Day 317 **A Tier 10-a-day: Model Solutions**

1 Expanding double brackets

Expand and simplify

$(2x + 8)^2$

Multiply every term in the first bracket by every term in the second

$= (2x + 8)(2x + 8) = 4x^2 + 16x + 16x + 64$

$= 4x^2 + 32x + 64$

Answer: $4x^2 + 32x + 64$

2 Median from a frequency table

The table shows information about 31 children.

(a) Find the median.

(b) Work out the range.

(a) The median is the 16th value $(31 + 1) \div 2 = 16$

Cumulative frequencies: 9, 14, 20, 23, 31

The 16th value is 2

(b) Range $= 4 - 0 = 4$

Answer: (a) 2 (b) 4

3 Surface area of a cuboid

A cuboid has length 7 cm and width 3 cm.

Its total surface area is 162 cm^2.

Work out the height of the cuboid.

$2 \times (7 \times 3 + 7\,h + 3\,h) = 162$

$21 + 10h = 81$

$10h = 60$

$h = 60 \div 10 = 6$

Answer: 6 cm

4 Expanding and simplifying

Expand and simplify

$(x + 3)^2 - (x - 4)(x + 6)$

$(x + 3)^2 = x^2 + 6x + 9$

$(x - 4)(x + 6) = x^2 + 2x - 24$

Subtract (take care with the signs): $(x^2 + 6x + 9) - (x^2 + 2x - 24)$

$= 4x + 33$

Answer: $4x + 33$

5 Probabilities adding to 1

The table shows the probabilities of the outcomes of a biased spinner.

(a) Work out the value of x.

(b) The spinner is spun 300 times. Estimate the number of times it lands on green.

(a) Probabilities add to 1: $0.15 + x + x + 0.65 = 1$

$0.8 + 2x = 1$, so $2x = 0.2$

$x = 0.1$

(b) P(green) = 0.1, so expected number $= 0.1 \times 300 = 30$

Answer: (a) x = 0.1 (b) 30

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6 Area of shaded regions with circles

A circle of radius 7 cm fits exactly inside a square.
The circle touches all four sides of the square. (Calculator)
Work out the area of the shaded region.
Give your answer to 3 significant figures.

Side of square = 2 × 7 = 14 cm
Square: 14 × 14 = 196
Circle: $\pi \times 7^2 = 49\pi$
Shaded area = 196 − 49π = 42.1
Answer: 42.1 cm^2

7 Dividing fractions in context

A roll of ribbon is $16\frac{7}{8}$ metres long. Pieces of $\frac{5}{8}$ metre are cut from it.
How many pieces can be cut?

Divide: $16\frac{7}{8} \div \frac{5}{8}$

As improper fractions and multiplying by the reciprocal: $\frac{135}{8} \times \frac{8}{5}$

= 27
Answer: 27

8 Growth and decay

A new car is worth £8000. (Calculator)
Its value falls by 5% each year.
Work out its value after 2 years.

Multiplier = 100% − 5% = 0.95
$8000 \times 0.95^2 = 7220.00$
= £7220 to the nearest whole number
Answer: £7220

9 Surface area of cones and spheres

A solid hemisphere has radius 8 cm.
Work out the total surface area of the hemisphere.
Give your answer in terms of π.

Curved surface = $\frac{1}{2} \times 4\pi r^2 = 128\pi$

Flat circular face = $\pi r^2 = 64\pi$
Total = 192π
Answer: 192π cm^2

10 Bounds and accuracy

A cyclist travels 310 metres in 16.3 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 = 315 ÷ 16.25 = 19.3846
Lower bound = 305 ÷ 16.35 = 18.6544
(b) Both bounds round to 19 to 2 s.f. but not to the same value to 3 s.f.
So the speed is 19 m/s to 2 significant figures.
Answer: (a) 19.3846, 18.6544 (b) 19 m/s (2 s.f.)