Day 84 **A Tier 10-a-day: Model Solutions**

1 Ordering numbers

Write these numbers in order of size, starting with the smallest.

$\frac{3}{20}$ 0.64 61% 0.87

Change each to a decimal: $\frac{3}{20}$ = 0.15, 0.64 = 0.64, 61% = 0.61, 0.87 = 0.87

Order the decimals: 0.15 < 0.61 < 0.64 < 0.87

Answer: $\frac{3}{20}$, 61%, 0.64, 0.87

2 Perimeter and area with algebra

A rectangle has length (2x + 7) cm and width (2x + 5) cm.
The perimeter of the rectangle is 112 cm.
(a) Work out the value of x.
(b) Work out the area of the rectangle.

(a) 2 × [(2x + 7) + (2x + 5)] = 112
(2x + 7) + (2x + 5) = 56
4x + 12 = 56
4x = 44
x = 11
(b) Length = 29 cm and width = 27 cm
Area = 29 × 27 = 783

Answer: (a) x = 11 (b) 783 cm^2

3 Double inequalities

(a) Solve $-7 \leq 4x - 3 \leq 21$
(b) Write down all the integer values of x that satisfy this inequality.

(a) Add 3 to every part: $-4 \leq 4x \leq 24$
Divide every part by 4: $-1 \leq x \leq 6$
(b) The integers are −1, 0, 1, 2, 3, 4, 5, 6

Answer: (a) $-1 \leq x \leq 6$ (b) −1, 0, 1, 2, 3, 4, 5, 6

4 Calculator and significant figures

Work out $\sqrt{5.2^2 + 5.1^2}$ (Calculator)
Give your answer correct to 3 significant figures.

$5.2^2 + 5.1^2 = 27.04 + 26.01 = 53.05$
= 7.28354...
= 7.28 to 3 significant figures

Answer: 7.28

5 Counting outcomes

A café offers 5 starters, 7 main courses and 4 desserts.
A meal is one starter, one main course and one dessert.
(a) How many different meals are possible?
(b) Hana picks her meal at random. Write down the probability that she picks her favourite meal.

(a) 5 × 7 × 4 = 140
(b) Only 1 of the 140 meals is her favourite

Answer: (a) 140 (b) $\frac{1}{140}$

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6 Area of parallelograms and kites

The diagram shows a kite.
The diagonals are 4 cm and 13 cm and cross at right angles.
Work out the area of the kite.
The diagram is not drawn accurately.

Area = $\frac{1}{2}$ × (diagonal 1) × (diagonal 2)

= $\frac{1}{2}$ × 4 × 13

= 26

Answer: 26 cm^2

7 Expanding three brackets

Expand and simplify
$(x + 2)(3x - 1)(x + 5)$

Expand the first two brackets: $(x + 2)(3x - 1) = 3x^2 + 5x - 2$

Multiply by the third bracket: $(3x^2 + 5x - 2)(x + 5)$

$= 3x^3 + 5x^2 - 2x + 15x^2 + 25x - 10$

$= 3x^3 + 20x^2 + 23x - 10$

Answer: $3x^3 + 20x^2 + 23x - 10$

8 Reverse compound change

The value of an investment grows by 4% each year. (Calculator)
After 2 years it is worth £43,264.
Work out its value at the start.

Yearly multiplier = 1.04

Overall multiplier = $1.04^2 = 1.0816$

Original value = £43,264 ÷ 1.0816 = £40,000

Answer: £40,000

9 Finding an interest rate

Amy invests £5000 in a savings account. (Calculator)
The account pays compound interest at a fixed rate each year.
After 2 years there is £6272 in the account.
Work out the annual rate of interest.

Let the yearly multiplier be m. Then $5000 \times m^2 = 6272$

$m^2 = 6272 \div 5000 = 1.2544$

$m = \sqrt{1.2544} = 1.12$

Rate = $(1.12 - 1) \times 100 = 12\%$

Answer: 12%

10 Bearings with the cosine rule

Ship A sails 20 km from a port on a bearing of 200°.
Ship B sails 19 km from the same port on a bearing of 280°. (Calculator)
Work out the distance between the two ships.
Give your answer to 3 significant figures.

The angle between the two paths = $|200° - 280°| = 80°$

$d^2 = 20^2 + 19^2 - 2 \times 20 \times 19 \times \cos 80°$

$d^2 = 629.03$

$d = 25.1$

Answer: 25.1 km