Day 11 **A Tier 10-a-day: Model Solutions**

1 Sharing in a ratio

Grace and Maya share some football cards in the ratio 9 : 8.
Grace gets 45 football cards.
How many football cards does Maya get?

9 parts = 45, so 1 part = 45 ÷ 9 = 5
Maya gets 8 parts: 8 × 5 = 40
Answer: 40

2 Circle area and circumference

A circular table top has radius 13 cm.
Work out, in terms of π,
(a) the circumference,
(b) the area.

(a) Circumference = $\pi d = \pi \times 26 = 26\pi$
(b) Area = $\pi r^2 = \pi \times 13^2 = 169\pi$
Answer: (a) 26π cm (b) 169π cm^2

3 Inequalities

Solve $-4x - 4 < -2x - 12$

Collect the x terms on the left: $-2x - 4 < -12$
Add 4: $-2x < -8$
Divide by -2. Dividing by a negative number reverses the inequality sign
$x > 4$
Answer: $x > 4$

4 Two-way tables

The table shows information about 72 people.
One person is chosen at random.
(a) Find the probability that the person is a child and chose coffee.
(b) The person chose tea. Find the probability that they are an adult.

(a) Children who chose coffee: 17 out of 72 = $\frac{17}{72}$
(b) Tea total = 31, of whom 25 are in the Adults row: $\frac{25}{31}$
Answer: (a) $\frac{17}{72}$ (b) $\frac{25}{31}$

5 Index equations

Solve $2^{3x+1} = 16$

$16 = 2^4$, so $3x + 1 = 4$
$3x = 4 - 1 = 3$
$x = 1$
Answer: $x = 1$

6 Simplifying algebraic fractions

Simplify fully

$$\frac{x^2 - 36}{x^2 - 6x}$$

Top: $x^2 - 36 = (x - 6)(x + 6)$
Bottom: $x^2 - 6x = x(x - 6)$
Cancel $(x - 6)$
Answer: $\frac{x + 6}{x}$

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7 Recurring decimals (mixed)

Write $0.5\dot{8}$ as a fraction in its simplest form.

Let x = 0.588...
Multiply by 10: 10x = 5.88...
Multiply by 100: 100x = 58.88...
Subtract: 90x = 58 − 5 = 53
$x = \frac{53}{90}$

Answer: $\frac{53}{90}$

8 Area of shaded regions with circles

4 identical circles of radius 5 cm fit exactly inside a rectangle.
The circles touch each other and the sides of the rectangle. (Calculator)
Work out the area of the shaded region.
Give your answer to 3 significant figures.

Rectangle: 40 × 10 = 400 cm^2
4 circles: $4 \times \pi \times 5^2 = 100\pi$
Shaded area = $400 - 100\pi = 85.8$
Answer: 85.8 cm^2

9 Equations with algebraic fractions

Solve $\frac{3}{(x+1)} + \frac{2}{(x-1)} = 1$

Multiply every term by (x + 1)(x − 1)
3(x − 1) + 2(x + 1) = (x + 1)(x − 1)
$5x - 1 = x^2 - 1$
$x^2 - 5x = 0$
x(x − 5) = 0
x = 0 or x = 5
Answer: x = 0 or x = 5

10 Growth and decay

A colony has 3,500 and grows by 15% per day. (Calculator)
Work out the number of bacteria after 2 days.
Give your answer to the nearest whole number.

Multiplier = 1.15
$3{,}500 \times 1.15^2 = 4{,}628.75$
= 4,629 to the nearest whole number
Answer: 4,629