Day 206 **A Tier 10-a-day: Model Solutions**

1 Roots and powers

(a) Work out $\sqrt{10000}$

(b) Work out $\sqrt[3]{125000}$

(a) $\sqrt{10000} = \sqrt{100 \times 100} = 10 \times 10 = 100$

(b) $\sqrt[3]{125000} = 5 \times 10 = 50$

Answer: (a) 100 (b) 50

2 Converting speeds

A car travels at 54 km/h.

Work out this speed in metres per second.

1 km = 1000 m and 1 hour = 3600 seconds

54 km/h = 54 × 1000 ÷ 3600 m/s

= 54 ÷ 3.6 = 15

Answer: 15 m/s

3 Straight line graphs

A straight line has equation $-4x + 2y = 20$

(a) Find the gradient of the line.

(b) Find the coordinates of the point where the line crosses the x-axis.

(a) Rearrange into y = mx + c: $2y = 4x + 20$

$y = 2x + 10$

The gradient is 2

(b) On the x-axis, y = 0: $-4x = 20$, so $x = -5$

Answer: (a) 2 (b) (−5, 0)

4 LCM in context

Bus A leaves a bus station every 12 minutes.

Bus B leaves the same station every 16 minutes.

Both buses leave together at 10:10 am.

At what time will they next leave together?

We need the LCM of 12 and 16.

Multiples of 12: 12, 24, 36, 48

Multiples of 16: 16, 32, 48

LCM = 48, so they leave together again 48 minutes later, at 10:58 am

Answer: 10:58 am

5 Congruent triangles

Triangle UVW: angle V = 90°, UW = 17 cm, UV = 15 cm.

Triangle JKL: angle L = 90°, JK = 17 cm, JL = 15 cm.

Are the two triangles congruent?

Give a reason for your answer.

Both triangles have a right angle

UW and JK are the hypotenuses: both 17 cm

UV = JL = 15 cm

Right angle, hypotenuse and one other side are equal, so the triangles are congruent (RHS)

Answer: Yes, congruent (RHS)

6 Compound interest

Femi invests £7,500 in an investment bond. (Calculator)

The account pays compound interest at 3% per year.

Work out the value of the investment after 4 years.

Multiplier = 1 + 3 ÷ 100 = 1.03

£7,500 × 1.03^4 = £8,441.32

Answer: £8,441.32

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7 Finding a missing value from an average

The mean of the five numbers 22, 23, 23, 22, x is 19.
Work out the value of x.

Total = 5 × 19 = 95
Known numbers add to 90
x = 95 − 90 = 5
Answer: x = 5

8 Simplifying algebraic fractions

Simplify fully

$$\frac{x^2 - 64}{x^2 - 8x}$$

Top: $x^2 - 64 = (x - 8)(x + 8)$
Bottom: $x^2 - 8x = x(x - 8)$
Cancel $(x - 8)$
Answer: $\frac{x + 8}{x}$

9 Mixing in a ratio

Jug A contains 7 litres of a mixture of orange juice and lemonade in the ratio 3 : 4.
Jug B contains 6 litres of a mixture of orange juice and lemonade in the ratio 1 : 5.
The contents of both jugs are mixed together.
Work out the ratio of orange juice to lemonade in the mixture. Give your answer in its simplest form.

Jug A: orange juice = 3 × 7 ÷ 7 = 3 litres, lemonade = 4 litres
Jug B: orange juice = 1 litres, lemonade = 5 litres
Total: orange juice = 4 litres, lemonade = 9 litres
Ratio = 4 : 9 = 4 : 9
Answer: 4 : 9

10 Bearings with the cosine rule

Ship A sails 8 km from a port on a bearing of 090°.
Ship B sails 19 km from the same port on a bearing of 345°. (Calculator)
Work out the distance between the two ships.
Give your answer to 3 significant figures.

The angle between the two paths = 360° − |90° − 345°| = 105°
$d^2 = 8^2 + 19^2 - 2 \times 8 \times 19 \times \cos 105°$
$d^2 = 503.68$
d = 22.4
Answer: 22.4 km