Day 183 **A Tier 10-a-day: Model Solutions**

1 Isosceles triangles and exterior angles

PQR is an isosceles triangle with PQ = PR.
QRS is a straight line.
Angle QPR = 72°.
Work out the size of angle x.
The diagram is not drawn accurately.

Base angles of an isosceles triangle are equal
Angle PQR = (180 − 72) ÷ 2 = 54°
Exterior angle of a triangle = sum of the two opposite interior angles
x = 72 + 54 = 126
Answer: x = 126°

2 Distance-time graphs

The graph shows the distance travelled by a runner.
(a) For how many minutes did the runner stop?
(b) Work out the speed during the final part of the journey. Give your answer in km/h.

(a) The graph is horizontal from 30 to 45 minutes, so the stop is 45 − 30 = 15 minutes
(b) Final part: distance 4 km in 16 minutes

Speed = distance ÷ time = $4 \div \frac{16}{60}$ = 15 km/h

Answer: (a) 15 minutes (b) 15 km/h

3 Finding a percentage change

The population of a village was 140 and is now 119.
Work out the percentage decrease.

Change = 140 − 119 = 21

Percentage decrease = $\frac{21}{140} \times 100 = 15\%$

Answer: 15% decrease

4 Double inequalities

(a) Solve $-7 \leq 5x - 7 < 18$
(b) Write down all the integer values of x that satisfy this inequality.

(a) Add 7 to every part: $0 \leq 5x < 25$
Divide every part by 5: $0 \leq x < 5$
(b) The integers are 0, 1, 2, 3, 4
Answer: (a) $0 \leq x < 5$ (b) 0, 1, 2, 3, 4

5 Interior angles of polygons

The size of each angle of a quadrilateral is shown as an expression:
(2x − 25)°, (3x + 20)°, (x + 5)°, (3x)°
Work out the value of x.

Sum of angles = (4 − 2) × 180 = 360°
2x − 25 + 3x + 20 + x + 5 + 3x = 360
9x = 360
9x = 360
x = 40
Answer: x = 40

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6 Expanding and simplifying

Expand and simplify

$4(x - 4)(x + 6) - (x + 6)(x - 6)$

$4(x - 4)(x + 6) = 4(x^2 + 2x - 24) = 4x^2 + 8x - 96$

$(x + 6)(x - 6) = x^2 - 36$

Subtract: $3x^2 + 8x - 60$

Answer: $3x^2 + 8x - 60$

7 Fraction calculations

Work out $(1\frac{3}{4} - 1\frac{1}{2}) \times 3\frac{1}{3}$

Give your answer as a mixed number in its simplest form.

Brackets first, as improper fractions: $\frac{7}{4} - \frac{3}{2} = \frac{1}{4}$

Then multiply: $\frac{1}{4} \times \frac{10}{3} = \frac{5}{6}$

$= \frac{5}{6}$

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

8 Frequency density

The table gives information about 163 measurements.
A histogram is drawn using this information.
(a) Work out the missing frequency.
(b) Work out the height of the bar for the class $40 < t \leq 45$.

(a) Missing frequency = $163 - (84 + 15 + 32) = 32$

(b) Class width = $45 - 40 = 5$

Frequency density = $15 \div 5 = 3$

Answer: (a) 32 (b) 3

9 Growth and decay

A new car is worth £25000. (Calculator)
Its value falls by 5% each year.
Work out its value after 4 years.

Multiplier = $100\% - 5\% = 0.95$

$25000 \times 0.95^4 = 20362.66$

= £20363 to the nearest whole number

Answer: £20363

10 Simultaneous equations (one quadratic)

Solve the simultaneous equations

$x^2 + y^2 = 25$

$y = 2x + 5$

Substitute $y = 2x + 5$ into $x^2 + y^2 = 25$

$x^2 + (2x + 5)^2 = 25$

$5x^2 + 20x = 0$

Divide by 5: $x^2 + 4x = 0$

$(x + 4)(x + 0) = 0$

$x = -4$ or $x = 0$

Use $y = 2x + 5$ to find y: when $x = -4$, $y = -3$; when $x = 0$, $y = 5$

Answer: $x = -4$, $y = -3$ and $x = 0$, $y = 5$