Selective High School Placement Test

Mathematical Reasoning

Explained answers for the sample test

1   Working with the 24-hour clock and then converting:
One quarter of an hour is 15 minutes.
10 minutes after 1850 is 1900, so 15 minutes after 1850 is 1905.

In the 12-hour format, 1905 is 7:05 pm, so the correct answer is **E 7:05 pm**.

Alternatively, converting to the 12-hour clock first:
Sandy's watch reads 1850 which is 6 hours after 1200 so it is 6:50 pm.
Adding on 15 minutes takes us to 7:05 pm.

2   The wall has ten equal sections. Jack paints $\frac{2}{5}$ of the whole wall yellow; this is the same as $\frac{4}{10}$ so Jack paints 4 sections yellow. The diagram below shows $\frac{2}{5}$ and $\frac{4}{10}$ are equivalent:
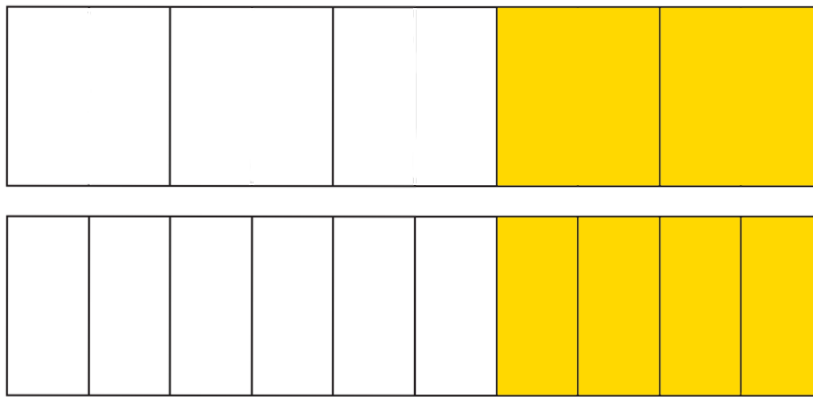
Jack paints 5 sections purple and 4 sections yellow. This leaves just one section to be painted green. So Jack paints 1 section green, and the correct answer is **A 1**.
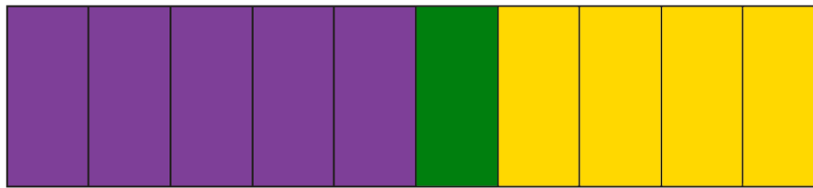
3   The smallest four-digit whole number is 1000.
The largest two-digit whole number is 99.

So multiplying the smallest four-digit whole number by the largest two-digit whole number is 1000 × 99 = 99 000. The correct answer is **A 99 000**.

4 Reading from the scale, the arrow is halfway between 700 g and 800 g so the jar and cooking sauce together weigh 750 g.

When the jar is empty it weighs 330 g so we need to subtract the weight of the empty jar to find the weight of the sauce. 750 − 330 = 420 so the weight of the sauce is 420 g.

Rana needs 650 g of sauce. She has 420 g so she needs 650 − 420 = 230 g more sauce, so the correct answer is **D 230 g**.

5 We are trying to make the largest two-digit number we can, so we need to make the tens digit as large as possible.

If we choose a 9 for the 'tens' digit, we can't make a line of symmetry.
If we choose an 8 for the 'tens' digit, we need to choose a digit with a horizontal line of symmetry for the 'ones' digit.

1, 3, 8 and 0 are the possible choices. If we choose 8, we would have the number 88, which has two lines of symmetry, so we should choose 3, which gives the correct answer **B 83**.

6 Kim's number is a multiple of 5 so it must end with a 5 or a 0. Kim's number is less than 50, so the largest possible value for Kim's number is 45.

Jamie's number is even and is also a multiple of 7. The smallest number greater than zero which is both a multiple of 7 and an even number is 14 because 2 × 7 = 14.

So the difference between the largest possible value of Kim's number and the smallest possible value of Jamie's number is 45 − 14 = 31. The correct answer is **A 31**.

7 To find the area of a rectangle, we multiply the length by the width.

Rectangle P has a length of 10 cm and a width of 6 cm so its area is 10 × 6 = 60 cm².

To find the length of rectangle Q, we have to work out what to multiply 4 cm by to give 60 cm². 60 ÷ 4 = 15, so 15 × 4 = 60. So the length of rectangle Q must be 15 cm, and the correct answer is **C 15 cm**.

8 Sooyoung had 250 mL of cordial and drank 10 mL, leaving 250 – 10 = 240 mL in the glass.

She poured water in up to the 500 mL mark, so she poured in 500 – 240 = 260 mL of water from the bottle.

The bottle originally contained 1 litre which is 1000 mL, so when she poured out 260 mL, she left 1000 – 260 = 740 mL of water in the bottle. So the correct answer is **C 740 mL**.

9 First, use the fact that 9 × □ = 108. We can work out that □ = 12, because 9 × 10 = 90 and 9 × 2 = 18 so 9 × 12 = 108 (or by working out that 108 ÷ 9 = 12).

Now we know that △ + 12 = 36 so △ = 36 – 12, and △ = 24.
So the correct answer is **C 24**.

10 Starting from the middle of the pattern so far, we can look for where the line of symmetry could go. The first chance we have to make the pattern symmetrical is by placing the vertical line of symmetry through the centre of the group of three black tiles:

Tahnee needs to add one black and one white tile to the right of the pattern:

So Tahnee can add on two more tiles, and the correct answer is **A 2**.

Alternatively, we can solve this by starting from the right and working out what tiles to add. Since the first tile is white, the last tile must also be white, but adding one white tile does not give a symmetric pattern. Since the second tile is black, the second-to-last tile must also be black, and that does give a symmetric pattern. So Tahnee can add on two more tiles.

11 The probability that the button is blue is 0.2.

There are twice as many red buttons as blue buttons, so the probability that the button is red must be 0.2 × 2 = 0.4.

The probability that the button is green is 0.3.

The probabilities of blue, green, red and yellow have to add up to 1 since those are all the possible outcomes.

0.2 + 0.4 + 0.3 = 0.9

1 − 0.9 = 0.1

So the probability that Jessica takes out a yellow button is 0.1, and the correct answer is **A 0.1**.

12 Checking each statement in turn:
1 *June had more than twice as much rainfall as August.*
June's rainfall was 70 mm. August's rainfall was 40 mm.
40 × 2 = 80 and 70 is less than 80, so statement 1 is not correct.

2 *December had 9 cm more rainfall than November.*
December's rainfall was 190 mm.
November's rainfall was 100 mm, so December's rainfall was 90 mm more than November's rainfall.
90 mm = 9 cm, so statement 2 is correct.

3 *The rainfall in February, March and April combined was more than 1 metre.*
February's rainfall was 430 mm. March's rainfall was 440 mm. April's rainfall was 230 mm.
1 metre is 1000 mm, and 430 + 440 + 230 = 1100 which is greater than 1000, so statement 3 is correct.

Statements 2 and 3 are correct, so the correct answer is **D statements 2 and 3 only**.

13 We can work backwards:

Lenny received $1.60 from Jason, which is half of what Jason received, so Jason must have received $3.20 ($1.60 × 2 = $3.20).

Jason received $3.20 from Alan, which is half of what Alan had left, so Alan must have had $6.40 left ($3.20 × 2 = $6.40).

If Alan had $6.40 left after giving some money to Kiana, he must have given Kiana $10 − $6.40 = $3.60. So the correct answer is **B $3.60**.

Alternatively, we could draw a diagram to help us to work it out:

$10

| Kiana | |

| | Alan | Jason | Lenny |

$1.60
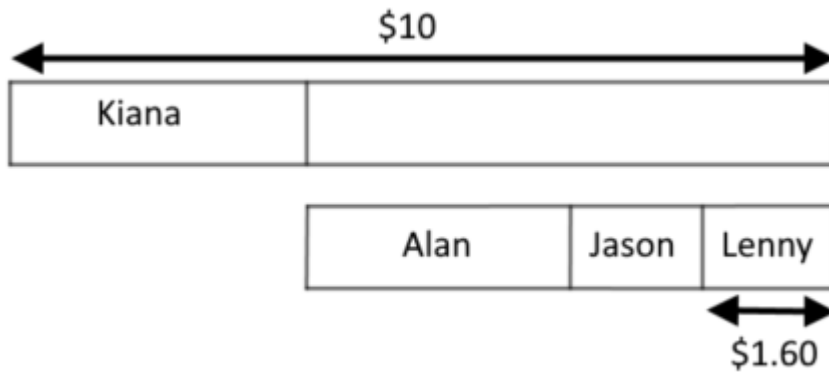
From the diagram we can see that Alan, Jason and Lenny have 4 × $1.60 = $6.40 altogether. So Kiana has $10 – $6.40 = $3.60.

14 Reading off the protractor, Noah has constructed lines at 30° and then 20° further round at 50°. Since the shape has one line of symmetry, the angles in his shape must be 30°, 20°, S, 20° and 30°:
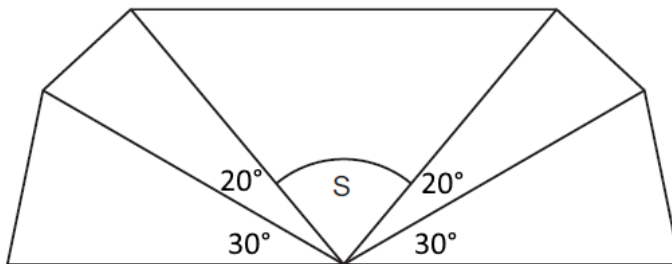
A straight angle is 180° so the missing angle S must be 180° – 20° – 30° – 20° – 30° = 80°. So the correct answer is **B 80°**.

Alternatively, we could use the line of symmetry to work out that the two lines at each side of S will be at 50° and 130° on the protractor, and 130° – 50° = 80°.

**15** If each of the 14 people get 8 chocolates, that is 14 × 8 chocolates.

There are 5 chocolates left over, so these are extra chocolates added to the 14 × 8, so the total number of chocolates is 14 × 8 + 5.

There are 117 chocolates altogether, so the correct answer is **E 14 × 8 + 5 = 117**.

Alternatively, 117 chocolates shared between 14 people is represented by the calculation 117 ÷ 14. The answer is 8 with a remainder of 5, so 117 must be equal to 14 × 8 + 5.

16 To find the perimeter, we need to work out the total length of the boundary of the shape.

We don't know every length but we do know that the highlighted horizontal lines must add up to 10 cm, and the highlighted vertical lines must add up to 8 cm. Then we need to count the bottom and the right of the shape, and the two sides going down into the top of the shape which are each 3 cm long.
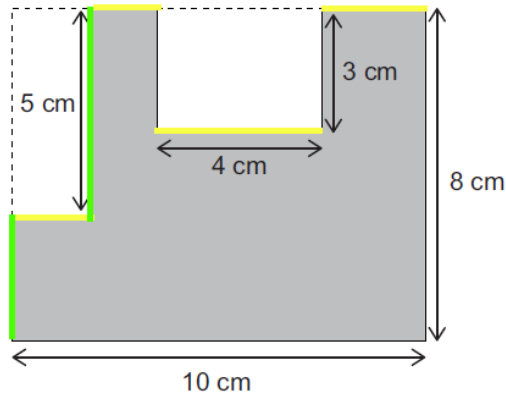
So the total perimeter is 10 cm + 8 cm + 10 cm + 8 cm + 3 cm + 3 cm = 42 cm. So the correct answer is **E 42 cm**.

17 Andy ate $\frac{1}{5}$ of the bar and Bella ate $\frac{2}{5}$ of the bar, so Carlo must have also eaten $\frac{2}{5}$ of the bar.

This number line shows the position of the relevant fractions:
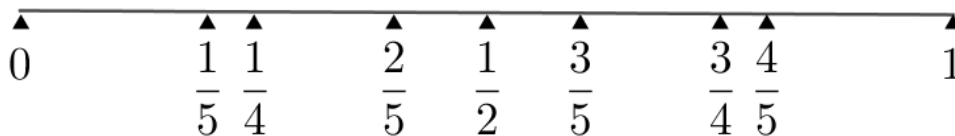
Checking each statement in turn:

1 *Carlo ate less than half of the chocolate bar.*
$\frac{2}{5}$ is less than one half, so statement 1 is correct.

2 *Andy ate more than one quarter of the chocolate bar.*
$\frac{1}{5}$ is less than one quarter, so statement 2 is not correct.

3 *Andy and Bella ate less than three quarters of the chocolate bar altogether.*
Together, Andy and Bella ate $\frac{3}{5}$ of the chocolate bar, so statement 3 is correct.

So the correct answer is **E statements 1 and 3 only** are correct.

18 Each of the rows, columns and diagonals add up to the same total.

The top row is complete so we can use that to find the total:
20 + 15 + 16 = 51.

Next we can look at the diagonal shown here with a dotted line:

The number in the very centre must be added to 16 + 18 to give 51, so the number in the centre is 51 − (16 + 18) = 17.

Finally, using the other diagonal, 20 + 17 + ◆ = 51, so ◆ = 51 − (20 + 17) = 14. So the correct answer is **B 14**.

Here is the completed magic square (although we do not need to work it all out in order to answer the question):

19 Checking each statement in turn:

X *The probability of Emily getting a 4 is $\frac{1}{4}$*
There are four equal sections, one of which is '4', so the probability of Emily getting a 4 when she spins is $\frac{1}{4}$, so statement X is correct. (The outcome of Chen's spin does not affect the outcome of Emily's spin.)

Y *The probability that Emily's number is less than Chen's is $\frac{1}{2}$*

Chen got a 4, so there are two numbers less than Chen's on the spinner (2 and 3).
This means the probability Emily's number is less than Chen's is $\frac{2}{4}$ which is equivalent to $\frac{1}{2}$, so statement Y is correct.

Z *The probability that Emily and Chen's scores add up to make more than 5 is* $\frac{3}{4}$

Chen got a 4. Here are the possibilities:

Emily gets a 2: total score 4 + 2 = 6

Emily gets a 3: total score 4 + 3 = 7

Emily gets a 4: total score 4 + 4 = 8

Emily gets a 5: total score 4 + 5 = 9

Whatever score Emily gets, the total will be more than five, so it is certain to happen, so the probability is 1, not $\frac{3}{4}$. So statement Z is incorrect.

So the correct answer is **B statements X and Y only** are correct.

20 Each mark on the scale represents 2 kg, because 10 kg is divided into five equal sections, and 10 ÷ 5 = 2.

When the scales are empty, the pointer is one mark below 10 kg so the reading is 8 kg.

When the blocks are placed on the scales, the pointer is two marks above 40 kg so the reading is 44 kg.

So the two blocks have a mass of 44 – 8 = 36 kg.

To find the mass of just one block we need to work out half of 36 kg, which is 18 kg.

So the correct answer is **C 18 kg**.

21 Alinta rounds 4 850 000 to the nearest million.
4 850 000 is between 4 000 000 and 5 000 000.
The hundred thousands digit is an 8, so Alinta rounds the number up to 5 000 000.

Tau rounds 4 850 000 to the nearest hundred thousand.
4 850 000 is between 4 800 000 and 4 900 000. The ten thousands digit is a 5, so Tau rounds the number up to 4 900 000.

The difference between their answers is 5 000 000 – 4 900 000 = 100 000, so the correct answer is **C 100 000**.

22 Checking each statement in turn:

1 The temperature was 10°C at four different times.
Reading horizontally across from 10, the places where the reading is 10 have been circled. There are four places, so statement 1 is correct.
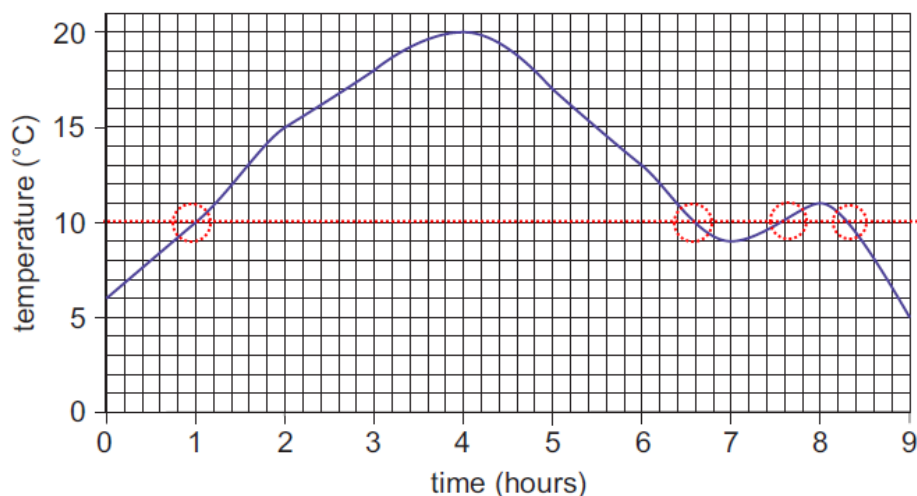
2 The temperature change between 1 hour and 3 hours was greater than the temperature change between 4 hours and 6 hours.
Between 1 hour and 3 hours, the temperature changes from 10°C to 18°C, an increase of 8 degrees. Between 4 hours and 6 hours, the temperature changes from 20°C to 13°C, a decrease of 7 degrees. A change of 8 degrees is greater than a change of 7 degrees. So statement 2 is correct.

3 The lowest temperature was 5°C.
At 9 hours, the reading is 5°C. The graph does not go any lower than this at any point, so statement 3 is correct.

The correct answer is **E statements 1, 2 and 3** are all correct.

23 Altogether, Amina, Fred and Sally ate $\frac{4}{5} + 1\frac{1}{5} + \frac{3}{5} = 2\frac{3}{5}$ pizzas. This leaves $1\frac{2}{5}$ for Quoc to eat, which is equivalent to $\frac{7}{5}$. So Quoc eats $\frac{7}{5} - \frac{4}{5} = \frac{3}{5}$ more pizza than Amina, and the correct answer is **B** $\frac{3}{5}$.

Alternatively, we could work it out by thinking about the number of slices. Imagine cutting each of the four pizzas into 5 slices, so there would be $4 \times 5 = 20$ slices altogether, with each slice being $\frac{1}{5}$ of a pizza.
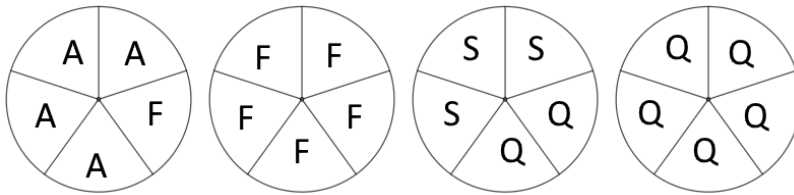
Amina ate $\frac{4}{5}$ of a pizza, which is 4 slices.
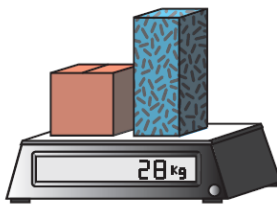Fred ate $1\frac{1}{5}$ of a pizza, which is $5 + 1 = 6$ slices.
Sally ate $\frac{3}{5}$ of a pizza which is 3 slices.

Altogether they have eaten 13 out of 20 slices, leaving 7 slices for Quoc. This is 3 slices more than Amina ate, which is $\frac{3}{5}$ of a pizza.

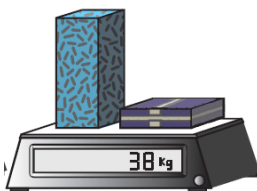We could also show this information using a diagram:

24 Let's label the three boxes 'tall', 'medium' and 'flat'.

This picture tells us that medium + tall = 28 kg.

This picture tells us that medium + flat = 32 kg.

So using both pieces of information together, we can work out that the flat box must be 4 kg heavier than the tall box.

Now we know the flat box is 4 kg heavier, we can work out that two tall boxes would have a mass of 34 kg, and so the tall box has a mass of 17 kg, and the flat box has a mass of 21 kg.

That means the medium box must have a mass of 11 kg, and the total mass of all three is 17 kg + 21 kg + 11 kg = 49 kg.

So the correct answer is **A 49 kg**.

Alternatively, if we add together the measurements from the three weighings, we get 28 kg + 32 kg + 38 kg = 98 kg. However, this includes every box twice, so to work out the mass of the three boxes together, we need to work out 98 ÷ 2 = 49.

25 A pyramid with a hexagonal base has 1 hexagonal face and six triangular faces, so 7 faces altogether.

The hexagonal base has six vertices, and there is one vertex at the top, so there are 7 vertices altogether.

The hexagonal base has six edges, and then there are six edges joining the vertices at the base to the vertex at the top, so there are 12 edges altogether.

So the sum of the number of faces, edges and vertices is 7 + 7 + 12 = 26. So the correct answer is **D 26**.
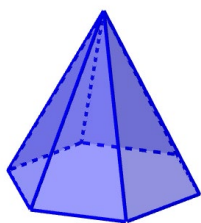
26 In the number 30 060, the value represented by the digit 3 is 30 000, and the value represented by the digit 6 is 60, so we need to work out how many times larger 30 000 is than 60.

60 000 is 1 000 times larger than 60, and 30 000 is half of 60 000, so 30 000 is 500 times larger than 60. So the correct answer is **C 500 times**.

Alternatively, 30 000 ÷ 60 is the same as 3000 ÷ 6 which is 500.

Or starting from 60 and multiplying:

5 × 60 = 300
50 × 60 = 3000
500 × 60 = 30 000

So the value represented by the digit 3 is 500 times the value represented by the digit 6.

27 When Kylie arrives in New York, the time in Las Vegas is 6 hours after 1300, which is 1900 on Friday. 24 hours is one full day later so when she leaves New York, the time in Las Vegas is 1900 on Saturday.

The flight to Sydney is 20 hours; 5 hours would take the time to midnight on Sunday, so the other 15 hours of the flight takes the time in Las Vegas to 1500 Sunday.

However, this is 17 hours behind the time in Sydney, so we need to add 17 hours. Adding 9 hours takes us to midnight on Monday, and then the remaining 8 hours takes us to 0800 Monday. So the time in Sydney when Kylie arrives is Monday at 0800 and the correct answer is **A Monday at 0800**.

Alternatively, Kylie's whole journey is 6 + 24 + 20 = 50 hours. 50 hours is 2 full days and 2 hours, so the time in Las Vegas when she arrives in Sydney is 1500 on Sunday. Adding on the 17 hour time difference means that the time in Sydney is 0800 on Monday.

We could also work out the time in Sydney when she leaves. 1300 on Friday in Las Vegas is 17 hours later which is 0600 on Saturday in Sydney. Then adding the 2 days and 2 hours of journey time takes us to 0800 on Monday.

28 The black regions are a 2 by 2 square which has area 4 cm^2 and two L shapes with area 7 cm^2 and 11 cm^2 as shown:
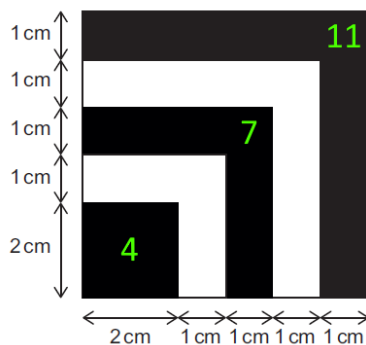
So the total area shaded black is 4 + 7 + 11 = 22, so the correct answer is **D 22 cm^2**.

Alternatively, the whole shape is a 6 by 6 square with area 6 × 6 = 36 cm^2. The two white areas are 5 cm^2 and 9 cm^2, so the black area is 36 − 5 − 9 = 22 cm^2.
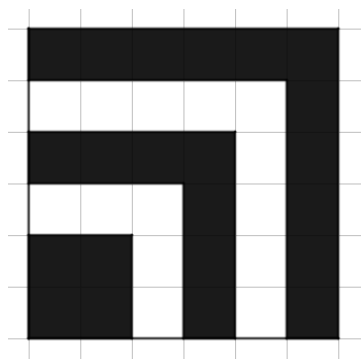
Or we could imagine a black 6 by 6 square with a white 5 by 5 square on top of it, and a black 4 by 4 square on top of that and so on. Using square numbers, the area is 36 − 25 + 16 − 9 + 4 = 22 cm^2.

29 Four marks on the scale is 200 mL, so each mark represents 200 ÷ 4 = 50 mL. Looking at the scale, we can see that Jan puts 150 mL of orange juice in the jug.

She adds six times as much apple juice. 6 × 150 = 900 mL.
(One way to work this out is to do 6 × 100 + 6 × 50 which is 600 + 300.)
So in total there is 900 + 150 = 1050 mL of fruit drink, so the correct answer is **D 1050 mL**.

30 An equilateral triangle has rotational symmetry of order 3, so it needs to turn through multiples of 120° to fit exactly on itself, because 360 ÷ 3 = 120.

The diagram shows how the triangle is transformed by rotating 120° anti-clockwise twice:

So the final image is after rotating 2 × 120° = 240° anti-clockwise, so the correct answer is **D 240°**.

31 If we imagine folding each partial net into a cube, then we can decide whether any faces will overlap or if it's possible to add an extra square to make a complete net.

For drawing 1, the two shaded squares would overlap if we try to fold it into a cube, so the net cannot be completed with a single square.

It is possible to add a square to drawing 2 to make a valid net of a cube:
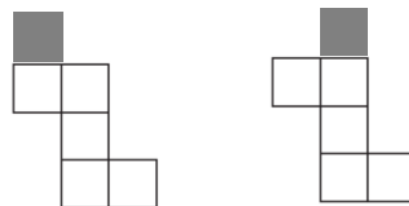
For drawing 3, as with drawing 1, if we try to fold it into a cube, the two shaded faces will overlap, so it's not possible to add just one more square to make a valid cube net.

So the correct answer is **B drawing 2 only**.

32 The perimeter of shape X is equivalent to four times the length of Harry's rectangle and twice the width.

The perimeter of shape Y is equivalent to four times the length of the rectangle and four times the width.

So the difference between the two perimeters is two times the width.

82 – 64 = 18

18 ÷ 2 = 9. So the width of Harry's rectangle is 9 cm and the correct answer is **E 9 cm**.

Alternatively, we can think about how much the perimeter increases when Harry adds the extra rectangle.

The perimeter added across the top is equivalent to the part of the original perimeter hidden by the extra rectangle, so the only change in perimeter is the two highlighted sections, which is twice the width of the rectangle. So the difference between the original and the new perimeter is twice the width of the rectangle.
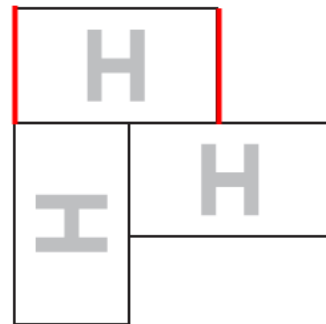
33 We know that 2 + X + 0 = Y, and X + 0 + Y = 6.

So we need two numbers that add up to 6, with Y two more than X. So X must be 2 and Y must be 4.

Finally, to work out Z, we know that 0 + Y + 6 = Z so Z = 10. So the correct answer is **C 10**.

Alternatively, we could use trial and improvement.

Let's try the number 1 in position X. Then by adding the numbers three at a time, the sequence would be:
2, 1, 0, 3, 4
This doesn't work because the number after Y is 6, not 4. So X needs to be bigger.

We could try 2. That would give the sequence:
2, 2, 0, 4, 6, 10
This time, the fifth number is 6 which is what we need. So the sixth number, Z, is 10.
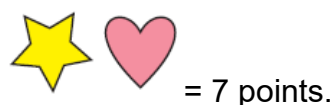
34 Looking at the two arrangements of stars and hearts, the second arrangement has two extra stars, and two extra hearts.

The difference between the two totals is 41 – 27 = 14 points.

 = 14 points.

One star and one heart must be worth half as much as two stars and two hearts, so

 = 7 points.

So the correct answer is **A 7**.

35 Between 1 and 100 there are 33 multiples of 3, because 3 × 33 = 99. However, some of these are multiples of 8.

The multiples of 8 less than 100 which are also multiples of 3 are 3 × 8 = 24, 6 × 8 = 48, 9 × 8 = 72 and 12 × 8 = 96.

So there are 33 – 4 = 29 numbers between 1 and 100 which are multiples of 3 but not multiples of 8. So the correct answer is **D 29**.

Alternatively, 100 ÷ 3 = 33 remainder 1, so there are 33 multiples of 3 between 1 and 100.

The lowest common multiple of 3 and 8 is 24.
There are four multiples of 24 between 1 and 100 (24, 48, 72 and 96).

So the remaining 29 multiples of 3 are not multiples of 8.

We are Cambridge Assessment Admissions Testing, part of the University of Cambridge. Our range of research-based admissions tests connects schools, universities, governments and employers to the most suitable applicants around the world.

Cambridge Assessment
Admissions Testing
The Triangle Building
Shaftesbury Road
Cambridge
CB2 8EA
United Kingdom