Day 320 **A Tier 10-a-day: Model Solutions**

1 Isosceles triangles and exterior angles

ABC is an isosceles triangle with AB = AC.
BCD is a straight line.
Angle ACD = 122°.
Work out the size of angle x.
The diagram is not drawn accurately.

Angles on a straight line add up to 180°
Angle ACB = 180 − 122 = 58°
Base angles are equal, so angle ABC = 58°
x = 180 − 58 − 58 = 64
Answer: x = 64°

2 Standard form in context

The population of City A is 8×10^5.
The population of City B is 1.6×10^5.
How many times bigger is the population of City A than the population of City B?

Divide: $(8 \times 10^5) \div (1.6 \times 10^5)$
$= 8 \div 1.6 \times 10^0 = 5$
Answer: 5 times

3 Pie charts

The pie chart shows how some students travel to school.
19 students chose walk.
(a) Work out the angle for cycle.
(b) How many students chose cycle?

(a) 360 − 114 − 24 − 90 = 132°
(b) 19 students is 114°, so 1 student is 114 ÷ 19 = 6°
Cycle: 132 ÷ 6 = 22
Answer: (a) 132° (b) 22

4 Adding and subtracting in standard form

Work out $(5.6 \times 10^{-2}) + (8.5 \times 10^{-3})$
Give your answer in standard form.

Write both numbers using 10^{-3}: $5.6 \times 10^{-2} = 56 \times 10^{-3}$
$(56 + 8.5) \times 10^{-3} = 64.5 \times 10^{-3}$
In standard form: 6.45×10^{-2}
Answer: 6.45×10^{-2}

5 Interior angles of polygons

The size of each angle of a quadrilateral is shown as an expression:
(2x + 10)°, (2x − 15)°, (3x + 40)°, (2x − 35)°
Work out the value of x.

Sum of angles = (4 − 2) × 180 = 360°
2x + 10 + 2x − 15 + 3x + 40 + 2x − 35 = 360
9x = 360
9x = 360
x = 40
Answer: x = 40

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6 Quadratic sequences

Here are the first five terms of a quadratic sequence.
6, 20, 40, 66, 98
(a) Find an expression for the nth term.
(b) Work out the 15th term.

First differences: 14, 20, 26
Second differences: 6, 6, so a = 6 ÷ 2 = 3
Subtract $3n^2$ from each term (3, 12, 27, 48): 3, 8, 13, 18
This is linear: 5n − 2
nth term = $3n^2 + 5n - 2$
(b) Substitute n = 15: $3 \times 15^2 + 5 \times 15 - 2 = 748$
Answer: (a) $3n^2 + 5n - 2$ (b) 748

7 Area of a triangle using sine

The area of triangle ABC is 155 m^2. (Calculator)
Angle x is acute.
Work out the size of angle x. Give your answer to 1 decimal place.
The diagram is not drawn accurately.

$\frac{1}{2} \times 19 \times 18 \times \sin x = 155$
171 sin x = 155
sin x = 0.9064
x = 65.0°
Answer: x = 65.0°

8 Inverse proportion formulae

y is inversely proportional to x.
When x = 25, y = 12.
(a) Find a formula for y in terms of x.
(b) Work out the value of y when x = 2.

(a) $y = \frac{k}{x}$. Substitute: $12 = \frac{k}{25}$, so k = 12 × 25 = 300
$y = \frac{300}{x}$
(b) $y = \frac{300}{2} = 150$
Answer: (a) $y = \frac{300}{x}$ (b) 150

9 Frequency density

The table gives information about 54 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 $30 < h \leq 45$.

(a) Missing frequency = 54 − (7 + 9 + 30) = 8
(b) Class width = 45 − 30 = 15
Frequency density = 30 ÷ 15 = 2
Answer: (a) 8 (b) 2

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10 Rearranging formulae (subject twice)

Make x the subject of $y = \frac{5x - 3}{-x - 3}$

Multiply both sides by $(-x - 3)$: $y(-x - 3) = 5x - 3$
Expand the bracket: $-xy - 3y = 5x - 3$
Collect the x terms on one side: $-xy - 5x = 3y - 3$
Factorise: $x(-y - 5) = 3y - 3$
Divide by $(-y - 5)$: $x = \frac{3y - 3}{-y - 5}$
Multiply the top and bottom by -1: $x = \frac{-3y + 3}{y + 5}$

Answer: $x = \frac{-3y + 3}{y + 5}$