Day 15 **A Tier 10-a-day: Model Solutions**

1 Direct proportion

Here are the ingredients for 10 flapjacks.
Milk: 500 ml
Sugar: 150 g
Oats: 250 g
(a) Work out how much milk is needed for 20 flapjacks.
(b) Hannah has 291 g of sugar. What is the greatest number of flapjacks she can make?

(a) milk for one: 500 ÷ 10 = 50 ml
For 20: 50 × 20 = 1000 ml
(b) sugar for one: 150 ÷ 10 = 15 g
291 ÷ 15 = 19 remainder 6, so she can make 19
Answer: (a) 1000 ml (b) 19

2 Mixed number addition and subtraction

Work out $4\frac{1}{3} - 2\frac{1}{5}$
Give your answer as a mixed number in its simplest form.

Write as improper fractions: $4\frac{1}{3} = \frac{13}{3}$ and $2\frac{1}{5} = \frac{11}{5}$

Common denominator 15: $\frac{65}{15} - \frac{33}{15}$

$= \frac{32}{15}$

$= 2\frac{2}{15}$

Answer: $2\frac{2}{15}$

3 Area of a triangle using sine

The area of triangle ABC is 74.3 m^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.

$\frac{1}{2} \times 10 \times 17 \times \sin x = 74.3$
$85 \sin x = 74.3$
$\sin x = 0.8741$
$x = 60.9°$
Answer: x = 60.9°

4 Profit and loss

Femi buys a phone for £390 and sells it making a profit of 20%.
Work out the selling price.

Selling price = 120% of the cost price
£390 × 1.2 = £468
Answer: £468

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5 Probability without replacement

A bag contains 2 mint and 6 fruit sweets.
Two sweets are taken at random without replacement.
Work out the probability that the two sweets are the same colour.

P(mint, mint) = $\frac{2}{8} \times \frac{1}{7} = \frac{2}{56}$

P(fruit, fruit) = $\frac{6}{8} \times \frac{5}{7} = \frac{30}{56}$

Add: $\frac{2}{56} + \frac{30}{56} = \frac{4}{7}$

Answer: $\frac{4}{7}$

6 Similar triangles with parallel lines

In triangle ABC, DE is parallel to BC.
D is on AB and E is on AC.
Work out the value of x.
The diagram is not drawn accurately.

Triangles ADE and ABC are similar (DE is parallel to BC)

Scale factor = AB ÷ AD = 7 ÷ 5 = $\frac{7}{5}$

$x = 10 \times \frac{7}{5} = 14$

Answer: x = 14

7 Completing the square

Solve $x^2 - 8x - 3 = 0$ by completing the square.
Give your answers in surd form.

$x^2 - 8x - 3 = (x - 4)^2 - 19$
$(x - 4)^2 = 19$
$x - 4 = \pm\sqrt{19}$
$x = 4 \pm \sqrt{19}$
Answer: x = 4 ± $\sqrt{19}$

8 Pie charts

The pie chart shows how some students travel to school.
5 students chose car.
(a) Work out the angle for cycle.
(b) How many students chose cycle?

(a) 360 − 104 − 168 − 40 = 48°
(b) 5 students is 40°, so 1 student is 40 ÷ 5 = 8°
Cycle: 48 ÷ 8 = 6
Answer: (a) 48° (b) 6

9 Volume of composite solids

A solid is made from a cylinder and a hemisphere.
The cylinder has radius 6 cm and height 5 cm.
The hemisphere has the same radius as the cylinder and sits on top of it.
Work out the total volume. Give your answer in terms of π.

Cylinder = $\pi \times 6^2 \times 5 = 180\pi$

Hemisphere = $\frac{2}{3} \times \pi \times 6^3 = 144\pi$

Total = $180\pi + 144\pi = 324\pi$

Answer: 324π cm^3

10 Simultaneous equations (one quadratic)

Solve the simultaneous equations

$y = x^2 + x - 13$

$y = -7$

Set the y values equal: $x^2 + x - 13 = -7$

$x^2 + x - 6 = 0$

$(x + 3)(x - 2) = 0$

$x = -3$ or $x = 2$

Substitute into $y = -7$: $y = -7$ and $y = -7$

Answer: $x = -3$, $y = -7$ and $x = 2$, $y = -7$