Day 46 **A Tier 10-a-day: Model Solutions**

1 Substitution

$E = \frac{1}{2}mv^2$

Work out the value of E when m = 14 and v = 5

$E = \frac{1}{2} \times 14 \times (5)^2$

$= 7 \times 25$

$= 175$

Answer: 175

2 Dividing fractions in context

A bag contains $16\frac{7}{8}$ kg of flour. Each cake uses $\frac{5}{8}$ kg of flour.

How many cakes can be made?

Divide: $16\frac{7}{8} \div \frac{5}{8}$

As improper fractions and multiplying by the reciprocal: $\frac{135}{8} \times \frac{8}{5}$

$= 27$

Answer: 27

3 Converting speeds

A lorry travels at 63 km/h.

Work out this speed in metres per minute.

In 1 hour: 63 km = 63000 m

1 hour = 60 minutes, so 63000 ÷ 60 = 1050 m per minute

Answer: 1050 m/min

4 LCM in context

On a stage, a lighthouse flashes every 15 seconds.

A green light flashes every 18 seconds.

They flash together at the start.

After how many seconds will they next flash together?

Find the LCM of 15 and 18.

$15 = 3 \times 5$ and $18 = 2 \times 3^2$

LCM = 90

They flash together again after 90 seconds.

Answer: 90 seconds

5 Area of a trapezium

The diagram shows a trapezium.

Work out the area of the trapezium.

The diagram is not drawn accurately.

$\text{Area} = \frac{1}{2} \times (8 + 10) \times 7$

$= \frac{1}{2} \times 18 \times 7$

$= 63$

Answer: 63 cm^2

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6 Inverse functions

$f(x) = \frac{x + 1}{4}$

(a) Find $f^{-1}(x)$

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

Let $y = \frac{x + 1}{4}$

$x = 4y - 1$

$f^{-1}(x) = 4x - 1$

(b) $f^{-1}(-5) = -21$

Answer: (a) $f^{-1}(x) = 4x - 1$ (b) -21

7 Area of a triangle using sine

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

Area $= \frac{1}{2} \times a \times b \times \sin C$

$= \frac{1}{2} \times 9 \times 10 \times \sin 43°$

$= 30.7$

Answer: 30.7 cm^2

8 Rearranging formulae (powers and roots)

Make x the subject of $y = 4x^2 - 4$

Add 4 to both sides: $y + 4 = 4x^2$

Divide by 4: $x^2 = \frac{y + 4}{4}$

Square root both sides (positive and negative roots)

Answer: $x = \pm \sqrt{\frac{y + 4}{4}}$

9 Rationalising with conjugates

Rationalise the denominator of $\frac{40}{4 + \sqrt{6}}$

Give your answer in the form $a + b\sqrt{c}$ where a and b are integers.

Multiply top and bottom by the conjugate $4 - \sqrt{6}$: $\frac{40(4 - \sqrt{6})}{(4 + \sqrt{6})(4 - \sqrt{6})}$

Denominator: $16 - 6 = 10$

$\frac{40(4 - \sqrt{6})}{10} = 4(4 - \sqrt{6})$

$= 16 - 4\sqrt{6}$

Answer: $16 - 4\sqrt{6}$

10 Inverse proportion formulae

y is inversely proportional to $\sqrt{x}$.
When x = 1, y = 3.
(a) Find a formula for y in terms of x.
(b) Work out the value of y when x = 100.

(a) $y = \frac{k}{\sqrt{x}}$. Substitute: $3 = \frac{k}{1}$, so $k = 3 \times 1 = 3$

$y = \frac{3}{\sqrt{x}}$

(b) $y = \frac{3}{10} = 0.3$

Answer: (a) $y = \frac{3}{\sqrt{x}}$ (b) 0.3