Day 222 **A Tier 10-a-day: Model Solutions**

1 Rounding

(a) Write 8958.6 correct to 3 significant figures.
(b) Write 29.704 correct to 2 decimal places.

(a) Count 3 significant figures and look at the next digit: 8958.6 rounds to 8960
(b) Look at the digit after decimal place 2: 29.704 rounds to 29.70
Answer: (a) 8960 (b) 29.70

2 Rates of flow

A tank is in the shape of a cuboid measuring 50 cm by 100 cm by 60 cm.
Water flows in at 12 litres per minute until the tank is full.
Work out how long this takes. Give your answer in minutes.

Volume = $50 \times 100 \times 60 = 300000$ cm^3 = 300 litres
Time = $300 \div 12 = 25$ minutes
Answer: 25 minutes

3 Trigonometry: finding a side

Work out the value of x. (Calculator)
Give your answer to 3 significant figures.
The diagram is not drawn accurately.

x is the adjacent and 12 cm is the hypotenuse, so use cos

$\cos 66° = \frac{x}{12}$

$x = 12 \times \cos 66°$
$x = 4.88$
Answer: x = 4.88 cm

4 Scatter graphs

The scatter graph shows the hours of sunshine and the number of ice creams sold on some days.
A line of best fit is drawn.
(a) Describe the correlation.
(b) Estimate the number of ice creams sold on a day with 6 hours of sunshine.

(a) As hours of sunshine increases, ice creams sold increases, so there is positive 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 26
Answer: (a) Positive correlation (b) 26

5 Inverse functions

$f(x) = \frac{x + 7}{2}$

(a) Find $f^{-1}(x)$
(b) Work out $f^{-1}(-5)$

Let $y = \frac{x + 7}{2}$

$x = 2y - 7$
$f^{-1}(x) = 2x - 7$
(b) $f^{-1}(-5) = -17$
Answer: (a) $f^{-1}(x) = 2x - 7$ (b) -17

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6 Trigonometry in context

A flagpole stands on horizontal ground. (Calculator)
From a point 25 m from the base of the flagpole, the angle of elevation of the top is 40°.
Work out the height of the flagpole. Give your answer to 3 significant figures.

$\tan 40° = \frac{\text{height}}{25}$

height = 25 × tan 40°
= 21.0

Answer: 21.0 m

7 Iteration

$x_{n+1} = \sqrt[3]{17 - x_n}$
$x_0 = 2$
Work out the values of x_1, x_2 and x_3.
Give your answers correct to 3 decimal places. (Calculator)

Substitute $x_0 = 2$ into the formula, then use each answer in the next step (keep the full calculator display)

$x_1 = 2.46621$
$x_2 = 2.44039$
$x_3 = 2.44184$

Answer: $x_1 = 2.466$, $x_2 = 2.440$, $x_3 = 2.442$

8 Recurring decimals (mixed)

Write $0.6\dot{2}$ as a fraction in its simplest form.

Let x = 0.622...
Multiply by 10: 10x = 6.22...
Multiply by 100: 100x = 62.22...
Subtract: 90x = 62 − 6 = 56
$x = \frac{56}{90} = \frac{28}{45}$

Answer: $\frac{28}{45}$

9 Surd fractions

Show that $\frac{\sqrt{72} + \sqrt{32}}{\sqrt{2}}$ is an integer, and find its value.

$\sqrt{72} = 6\sqrt{2}$ and $\sqrt{32} = 4\sqrt{2}$
Numerator = $6\sqrt{2} + 4\sqrt{2} = 10\sqrt{2}$
$\frac{10\sqrt{2}}{\sqrt{2}} = 10$

Answer: 10

10 Completing the square

Solve $x^2 + 6x + 7 = 0$ by completing the square.
Give your answers in surd form.

$x^2 + 6x + 7 = (x + 3)^2 - 2$
$(x + 3)^2 = 2$
$x + 3 = \pm\sqrt{2}$
$x = -3 \pm \sqrt{2}$

Answer: $x = -3 \pm \sqrt{2}$