Day 187 **A Tier 10-a-day: Model Solutions**

1 Expanding double brackets

Expand and simplify
$(3x + 1)(3x + 6)$

Multiply every term in the first bracket by every term in the second
$= 9x^2 + 18x + 3x + 6$
$= 9x^2 + 21x + 6$
Answer: $9x^2 + 21x + 6$

2 Converting speeds

A lorry travels at 81 km/h.
Work out this speed in metres per minute.

In 1 hour: 81 km = 81000 m
1 hour = 60 minutes, so 81000 ÷ 60 = 1350 m per minute
Answer: 1350 m/min

3 Fraction calculations

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

Brackets first, as improper fractions: $\frac{10}{3} - \frac{3}{2} = \frac{11}{6}$
Then divide by multiplying by the reciprocal: $\frac{11}{6} \times \frac{3}{11} = \frac{1}{2}$
$= \frac{1}{2}$
Answer: $\frac{1}{2}$

4 Compound shapes with circles

The diagram shows a shape made from a rectangle and a semicircle.
Work out the perimeter of the shape.
Give your answer in terms of π.
The diagram is not drawn accurately.

Curved edge: $\frac{1}{2} \times \pi \times 6 = 3\pi$
Straight edges: 6 + 10 + 10 = 26
Total = $26 + 3\pi$
Answer: $26 + 3\pi$ cm

5 Simultaneous equations in context

5 adult tickets and 3 child tickets cost £78.
5 adult tickets and 2 child tickets cost £72.
Work out the cost of one adult ticket.

Let a = cost of one adult ticket in £ and c = cost of one child ticket in £
5a + 3c = 78 (1)
5a + 2c = 72 (2)
Multiply (1) by 2 and (2) by 3 to make the c coefficients match
10a + 6c = 156 (1)
15a + 6c = 216 (2)
The c terms have the same sign, so subtract equation (1) from equation (2)
5a = 60, so a = 12
Substitute a = 12 into equation (1) to find c = 6
Answer: £12

Day 187 **A Tier 10-a-day: Model Solutions**

6 Probability without replacement

A bag contains 5 red and 2 blue counters.
Two counters are taken at random without replacement.
Work out the probability that the two counters are different colours.

P(same colour) = $\frac{5}{7} \times \frac{4}{6} + \frac{2}{7} \times \frac{1}{6} = \frac{11}{21}$

P(different) = $1 - \frac{11}{21} = \frac{10}{21}$

Answer: $\mathbf{\frac{10}{21}}$

7 Inequalities

Solve $2x + 4 > 7$

Subtract 4: $2x > 3$
Divide by 2
$x > \frac{3}{2}$

Answer: $\mathbf{x > \frac{3}{2}}$

8 Recurring decimals, show that

(a) Show that $0.\dot{3}\dot{5} = \frac{35}{99}$

(b) Hence write $1.\dot{3}\dot{5}$ as a mixed number in its simplest form.

(a) Let x = 0.353535..., so 100x = 35.3535...

$100x - x = 35$, so $99x = 35$ and $x = \frac{35}{99}$

(b) $1.\dot{3}\dot{5} = 1 + \frac{35}{99} = 1\frac{35}{99}$

Answer: (b) $\mathbf{1\frac{35}{99}}$

9 Area of a sector

The diagram shows a sector of a circle of radius 14 cm.
Work out the area of the sector.
Give your answer in terms of π.
The diagram is not drawn accurately.

Area = $\frac{135}{360} \times \pi \times 14^2$

$= \frac{3}{8} \times 196\ \pi$

$= \frac{147}{2}\pi$

Answer: $\mathbf{\frac{147}{2}\pi\ cm^2}$

10 Dividing fractions in context

A roll of ribbon is $3\frac{5}{8}$ metres long. Pieces of $\frac{1}{8}$ metre are cut from it.

How many pieces can be cut?

Divide: $3\frac{5}{8} \div \frac{1}{8}$

As improper fractions and multiplying by the reciprocal: $\frac{29}{8} \times 8$

$= 29$

Answer: 29