Day 24 **A Tier 10-a-day: Model Solutions**

1 Calculator and significant figures

Work out $\sqrt{8.3^2 + 5.7^2}$ (Calculator)
Give your answer correct to 3 significant figures.

$8.3^2 + 5.7^2 = 68.89 + 32.49 = 101.38$
$= 10.06876...$
= 10.1 to 3 significant figures
Answer: 10.1

2 Arc length and perimeter of a sector

The diagram shows a sector of a circle of radius 18 cm.
Work out the perimeter of the sector.
Give your answer in terms of π.
The diagram is not drawn accurately.

Arc length = $\frac{80}{360} \times 2 \times \pi \times 18 = 8\pi$
Perimeter = arc + two radii
$= 8\pi + 36$
Answer: $8\pi + 36$ cm

3 Ordering numbers

Write these numbers in order of size, starting with the smallest.

86% $\frac{3}{5}$ 0.32 0.07

Change each to a decimal: 86% = 0.86, $\frac{3}{5}$ = 0.6, 0.32 = 0.32, 0.07 = 0.07
Order the decimals: 0.07 < 0.32 < 0.6 < 0.86
Answer: 0.07, 0.32, $\frac{3}{5}$, 86%

4 Probabilities adding to 1

The table shows the probabilities of the outcomes of a biased spinner.
(a) Work out the value of y.
(b) The spinner is spun 800 times. Estimate the number of times it lands on 2.

(a) Probabilities add to 1: 0.25 + y + y + 0.35 = 1
0.6 + 2y = 1, so 2y = 0.4
y = 0.2
(b) P(2) = 0.2, so expected number = 0.2 × 800 = 160
Answer: (a) y = 0.2 (b) 160

5 Angles in regular polygons around a point

A regular octagon and a regular dodecagon share the side AB and are on opposite sides of it.
The two shapes meet at the point A.
Work out the size of the angle at A that is not inside either shape.

Interior angle of the regular octagon = 180 − 360 ÷ 8 = 135°
Interior angle of the regular dodecagon = 180 − 360 ÷ 12 = 150°
Angles round a point add up to 360°
360 − 135 − 150 = 75
Answer: 75°

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6 Functions

f(x) = 3x − 4

g(x) = x^2 + 4

(a) Find f(3)

(b) Find fg(x). Give your answer in its simplest form.

(a) f(3) = 3 × 3 − 4 = 5

(b) fg(x) means f(g(x)), so replace x in f with x^2 + 4

fg(x) = 3(x^2 + 4) − 4

= 3x^2 + 8

Answer: (a) 5 (b) 3x^2 + 8

7 Simple and compound interest

Dev and Ravi each invest £2500 for 2 years. (Calculator)

Dev's account pays 5% simple interest per year.

Ravi's account pays 5% compound interest per year.

Work out how much more interest Ravi earns than Dev.

Simple interest = £2500 × 5% × 2 = £250

Compound: £2500 × 1.05^2 = £2756.25, so interest = £256.25

Difference = 256.25 − 250 = £6.25 (to the nearest penny)

Answer: £6.25

8 Adding algebraic fractions

Write as a single fraction

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

Common denominator is (x − 3)(x + 1)

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

$$= \frac{7x-5}{(x-3)(x+1)}$$

Answer: $\mathbf{\frac{7x-5}{(x-3)(x+1)}}$

9 Direct proportion formulae

y is directly proportional to the square root of x.

When x = 64, y = 64.

(a) Find a formula for y in terms of x.

(b) Work out the positive value of x when y = 80.

(a) $y = k\sqrt{x}$. Substitute: 64 = k × 8, so k = 8

$y = 8\sqrt{x}$

(b) $80 = 8\sqrt{x}$, so $\sqrt{x} = 80 \div 8 = 10$, so $x = 10^2 = 100$

Answer: (a) $y = 8\sqrt{x}$ (b) x = 100

10 Trigonometry in context

A kite is on the end of a straight string of length 30 m. (Calculator)

The string makes an angle of 51° with the horizontal ground.

Work out the height of the kite above the ground. Give your answer to 3 significant figures.

$$\sin 51° = \frac{\text{height}}{30}$$

height = 30 × sin 51°

= 23.3

Answer: 23.3 m