Day 61 **A Tier 10-a-day: Model Solutions**

1 Mixed number addition and subtraction

Work out $4\frac{1}{3} + 3\frac{4}{5}$

Give your answer as a mixed number in its simplest form.

Write as improper fractions: $4\frac{1}{3} = \frac{13}{3}$ and $3\frac{4}{5} = \frac{19}{5}$

Common denominator 15: $\frac{65}{15} + \frac{57}{15}$

$= \frac{122}{15}$

$= 8\frac{2}{15}$

Answer: $8\frac{2}{15}$

2 Sharing in a ratio

Hugo, Isla and Ella share 320 stickers in the ratio 6 : 7 : 3.
How many more stickers does Isla get than Ella?

Total number of parts = 6 + 7 + 3 = 16
One part = 320 ÷ 16 = 20
Isla gets 7 × 20 = 140 and Ella gets 3 × 20 = 60
Difference = 140 − 60 = 80
Answer: 80

3 Fractions of an amount

Chloe has £600.

Chloe spends $\frac{3}{8}$ of the money on a coat and $\frac{3}{5}$ of the money that is left on some shoes.

How much money does Chloe have left?

$\frac{3}{8}$ of £600 = £225, so after buying a coat, £375 is left.

$\frac{3}{5}$ of £375 = £225

£375 − £225 = £150
Answer: £150

4 Pythagoras' theorem

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

$x^2 = 3^2 + 9^2$

$x^2 = 9 + 81 = 90$

$x = \sqrt{90} = 9.49$

Answer: x = 9.49 mm

5 Expanding and simplifying

Expand and simplify
$2(x - 3)(x - 2) - (x - 6)(x + 6)$

$2(x - 3)(x - 2) = 2(x^2 - 5x + 6) = 2x^2 - 10x + 12$

$(x - 6)(x + 6) = x^2 - 36$

Subtract: $x^2 - 10x + 48$

Answer: $x^2 - 10x + 48$

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6 Venn diagrams from information

There are 35 students in a class.
16 students do drama and 13 students do choir.
9 students do neither.
(a) Work out how many students do both.
(b) One student is chosen at random. Find the probability that they do drama only.

(a) Students doing at least one = 35 − 9 = 26
Both = 16 + 13 − 26 = 3
(b) drama only = 16 − 3 = 13

Probability = $\frac{13}{35}$

Answer: (a) 3 (b) $\frac{13}{35}$

7 The sine rule

Work out the size of angle x. (Calculator)
Give your answer to 1 decimal place.
The diagram is not drawn accurately.

$\frac{\sin x}{22} = \frac{\sin 52°}{23}$

$\sin x = \frac{22 \times \sin 52°}{23}$

$x = \sin^{-1}(0.7537)$
$x = 48.9°$
Answer: x = 48.9°

8 Inverse functions

$f(x) = \frac{x - 9}{4}$

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

Let $y = \frac{x - 9}{4}$

$x = 4y + 9$
$f^{-1}(x) = 4x + 9$
(b) $f^{-1}(5) = 29$
Answer: (a) $f^{-1}(x) = 4x + 9$ (b) 29

9 Stratified sampling

A school has 325 students in Year 9, 150 in Year 10 and 325 in Year 11.
A stratified sample of 32 students is to be taken.
Work out how many students should be chosen from Year 10.

Total = 325 + 150 + 325 = 800

Number from Year 10 = $\frac{150}{800} \times 32$

= 6
Answer: 6

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10 Vector geometry

OAB is a triangle. $\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$.
P is on OA with OP : PA = 1 : 1.
Q is on OB with OQ : QB = 1 : 1.
(a) Find $\overrightarrow{PQ}$ in terms of $\mathbf{a}$ and $\mathbf{b}$.
(b) What do you notice about PQ and AB?

(a) $\overrightarrow{OP} = \frac{1}{2}\mathbf{a}$ and $\overrightarrow{OQ} = \frac{1}{2}\mathbf{b}$

$\overrightarrow{PQ} = \overrightarrow{PO} + \overrightarrow{OQ} = -\frac{1}{2}\mathbf{a} + \frac{1}{2}\mathbf{b} = \frac{1}{2}(\mathbf{b} - \mathbf{a})$

(b) $\overrightarrow{AB} = \mathbf{b} - \mathbf{a}$, so $\overrightarrow{PQ} = \frac{1}{2}\overrightarrow{AB}$

Answer: (a) $\frac{1}{2}\mathbf{b} - \frac{1}{2}\mathbf{a}$ (b) PQ is parallel to AB and $\frac{1}{2}$ times as long