Day 363 **A Tier 10-a-day: Model Solutions**

1 Exchange rates

£1 = €1.6.
(a) Change £80 to euros.
(b) Change €256 to pounds.

(a) 80 × 1.6 = 128
(b) 256 ÷ 1.6 = 160
Answer: (a) €128 (b) £160

2 Forming quadratic equations

A rectangle has width x cm and length (x + 5) cm.
The area of the rectangle is 84 cm^2.
(a) Show that $x^2 + 5x - 84 = 0$
(b) Work out the value of x.

(a) Area = length × width, so x(x + 5) = 84
$x^2 + 5x = 84$
$x^2 + 5x - 84 = 0$
(b) Factorise: (x − 7)(x + 12) = 0
x = 7 or x = −12
A length cannot be negative, so x = 7
Answer: (a) Shown (b) x = 7

3 Estimation

By rounding each number to 1 significant figure, estimate the value of

$$\frac{19.7 + 9.7}{0.64}$$

Round each number to 1 significant figure: 20, 10, 0.6

$$\frac{20 + 10}{0.6} = 50$$

Answer: 50

4 Area of a trapezium

The diagram shows a trapezium.
Work out the area of the trapezium.
The diagram is not drawn accurately.

Area = $\frac{1}{2} \times (5 + 12) \times 11$

$= \frac{1}{2} \times 17 \times 11$

= 93.5

Answer: 93.5 cm^2

5 Rates of flow

A tank is in the shape of a cuboid measuring 50 cm by 120 cm by 150 cm.
Water flows in at 20 litres per minute until the tank is full.
Work out how long this takes. Give your answer in minutes.

Volume = 50 × 120 × 150 = 900000 cm^3 = 900 litres
Time = 900 ÷ 20 = 45 minutes
Answer: 45 minutes

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6 Expanding three brackets

Expand and simplify
$(x + 5)(3x - 5)(x - 4)$

Expand the first two brackets: $(x + 5)(3x - 5) = 3x^2 + 10x - 25$
Multiply by the third bracket: $(3x^2 + 10x - 25)(x - 4)$
$= 3x^3 + 10x^2 - 25x - 12x^2 - 40x + 100$
$= 3x^3 - 2x^2 - 65x + 100$
Answer: $3x^3 - 2x^2 - 65x + 100$

7 Bounds of a speed or density

A runner travels 350 m in 10.7 s. The distance is measured to the nearest 10 metres and the time to the nearest 0.1 second. (Calculator)
Work out the upper bound for the runner's speed in m/s.
Give your answer correct to 3 significant figures.

speed = distance ÷ time
For the upper bound of speed use the upper bound of distance and the lower bound of time.
355 ÷ 10.65 = 33.33333
= 33.3 m/s (3 s.f.)
Answer: 33.3 m/s

8 Exact trigonometric values

Without using a calculator, work out the exact value of
$\tan 60° \times \cos 30°$
Give your answer in its simplest form.

$\tan 60° = \sqrt{3}$ and $\cos 30° = \frac{\sqrt{3}}{2}$

$\sqrt{3} \times \frac{\sqrt{3}}{2} = \frac{3}{2}$

Answer: $\frac{3}{2}$

9 Box plots

The box plot shows the scores of the students in Class A in a test.
(a) Write down the median and the interquartile range.
For Class B the median is 30 and the interquartile range is 5.
(b) Compare the distributions of the two classes.

(a) Median = 25
Interquartile range = 30 − 20 = 10
(b) The median for Class B is higher (30 compared with 25), so it has the higher values on average
The IQR for Class B is smaller (5 compared with 10), so its values are more consistent
Answer: (a) Median 25, IQR 10 (b) Class B has the higher median; Class B has the smaller IQR so is more consistent

10 Bounds and accuracy

A cyclist travels 540 metres in 4.6 seconds. The distance is correct to the nearest 10 metres and the time to the nearest 0.1 second.
(a) Work out the upper bound and the lower bound of the speed in m/s.
(b) Write the speed to a suitable degree of accuracy. Give a reason for your answer.

(a) Upper bound = 545 ÷ 4.55 = 119.7802
Lower bound = 535 ÷ 4.65 = 115.0538
(b) Both bounds round to 120 to 2 s.f. but not to the same value to 3 s.f.
So the speed is 120 m/s to 2 significant figures.
Answer: (a) 119.7802, 115.0538 (b) 120 m/s (2 s.f.)