Day 290 **A Tier 10-a-day: Model Solutions**

1 Negative and fractional indices

Work out the value of

(a) $16^{\frac{1}{4}}$

(b) $(\frac{2}{3})^{-2}$

(a) $16^{\frac{1}{4}} = \sqrt[4]{16} = 2$

(b) $(\frac{2}{3})^{-2} = (\frac{3}{2})^{2} = \frac{3^2}{2^2} = \frac{9}{4}$

Answer: (a) 2 (b) $\frac{9}{4}$

2 Area of a triangle using sine

Work out the area of triangle ABC. (Calculator)
Give your answer to 3 significant figures.
The diagram is not drawn accurately.

Area = $\frac{1}{2} \times a \times b \times \sin C$

$= \frac{1}{2} \times 11 \times 13 \times \sin 77°$

$= 69.7$

Answer: 69.7 cm^2

3 Pie charts

The pie chart shows how some students chose a drink.
9 students chose juice.
(a) Work out the angle for water.
(b) How many students chose water?

(a) $360 - 40 - 160 - 90 = 70°$

(b) 9 students is 90°, so 1 student is $90 \div 9 = 10°$

Water: $70 \div 10 = 7$

Answer: (a) 70° (b) 7

4 Midpoints and length of a line segment

C is the point $(1, -6)$ and D is the point $(8, 18)$.
(a) Find the midpoint of CD.
(b) Work out the length of CD. Give your answer as a whole number.

(a) Midpoint = $(\frac{1+8}{2}, \frac{-6+18}{2}) = (4.5, 6)$

(b) Length = $\sqrt{(7)^2 + (24)^2}$

$= \sqrt{625} = 25$

Answer: (a) (4.5, 6) (b) 25

5 Capture-recapture

A scientist wants to estimate the number of frogs in a pond.
She catches 80 frogs, marks each one and returns them.
Later she catches a second sample of 60 frogs. 8 of these are marked.
Work out an estimate for the total number of frogs in a pond.

Proportion marked in the second sample = $\frac{8}{60}$

This is the same as the proportion in the whole population: $\frac{80}{N}$

$\frac{80}{N} = \frac{8}{60}$, so $N = 80 \times 60 \div 8 = 600$

Answer: 600

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6 Error intervals

m = 930 is rounded to 2 significant figures.
Write down the error interval for m.

The rounding unit is 10, so the value could be up to half of this, 5, either side.
Lower bound = 930 − 5 = 925, upper bound = 930 + 5 = 935
Answer: $925 \leq m < 935$

7 Similar triangles with parallel lines

In triangle ABC, DE is parallel to BC.
D is on AB and E is on AC.
Work out the value of x.
The diagram is not drawn accurately.

Triangles ADE and ABC are similar (DE is parallel to BC)
Scale factor = AB ÷ AD = 7 ÷ 3 = $\frac{7}{3}$
$x = 9 \times \frac{7}{3} = 21$
Answer: x = 21

8 Quadratic inequalities

Solve $x^2 + 5x - 14 \geq 0$

Solve $x^2 + 5x - 14 = 0$: $(x + 7)(x - 2) = 0$
$x = -7$ or $x = 2$
Sketch the U-shaped curve $y = x^2 + 5x - 14$, crossing the x-axis at -7 and 2
The curve is above the x-axis outside the roots
$x \leq -7$ or $x \geq 2$
Answer: $x \leq -7$ or $x \geq 2$

9 Reading a histogram

The histogram shows information about the time of some items.
(a) Work out the number of items with a time in the class 20 to 30 minutes.
(b) Work out an estimate for the number with a time greater than 35 minutes.

(a) Frequency = frequency density × class width
0.6 × 10 = 6
(b) 35 to 40: 2.2 × 5 = 11
Class 40 to 50: 2 × 10 = 20
Total = 11 + 20 = 31
Answer: (a) 6 (b) 31

10 Factorising

Factorise $15x^2 - 11x + 2$

Multiply 15 × 2 = 30. Find two numbers that multiply to 30 and add to −11: −5 and −6
$15x^2 - 11x + 2 = 15x^2 - 5x - 6x + 2$
Factorise in pairs to get $(5x - 2)(3x - 1)$
Answer: $(5x - 2)(3x - 1)$