Day 217 **B Tier 10-a-day: Model Solutions**

1 Perimeter and area of compound shapes

The diagram shows the shape of a field.
All the corners are right angles. All lengths are in m.
(a) Find the perimeter.
(b) Find the area.

(a) Missing lengths: $11 - 6 = 5$ and $14 - 10 = 4$
Perimeter = $11 + 10 + 5 + 4 + 6 + 14 = 50$
(b) Split into two rectangles: $11 \times 10 = 110$ and $6 \times 4 = 24$
$110 + 24 = 134$
Answer: (a) 50 m (b) 134 m^2

2 Powers and roots

Work out
(a) $9^2 + 5^3$
(b) $\sqrt{100} - 2^2$

(a) $9^2 = 81$ and $5^3 = 125$, so $81 + 125 = 206$
(b) $\sqrt{100} = 10$ and $2^2 = 4$, so $10 - 4 = 6$
Answer: (a) 206 (b) 6

3 Tables of values

Complete the table of values for $y = -4x - 1$

$x = -2$: $y = -4 \times (-2) - 1 = 7$
$x = -1$: $y = -4 \times (-1) - 1 = 3$
$x = 2$: $y = -4 \times 2 - 1 = -9$
Answer: $x = -2$: 7, $x = -1$: 3, $x = 2$: -9

4 Pythagoras in context

A ladder 25 m long leans against a vertical wall.
The foot of the ladder is 7 m from the wall.
Work out how high up the wall the ladder reaches.

Draw a right-angled triangle. The ladder is the hypotenuse
$25^2 = 7^2 + h^2$
$h^2 = 625 - 49 = 576$
$h = \sqrt{576} = 24$
Answer: 24 m

5 Combined mean

In a test, the mean mark of 6 Year 10 is 42.
The mean mark of 4 Year 11 is 62.
Work out the mean mark of all 10 students.

Total for Year 10 = $6 \times 42 = 252$
Total for Year 11 = $4 \times 62 = 248$
Overall mean = $(252 + 248) \div 10 = 500 \div 10 = 50$
Answer: 50

Day 217 **B Tier 10-a-day: Model Solutions**

6 Fractions of amounts

Ella has £180.

They spends $\frac{2}{3}$ of the money on a book.

They then spends $\frac{1}{3}$ of the money left on a drink.

How much money is left?

Book: £180 ÷ 3 × 2 = £120
Left: £180 − £120 = £60
Drink: £60 ÷ 3 × 1 = £20
Money left: £60 − £20 = £40
Answer: £40

7 Midpoint and length of a line

A is the point (−3, −2) and B is the point (−11, 4).
(a) Work out the coordinates of the midpoint of AB.
(b) Work out the length of AB.

(a) Midpoint = (−14 ÷ 2, 2 ÷ 2) = (−7, 1)
(b) Horizontal distance = 8, vertical distance = 6
$AB^2 = 8^2 + 6^2 = 64 + 36 = 100$
$AB = \sqrt{100} = 10$
Answer: (a) (−7, 1) (b) 10

8 Grouped frequency tables

The table shows the times taken by some students to complete a task.
(a) Write down the modal class.
(b) Work out an estimate for the mean.

(a) The highest frequency is 8
(b) Use the midpoint of each class: 5, 15, 25, 35, 45
Sum of midpoint × frequency = 5 × 2 + 15 × 5 + 25 × 3 + 35 × 7 + 45 × 8 = 765
Total frequency = 25
Estimate = 765 ÷ 25 = 30.6
Answer: (a) $40 < t \leq 50$ (b) 30.6

9 Laws of indices

Simplify fully
(a) $4a^2 \times 6a^6$
(b) $(a^4)^3$

(a) Multiply the numbers: 4 × 6 = 24. Add the powers: 2 + 6 = 8
(b) Multiply the powers: 4 × 3 = 12
Answer: (a) $24a^8$ (b) a^{12}

10 Quadratic equation problem

A rectangle has length (x + 2) cm and width (x − 2) cm.
The area of the rectangle is 32 cm^2.
(a) Show that $x^2 - 36 = 0$
(b) Hence work out the length of the rectangle.

(a) Area = length × width: (x + 2)(x − 2) = 32
Expand: $x^2 - 4 = 32$
Subtract 32 from both sides: $x^2 - 36 = 0$
(b) Factorise: (x − 6)(x + 6) = 0, so x = 6 or x = −6
A length cannot be negative, so x = 6. Length = 6 + 2 = 8
Answer: (b) 8 cm