack contains 10 bottles of juice, each 150 mL. After 100 mL is poured out for a recipe, what is the total remaining volume in L?

Correct answer: 1.4 L

Strategy. Multiply to get the total in mL, take off the amount poured out, then change to L.

10 bottles each holding 150 mL: $10 \times 150 = 1500$ mL.

Pour out 100 mL: $1500 - 100 = 1400$ mL.

Change mL to L by dividing by 1000: $1400 \div 1000 = 1.4$ L.

Check. $1.4 \text{ L} \times 1000 = 1400$ mL, plus the 100 mL removed gives $1500 \text{ mL} = 10 \times 150 \text{ mL}$.

Why the others are wrong

B. Forgot to subtract the 100 mL poured out.

C. Divided by 100 instead of by 1000 when changing mL to L.

D. 1.25 L equals 1250 mL, which is less than the 1400 mL actually remaining.

E. 2.4 L equals 2400 mL, more than the 1500 mL the whole pack held to begin with.

Question 14 - Answer A

Georgia has one and a half times as many apples as Zac, and Zac has 5 times as many apples as Quincy. Quincy has 28 apples. How many apples does Georgia have?

Correct answer: 210

Strategy. Go along the chain: first Quincy to Zac, then Zac to Georgia.

Zac has $5 \times$ Quincy's count. $5 \times 28 = 140$.

Georgia has $1\frac{1}{2} \times$ Zac's count. $1\frac{1}{2} \times 140 = 210$.

Check. Back along the chain: $210 \div 3 \times 2 = 140$ and $140 \div 5 = 28$. correct

Why the others are wrong

- B. Used the link between Zac and Quincy ('5 times as many') for both steps: $5 \times 28 = 140$, then $5 \times 140 = 700$.
- C. Stopped at Zac's count ($5 \times 28 = 140$) and did not go on to Georgia.
- D. Used the link between Georgia and Zac ('one and a half times as many') for both steps: $1\frac{1}{2} \times 28 = 42$, then $1\frac{1}{2} \times 42 = 63$.
- E. Used $1\frac{1}{2} \times$ Quincy's 28 directly, skipping Zac: $1\frac{1}{2} \times 28 = 42$. Georgia has one and a half times as many apples as Zac, not Quincy.

Question 15 - Answer D

A bag contains apple, banana and cherry counters (and no others). The probability of spinning (or picking) apple is $\frac{1}{5}$, and the probability of banana is $\frac{3}{10}$. What is the probability of cherry?

Correct answer: $\frac{1}{2}$

Strategy. The three outcomes cover everything, so their probabilities add to 1; subtract the two known ones from 1.

$P(\text{apple}) + P(\text{banana}) + P(\text{cherry}) = 1$, since one of the three must happen.

Add the two known probabilities: $\frac{1}{5} + \frac{3}{10} = \frac{1}{2}$.

Subtract from 1: $P(\text{cherry}) = 1 - \frac{1}{2} = \frac{1}{2}$.

Check. $\frac{1}{5} + \frac{3}{10} + \frac{1}{2} = 1$, as required.

Why the others are wrong

- A. Subtracted only $\frac{1}{5}$ from 1 and ignored the chance of banana.
- B. Subtracted only $\frac{3}{10}$ from 1 and ignored the chance of apple.
- C. Subtracted the two given probabilities from each other instead of adding them.
- E. Reported the chance of banana, not cherry.

Question 16 - Answer C

Five scales, labelled A to E, each show a reading in g. How much more does scale E read than scale B?

Correct answer: 60 g

Strategy. Read scale E and scale B, then subtract.

Scale E reads 90 g.

Scale B reads 30 g.

Subtract: $90 - 30 = 60$ g.

Check. $30 + 60 = 90$, so E is 60 g more than B.

Why the others are wrong

- A. Added the two readings instead of subtracting.
- B. Reported scale E's reading instead of the difference.
- D. Reported scale B's reading instead of the difference.
- E. 70 g is not the difference between 90 and 30.

Question 17 - Answer A

The line graph shows the monthly revenue of a shop. Consider these statements:

1. The revenue was lowest in Apr.
2. Between Apr and Jun, the revenue rose by \$80.
3. Between Jan and Mar, the revenue rose by \$40.

Which of the statements are true?

Correct answer: 1 and 2 only

Strategy. Read each statement off the graph, then combine the true ones.

Read each plotted value off the line.

Statement 1: The lowest reading is \$20 in Apr, so it is TRUE.

Statement 2: The line goes from \$20 in Apr to \$100 in Jun, a rise of \$80, so it is TRUE.

Statement 3: The line goes from \$60 in Jan to \$110 in Mar, a change of \$50, not \$40, so it is FALSE.

Check. Check: 2 of 3 statements hold; the matching combination is 1 and 2 only. correct

Why the others are wrong

E. This is wrong because statement 3 is actually false (the line goes from \$60 in Jan to \$110 in Mar, a change of \$50, not \$40) and statement 2 is actually true (the line goes from \$20 in Apr to \$100 in Jun, a rise of \$80).

B. This is wrong because statement 3 is actually false (the line goes from \$60 in Jan to \$110 in Mar, a change of \$50, not \$40) and statement 1 is actually true (the lowest reading is \$20 in Apr).

D. This is wrong because statement 2 is actually true (the line goes from \$20 in Apr to \$100 in Jun, a rise of \$80).

C. This is wrong because statement 1 is actually true (the lowest reading is \$20 in Apr).

Question 18 - Answer D

Each shape stands for a whole number. If $2 \times \text{triangle} + 3 \times \text{circle} = 17$ and $\text{triangle} + \text{circle} = 6$, what is the value of $\text{triangle} + 2 \times \text{circle}$?

Correct answer: 11

Strategy. Solve the two equations to find each shape, then plug into the asked expression.

Solve $2 \times \text{triangle} + 3 \times \text{circle} = 17$ and $\text{triangle} + \text{circle} = 6$ together: $\text{triangle} = 1$ and $\text{circle} = 5$.

Substitute into $\text{triangle} + 2 \times \text{circle}$: $1 + 2 \times 5 = 1 + 10$.

Add: $1 + 10 = 11$.

Check. With $\text{triangle} = 1$ and $\text{circle} = 5$, $\text{triangle} + 2 \times \text{circle} = 11$.

Why the others are wrong

A. Reported triangle alone instead of the asked combination.

B. Reported circle alone instead of the asked combination.

C. Added triangle and circle but ignored the coefficients in the asked expression.

E. Swapped the two coefficients onto the wrong shapes.

Question 19 - Answer C

Three boxes labelled X, M and Q are weighed two at a time on a balance. Boxes X and M together weigh 19 kg. Boxes M and Q together weigh 12 kg. Boxes X and Q together weigh 11 kg. What is the weight of box X?

Correct answer: 9 kg

Strategy. Add the three pair sums to get twice the total, halve to get the total, then subtract the pair without X.

Add the three pair sums; every box is counted twice: $19 + 12 + 11 = 42$.

Halve to get the total of all three boxes: $42 \div 2 = 21$.

Subtract the pair that does not include X (boxes M and Q together weigh 12 kg): $21 - 12 = 9$.

Check. Box X weighs 9 kg, so box M weighs $19 - 9 = 10$ kg and box Q weighs $11 - 9 = 2$ kg; together M and Q weigh $10 + 2 = 12$ kg, which matches.

Why the others are wrong

A. Solved for box M instead of box X - this is box M's weight.

B. Solved for box Q instead of box X - this is box Q's weight.

D. Read off the pair sum that does not contain X instead of subtracting it from the total.

E. Reported the total of all three boxes instead of just X.

Question 20 - Answer D

Rhea walked down the main street with some money. At the bookshop she spent \$22. At the supermarket she spent half of the money she had left. At the milk bar she spent \$9. Rhea now has \$14 left. How much money did Rhea start with?

Correct answer: \$68

Strategy. Work backwards from the \$14 left at the end, undoing each transaction in reverse order.

Start with the \$14 left at the end.

Add back the \$9 spent at the milk bar: $14 + 9 = 23$.

She spent half at the supermarket, so before halving she had twice \$23: $2 \times 23 = 46$.

Add back the \$22 spent at the bookshop: $46 + 22 = 68$.

Check. Forward check: $\$68 - \$22 = \$46$, halve = \$23, $-\$9 = \$14$.

Why the others are wrong

A. Worked forward (subtracting) from the leftover instead of backwards (adding).

B. Added the two fixed spends to the leftover but forgot to undo the halving.

C. Doubled only the \$9 spent at the milk bar instead of doubling the whole amount that was left after halving.

E. Stopped at the amount before the supermarket instead of going all the way back to the start.

Question 21 - Answer A

The bar graph shows the stickers each child collected. What is the median number of stickers?

Correct answer: 11 stickers

Strategy. Sort the bar heights from smallest to largest, then pick the middle one.

List the bar heights: 3, 18, 11, 13, 8.

Sort them: 3, 8, 11, 13, 18.

The middle value of five sorted numbers is the third: 11.

Check. Half the bars are at most 11 and half are at least 11.

Why the others are wrong

- B. 10 is not one of the bar heights.
- C. Gave the largest bar (18) instead of the middle.
- D. Gave the smallest bar (3) instead of the middle.
- E. 12 is not one of the bar heights.

Question 22 - Answer B

Jia starts with a whole number. Jia's number is multiplied by 3, and then 6 is added. The result is at least 7 and at most 32. What is the sum of all the whole numbers Jia could have picked?

Correct answer: 36

Strategy. Find the smallest and largest whole numbers that satisfy both bounds, then add them up.

Try $3 \times 1 + 6 = 9$, which is at least 7, and $3 \times 0 + 6 = 6$, which is too small, so the smallest whole number that works is 1.

Try $3 \times 8 + 6 = 30$, which is at most 32, and $3 \times 9 + 6 = 33$, which is too big, so the largest whole number that works is 8.

There are 8 consecutive whole numbers from 1 to 8.

Sum them with the shortcut (first + last) $\times$ count $\div 2$: $(1 + 8) \times 8 \div 2 = 36$.

Check. Listing them confirms $1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 = 36$.

Why the others are wrong

- A. Reported the count of valid values (8) instead of their sum.
- C. 45 is larger than the correct answer (36) - if you landed on it, re-check that every step used the numbers exactly as the question gives them.
- D. 35 is smaller than the correct answer (36) - if you landed on it, re-check that every step used the numbers exactly as the question gives them.
- E. 28 is smaller than the correct answer (36) - if you landed on it, re-check that every step used the numbers exactly as the question gives them.

Question 23 - Answer E

Five digit cards show 2, 8, 6, 4 and 0. All five cards are placed in the blanks, one card in each blank, to make this multiplication true:

$$\underline{\quad} \underline{\quad} \times 3 = \underline{\quad} \underline{\quad} \underline{\quad}$$

Which card goes in the tens place of the three-digit answer?

Correct answer: 0

Strategy. Find the only way to place the five cards so the multiplication is true, then read the tens digit of the three-digit answer.

A two-digit number times 3 gives a three-digit answer only if it is from 34 to 99.

Try the two-digit numbers the cards can make. Only one uses all five cards exactly once. $68 \times 3 = 204$.

The tens digit of the three-digit answer, 204, is 0.

Check. $68 \times 3 = 204$ uses the cards 0, 2, 4, 6, 8 once each correct

Why the others are wrong

- A. The 2 card is in the hundreds place of the answer 204, not the tens place of the three-digit answer: the only arrangement that works is 68×3 , which gives 204.

- B. The 6 card is in the tens place of the two-digit number 68, not the tens place of the three-digit answer: the only arrangement that works is 68×3 , which gives 204.
- C. The 4 card is in the ones place of the answer 204, not the tens place of the three-digit answer: the only arrangement that works is 68×3 , which gives 204.
- D. The 8 card is in the ones place of the two-digit number 68, not the tens place of the three-digit answer: the only arrangement that works is 68×3 , which gives 204.

Question 24 - Answer B

A triangle has one of its vertices at the centre of the protractor, with two sides running outwards along the directions shown. What is the size of the marked angle at that vertex?

Correct answer: 140°

Strategy. A protractor has two scales. Use the scale whose 0° sits on the side of the triangle that runs along the baseline.

Spot the baseline side of the triangle: it runs to the right from the centre.

Pick the scale whose 0° lines up with that baseline side.

Follow that scale around the arc to where the other side of the triangle meets it.

That tick reads 140° , so the marked angle is 140° .

Check. The other scale reads 40° at the same tick, and $140 + 40 = 180$. correct

Why the others are wrong

- A. Read the wrong scale; 40° is what the other scale shows at the same tick.
- C. Off by one major tick (10°) below the correct reading.
- D. Off by one major tick (10°) above the correct reading.
- E. Off by one minor tick (5°) below the correct reading.

Question 25 - Answer C

A tile design is drawn on a 6 by 6 grid and has no line of symmetry yet. Counting the diagonals too, how many single blank squares would each give it a line of symmetry when shaded?

Correct answer: 2

Strategy. For each of the four possible lines, list the mirror squares that are still blank; a line can be completed by one square only when exactly one is missing.

Shading one square can only give a line of symmetry if that line is missing exactly one mirror square. Check all four lines by folding the grid along each one (corner to corner for a diagonal): vertical, horizontal and both diagonals.

For the vertical line 7 squares are missing, so one square cannot fix it; for the horizontal line 7 squares are missing, so one square cannot fix it; for the bottom-left to top-right diagonal only row 5, column 6 is missing, so shading it works; for the top-left to bottom-right diagonal only row 2, column 1 is missing, so shading it works.

The squares that work are row 2, column 1 and row 5, column 6. $1 + 1 = 2$.

Check. Shading any one of these 2 squares gives a line of symmetry; every other blank square leaves each line with an unmatched square. correct

Why the others are wrong

- A. 0 counts only the squares that give a vertical or horizontal line; the diagonals give 2 squares more.
- B. 7 is the number of shaded squares with no partner across the vertical line, not the number of single squares that would give a line of symmetry.
- D. 10 counts every blank square that is the mirror image of a shaded square in some line, but shading one of them only completes a line when it is the only square that line is missing.
- E. 4 counts two squares for each line that can be completed, the unmatched shaded square and the blank square it needs; only the blank one can be shaded.

Question 26 - Answer E

A cardboard sign is cut in the shape of a plus sign, as shown. How far is it all the way around the edge of the sign?

Correct answer: 124 cm

Strategy. Count edges of the plus sign: 8 long arm edges and 4 short tip edges, then add up the lengths.

Each of the 4 arms has 2 long sides of length 11 cm, giving 8 long edges in total. $8 \times 11 = 88$.

Each arm tip is a short edge of length 9 cm; 4 tips in total. $4 \times 9 = 36$.

Add the two totals. $88 + 36 = 124$.

Check. Forward check: 8 long edges + 4 tip edges = 12 sides on the plus, totalling 124 cm. correct

Why the others are wrong

- A. $31 \times 31 = 961$ is the area of the square around the plus sign, not the distance around the plus.
- B. $31 \times 31 - 4 \times 11 \times 11 = 477$ is the area of the plus sign in square centimetres, not its perimeter.
- C. Counted only 2 tip edges instead of 4, so $8 \times 11 + 2 \times 9 = 106$.
- D. Counted 12 long arm edges instead of 8, so $12 \times 11 + 4 \times 9 = 168$.

Question 27 - Answer B

A rectangular tray is packed with identical tiles, each 7 cm by 4 cm. Along the bottom, 4 tiles stand upright side by side and fill the tray's width exactly. Along the top, 2 tiles lie flat, end to end. The part of the tray that is not covered is shaded. What is the area of the shaded part?

Correct answer: 8 cm²

Strategy. Compare the width of the upright row with the length of the flat row; the difference is the gap's width.

The 4 upright tiles are each 4 cm wide, so the tray is $4 \times 4 = 16$ cm wide.

The 2 flat tiles on top cover $2 \times 7 = 14$ cm of that width.

The shaded gap is the width left over. $16 - 14 = 2$ cm.

The gap is as tall as a flat tile, 4 cm. Multiply. $2 \times 4 = 8$ cm².

Check. Tray $16 \times 11 = 176$ cm² = tiles 168 + gap 8. correct

Why the others are wrong

- A. Used each upright tile's length, not its width, for the tray: $(4 \times 7 - 2 \times 7) \times 4 = 56$ cm².
- C. Used the tile's long side as the gap's height: $2 \times 7 = 14$ cm².
- D. Gave the area of the whole tray, $16 \times 11 = 176$ cm².
- E. Found the gap's perimeter, $2 \times (2 + 4) = 12$ cm, not its area.

Question 28 - Answer D

A hiker starts facing north-west (NW). She turns 45° anticlockwise, then turns 90° clockwise. In what direction is she now facing?

Correct answer: N

Strategy. Apply each turn one at a time, counting 45° as one compass step.

Start facing north-west (NW).

Turn 1: 45° anticlockwise from NW is one step, landing on west (W).

Turn 2: 90° clockwise from W is two steps: W $\rightarrow$ NW $\rightarrow$ N.

End facing north (N).

Check. Net rotation is 45° clockwise from NW, which lands on N.

Why the others are wrong

- A. Applied the second turn in the wrong direction.
- B. Applied the first turn in the wrong direction.
- C. NE is not 45° clockwise from NW.
- E. Forgot to apply the turns at all.

Question 29 - Answer B

The grid shows a start cell S at (2, 4). Each cell is named by the point at its bottom-left corner. A token on S moves right 4, up 5, down 2 and then left 2. On which cell does the token land?

Correct answer: (4, 7)

Strategy. Update x and y one move at a time, then read off the final cell.

Start at S = (2, 4).

Right 4 adds 4 to x: (2, 4) $\rightarrow$ (6, 4).

Up 5 adds 5 to y: (6, 4) $\rightarrow$ (6, 9).

Down 2 subtracts 2 from y: (6, 9) $\rightarrow$ (6, 7).

Left 2 subtracts 2 from x: (6, 7) $\rightarrow$ (4, 7).

Check. Walking the four moves from (2, 4) lands the token on (4, 7).

Why the others are wrong

- A. Swapped x and y at the end. The first number is x; the second is y.
- C. (6, 7) is the cell before the last move; one step is missing.
- D. Moved left 1 instead of left 2 on the last move: $6 - 1 = 5$.
- E. Left out the first move, right 4, and did the other three: $2 - 2 = 0$.

Question 30 - Answer C

A 3-digit number has three different digits chosen from 0 to 9, and the sum of its digits is 18. The number is exactly divisible by 5. What is the largest such number? (digits may include 0 but the number must be a 3-digit number)

Correct answer: 945

Strategy. Search from the largest 3-digit numbers downward for one with three different digits summing to 18 and divisible by 5.

The largest digits adding to 18, arranged largest-first, give 981, but 981 is not divisible by 5.
 Try hundreds digit 9: the other two digits must sum to 9 and the number must end in 0 or 5.
 The biggest such pair is 4 and 5, giving 945, which is divisible by 5.
 So the answer is 945, with digits 9, 4 and 5.

Check. 945: digits sum to 18, all different, and $945 \div 5 = 189$.

Why the others are wrong

- A. Picked the biggest digits adding to 18, but 981 is not divisible by 5.
- B. Largest 3-digit number divisible by 5 with different digits, but $9 + 8 + 5 = 22$, not 18.
- D. Has digit sum 18 and is divisible by 5, but the digits 9, 9, 0 are not all different.
- E. $9 + 4 + 0 = 13$, not 18.

Question 31 - Answer C

The figure on the left has been transformed to produce the figure on the right. Which single transformation was applied?

Correct answer: rotation 270° clockwise (= 90° anticlockwise)

Strategy. Track one labelled corner across the centre crosshairs and check whether the labels still run the same way round, to tell a turn from a flip.

Corner a on the before figure sits below the centre and to the left.

On the after figure, corner a is below the centre and to the right. Reading the corner labels a, b, c, d, e, f, g, h around the shape, they still run the same way round in the after figure, so the shape was turned about the centre - a rotation, not a flip.

Corner a has moved from below the centre and to the left to below the centre and to the right, which is a rotation 270° clockwise (= 90° anticlockwise).

Check. Forward check: applying a rotation 270° clockwise (= 90° anticlockwise) to every corner of the before figure produces the after figure. correct

Why the others are wrong

- A. A rotation 90° clockwise would put corner a above the centre and to the left, but the after figure shows a below the centre and to the right.
- B. A rotation 180° would put corner a above the centre and to the right, but the after figure shows a below the centre and to the right.
- D. A reflection in the vertical axis would put corner b below the centre and to the left, but the after figure shows b above the centre and to the right.
- E. A reflection in the horizontal axis would put corner a above the centre and to the left, but the after figure shows a below the centre and to the right.

Question 32 - Answer E

At an arcade, a cup of 6 arcade tokens costs \$6.75 and a single token costs \$1.40. Arjun has \$18. He buys as many cups of 6 as he can. Then, with the money left over, he buys two single tokens. How much money does Arjun have left at the end?

Correct answer: \$1.70

Strategy. Spend in the order given: first the cups of 6, then the two single tokens, and subtract each purchase from the money.

Find how many cups of 6 \$18 covers. $2 \times \$6.75 = \$13.50$, and $3 \times \$6.75 = \$20.25$ is more than \$18.

Money left after the first purchase: $\$18 - \$13.50 = \$4.50$.

Then pay for the two single tokens. $2 \times \$1.40 = \$2.80$; $\$4.50 - \$2.80 = \$1.70$.

Check. $2 \times \$6.75 + 2 \times \$1.40 + \$1.70 = \$18$. correct

Why the others are wrong

A. Subtracted $\$4.50 - \$2.80$ column by column, taking the smaller digit from the larger each time instead of regrouping, and got \$2.30.

B. Gave what the two single tokens cost, not the change: $2 \times \$1.40 = \$2.80$.

C. Paid for one single token instead of 2: $\$4.50 - \$1.40 = \$3.10$.

D. Stopped after the cups of 6: $\$18 - 2 \times \$6.75 = \$4.50$, and forgot to pay for the two single tokens.

Question 33 - Answer C

Which solid does the net below fold to form?

Correct answer: triangular prism

Strategy. Look at the shapes of the faces in the net and match them to a solid.

The net shows three rectangles in a row with two triangles attached.

Three rectangles fold into the side faces and the two triangles fold into the bases.

That set of faces fits together into a triangular prism.

Check. The face shapes in the net match the faces of a triangular prism.

Why the others are wrong

A. A pentagonal prism's net has 5 rectangles and 2 pentagons, not 3 and 2 triangles.

B. A square pyramid's net has 1 square base and 4 triangle sides, not rectangles.

D. A cube's net has 6 squares, not rectangles plus triangles.

E. A rectangular prism's net has 6 rectangles, with no triangles.

Question 34 - Answer C

A block of small cubes is 7 cubes long, 7 cubes wide and 6 cubes tall. It sits on a table and is sprayed with red paint, as shown. The paint covers the top and all four sides but not the bottom, which is on the table. The block is then taken apart. How many of the small cubes have exactly one painted face?

Correct answer: 125

Strategy. With the bottom bare, one painted face means the middle of the top or a side cube away from the edges and the top row.

The middle of the top has one painted face: $(7 - 2) \times (7 - 2)$. $5 \times 5 = 25$.

On each side, the cubes away from the upright edges and below the top row have one painted face; the bottom row counts, because the bottom is bare. The two sides 7 cubes long give 5×5 each and the two sides 7 cubes wide give 5×5 each. $2 \times 5 \times 5 + 2 \times 5 \times 5 = 100$.

Add the top and the sides. $25 + 100 = 125$.

Check. 4 top corners + 40 two-face + 125 one-face + 125 unpainted = 294. correct

Why the others are wrong

- A. Counted only the middle of the top, $5 \times 5 = 25$, and forgot the middles of the four sprayed sides.
- B. Forgot the top: $2 \times 5 \times 5 + 2 \times 5 \times 5 = 100$.
- D. Counted the top and only the two sides you can see, $5 \times 5 + 5 \times 5 + 5 \times 5 = 75$; the two hidden sides are painted too.
- E. Used the rule for a block painted on all six faces, $2 \times (5 \times 5 + 5 \times 4 + 5 \times 4) = 130$, but the bottom is not painted.

Question 35 - Answer D

A prism has two ends that are regular pentagons with sides 3 cm long. The edges joining the two pentagons are each 8 cm long. What is the total length of all its edges?

Correct answer: 70 cm

Strategy. A pentagonal prism has 15 edges: two pentagon bases plus five joining edges connecting them.

Each pentagon base has 5 edges of length 3 cm: $5 \times 3 = 15$ cm.

There are 2 pentagons, so the base edges total $2 \times 15 = 30$ cm.

There are 5 joining edges of length 8 cm: $5 \times 8 = 40$ cm.

Add the base-edge and joining-edge totals: $30 + 40 = 70$ cm.

Check. $10 \text{ base edges} \times 3 \text{ cm} + 5 \text{ joining edges} \times 8 \text{ cm} = 30 + 40 = 70 \text{ cm}$.

Why the others are wrong

- A. Counted the pentagon edges only once but there are two pentagon bases.
- B. Counted all the base edges but only one joining edge.
- C. 23 cm is smaller than the correct answer (70 cm) - if you landed on it, re-check that every step used the numbers exactly as the question gives them.
- E. Forgot to add the 5 joining edges that connect the two pentagons.