Day 321 **A Tier 10-a-day: Model Solutions**

1 Trigonometry in context

A flagpole stands on horizontal ground. (Calculator)
From a point 50 m from the base of the flagpole, the angle of elevation of the top is 41°.
Work out the height of the flagpole. Give your answer to 3 significant figures.

$\tan 41° = \frac{\text{height}}{50}$
height = 50 × tan 41°
= 43.5
Answer: 43.5 m

2 Equations with brackets

Solve 3(x − 2) = 6(x + 1) − 3

Expand the brackets: 3x − 6 = 6x + 6 − 3
Simplify: 3x − 6 = 6x + 3
Collect x terms on one side and numbers on the other: −3x = 9
x = −3
Answer: x = −3

3 Best buys

A shop sells rice in 2 different sizes.
Small bag: 250 g for £1.65
Large bag: 400 g for £2.50
Which bag is the best value for money? You must show your working.

Small bag: 165p ÷ 2.5 = 66p per 100 g
Large bag: 250p ÷ 4 = 62.5p per 100 g
The large bag has the lowest price per 100 g, so it is the best value
Answer: The large bag

4 Forming and solving equations

A rectangle has length (4x + 4) cm and width (4x + 4) cm.
The perimeter of the rectangle is 112 cm.
(a) Work out the value of x.
(b) Work out the length of the rectangle.

(a) Perimeter = 2 × (length + width), so 2(4x + 4 + 4x + 4) = 112
4x + 4 + 4x + 4 = 56 (half of the perimeter)
8x + 8 = 56
8x = 48
x = 6
(b) Length = 4 × 6 + 4 = 28 cm
Answer: (a) x = 6 (b) 28 cm

5 Converting area and volume units

Change 16000 cm^2 to m^2.

1 m^2 = 10 000 cm^2
16000 ÷ 10 000 = 1.6
Answer: 1.6 m^2

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6 Straight line graphs

A straight line has equation $4x - 3y = 12$
(a) Find the gradient of the line.
(b) Find the coordinates of the point where the line crosses the x-axis.

(a) Rearrange into y = mx + c: $-3y = -4x + 12$

$y = \frac{4}{3}x - 4$

The gradient is $\frac{4}{3}$

(b) On the x-axis, y = 0: $4x = 12$, so $x = 3$

Answer: (a) $\frac{4}{3}$ (b) (3, 0)

7 Simple and compound interest

Noah and Isla each invest £2000 for 2 years. (Calculator)
Noah's account pays 4% simple interest per year.
Isla's account pays 4% compound interest per year.
Work out how much more interest Isla earns than Noah.

Simple interest = £2000 × 4% × 2 = £160

Compound: £2000 × 1.04^2 = £2163.20, so interest = £163.20
Difference = 163.20 − 160 = £3.20 (to the nearest penny)
Answer: £3.20

8 Surd fractions

Show that $\frac{\sqrt{175} + \sqrt{63}}{\sqrt{7}}$ is an integer, and find its value.

$\sqrt{175} = 5\sqrt{7}$ and $\sqrt{63} = 3\sqrt{7}$
Numerator = $5\sqrt{7} + 3\sqrt{7} = 8\sqrt{7}$
$\frac{8\sqrt{7}}{\sqrt{7}} = 8$
Answer: 8

9 Bounds in measurement

A rectangle measures 10 cm by 11 cm, each correct to the nearest cm. (Calculator)
Work out the upper bound for the length of a diagonal of the rectangle.
Give your answer to 3 significant figures.

Upper bounds of the sides are 10.5 cm and 11.5 cm

Diagonal = $\sqrt{10.5^2 + 11.5^2} = \sqrt{242.5}$
= 15.6
Answer: 15.6 cm

10 Bounds and accuracy

A cyclist travels 790 metres in 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 = 795 ÷ 6.95 = 114.3885
Lower bound = 785 ÷ 7.05 = 111.3475
(b) Both bounds round to 110 to 2 s.f. but not to the same value to 3 s.f.
So the speed is 110 m/s to 2 significant figures.
Answer: (a) 114.3885, 111.3475 (b) 110 m/s (2 s.f.)