Day 100 **A Tier 10-a-day: Model Solutions**

1 Sectors: finding an angle or radius

A pizza slice is a sector of a circle has radius 18 cm and an arc length of 8π cm.
Work out the angle at the centre of the sector.

Arc length = $\frac{\theta}{360} \times 2 \times \pi \times 18$

$8\pi = \frac{\theta}{360} \times 36\pi$

$\theta = 8 \times 360 \div 36$

$\theta = 80$

Answer: 80°

2 Reverse fractions

Aisha reads $\frac{5}{8}$ of a book and has now read 70 pages.

How many pages does the whole book have?

$\frac{5}{8}$ of the total = 70

$\frac{1}{8}$ of the total = $70 \div 5 = 14$

Whole = $14 \times 8 = 112$

Answer: 112

3 Independent events

The probability that Isla scores a goal is 0.7.
The probability that Cara scores a goal is 0.3.
The two events are independent.
Work out the probability that at least one of them will score a goal.

P(neither) = $0.3 \times 0.7 = 0.21$
P(at least one) = $1 - 0.21 = 0.79$

Answer: 0.79

4 Profit and loss

Dev buys a watch for £270 and sells it making a profit of 30%.
Work out the selling price.

Selling price = 130% of the cost price
£270 × 1.3 = £351

Answer: £351

5 Difference of two squares

(a) Factorise $x^2 - 9$

(b) Use the same idea to work out $149^2 - 51^2$ without a calculator.

(a) Difference of two squares: $x^2 - 9 = x^2 - 3^2$
$(x - 3)(x + 3)$

(b) $a^2 - b^2 = (a + b)(a - b)$, so $149^2 - 51^2 = (149 + 51)(149 - 51)$
$= 200 \times 98 = 19600$

Answer: (a) $(x - 3)(x + 3)$ (b) 19600

6 Simple and compound interest

Ella and Omar each invest £2500 for 2 years. (Calculator)
Ella's account pays 6% simple interest per year.
Omar's account pays 6% compound interest per year.
Work out how much more interest Omar earns than Ella.

Simple interest = £2500 × 6% × 2 = £300

Compound: £2500 × 1.06^2 = £2809.00, so interest = £309.00
Difference = 309.00 − 300 = £9.00 (to the nearest penny)

Answer: £9.00

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7 Terminating and recurring decimals

Here are four fractions: $\frac{5}{6}$ $\frac{9}{24}$ $\frac{1}{2}$ $\frac{14}{40}$

Which one of these fractions is equal to a recurring decimal?

Simplify each fraction: $\frac{5}{6}$, $\frac{9}{24} = \frac{3}{8}$, $\frac{1}{2}$, $\frac{14}{40} = \frac{7}{20}$

A fraction in simplest form is a terminating decimal only if its denominator has no prime factors other than 2 and 5.

$\frac{5}{6}$ has denominator $6 = 2 \times 3$, which includes a factor other than 2 and 5.

Answer: $\frac{5}{6}$

8 Bounds in measurement

The length and width of a rectangular garden are 9.3 m and 6.4 m.
Each measurement is correct to 1 decimal place.
Work out the lower bound for the perimeter.

Lower bounds: length = 9.2 m and width = 6.3 m
Lower bound of perimeter = 2 × (9.25 + 6.35) = 31.2
Answer: 31.2 m

9 Circle theorems: angles in the same segment

A, B, C and D are points on a circle. AC and BD meet at E.
Angle BAC = 47° and angle ACD = 54°.
Work out the size of angle x (angle AEB).
Give reasons for your working.

Angles in the same segment are equal, so angle ABD = angle ACD = 54°
In triangle ABE: angle BAE = 47° and angle ABE = 54°
$x = 180 - 47 - 54 = 79$
Answer: x = 79°

10 Simultaneous equations (one quadratic)

Solve the simultaneous equations
$y = x^2 + 3x - 12$
$y = x + 3$

Set the y values equal: $x^2 + 3x - 12 = x + 3$
$x^2 + 2x - 15 = 0$
$(x + 5)(x - 3) = 0$
$x = -5$ or $x = 3$
Substitute into $y = x + 3$: $y = -2$ and $y = 6$
Answer: x = −5, y = −2 and x = 3, y = 6