Day 359 **A Tier 10-a-day: Model Solutions**

1 Isosceles triangles and exterior angles

LMN is an isosceles triangle with LM = LN.
MNK is a straight line.
Angle MLN = 34°.
Work out the size of angle x.
The diagram is not drawn accurately.

Base angles of an isosceles triangle are equal
Angle LMN = (180 − 34) ÷ 2 = 73°
Exterior angle of a triangle = sum of the two opposite interior angles
x = 34 + 73 = 107
Answer: x = 107°

2 Algebraic formulae in context

A mechanic charges £25 plus £30 for each hour of work.
(a) Write a formula for the total cost, £C, after t hours.
(b) Aisha pays £295 in total. Work out the number of hours.

(a) C = 25 + 30t
(b) 25 + 30t = 295
30t = 270
t = 9
Answer: (a) C = 25 + 30t (b) 9

3 Pie charts

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

(a) 360 − 150 − 120 − 50 = 40°
(b) 5 students is 50°, so 1 student is 50 ÷ 5 = 10°
Cycle: 40 ÷ 10 = 4
Answer: (a) 40° (b) 4

4 Rearranging to solve quadratics

Solve x(x + 1) = 2

Expand the bracket: $x^2 + x = 2$
Rearrange: $x^2 + x - 2 = 0$
(x + 2)(x − 1) = 0
x = −2 or x = 1
Answer: x = −2 or x = 1

5 Loci and constructions

AB is a straight line.
A point S moves so that it is always 6 cm from the line AB, on one side of it.
Describe the locus of S.

Points a fixed distance from a straight line, on one side, form a parallel line
It is parallel to AB and 6 cm from it
Answer: A straight line parallel to AB, 6 cm away from it

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6 Rationalising the denominator

Rationalise the denominator of $\frac{30}{2\sqrt{5}}$

Give your answer in its simplest form.

Multiply top and bottom by $\sqrt{5}$: $\frac{30\sqrt{5}}{2 \times 5}$

$= \frac{30\sqrt{5}}{10} = 3\sqrt{5}$

Answer: $3\sqrt{5}$

7 Quadratic graph from its roots

The diagram shows the graph of $y = x^2 + bx + c$.
Find the value of b and the value of c.

The curve crosses the x-axis at x = 2 and x = 5
So $y = (x - 2)(x - 5)$
Expand: $y = x^2 - 7x + 10$
b = −7 and c = 10
Answer: b = −7, c = 10

8 Recurring decimals (mixed)

Write $0.1\dot{8}$ as a fraction in its simplest form.

Let x = 0.188...
Multiply by 10: 10x = 1.88...
Multiply by 100: 100x = 18.88...
Subtract: 90x = 18 − 1 = 17
$x = \frac{17}{90}$

Answer: $\frac{17}{90}$

9 Bearings and distances

A plane leaves an airport and travels 6 km on a bearing of 155°. (Calculator)
It then travels 8 km on a bearing of 065°.
(a) Work out how far it is now from the airport.
(b) Work out the bearing of its final position from the airport. Give your answer to the nearest degree.

The two bearings differ by 90°, so the path makes a right angle
(a) $\text{Distance}^2 = 6^2 + 8^2 = 100$, so distance = 10 km

(b) The angle at the port between the first leg and the line to the end: $\tan^{-1}(\frac{8}{6}) = 53.1°$

Bearing = 155° − 53.1° = 101.9°
Bearing = 102°
Answer: (a) 10 km (b) 102°

10 Mixing in a ratio

Jug A contains 35 litres of a mixture of concentrate and water in the ratio 4 : 3.
Jug B contains 12 litres of a mixture of concentrate and water in the ratio 1 : 1.
The contents of both jugs are mixed together.
Work out the ratio of concentrate to water in the mixture. Give your answer in its simplest form.

Jug A: concentrate = 4 × 35 ÷ 7 = 20 litres, water = 15 litres
Jug B: concentrate = 6 litres, water = 6 litres
Total: concentrate = 26 litres, water = 21 litres
Ratio = 26 : 21 = 26 : 21
Answer: 26 : 21