Day 239 **A Tier 10-a-day: Model Solutions**

1 Circle area and circumference

A circular table top has diameter 14 cm.
Work out, in terms of π,
(a) the circumference,
(b) the area.

(a) Circumference = πd = π × 14 = 14π

(b) Area = $\pi r^2 = \pi \times 7^2 = 49\pi$

Answer: (a) 14π cm (b) 49π cm^2

2 Expanding double brackets

Expand and simplify
(3x + 1)(x + 5)

Multiply every term in the first bracket by every term in the second

= $3x^2 + 15x + x + 5$

= $3x^2 + 16x + 5$

Answer: $3x^2 + 16x + 5$

3 Surface area of a cuboid

A closed block is a cuboid measuring 4 cm by 12 cm by 9 cm.
Work out the total surface area.

Faces: 4 × 12, 4 × 9 and 12 × 9 each appear twice

2 × (48 + 36 + 108)

= 2 × 192 = 384

Answer: 384 cm^2

4 Counting

A shop sells 4 different shirts, 4 different pairs of trousers and 4 different hats.
How many different outfits, made of one shirt, one pair of trousers and one hat, are possible?

Multiply the number of choices: 4 × 4 × 4 = 64

Answer: 64

5 Equations with fractions

Solve $\frac{x+3}{3} - \frac{x+1}{6} = 2$

Multiply every term by 6 (the lowest common multiple of 3 and 6)

2(x + 3) − (x + 1) = 6 × 2

x + 5 = 12

x = 7

Answer: x = 7

6 Circle theorems: tangents

PA and PB are tangents to a circle with centre O.
Angle APB = 70°.
Work out the size of angle x (angle AOB).
Give a reason for each step of your working.

A tangent is perpendicular to the radius, so angles OAP and OBP are both 90°

The angles in quadrilateral OAPB add up to 360°

x = 360 − 90 − 90 − 70 = 110

Answer: x = 110°

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7 Rationalising the denominator

Rationalise the denominator of $\frac{9}{\sqrt{5}}$

Give your answer in its simplest form.

Multiply top and bottom by $\sqrt{5}$: $\frac{9}{\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}} = \frac{9\sqrt{5}}{5}$

$= \frac{9\sqrt{5}}{5}$

Answer: $\frac{9\sqrt{5}}{5}$

8 Simple and compound interest

Zac and Noah each invest £2000 for 3 years. (Calculator)
Zac's account pays 2% simple interest per year.
Noah's account pays 2% compound interest per year.
Work out how much more interest Noah earns than Zac.

Simple interest = £2000 × 2% × 3 = £120

Compound: £2000 × 1.02^3 = £2122.416, so interest = £122.416

Difference = 122.416 − 120 = £2.42 (to the nearest penny)

Answer: £2.42

9 Equations with algebraic fractions

Solve $\frac{4}{(x-1)} + \frac{6}{(x-4)} = 1$

Multiply every term by $(x-1)(x-4)$

$4(x-4) + 6(x-1) = (x-1)(x-4)$

$10x - 22 = x^2 - 5x + 4$

$x^2 - 15x + 26 = 0$

$(x-2)(x-13) = 0$

$x = 2$ or $x = 13$

Answer: x = 2 or x = 13

10 Independent events

The probability that Lena scores a goal is 0.8.
The probability that Noah scores a goal is 0.1.
The two events are independent.
Work out the probability that neither Lena nor Noah will score a goal.

P(Lena does not) = 1 − 0.8 = 0.2 and P(Noah does not) = 1 − 0.1 = 0.9

0.2 × 0.9 = 0.18

Answer: 0.18