Day 332 **A Tier 10-a-day: Model Solutions**

1 Exchange rates

£1 = $1.12.
(a) Change £240 to dollars.
(b) Change $134.4 to pounds.

(a) 240 × 1.12 = 268.8
(b) 134.4 ÷ 1.12 = 120
Answer: (a) $268.8 (b) £120

2 Vector geometry

OAB is a triangle. $\rightarrow$OA = **a** and $\rightarrow$OB = **b**.
P is the point on AB such that AP : PB = 4 : 1.
Find $\rightarrow$OP in terms of **a** and **b**.

$\rightarrow AB = -\mathbf{a} + \mathbf{b}$

$\rightarrow AP = \frac{4}{5}\rightarrow AB = \frac{4}{5}(\mathbf{b} - \mathbf{a})$

$\rightarrow OP = \rightarrow OA + \rightarrow AP = \mathbf{a} + \frac{4}{5}(\mathbf{b} - \mathbf{a})$

$= \frac{1}{5}\mathbf{a} + \frac{4}{5}\mathbf{b}$

Answer: $\mathbf{\rightarrow OP = \frac{1}{5}a + \frac{4}{5}b}$

3 Algebraic formulae in context

A hall is hired for £60 plus £25 for each hour.
(a) Write a formula for the total cost, £C, after h hours.
(b) Leo pays £310 in total. Work out the number of hours.

(a) C = 60 + 25h
(b) 60 + 25h = 310
25h = 250
h = 10
Answer: (a) C = 60 + 25h (b) 10

4 LCM in context

Tom runs around a track in 40 seconds.
Kiran runs around the same track in 90 seconds.
They start together at the start line and keep running.
How many laps will each have run when they are next together at the start line?

Find the LCM of 40 and 90: LCM = 360 seconds.
Tom: 360 ÷ 40 = 9 laps
Kiran: 360 ÷ 90 = 4 laps
Answer: Tom 9 laps, Kiran 4 laps

5 Rearranging to solve quadratics

Solve $3x^2 = 10x - 3$

Move everything to one side: $3x^2 - 10x + 3 = 0$
Factorise: $(3x - 1)(x - 3) = 0$
$x = \frac{1}{3}$ or $x = 3$

Answer: $\mathbf{x = \frac{1}{3}}$ **or x = 3**

Day 332 **A Tier 10-a-day: Model Solutions**

6 Probability without replacement

A bag contains 5 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) = $\frac{5}{11} \times \frac{4}{10} = \frac{20}{110}$

P(fruit, fruit) = $\frac{6}{11} \times \frac{5}{10} = \frac{30}{110}$

Add: $\frac{20}{110} + \frac{30}{110} = \frac{5}{11}$

Answer: $\mathbf{\frac{5}{11}}$

7 Reverse fractions

$\frac{2}{7}$ of the books in a library are fiction.

There are 12 fiction books.
Work out the total number of books in the library.

$\frac{2}{7}$ of the total = 12

$\frac{1}{7}$ of the total = 12 ÷ 2 = 6

Whole = 6 × 7 = 42

Answer: 42

8 The sine rule

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

$\frac{\sin x}{9} = \frac{\sin 65°}{14}$

$\sin x = \frac{9 \times \sin 65°}{14}$

$x = \sin^{-1}(0.5826)$

$x = 35.6°$

Answer: x = 35.6°

9 Rearranging formulae (subject twice)

Make x the subject of $y = \frac{3x + 3}{x - 6}$

Multiply both sides by $(x - 6)$: $y(x - 6) = 3x + 3$
Expand the bracket: $xy - 6y = 3x + 3$
Collect the x terms on one side: $xy - 3x = 6y + 3$
Factorise: $x(y - 3) = 6y + 3$

Divide by $(y - 3)$: $x = \frac{6y + 3}{y - 3}$

Answer: $\mathbf{x = \frac{6y + 3}{y - 3}}$

Day 332 **A Tier 10-a-day: Model Solutions**

10 Bearings with the cosine rule

Ship A sails 12 km from a port on a bearing of 160°.
Ship B sails 8 km from the same port on a bearing of 240°. (Calculator)
Work out the distance between the two ships.
Give your answer to 3 significant figures.

The angle between the two paths = $|160° - 240°| = 80°$

$d^2 = 12^2 + 8^2 - 2 \times 12 \times 8 \times \cos 80°$

$d^2 = 174.66$

$d = 13.2$

Answer: 13.2 km