Day 124 **B Tier 10-a-day: Model Solutions**

1 Faces, edges and vertices

Write down the number of faces and vertices of a triangular prism.

Faces: two 3-sided ends and 3 rectangles = 5
Vertices: 3 on each end = 6
Answer: faces: 5 vertices: 6

2 Grouped frequency tables

The table shows the masses of some parcels.
(a) Write down the modal class.
(b) Work out an estimate for the mean.

(a) The highest frequency is 8
(b) Use the midpoint of each class: 22.5, 27.5, 32.5, 37.5, 42.5
Sum of midpoint × frequency = 22.5 × 3 + 27.5 × 8 + 32.5 × 4 + 37.5 × 5 + 42.5 × 5 = 817.5
Total frequency = 25
Estimate = 817.5 ÷ 25 = 32.7
Answer: (a) $25 < m \leq 30$ (b) 32.7

3 Cost formulae

A plumber charges a call-out fee of £8 plus £2 for each hour of work.
(a) Work out the total cost for 7 hours.
(b) The total cost is £32. Work out the number of hours.

(a) 2 × 7 = 14, then 8 + 14 = 22
(b) Take off the fixed charge: 32 − 8 = 24
Divide by the cost for each: 24 ÷ 2 = 12
Answer: (a) £22 (b) 12

4 Combining ratios

In a bag of counters, the ratio of red to green is 1 : 7.
The ratio of green to yellow is 1 : 6.
Write down the ratio red : green : yellow.

Make the green part the same in both ratios: lowest common multiple of 7 and 1 is 7
red : green = 1 : 7
green : yellow = 7 : 42
red : green : yellow = 1 : 7 : 42
Answer: 1 : 7 : 42

5 Expanding double brackets

Expand and simplify $(3x - 7)(x - 4)$

Multiply every term in the first bracket by every term in the second:
$3x^2 - 12x - 7x + 28$
Collect the x terms: $3x^2 - 19x + 28$
Answer: $3x^2 - 19x + 28$

6 Repeated percentage change

The price of a laptop is £80.
The price is first increased by 40%, then the new price is increased by 20%.
(a) Work out the final price.
(b) Work out the overall percentage increase in the price.

(a) Multipliers: 1.4 and 1.2
80 × 1.4 × 1.2 = £134.40
(b) Overall multiplier = 1.68
Overall increase = 68%
Answer: (a) £134.40 (b) 68% increase

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7 Quadratic graphs

The diagram shows the graph of

$y = x^2 + 6x + 8$

(a) Write down the solutions of $x^2 + 6x + 8 = 0$

(b) Write down the coordinates of the minimum point of the graph.

(a) The solutions are where the graph crosses the x-axis

(b) The lowest point of the curve is halfway between the two solutions, at $x = -3$

Answer: (a) $x = -4$ and $x = -2$ (b) $(-3, -1)$

8 Fraction problems

A paddling pool is $\frac{1}{2}$ full.

36 litres of water are added.

The paddling pool is now $\frac{3}{5}$ full.

Work out the capacity of the paddling pool.

Fraction added = $\frac{3}{5} - \frac{1}{2} = \frac{1}{10}$

$\frac{1}{10}$ of the capacity = 36 litres

Whole capacity = 36 × 10 = 360 litres

Answer: 360 litres

9 Trigonometry in isosceles triangles

Triangle ABC is isosceles with AB = AC = 12 m. (Calculator)

The base BC = 18 m.

Work out the size of angle ABC.

Give your answer correct to 1 decimal place.

Split the triangle into two right-angled triangles. Half the base = 18 ÷ 2 = 9

$\cos B = \frac{9}{12}$

Angle ABC = $\cos^{-1}(\frac{9}{12})$ = 41.410...

= 41.4° (1 d.p.)

Answer: 41.4°

10 Compound percentages

A new car costs £13,000. (Calculator)

Its value falls by 3% each year.

Work out its value after 3 years.

Give your answer to the nearest pound.

Multiplier = 100% − 3% = 0.97

Value = 13000×0.97^3

= £11,864.75, which is £11,865 to the nearest pound

Answer: £11,865