Day 195 **B Tier 10-a-day: Model Solutions**

1 Expanding and simplifying

Expand and simplify $2(x + 2) + 5(x - 1)$

Expand each bracket: $2x + 4 + 5x - 5$
Collect like terms: $7x - 1$
Answer: $7x - 1$

2 HCF and LCM from prime factors

$A = 2^3 \times 3^3$
$B = 3^3 \times 7^2$
Write down, as a product of prime factors,
(a) the HCF of A and B
(b) the LCM of A and B

(a) HCF: take the smaller power of each prime that is in both: 3^3
(b) LCM: take the larger power of every prime: $2^3 \times 3^3 \times 7^2$
Answer: (a) 3^3 (b) $2^3 \times 3^3 \times 7^2$

3 Best buys

Cereal is sold in two sizes.
Small: 500 g for £2.05
Large: 750 g for £3.52
Which size is better value for money?
You must show your working.

Compare the cost of 1500 g of each
Large: 2 × £3.52 = £7.04
Small: 3 × £2.05 = £6.15
The small is cheaper for the same amount
Answer: The small size

4 Where a line crosses the axes

A straight line has equation $y = x - 4$
(a) Write down the coordinates of the point where the line crosses the y-axis.
(b) Work out the coordinates of the point where the line crosses the x-axis.

(a) When $x = 0$, $y = -4$
(b) The line crosses the x-axis when $y = 0$: $x - 4 = 0$
$1x = 4$
$x = 4$
Answer: (a) $(0, -4)$ (b) $(4, 0)$

5 Venn diagrams

The Venn diagram shows information about 33 pupils in Year 9.
One of them is chosen at random.
Find the probability that the person chose both French and Spanish.

Number in both circles = 9
Total = 10 + 9 + 5 + 9 = 33
P = 9 out of 33
Answer: $\frac{3}{11}$

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6 LCM problems

Two lights flash at 07:45.
One light flashes every 30 minutes.
The other light flashes every 15 minutes.
At what time do both lights next flash together?

Multiples of 30: 30
Multiples of 15: 15, 30
The first common multiple is 30, so the LCM is 30 minutes
07:45 + 30 minutes = 08:15
Answer: 08:15

7 Isosceles triangles and Pythagoras

Triangle PQR is isosceles with PQ = PR = 5 m.
The base QR = 6 m.
(a) Work out the perpendicular height of the triangle.
(b) Work out the area of the triangle.

(a) The height splits the base in half: 6 ÷ 2 = 3
$h^2 = 5^2 - 3^2 = 25 - 9 = 16$, so h = 4
(b) Area = ½ × 6 × 4 = 12
Answer: (a) 4 m (b) 12 m^2

8 Error intervals

The length of a pencil is 10.23 cm, correct to 2 decimal places.
Write down the error interval for the length.
Use the letter L.

The rounding unit is 0.01, so half of it is 0.005
Lower bound = 10.23 − 0.005 = 10.225
Upper bound = 10.23 + 0.005 = 10.235
Answer: 10.225 ≤ L < 10.235

9 Algebraic proof

Show that $(2n + 7)^2 - (2n - 7)^2$ is a multiple of 56 for any whole number n.

Expand: $(2n + 7)^2 = 4n^2 + 28n + 49$ and $(2n - 7)^2 = 4n^2 - 28n + 49$
Subtract: the $4n^2$ terms and the 49s cancel, leaving 56n
56n is a multiple of 56
Answer: 56n is a multiple of 56

10 Bearings with Pythagoras and trigonometry

A boat sails 12 km on a bearing of 180° from P to Q, then 5 km on a bearing of 270° to R. (Calculator)
(a) Work out the distance PR.
(b) Work out the bearing of R from P.
Give your answers correct to 1 decimal place.

(a) Triangle PQR has a right angle at Q
$PR^2 = 12^2 + 5^2 = 169$
$PR = \sqrt{169} = 13$ km
(b) tan (angle QPR) = $\frac{5}{12}$, so angle QPR = 22.620° (to 3 d.p.)
PQ is on a bearing of 180°, and R is a further 22.620° clockwise from PQ
Bearing = 180 + 22.620 = 202.6°
Answer: (a) 13 km (b) 202.6°