Day 300 **B Tier 10-a-day: Model Solutions**

1 Laws of indices

Write each answer as a single power of 7.

(a) $(7^5)^2$

(b) $7^9 \times 7^2 \div 7^3$

(a) Multiply the powers: $5 \times 2 = 10$

(b) Add then subtract: $9 + 2 - 3 = 8$

Answer: (a) 7^{10} (b) 7^8

2 Metric conversions

(a) Convert 3.5 km to m.

(b) Convert 3 000 000 cm^3 to m^3.

(a) km → m: multiply by 1000: $3.5 \times 1000 = 3500$

(b) 1 m = 100 cm, so 1 m^3 = $100 \times 100 \times 100 = 1\,000\,000$ cm^3. $3\,000\,000 \div 1\,000\,000 = 3$

Answer: (a) 3500 m (b) 3 m^3

3 Decimal calculations

Work out

(a) 4.4×0.3

(b) 0.21×3

(a) $44 \times 3 = 132$

There are 2 decimal places in total, so the answer is 1.32

(b) $21 \times 3 = 63$, then divide by 100: 0.63

Answer: (a) 1.32 (b) 0.63

4 Enlargement

A rectangle is 12 m long and 8 m wide.

It is enlarged by scale factor 1.5.

(a) Write down the length and width of the enlarged rectangle.

(b) Work out the perimeter of the enlarged rectangle.

(a) $12 \times 1.5 = 18$ and $8 \times 1.5 = 12$

(b) Perimeter = $2 \times (18 + 12) = 60$

Answer: (a) 18 m by 12 m (b) 60 m

5 Function notation

$f(x) = 7x + 6$

(a) Work out f(6)

(b) Solve $f(x) = 62$

(a) $f(6) = 7 \times 6 + 6 = 48$

(b) $7x + 6 = 62$

Subtract 6 from both sides: $7x = 56$

Divide both sides by 7

Answer: (a) 48 (b) $x = 8$

6 Combined mean

In a test, the mean mark of 20 boys is 60.

The mean mark of 5 girls is 50.

Work out the mean mark of all 25 students.

Total for boys = $20 \times 60 = 1200$

Total for girls = $5 \times 50 = 250$

Overall mean = $(1200 + 250) \div 25 = 1450 \div 25 = 58$

Answer: 58

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7 Equations with fractions

Solve $\frac{4x}{5} + 4 = 36$

Subtract 4 from both sides: $\frac{4x}{5} = 32$

Multiply both sides by 5: $4x = 160$

Divide both sides by 4

Answer: x = 40

8 Midpoint and length of a line

A is the point (−3, 1) and B is the point (13, 13).

(a) Work out the coordinates of the midpoint of AB.

(b) Work out the length of AB.

(a) Midpoint = (10 ÷ 2, 14 ÷ 2) = (5, 7)

(b) Horizontal distance = 16, vertical distance = 12

$AB^2 = 16^2 + 12^2 = 256 + 144 = 400$

$AB = \sqrt{400} = 20$

Answer: (a) (5, 7) (b) 20

9 Combining ratios

In a bag of counters, the ratio of black to blue is 3 : 4.

The ratio of blue to red is 1 : 4.

Write down the ratio black : blue : red.

Make the blue part the same in both ratios: lowest common multiple of 4 and 1 is 4

black : blue = 3 : 4

blue : red = 4 : 16

black : blue : red = 3 : 4 : 16

Answer: 3 : 4 : 16

10 Simultaneous equations

Solve the simultaneous equations

$x - 2y = -17$

$4x + y = -5$

Multiply the second equation by 2: $8x + 2y = -10$

The y terms have opposite signs, so add the equations: $9x = -27$

$x = -3$

Substitute $x = -3$ into the first equation: $-2y = -17 - (-3) = -14$

$y = 7$

Answer: x = −3, y = 7