Day 1 **A Tier 10-a-day: Model Solutions**

1 Expanding double brackets

Expand and simplify $(2x + 3)(x - 4)$

$2x^2 - 8x + 3x - 12$

$= 2x^2 - 5x - 12$

Answer: $2x^2 - 5x - 12$

2 Fractional and negative indices

Work out

(a) $27^{\frac{2}{3}}$

(b) $16^{\frac{-3}{4}}$

Give each answer as an integer or a fraction.

(a) $27^{\frac{2}{3}} = (\sqrt[3]{27})^2 = 3^2 = 9$

(b) $16^{\frac{-3}{4}} = \frac{1}{16^{\frac{3}{4}}} = \frac{1}{(\sqrt[4]{16})^3} = \frac{1}{2^3} = \frac{1}{8}$

Answer: (a) 9 (b) $\frac{1}{8}$

3 Area of a sector

The diagram shows a sector of a circle of radius 12 cm.
The angle of the sector is 75°.
Work out the area of the sector.
Give your answer in terms of π.

Fraction of the circle = $\frac{75}{360} = \frac{5}{24}$

Area of full circle = $\pi \times 12^2 = 144\pi$

$\frac{5}{24} \times 144\pi = 30\pi$

Answer: 30π cm^2

4 Probability without replacement

A bag contains 5 red counters and 3 blue counters.
Two counters are taken at random, without replacement.
Work out the probability that the two counters are the same colour.

P(red, red) = $\frac{5}{8} \times \frac{4}{7} = \frac{20}{56}$

P(blue, blue) = $\frac{3}{8} \times \frac{2}{7} = \frac{6}{56}$

Add: $\frac{20}{56} + \frac{6}{56} = \frac{26}{56} = \frac{13}{28}$

Answer: $\frac{13}{28}$

5 Solving quadratics

Solve $2x^2 + 5x - 3 = 0$

Factorise: $(2x - 1)(x + 3) = 0$

$2x - 1 = 0$ or $x + 3 = 0$

Answer: $x = \frac{1}{2}$ or $x = -3$

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6 Estimating the mean from grouped data

The table shows the times taken by 30 students to complete a puzzle.
Work out an estimate for the mean time.

Use the midpoints: 5, 15, 25, 35
$5 \times 4 + 15 \times 9 + 25 \times 12 + 35 \times 5 = 20 + 135 + 300 + 175 = 630$
$630 \div 30 = 21$
Answer: 21 minutes

7 Inverse proportion

y is inversely proportional to x^2.
When x = 4, y = 5.
Find the value of y when x = 2.

$y = \frac{k}{x^2}$

$5 = \frac{k}{16}$, so k = 80

When x = 2: $y = \frac{80}{4} = 20$

Answer: y = 20

8 Recurring decimals

Write the recurring decimal 0.272727... as a fraction in its simplest form.

Let n = 0.272727... Then 100n = 27.272727...
Subtract: 99n = 27
$n = \frac{27}{99} = \frac{3}{11}$

Answer: $\frac{3}{11}$

9 Cosine rule

Work out the length BC.
Give your answer as a surd.
The diagram is not drawn accurately.

$x^2 = 7^2 + 9^2 - 2 \times 7 \times 9 \times \cos 60°$

$\cos 60° = \frac{1}{2}$, so $x^2 = 49 + 81 - 63 = 67$

$x = \sqrt{67}$

Answer: BC = $\sqrt{67}$ **cm**

10 Changing the subject

Make x the subject of the formula

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

Multiply by $(x - 2)$: $y(x - 2) = 3x + 1$
Expand: $xy - 2y = 3x + 1$
Collect x terms: $xy - 3x = 2y + 1$
Factorise: $x(y - 3) = 2y + 1$

Answer: $x = \frac{(2y + 1)}{(y - 3)}$