Day 162 **A Tier 10-a-day: Model Solutions**

1 Two-way tables

The table shows information about 67 people.
One person is chosen at random.
(a) Find the probability that the person chose chicken.
(b) The person is a woman. Find the probability that they chose pasta.

(a) Chicken total = 36 out of 67 = $\frac{36}{67}$

(b) Women total = 40, of whom 15 are in the Pasta column: $\frac{3}{8}$

Answer: (a) $\frac{36}{67}$ (b) $\frac{3}{8}$

2 Equations with brackets

Solve $5(x - 5) = -3(x - 5)$

Expand the brackets: $5x - 25 = -3x + 15$
Simplify: $5x - 25 = -3x + 15$
Collect x terms on one side and numbers on the other: $8x = 40$
$x = 5$
Answer: x = 5

3 Probabilities adding to 1

The table shows the probabilities of the outcomes of a biased four-sided dice.
(a) Work out the value of y.
(b) The four-sided dice is rolled 300 times. Estimate the number of times it lands on 2.

(a) Probabilities add to 1: $0.25 + y + 3y + 0.55 = 1$
$0.8 + 4y = 1$, so $4y = 0.2$
$y = 0.05$
(b) P(2) = 0.05, so expected number = $0.05 \times 300 = 15$
Answer: (a) y = 0.05 (b) 15

4 Column vectors

$\mathbf{p} = \begin{pmatrix} 3 \\ -4 \end{pmatrix}$.
Work out the magnitude (length) of $\mathbf{p}$.

Magnitude = $\sqrt{(3)^2 + (-4)^2}$
$= \sqrt{9 + 16} = \sqrt{25}$
$= 5$
Answer: 5

5 Compound interest

Zara invests £500 in a savings account. (Calculator)
The account pays compound interest at 2.5% per year.
Work out the total interest earned after 5 years.

Multiplier = $1 + 2.5 \div 100 = 1.025$
£500 × 1.025^5 = £565.70
Interest = £565.70 − £500 = £65.70
Answer: £65.70

6 Substitution

Work out the value of $3a^2 - 2ab - 2b^2$
when $a = -2$ and $b = 2$

Substitute: $3 \times (-2)^2 - 2 \times (-2) \times 2 - 2 \times 2^2$
$= 12 + 8 - 8$
$= 12$
Answer: 12

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7 Surd fractions

Show that $\frac{\sqrt{32}+\sqrt{72}}{\sqrt{2}}$ is an integer, and find its value.

$\sqrt{32} = 4\sqrt{2}$ and $\sqrt{72} = 6\sqrt{2}$
Numerator $= 4\sqrt{2} + 6\sqrt{2} = 10\sqrt{2}$
$\frac{10\sqrt{2}}{\sqrt{2}} = 10$
Answer: 10

8 Combining ratios

x : y = 2 : 1
y : z = 7 : 6
(a) Work out the ratio x : y : z
(b) x, y and z add up to 108. Work out the value of z.

(a) Make the y parts equal: lowest common multiple of 1 and 7 is 7
x : y = 14 : 7 and y : z = 7 : 6
x : y : z = 14 : 7 : 6
(b) 14 + 7 + 6 = 27 parts, so 1 part = 108 ÷ 27 = 4
z = 6 × 4 = 24
Answer: (a) 14 : 7 : 6 (b) 24

9 Circle theorems: angles in the same segment

A, B, C and D are points on a circle. AC and BD meet at E.
Angle BAC = 48° and angle ACD = 58°.
Work out the size of angle x (angle AEB).
Give reasons for your working.

Angles in the same segment are equal, so angle ABD = angle ACD = 58°
In triangle ABE: angle BAE = 48° and angle ABE = 58°
x = 180 − 48 − 58 = 74
Answer: x = 74°

10 Bounds and accuracy

A cyclist travels 630 metres in 15 seconds. The distance is correct to the nearest 10 metres and the time to the nearest 0.1 second.
(a) Work out the upper bound and the lower bound of the speed in m/s.
(b) Write the speed to a suitable degree of accuracy. Give a reason for your answer.

(a) Upper bound = 635 ÷ 14.95 = 42.4749
Lower bound = 625 ÷ 15.05 = 41.5282
(b) Both bounds round to 42 to 2 s.f. but not to the same value to 3 s.f.
So the speed is 42 m/s to 2 significant figures.
Answer: (a) 42.4749, 41.5282 (b) 42 m/s (2 s.f.)