Day 228 **A Tier 10-a-day: Model Solutions**

1 Direct proportion

Here are the ingredients for 10 flapjacks.
Water: 750 ml
Oats: 400 g
Sugar: 150 g
(a) Work out how much water is needed for 2 flapjacks.
(b) Hannah has 709 g of oats. What is the greatest number of flapjacks she can make?

(a) water for one: 750 ÷ 10 = 75 ml
For 2: 75 × 2 = 150 ml
(b) oats for one: 400 ÷ 10 = 40 g
709 ÷ 40 = 17 remainder 29, so she can make 17
Answer: (a) 150 ml (b) 17

2 Mixed number addition and subtraction

Work out $4\frac{3}{4} - 4\frac{1}{5}$
Give your answer as a mixed number in its simplest form.

Write as improper fractions: $4\frac{3}{4} = \frac{19}{4}$ and $4\frac{1}{5} = \frac{21}{5}$

Common denominator 20: $\frac{95}{20} - \frac{84}{20}$

$= \frac{11}{20}$

Answer: $\mathbf{\frac{11}{20}}$

3 Equations with brackets

Solve $6(x - 3) = -4(x - 5) - 8$

Expand the brackets: $6x - 18 = -4x + 20 - 8$
Simplify: $6x - 18 = -4x + 12$
Collect x terms on one side and numbers on the other: $10x = 30$
$x = 3$
Answer: x = 3

4 Simplifying surds

(a) Simplify $\sqrt{180}$
(b) Simplify $\sqrt{180} - \sqrt{125}$

(a) $\sqrt{180} = \sqrt{36} \times \sqrt{5} = 6\sqrt{5}$
(b) $\sqrt{125} = 5\sqrt{5}$, so $6\sqrt{5} - 5\sqrt{5} = \sqrt{5}$
Answer: (a) $6\sqrt{5}$ (b) $\sqrt{5}$

5 Is it a right-angled triangle?

A triangle has sides of length 42 m, 9 m and 40 m.
Is the triangle right-angled?
You must show your working.

Longest side$^2 = 42^2 = 1764$
Sum of the squares of the other two sides $= 9^2 + 40^2 = 81 + 1600 = 1681$
$1764 \neq 1681$, so the triangle is not right-angled
Answer: No, it is not right-angled

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6 The quadratic formula

Solve $2x^2 - 9x - 2 = 0$
Give your solutions correct to 2 decimal places. (Calculator)

Use $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ with $a = 2$, $b = -9$, $c = -2$

$x = \frac{9 \pm \sqrt{(-9)^2 - 4 \times 2 \times (-2)}}{4}$

$x = \frac{9 \pm \sqrt{97}}{4}$

$x = 4.71$ or $x = -0.21$

Answer: $x = 4.71$ or $x = -0.21$

7 Direct proportion formulae

y is directly proportional to the cube of x.
When x = 5, y = 875.
(a) Find a formula for y in terms of x.
(b) Work out the value of y when x = 2.

(a) $y = kx^3$. Substitute: $875 = k \times 125$, so $k = 7$

$y = 7x^3$

(b) $y = 7 \times 8 = 56$

Answer: (a) $y = 7x^3$ (b) 56

8 Calculator and significant figures

Work out $2.6 \times (1 + 2.1 \div 100)^3$ (Calculator)
Give your answer correct to 3 significant figures.

$1 + 2.1 \div 100 = 1.021$

$= 2.76726...$

= 2.77 to 3 significant figures

Answer: 2.77

9 Arc length and perimeter of a sector

The diagram shows a sector of a circle of radius 18 cm.
Work out the perimeter of the sector.
Give your answer in terms of π.
The diagram is not drawn accurately.

Arc length $= \frac{270}{360} \times 2 \times \pi \times 18 = 27\pi$

Perimeter = arc + two radii

$= 27\pi + 36$

Answer: $27\pi + 36$ cm

10 Substitution

Work out the value of $2a^2 + 4ab - 2b^2$
when $a = -4$ and $b = 3$

Substitute: $2 \times (-4)^2 + 4 \times (-4) \times 3 - 2 \times 3^2$

$= 32 - 48 - 18$

$= -34$

Answer: -34