Day 43 **S Tier 10-a-day: Model Solutions**

1 Angles in polygons

The interior angles of a pentagon are
$x°$, $(2x - 10)°$, $(x + 35)°$, $(x - 10)°$, $(2x)°$
(a) Work out the value of x.
(b) Work out the size of the largest angle.

(a) Sum of interior angles = $(5 - 2) \times 180 = 540°$
$7x + 15 = 540$, so $7x = 525$
$x = 75$
(b) The angles are 75°, 140°, 110°, 65°, 150°
The largest is 150°
Answer: (a) x = 75 (b) 150°

2 Expanding brackets with surds

Expand and simplify $(5 + \sqrt{7})^2$
Give your answer in the form $p + q\sqrt{7}$

$(5 + \sqrt{7})^2 = 25 + 10\sqrt{7} + 7$
$= 32 + 10\sqrt{7}$
Answer: $32 + 10\sqrt{7}$

3 Solving quadratics by factorising

Solve $x^2 - 6x = -5$

Rearrange so that one side is 0: $x^2 - 6x + 5 = 0$
Factorise: $(x - 1)(x - 5) = 0$
$x - 1 = 0$ or $x - 5 = 0$
$x = 1$ or $x = 5$
Answer: x = 1 or x = 5

4 Using a line of best fit

The scatter graph shows hours of revision (x) and test mark (y).
The equation of the line of best fit is $y = 3x + 9$.
(a) Estimate y when x = 7.
(b) Explain why an estimate of y when x = 25 may be unreliable.

(a) $y = 3 \times 7 + 9 = 30$
(b) x = 25 is outside the range of the data on the graph, so the estimate relies on the pattern continuing (extrapolation)
Answer: (a) 30 (b) x = 25 is outside the range of the data

5 Alternate segment theorem

PAQ is a tangent to the circle at A. B and C are points on the circle. Angle PAB = 58° and angle CAQ = 40°.
(a) Work out the size of angle ABC.
(b) Work out the size of angle ACB.
The diagram is not drawn accurately.

(a) Angle ABC = angle CAQ = 40° (alternate segment theorem)
(b) Angle ACB = angle PAB = 58° (alternate segment theorem)
Answer: (a) 40° (b) 58°

6 HCF and LCM

(a) Write 2058 and 4116 as products of prime factors.
(b) Find the HCF and the LCM of 2058 and 4116.
Give your answers as numbers.

(a) $2058 = 2 \times 3 \times 7^3$ and $4116 = 2^2 \times 3 \times 7^3$
(b) HCF = $2 \times 3 \times 7^3 = 2058$
LCM = $2^2 \times 3 \times 7^3 = 4116$
Answer: (a) $2 \times 3 \times 7^3$; $2^2 \times 3 \times 7^3$ (b) HCF = 2058, LCM = 4116

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7 Simultaneous equations

Solve the simultaneous equations
$6x + 2y = -34$
$x + 4y = -2$

To match the x terms: (2) × 6 gives $6x + 24y = -12$
Subtract the equations to eliminate x: $-22y = -22$
$y = 1$
Substitute $y = 1$ into (1): $6x + 2 = -34$
$6x = -36$, so $x = -6$
Answer: $x = -6$, $y = 1$

8 Estimated mean with an unknown frequency

The table gives information about the times taken by some people to travel to work.
An estimate for the mean is 20.
Work out the value of x.

Mid-points: 12.5, 17.5, 22.5, 27.5
Estimated mean = $\Sigma fm \div \Sigma f$, so $(985 + 17.5x) \div (48 + x) = 20$
$985 + 17.5x = 20(48 + x) = 960 + 20x$
$(17.5 - 20)x = 960 - 985$
$-2.5x = -25$, so $x = 10$
Answer: $x = 10$

9 Growth and decay

Tom puts £2,000 into a savings account.
The account pays 3% compound interest each year.
After how many whole years will there first be more than £3,000 in the account? (Calculator)

Multiplier each year = 1.03
After 13 years: $£2{,}000 \times 1.03^{13} = £2{,}937.07$
After 14 years: $£2{,}000 \times 1.03^{14} = £3{,}025.18$
So the first time it is more than £3,000 is after 14 years
Answer: 14 years

10 Histograms with an unmarked scale

The histogram shows the ages of visitors to a museum.
160 of them had an age between 20 and 30 years.
(a) How many had an age between 30 and 50 years?
(b) How many visitors are there in total?

Frequency is proportional to the area of a bar
20 to 30: bar is 4 squares high and 10 wide, area 40, which represents 160
So 1 unit of area represents $160 \div 40 = 4$
(a) 30 to 50: $7 \times 20 = 140$ units of area, so $140 \times 4 = 560$
(b) Total area $= 60 + 40 + 140 + 30 = 270$, so total $= 270 \times 4 = 1080$
Answer: (a) 560 (b) 1080