Day 349 **A Tier 10-a-day: Model Solutions**

1 Venn diagram probability

The Venn diagram shows information about 29 people.
One person is chosen at random.
(a) Find the probability that the person is in French only.
(b) Find the probability that the person is in neither set.

(a) French only: 12 out of 29 = $\frac{12}{29}$

(b) Neither: 2 out of 29 = $\frac{2}{29}$

Answer: (a) $\frac{12}{29}$ (b) $\frac{2}{29}$

2 Prime factors

Express 539 as a product of prime factors. Give your answer in index form.

Divide by prime numbers in turn: 539 ÷ 7 = 77, 77 ÷ 7 = 11, 11 ÷ 11 = 1
539 = 7 × 7 × 11
In index form: 539 = 7^2 × 11
Answer: 539 = 7^2 × 11

3 Expanding and simplifying

Expand and simplify
$(x - 6)^2 - (x - 1)(x - 5)$

$(x - 6)^2 = x^2 - 12x + 36$
$(x - 1)(x - 5) = x^2 - 6x + 5$
Subtract (take care with the signs): $(x^2 - 12x + 36) - (x^2 - 6x + 5)$
$= -6x + 31$
Answer: $-6x + 31$

4 Bounds in measurement

The length and width of a rectangular poster are 18.1 cm and 10.5 cm.
Each measurement is correct to 1 decimal place.
Work out the lower bound for the perimeter.

Lower bounds: length = 18.1 cm and width = 10.4 cm
Lower bound of perimeter = 2 × (18.05 + 10.45) = 57
Answer: 57 cm

5 Adding algebraic fractions

Write as a single fraction in its simplest form
$\frac{x - 6}{2} + \frac{x - 4}{7}$

Common denominator is 14
$= \frac{7(x - 6) + 2(x - 4)}{14}$
$= \frac{9x - 50}{14}$
Answer: $\frac{9x - 50}{14}$

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6 Fraction calculations

Work out $(4\frac{1}{2} - 1\frac{1}{3}) \times 4\frac{1}{2}$

Give your answer as a mixed number in its simplest form.

Brackets first, as improper fractions: $\frac{9}{2} - \frac{4}{3} = \frac{19}{6}$

Then multiply: $\frac{19}{6} \times \frac{9}{2} = \frac{57}{4}$

$= 14\frac{1}{4}$

Answer: $14\frac{1}{4}$

7 Volume of composite solids

A solid is made from a cylinder and a cone.
The cylinder has radius 6 cm and height 10 cm.
The cone has the same radius as the cylinder and perpendicular height 9 cm.
Work out the total volume. Give your answer in terms of π.

Cylinder = $\pi \times 6^2 \times 10 = 360\pi$

Cone = $\frac{1}{3} \times \pi \times 6^2 \times 9 = 108\pi$

Total = $360\pi + 108\pi = 468\pi$

Answer: 468π cm^3

8 Stratified sampling

A school has 160 students in Year 9, 80 in Year 10 and 200 in Year 11.
A stratified sample of 22 students is to be taken.
Work out how many students should be chosen from Year 10.

Total = 160 + 80 + 200 = 440

Number from Year 10 = $\frac{80}{440} \times 22$

= 4

Answer: 4

9 Factorising

Factorise $3x^2 - 8x + 4$

Multiply $3 \times 4 = 12$. Find two numbers that multiply to 12 and add to -8: -6 and -2
$3x^2 - 8x + 4 = 3x^2 - 6x - 2x + 4$
Factorise in pairs to get $(3x - 2)(x - 2)$
Answer: $(3x - 2)(x - 2)$

10 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 = 49° and angle ACD = 50°.
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 = 50°
In triangle ABE: angle BAE = 49° and angle ABE = 50°
x = 180 − 49 − 50 = 81
Answer: x = 81°