Day 25 **A Tier 10-a-day: Model Solutions**

1 Circle area and circumference

The area of a circle is 49π cm^2.
(a) Work out the radius of the circle.
(b) Work out the circumference. Give your answer in terms of π.

(a) $\pi r^2 = 49\pi$, so $r^2 = 49$
$r = 7$
(b) Circumference $= 2\pi r = 2 \times \pi \times 7 = 14\pi$
Answer: (a) 7 cm (b) 14π cm

2 Reverse percentages

Jack's salary increases by 40%. (Calculator)
Her new salary is £49.
Work out her salary before the increase.

The new salary is 140% of the old salary.
140% = £49, so 1% = £49 ÷ 140 = £0.35
100% = £0.35 × 100 = £35
Answer: £35

3 Ratio and a difference

The ratio of boys to girls in a youth club is 1 : 3.
There are 28 more girls than boys.
Work out the total number of boys and girls.

Difference in parts = 3 − 1 = 2
2 parts = 28, so 1 part = 28 ÷ 2 = 14
Total parts = 1 + 3 = 4, so total = 4 × 14 = 56
Answer: 56

4 Sequences

Here are the first four terms of a geometric sequence.
32, 16, 8, 4
(a) Write down the next two terms.
(b) Work out the 8th term.

Divide each term by the one before: $16 \div 32 = \frac{1}{2}$, so each term is multiplied by $\frac{1}{2}$

(a) $4 \times \frac{1}{2} = 2$ and $2 \times \frac{1}{2} = 1$

(b) Keep multiplying: 8th term $= 32 \times \left(\frac{1}{2}\right)^7 = \frac{1}{4}$

Answer: (a) 2, 1 (b) $\frac{1}{4}$

5 Converting area and volume units

Change 350000 cm^2 to m^2.

1 m^2 = 10 000 cm^2
350000 ÷ 10 000 = 35
Answer: 35 m^2

6 Circle theorems: angle at the centre

X, Y and Z are points on a circle with centre O.
Angle XZY = 77°.
Work out the size of angle x.
Give a reason for your answer.

The angle at the centre is twice the angle at the circumference
$x = 2 \times 77 = 154$
Answer: x = 154°

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7 Iteration

$x_{n+1} = \sqrt{2x_n + 3}$

$x_0 = 4$

Work out the values of x_1, x_2 and x_3.

Give your answers correct to 3 decimal places. (Calculator)

Substitute $x_0 = 4$ into the formula, then use each answer in the next step (keep the full calculator display)

$x_1 = 3.31662$

$x_2 = 3.10375$

$x_3 = 3.03439$

Answer: $x_1 = 3.317$, $x_2 = 3.104$, $x_3 = 3.034$

8 Index equations

Solve $2^x = \frac{1}{2}$

Write the right-hand side as a power of 2: $\frac{1}{2} = 2^{-1}$

So $x = -1$

Answer: $x = -1$

9 Reverse compound change

The value of a car falls by 20% each year. (Calculator)

After 3 years it is worth £1,792.

Work out its value at the start.

Yearly multiplier = 0.8

Overall multiplier = $0.8^3 = 0.512$

Original value = £1,792 ÷ 0.512 = £3,500

Answer: £3,500

10 Probability with three selections

A bag contains 4 black pens and 3 blue pens.

Three pens are taken at random without replacement.

Work out the probability that all three pens are black.

P(all black) = $\frac{4}{7} \times \frac{3}{6} \times \frac{2}{5}$

$= \frac{24}{210} = \frac{4}{35}$

Answer: $\frac{4}{35}$