Day 68 **B Tier 10-a-day: Model Solutions**

1 Angles in quadrilaterals

ABCD is a parallelogram.
Angle DAB = 44°.
(a) Write down the size of angle BCD.
(b) Work out the size of angle ABC.

(a) Opposite angles are equal, so angle BCD = 44°
(b) Angles next to each other add up to 180°
180 − 44 = 136
Answer: (a) 44° (b) 136°

2 Expected outcomes

The probability that a biased coin lands on heads is 20%.
Work out how many times you would expect this to happen in 240 throws of the coin.

Expected number = probability × number of trials
20% of 240 = 48
Answer: 48

3 Simplifying expressions

Simplify fully
(a) $10x^2 \div 5x$
(b) $16cd \div 4c$

(a) $10 \div 5 = 2$ and $x^2 \div x = x$
(b) Divide the numbers: $16 \div 4 = 4$. The c cancels, leaving 4d
Answer: (a) 2x (b) 4d

4 Percentage increase and decrease

A train ticket costs £400. The price goes up by 30%.
(a) Work out the new price.
(b) A car is worth £1200. Its value goes down by 30% in a year. Work out its new value.

(a) The multiplier is 1.3, so new price = £400 × 1.3 = £520
(b) The multiplier is 0.7, so new value = £1200 × 0.7 = £840
Answer: (a) £520 (b) £840

5 Volume of a cylinder

A tin of beans has radius 3 m and height 11 m. (Calculator)
Work out its volume.
Give your answer correct to 1 decimal place.

Volume = $\pi \times \text{radius}^2 \times \text{height}$
$\pi \times 3^2 \times 11 = 311.018...$
$= 311.0\ m^3$ (1 d.p.)
Answer: 311.0 m^3

6 Direct proportion

P is directly proportional to n.
When n = 2, P = 1.
Find a formula for P in terms of n.

P = kn
1 = k × 2, so k = 1 ÷ 2 = 0.5
Answer: P = 0.5n

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7 Reverse percentages

Priya's rent goes up by 25%. (Calculator)
The new rent is £375 a month.
Work out the rent before the increase.

The new rent is 100% + 25% = 125% of the old rent.
125% = £375, so 1% = £375 ÷ 125 = £3
100% = £3 × 100 = £300
Answer: £300

8 Trigonometry in context

Sam stands 50 m from the base of a lighthouse on level ground. (Calculator)
The angle of elevation of the top of the lighthouse is 48°.
Work out the height of the lighthouse.
Give your answer correct to 1 decimal place.

The distance is the adjacent side and the height is the opposite side

$\tan 48° = \frac{h}{50}$

h = 50 × tan 48° = 55.531...
h = 55.5 m (1 d.p.)
Answer: 55.5 m

9 Simultaneous equations problem

A cafe sells cakes and drinks. All cakes cost the same and all drinks cost the same.
1 cake and 3 drinks cost £6.
4 cakes and 3 drinks cost £15.
Work out the cost of one cake and the cost of one drink.

Let a = cost of one cake and b = cost of one drink
1a + 3b = 6 and 4a + 3b = 15
Subtract: 3a = 15 − 6 = 9, so a = 3
Substitute: 1 × 3 + 3b = 6, so 3b = 3 and b = 1
Answer: One cake costs £3 and one drink costs £1

10 Quadratic equation problem

A rectangle has length (x + 4) cm and width (x − 2) cm.
The area of the rectangle is 40 cm^2.
(a) Show that $x^2 + 2x - 48 = 0$
(b) Hence work out the length of the rectangle.

(a) Area = length × width: (x + 4)(x − 2) = 40
Expand: $x^2 + 2x - 8 = 40$
Subtract 40 from both sides: $x^2 + 2x - 48 = 0$
(b) Factorise: (x − 6)(x + 8) = 0, so x = 6 or x = −8
A length cannot be negative, so x = 6. Length = 6 + 4 = 10
Answer: (b) 10 cm