Day 52 **A Tier 10-a-day: Model Solutions**

1 Percentage change

The number of visitors to a museum changes from 800 to 1160.
Work out the percentage increase.

Increase = 1160 − 800 = 360

Percentage increase = $\frac{360}{800} \times 100 = 45\%$

Answer: 45%

2 Simultaneous equations

Solve the simultaneous equations
$-x - y = 3$
$5x + 2y = -9$

Multiply (1) by 2 to make the y coefficients match
$-2x - 2y = 6$ (1)
$5x + 2y = -9$ (2)
The y terms have opposite signs, so add the equations
$3x = -3$, so $x = -1$
Substitute $x = -1$ into equation (1) to find $y = -2$
Answer: $x = -1$, $y = -2$

3 Compound interest

Kai invests £6000 in a savings account. (Calculator)
The account pays 6% compound interest per year.
Work out the amount in the account after 3 years.

Multiplier = 100% + 6% = 1.06
£6000 × 1.06^3 = £7146.096
= £7146.10 to the nearest penny
Answer: £7146.10

4 Volume of a hollow cylinder

The diagram shows the cross-section of a metal pipe.
The outer radius is 5 cm and the inner radius is 2 cm.
The pipe is 30 cm long.
Work out the volume of metal used. Give your answer to 3 significant figures. (Calculator)

Area of the ring = $\pi \times 5^2 - \pi \times 2^2 = \pi(25 - 4) = 21\pi$
Volume = area × length = $21\pi \times 30$
= 1980
Answer: 1980 cm^3

5 Reverse fractions

$\frac{7}{10}$ of the books in a library are fiction.
There are 168 fiction books.
Work out the total number of books in the library.

$\frac{7}{10}$ of the total = 168
$\frac{1}{10}$ of the total = 168 ÷ 7 = 24
Whole = 24 × 10 = 240
Answer: 240

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6 Direct and inverse proportion

y is inversely proportional to x.
When x = 5, y = 6.
(a) Find a formula for y in terms of x.
(b) Work out the value of y when x = 10.

(a) $y = \frac{k}{x}$. Substitute x = 5 and y = 6: $6 = \frac{k}{5}$, so $k = 6 \times 5 = 30$

$y = \frac{30}{x}$

(b) $y = \frac{30}{10} = 3$

Answer: (a) $y = \frac{30}{x}$ (b) 3

7 Combined means

The mean mark of 14 boys in a test is 52.
The mean mark of 6 girls in the same test is 62.
Work out the mean mark of all 20 people.

Total for boys = 14 × 52 = 728
Total for girls = 6 × 62 = 372
Total = 1100, and number of students = 20
Mean = 1100 ÷ 20 = 55
Answer: 55

8 Equations with algebraic fractions

Solve $\frac{3}{(x+1)} + \frac{1}{(x-3)} = 1$

Multiply every term by $(x + 1)(x - 3)$
$3(x - 3) + 1(x + 1) = (x + 1)(x - 3)$
$4x - 8 = x^2 - 2x - 3$
$x^2 - 6x + 5 = 0$
$(x - 1)(x - 5) = 0$
$x = 1$ or $x = 5$
Answer: x = 1 or x = 5

9 Recurring decimals, show that

(a) Show that $0.\dot{7}\dot{4} = \frac{74}{99}$

(b) Hence write $4.\dot{7}\dot{4}$ as a mixed number in its simplest form.

(a) Let x = 0.747474..., so 100x = 74.7474...

$100x - x = 74$, so $99x = 74$ and $x = \frac{74}{99}$

(b) $4.\dot{7}\dot{4} = 4 + \frac{74}{99} = 4\frac{74}{99}$

Answer: (b) $4\frac{74}{99}$

10 Bounds in measurement

The length and width of a rectangle are 10.7 cm and 10.8 cm.
Each measurement is correct to 1 decimal place.
Work out the lower bound for the area.

Lower bound of length = 10.7 cm, lower bound of width = 10.8 cm
Lower bound of area = 10.65 × 10.75 = 114.4875
Answer: 114.4875 cm^2