Day 58 **A Tier 10-a-day: Model Solutions**

1 Volume of a prism

The diagram shows a prism with a rectangle as its cross-section.
The volume of the prism is 378 cm^3.
Work out the value of x.
The diagram is not drawn accurately.

Area of cross-section = 9 × 7 = 63
Volume = area × length
378 = 63 × length
length = 378 ÷ 63 = 6
Answer: x = 6

2 Mixed number addition and subtraction

Work out $4\frac{1}{3} + 4\frac{1}{2}$
Give your answer as a mixed number in its simplest form.

Write as improper fractions: $4\frac{1}{3} = \frac{13}{3}$ and $4\frac{1}{2} = \frac{9}{2}$

Common denominator 6: $\frac{26}{6} + \frac{27}{6}$

$= \frac{53}{6}$

$= 8\frac{5}{6}$

Answer: $8\frac{5}{6}$

3 Growth and decay

A house is worth £400000. (Calculator)
Its value increases by 20% each year.
Work out its value after 2 years., to the nearest pound.

Multiplier = 100% + 20% = 1.2
$400000 \times 1.2^2 = 576000.00$
= £576000 to the nearest whole number
Answer: £576000

4 Simplifying surds

(a) Simplify $\sqrt{175}$
(b) Simplify $\sqrt{6} \times \sqrt{24}$

(a) $\sqrt{175} = \sqrt{25} \times \sqrt{7} = 5\sqrt{7}$
(b) $\sqrt{6} \times \sqrt{24} = \sqrt{144} = 12$
Answer: (a) $5\sqrt{7}$ (b) 12

5 Midpoints and length of a line segment

C is the point (−4, −4) and D is the point (−1, −8).
(a) Find the midpoint of CD.
(b) Work out the length of CD. Give your answer as a whole number.

(a) Midpoint = $(\frac{-4 + (-1)}{2}, \frac{-4 + (-8)}{2}) = (-2.5, -6)$

(b) Length = $\sqrt{(3)^2 + (-4)^2}$

$= \sqrt{25} = 5$

Answer: (a) (−2.5, −6) (b) 5

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6 Algebraic proof

Prove that the sum of two consecutive multiples of 9 is always an odd multiple of 9.

Let the multiples be 9n and 9(n + 1)
Sum = 9n + 9n + 9 = 18n + 9
= 9(2n + 1)
2n + 1 is odd, so the sum is an odd multiple of 9
Answer: Proved

7 Combined means

The mean age of 9 students is 59 years.
One of them, aged 63, leaves.
Work out the mean age of the remaining students.

Total age = 9 × 59 = 531
Total after one leaves = 531 − 63 = 468
Mean = 468 ÷ 8 = 58.5
Answer: 58.5 years

8 Similar shapes: area and volume

Two similar statues have heights 8 cm and 12 cm.
The surface area of the smaller one is 32 cm^2.
Work out the surface area of the larger one.

Length scale factor = 12 ÷ 8 = $\frac{3}{2}$

Area scale factor = $(\frac{3}{2})^2 = \frac{9}{4}$

Area = 32 × $\frac{9}{4}$ = 72

Answer: 72 cm^2

9 Substitution

Work out the value of $3x^2 - 7x + 1$ when $x = -2$

Substitute $x = -2$: $3 \times (-2)^2 - 7 \times (-2) + 1$
= 12 + 14 + 1
= 27
Answer: 27

10 Finding a rate of compound change

Tom invests £1,000 in a savings account. (Calculator)
Compound interest is paid at a fixed rate each year.
After 2 years the investment is worth £1,081.60.
Work out the annual rate of interest.

Overall multiplier = £1,081.60 ÷ £1,000 = 1.0816
Take the square root: $\sqrt{1.0816}$ = 1.04
Rate = (1.04 − 1) × 100 = 4%
Answer: 4%