Day 293 **A Tier 10-a-day: Model Solutions**

1 Laws of indices

Simplify fully

(a) $\frac{6x^6y^4}{3x^4y^2}$

(b) $(4x^2y)^4$

(a) Divide the numbers: $6 \div 3 = 2$

Subtract the powers: $x^6 \div x^4 = x^2$ and $y^4 \div y^2 = y^2$

$= 2x^2y^2$

(b) Raise every part to the power 4: $4^4 = 256$, $(x^2)^4 = x^8$, $y^4 = y^4$

$= 256x^8y^4$

Answer: (a) $2x^2y^2$ (b) $256x^8y^4$

2 Surface area of a cuboid

A closed box is a cuboid measuring 4 cm by 4 cm by 4 cm.

Work out the total surface area.

Faces: 4×4, 4×4 and 4×4 each appear twice

$2 \times (16 + 16 + 16)$

$= 2 \times 48 = 96$

Answer: 96 cm^2

3 Venn diagram probability

The Venn diagram shows information about 28 people.

One person is chosen at random.

(a) Find the probability that the person is in both Cinema and Theatre.

(b) Find the probability that the person is in Cinema or Theatre or both.

(a) Both: 5 out of 28 = $\frac{5}{28}$

(b) $4 + 5 + 9 = 18$, so 18 out of 28 = $\frac{9}{14}$

Answer: (a) $\frac{5}{28}$ (b) $\frac{9}{14}$

4 Mixed number multiplication and division

Work out $5\frac{1}{2} \div 1\frac{2}{3}$

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

Improper fractions: $\frac{11}{2}$ and $\frac{5}{3}$

Turn the second fraction upside down and multiply: $\frac{11}{2} \times \frac{3}{5} = \frac{33}{10}$

Simplify: $3\frac{3}{10}$

Answer: $3\frac{3}{10}$

5 Finding a missing value from an average

The mean of the five numbers x, 18, 10, 7, 3 is 9.

Work out the value of x.

Total = $5 \times 9 = 45$

Known numbers add to 38

$x = 45 - 38 = 7$

Answer: x = 7

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6 Volume of a cylinder

A cylinder has radius 4 cm. It contains water to a depth of 20 cm. (Calculator)
All the water is poured into an empty tank with a rectangular base 15 cm by 16 cm.
Work out the depth of the water in the tank. Give your answer to 3 significant figures.

Volume of water = $\pi \times 4^2 \times 20 = 320\pi$ cm^3
Depth = volume ÷ base area = $320\pi \div (15 \times 16)$
= 4.19
Answer: 4.19 cm

7 Forming quadratic equations

A rectangle has width x cm and length (x + 8) cm.
The area of the rectangle is 20 cm^2.
(a) Show that $x^2 + 8x - 20 = 0$
(b) Work out the value of x.

(a) Area = length × width, so $x(x + 8) = 20$
$x^2 + 8x = 20$
$x^2 + 8x - 20 = 0$
(b) Factorise: $(x - 2)(x + 10) = 0$
$x = 2$ or $x = -10$
A length cannot be negative, so $x = 2$
Answer: (a) Shown (b) x = 2

8 Bounds in measurement

The length and width of a rectangular garden are 9.4 m and 5.9 m.
Each measurement is correct to 1 decimal place.
Work out the upper bound for the area.

Upper bound of length = 9.4 m, upper bound of width = 6.0 m
Upper bound of area = 9.45 × 5.95 = 56.2275
Answer: 56.2275 m^2

9 Bounds

A rectangle has length 14.4 m and width 4.8 m. (Calculator)
Each measurement is correct to the nearest 0.1 m.
Work out the upper bound for the area of the rectangle.

Upper bound of length = 14.4 + 0.05 = 14.45 m
Upper bound of width = 4.8 + 0.05 = 4.85 m
Upper bound of area = 14.45 × 4.85 = 70.0825 m^2
Answer: 70.0825 m^2

10 Reading a histogram

The histogram shows information about the length of some items.
(a) Work out the number of items with a length in the class 0 to 30 mm.
(b) Work out an estimate for the number with a length greater than 35 mm.

(a) Frequency = frequency density × class width
1 × 30 = 30
(b) 35 to 40: 2.4 × 5 = 12
Class 40 to 50: 0.6 × 10 = 6
Class 50 to 60: 0.8 × 10 = 8
Total = 12 + 6 + 8 = 26
Answer: (a) 30 (b) 26