Day 340 **A Tier 10-a-day: Model Solutions**

1 Pythagoras' theorem

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

$x^2 = 12^2 + 13^2$

$x^2 = 144 + 169 = 313$

$x = \sqrt{313} = 17.7$

Answer: x = 17.7 m

2 Calculator and significant figures

Work out $\frac{8.9 + 0.44}{4.8 - 0.11}$ (Calculator)

Give your answer correct to 3 significant figures.

Numerator = 8.9 + 0.44 = 9.34
Denominator = 4.8 − 0.11 = 4.69
= 1.99147...
= 1.99 to 3 significant figures

Answer: 1.99

3 Area of a triangle using sine

The area of triangle ABC is 26 cm^2. (Calculator)
Angle x is acute.
Work out the size of angle x. Give your answer to 1 decimal place.
The diagram is not drawn accurately.

$\frac{1}{2} \times 15 \times 5 \times \sin x = 26$

$37.5 \sin x = 26$

$\sin x = 0.6933$

$x = 43.9°$

Answer: x = 43.9°

4 Sequences

A sequence is generated by the rule $u_{n+1} = 4u_n - 3$
The first term, u_1, is 3.
Work out the 5th term, u_5.

$u_2 = 4 \times 3 - 3 = 9$

$u_3 = 4 \times 9 - 3 = 33$

$u_4 = 4 \times 33 - 3 = 129$

$u_5 = 4 \times 129 - 3 = 513$

Answer: 513

5 Profit and loss

Ben buys a bike for £230 and sells it making a profit of 30%.
Work out the selling price.

Selling price = 130% of the cost price
£230 × 1.3 = £299

Answer: £299

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6 Double inequalities

(a) Solve $-14 \leq 5x - 4 \leq 1$
(b) Write down all the integer values of x that satisfy this inequality.

(a) Add 4 to every part: $-10 \leq 5x \leq 5$
Divide every part by 5: $-2 \leq x \leq 1$
(b) The integers are $-2, -1, 0, 1$
Answer: (a) $-2 \leq x \leq 1$ (b) $-2, -1, 0, 1$

7 Combining ratios

a : b = 5 : 7
b : c = 3 : 5
(a) Work out the ratio a : b : c
(b) a, b and c add up to 355. Work out the value of c.

(a) Make the b parts equal: lowest common multiple of 7 and 3 is 21
a : b = 15 : 21 and b : c = 21 : 35
a : b : c = 15 : 21 : 35
(b) 15 + 21 + 35 = 71 parts, so 1 part = 355 ÷ 71 = 5
c = 35 × 5 = 175
Answer: (a) 15 : 21 : 35 (b) 175

8 Circle theorems: angle at the centre

X, Y and Z are points on a circle with centre O.
Angle XOY = 96°.
Work out the size of angle x.
Give a reason for your answer.

The angle at the centre is twice the angle at the circumference
x = 96 ÷ 2 = 48
Answer: x = 48°

9 Simplifying algebraic fractions

Simplify fully

$$\frac{x^2 + 7x + 12}{x^2 - 3x - 28}$$

Factorise the top: (x + 4)(x + 3)
Factorise the bottom: (x + 4)(x − 7)
Cancel the common factor (x + 4)

Answer: $\mathbf{\frac{x + 3}{x - 7}}$

10 Inverse proportion formulae

y is inversely proportional to x^2.
When x = 4, y = 7.
(a) Find a formula for y in terms of x.
(b) Work out the value of y when x = 8.

(a) $y = \frac{k}{x^2}$. Substitute: $7 = \frac{k}{16}$, so $k = 7 \times 16 = 112$

$y = \frac{112}{x^2}$

(b) $y = \frac{112}{64} = 1.75$

Answer: (a) $y = \frac{112}{x^2}$ (b) 1.75