Day 170 **A Tier 10-a-day: Model Solutions**

1 Expanding double brackets

Expand and simplify

$(3x + 7)^2$

Multiply every term in the first bracket by every term in the second

$= (3x + 7)(3x + 7) = 9x^2 + 21x + 21x + 49$

$= 9x^2 + 42x + 49$

Answer: $9x^2 + 42x + 49$

2 Isosceles triangles and exterior angles

XYZ is an isosceles triangle with XY = XZ.
YZW is a straight line.
Angle XZW = 141°.
Work out the size of angle x.
The diagram is not drawn accurately.

Angles on a straight line add up to 180°
Angle XZY = 180 − 141 = 39°
Base angles are equal, so angle XYZ = 39°
x = 180 − 39 − 39 = 102
Answer: x = 102°

3 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 7 years old.

(a) As age of car increases, value decreases, so there is negative correlation
(b) Draw a line up from 7 on the horizontal axis to the line of best fit, then across to the vertical axis
The line gives a value of 36
Answer: (a) Negative correlation (b) 36

4 Volume of cones and spheres

A cone has height 15 cm and base radius 5 cm.
Work out the volume of the cone. Give your answer in terms of π.

Volume = $\frac{1}{3} \times \pi \times r^2 \times h$

$= \frac{1}{3} \times \pi \times 5^2 \times 15$

$= 125\pi$

Answer: 125π cm^3

5 The quadratic formula

Solve $5x^2 + 4x - 8 = 0$
Give your solutions correct to 2 decimal places. (Calculator)

Use $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ with a = 5, b = 4, c = −8

$x = \frac{-4 \pm \sqrt{4^2 - 4 \times 5 \times (-8)}}{10}$

$x = \frac{-4 \pm \sqrt{176}}{10}$

x = 0.93 or x = −1.73
Answer: x = 0.93 or x = −1.73

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6 Compound interest

Jack invests £800 in a savings account. (Calculator)
The account pays 3% compound interest per year.
Work out the amount in the account after 3 years.

Multiplier = 100% + 3% = 1.03
£800 × 1.03^3 = £874.182
= £874.18 to the nearest penny
Answer: £874.18

7 Sequences

A sequence is generated by the rule $u_{n+1} = 3u_n - 5$
The first term, u_1, is 2.
Work out the 5th term, u_5.

$u_2 = 3 \times 2 - 5 = 1$
$u_3 = 3 \times 1 - 5 = -2$
$u_4 = 3 \times (-2) - 5 = -11$
$u_5 = 3 \times (-11) - 5 = -38$
Answer: −38

8 Decimal calculations

(a) Work out 0.8 × 0.2
(b) Work out 2.4 ÷ 0.2

(a) 8 × 2 = 16, and there are 2 decimal places in total, so 0.16
(b) Multiply both numbers by 10: 24 ÷ 2 = 12
Answer: (a) 0.16 (b) 12

9 Circle theorems: angles in the same segment

A, B, C and D are points on a circle. AC and BD meet at E.
Angle BAC = 63° and angle ACD = 55°.
Work out the size of angle x (angle AEB).
Give reasons for your working.

Angles in the same segment are equal, so angle ABD = angle ACD = 55°
In triangle ABE: angle BAE = 63° and angle ABE = 55°
x = 180 − 63 − 55 = 62
Answer: x = 62°

10 Bounds and accuracy

A cyclist travels 550 metres in 16.7 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 = 555 ÷ 16.65 = 33.3333
Lower bound = 545 ÷ 16.75 = 32.5373
(b) Both bounds round to 33 to 2 s.f. but not to the same value to 3 s.f.
So the speed is 33 m/s to 2 significant figures.
Answer: (a) 33.3333, 32.5373 (b) 33 m/s (2 s.f.)