Day 124 **A Tier 10-a-day: Model Solutions**

1 Sharing in a ratio

Ben and Jack share 280 stickers in the ratio 5 : 9.
How many more stickers does Jack get than Ben?

Total number of parts = 5 + 9 = 14
One part = 280 ÷ 14 = 20
Jack gets 9 × 20 = 180 and Ben gets 5 × 20 = 100
Difference = 180 − 100 = 80
Answer: 80

2 Expanding and simplifying

Expand and simplify
$(x + 5)^2 - (x + 5)(x + 5)$

$(x + 5)^2 = x^2 + 10x + 25$
$(x + 5)(x + 5) = x^2 + 10x + 25$
Subtract (take care with the signs): $(x^2 + 10x + 25) - (x^2 + 10x + 25)$
$= 0$
Answer: 0

3 Best buys

A shop sells pasta in 2 different sizes.
Small bag: 250 g for 55p
Large bag: 400 g for 80p
Which bag is the best value for money? You must show your working.

Small bag: 55p ÷ 2.5 = 22p per 100 g
Large bag: 80p ÷ 4 = 20p per 100 g
The large bag has the lowest price per 100 g, so it is the best value
Answer: The large bag

4 Adding algebraic fractions

Write as a single fraction

$$\frac{-1}{(x-3)} + \frac{4}{(x-4)}$$

Common denominator is $(x - 3)(x - 4)$

$$= \frac{-1(x-4) + 4(x-3)}{(x-3)(x-4)}$$

$$= \frac{3x - 8}{(x-3)(x-4)}$$

Answer: $\mathbf{\frac{3x - 8}{(x-3)(x-4)}}$

5 Negative and fractional indices

Work out the value of
(a) 4^{-2}
(b) $9^{\frac{3}{2}}$

(a) $4^{-2} = \frac{1}{4^2} = \frac{1}{16}$

(b) $9^{\frac{3}{2}} = (\sqrt{9})^3 = 3^3 = 27$

Answer: (a) $\mathbf{\frac{1}{16}}$ **(b) 27**

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6 Simplifying algebraic fractions

Simplify fully

$$\frac{x^2 + x - 6}{x^2 + 4x - 12}$$

Factorise the top: $(x - 2)(x + 3)$
Factorise the bottom: $(x - 2)(x + 6)$
Cancel the common factor $(x - 2)$

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

7 Surd fractions

Show that $\frac{\sqrt{75} + \sqrt{48}}{\sqrt{3}}$ is an integer, and find its value.

$\sqrt{75} = 5\sqrt{3}$ and $\sqrt{48} = 4\sqrt{3}$
Numerator $= 5\sqrt{3} + 4\sqrt{3} = 9\sqrt{3}$
$\frac{9\sqrt{3}}{\sqrt{3}} = 9$
Answer: 9

8 Bounds in measurement

The length and width of a rectangular poster are 7.3 cm and 9.3 cm.
Each measurement is correct to 1 decimal place.
Work out the lower bound for the area.

Lower bound of length = 7.2 cm, lower bound of width = 9.2 cm
Lower bound of area $= 7.25 \times 9.25 = 67.0625$
Answer: 67.0625 cm^2

9 Fraction calculations

Work out $(2\frac{5}{6} - 2\frac{1}{2}) \times 1\frac{1}{3}$

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

Brackets first, as improper fractions: $\frac{17}{6} - \frac{5}{2} = \frac{1}{3}$

Then multiply: $\frac{1}{3} \times \frac{4}{3} = \frac{4}{9}$

$= \frac{4}{9}$

Answer: $\mathbf{\frac{4}{9}}$

10 Volume of composite solids

A solid is made from a cylinder and a hemisphere.
The cylinder has radius 3 cm and height 13 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 $= \pi \times 3^2 \times 13 = 117\pi$
Hemisphere $= \frac{2}{3} \times \pi \times 3^3 = 18\pi$
Total $= 117\pi + 18\pi = 135\pi$
Answer: 135π cm^3