Day 246 **A Tier 10-a-day: Model Solutions**

1 Exchange rates

£1 = €1.15.
(a) Change £60 to euros.
(b) Change €230 to pounds.

(a) 60 × 1.15 = 69
(b) 230 ÷ 1.15 = 200
Answer: (a) €69 (b) £200

2 Algebraic formulae in context

A taxi company charges £2 plus £1 for each mile.
(a) Write a formula for the total cost, £C, after m miles.
(b) Omar pays £8 in total. Work out the number of miles.

(a) C = 2 + 1m
(b) 2 + 1m = 8
1m = 6
m = 6
Answer: (a) C = 2 + 1m (b) 6

3 Circle theorems: tangents

PA and PB are tangents to a circle with centre O.
Angle APB = 82°.
Work out the size of angle x (angle OAB).
Give a reason for each step of your working.

A tangent is perpendicular to the radius, so angles OAP and OBP are both 90°
Angle AOB = 360 − 90 − 90 − 82 = 98°
OA = OB (radii), so triangle OAB is isosceles
x = (180 − 98) ÷ 2 = 41
Answer: x = 41°

4 Rounding

(a) Write 4353.2 correct to 3 significant figures.
(b) Write 24.447 correct to 1 decimal place.

(a) Count 3 significant figures and look at the next digit: 4353.2 rounds to 4350
(b) Look at the digit after decimal place 1: 24.447 rounds to 24.4
Answer: (a) 4350 (b) 24.4

5 Column vectors

A is the point (1, −2) and B is the point (−5, 6).
(a) Write →AB as a column vector.
(b) Work out the length of AB.

(a) $\overrightarrow{AB} = \overrightarrow{OB} - \overrightarrow{OA} = \begin{pmatrix} -5 \\ 6 \end{pmatrix} - \begin{pmatrix} 1 \\ -2 \end{pmatrix} = \begin{pmatrix} -6 \\ 8 \end{pmatrix}$

(b) Length = $\sqrt{(-6)^2 + (8)^2} = \sqrt{100} = 10$

Answer: (a) $\begin{pmatrix} \mathbf{-6} \\ \mathbf{8} \end{pmatrix}$ **(b) 10**

6 Expanding with surds

Expand and simplify $(4 + \sqrt{11})(4 - \sqrt{11})$

The middle terms cancel: $(4 + \sqrt{11})(4 - \sqrt{11}) = 16 - 11$
= 5
Answer: 5

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7 Scatter graphs

The scatter graph shows the ages and values of some cars.
A line of best fit is drawn.
(a) Describe the correlation.
(b) Estimate the value, in £100s, of a car that is 6 years old.

(a) As age of car increases, value decreases, so there is negative correlation
(b) Draw a line up from 6 on the horizontal axis to the line of best fit, then across to the vertical axis
The line gives a value of 38
Answer: (a) Negative correlation (b) 38

8 Exact trigonometric values

Without using a calculator, work out the exact value of
$4 \cos 30° + \tan 45°$
Give your answer in its simplest form.

$\cos 30° = \frac{\sqrt{3}}{2}$ and $\tan 45° = 1$

$4 \times \frac{\sqrt{3}}{2} + 1 = 1 + 2\sqrt{3}$

Answer: $1 + 2\sqrt{3}$

9 Rearranging formulae (subject twice)

Make x the subject of $y = \frac{5x + 5}{-x - 3}$

Multiply both sides by $(-x - 3)$: $y(-x - 3) = 5x + 5$
Expand the bracket: $-xy - 3y = 5x + 5$
Collect the x terms on one side: $-xy - 5x = 3y + 5$
Factorise: $x(-y - 5) = 3y + 5$
Divide by $(-y - 5)$: $x = \frac{3y + 5}{-y - 5}$
Multiply the top and bottom by -1: $x = \frac{-3y - 5}{y + 5}$

Answer: $x = \frac{-3y - 5}{y + 5}$

10 Bounds and accuracy

A cyclist travels 260 metres in 17.3 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 = 265 ÷ 17.25 = 15.3623
Lower bound = 255 ÷ 17.35 = 14.6974
(b) Both bounds round to 15 to 2 s.f. but not to the same value to 3 s.f.
So the speed is 15 m/s to 2 significant figures.
Answer: (a) 15.3623, 14.6974 (b) 15 m/s (2 s.f.)