Day 183 **B Tier 10-a-day: Model Solutions**

1 Equations with brackets

Solve 5(3x + 3) = 45

Divide both sides by 5: 3x + 3 = 9
Subtract 3 from both sides: 3x = 6
Divide both sides by 3
Answer: x = 2

2 Loci

A and B are two points 4 cm apart.
A point P is always the same distance from A and from B.
Describe the locus of the point P.

Points equal distances from A and B lie on the perpendicular bisector of AB
It passes through the midpoint of AB (2 cm from each point) at right angles to AB
Answer: The perpendicular bisector of AB

3 Comparing data sets

Here are Isla's and Femi's scores in a game.
Isla: 33, 32, 28, 42, 49
Femi: 39, 35, 41, 39, 38
Compare their results using the mean and the range.

Isla: mean = 184 ÷ 5 = 36.8, range = 49 − 28 = 21
Femi: mean = 192 ÷ 5 = 38.4, range = 41 − 35 = 6
Femi has the higher mean
Femi has the smaller range, so is more consistent
Answer: Femi has the higher mean (38.4 v 36.8). Femi is more consistent (range 6 v 21)

4 Place value

Here are four digit cards.
9 3 2 8
Use all four cards to make the largest possible number.
Work out the difference between the largest and smallest possible numbers.

Largest: put the digits in order, biggest first: 9832
Smallest: put the digits in order, smallest first: 2389
9832 − 2389 = 7443
Answer: 7443

5 Inequalities on a number line

(a) Write down the inequality shown on the number line.
(b) Write down all the integers that satisfy the inequality.

(a) The circle at 1 is filled in and the circle at 4 is open
$1 \leq x < 4$
(b) The whole numbers on the shaded part: 1, 2, 3
Answer: (a) $1 \leq x < 4$ (b) 1, 2, 3

6 Trigonometry: finding a side

Find the length of t. (Calculator)
Give your answer correct to 1 decimal place.
The diagram is not drawn accurately.

Label the sides: t is the opposite and 9 cm is the hypotenuse
We use sin (opposite and hypotenuse)

$\sin 45° = \frac{t}{9}$

t = 9 × sin 45° = 6.364...
t = 6.4 cm (1 d.p.)
Answer: t = 6.4 cm

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7 Substitution into formulae

$E = \frac{1}{2}mv^2$

Work out the value of E when m = 5 and v = 4

$E = \frac{1}{2} \times 5 \times 4^2$

$E = \frac{1}{2} \times 5 \times 16 = 40$

Answer: E = 40

8 Standard form calculations

A spacecraft travels at 9×10^8 km per hour.
It travels for 3.2×10^3 hours at this speed.
Work out how far it travels.
Give your answer in standard form.

Distance = speed × time

$(9 \times 10^8) \times (3.2 \times 10^3) = 28.8 \times 10^{11}$

In standard form: 2.88×10^{12}

Answer: 2.88×10^{12} km

9 Tree diagrams

A bag contains 7 mint sweets and 6 toffee sweets.
Ben takes one at random and does not replace it, then takes a second.
Work out the probability that the two are different colours.

P(mint then toffee) = $\frac{7}{26}$

P(toffee then mint) = $\frac{7}{26}$

Add: $\frac{7}{26} + \frac{7}{26} = \frac{7}{13}$

Answer: $\frac{7}{13}$

10 Average speed

A cyclist travels at 60 km/h for 0.5 hours and then at 72 km/h for 1.5 hours.
Work out its average speed for the whole journey.

Distance: $60 \times 0.5 = 30$ km and $72 \times 1.5 = 108$ km

Total distance = 138 km and total time = 2 hours

Average speed = $138 \div 2 = 69$

Answer: 69 km/h