Day 243 **B Tier 10-a-day: Model Solutions**

1 Laws of indices

Simplify fully

(a) $y^{10} \div y^5$

(b) $a^5 \times a^2$

(a) Subtract the powers: $10 - 5 = 5$

(b) Add the powers: $5 + 2 = 7$

Answer: (a) y^5 (b) a^7

2 Median and range

Here are the number of customers at a shop each day.

34, 34, 12, 29, 30

(a) Find the median.

(b) Work out the range.

(a) Put in order: 12, 29, 30, 34, 34

The middle value is number 3: 30

(b) Range = largest − smallest = 34 − 12 = 22

Answer: (a) 30 (b) 22

3 Metric conversions

(a) Convert 12 tonnes to kg.

(b) Convert 2 litres to cm^3.

(a) tonnes → kg: multiply by 1000: $12 \times 1000 = 12\,000$

(b) 1 litre = 1000 cm^3. $2 \times 1000 = 2000$

Answer: (a) 12 000 kg (b) 2000 cm^3

4 Solving double inequalities

(a) Solve $11 < 2x + 7 < 15$

(b) Write down the integer values of x that satisfy this inequality.

(a) Subtract 7 in all three parts: $4 < 2x < 8$

Divide all three parts by 2: $2 < x < 4$

(b) The whole numbers in this range are 3

Answer: (a) $2 < x < 4$ (b) 3

5 Mode and median from a table

The table shows the shoe sizes of students in a class.

(a) Write down the mode.

(b) Work out the median.

(a) The highest frequency is 10, for 7

(b) Total frequency = 20, so the median is the numbers 10 and 11 values

Running totals of frequency: 1, 4, 14, 18, 20

The median is 7

Answer: (a) 7 (b) 7

6 Proving a triangle is right-angled

A triangle has sides of length 3 cm, 6 cm and 4 cm.

Is the triangle right-angled?

You must show your working.

The longest side is 6. Check whether $a^2 + b^2 = c^2$

$3^2 + 4^2 = 9 + 16 = 25$

$6^2 = 36$

These are not equal, so the triangle is not right-angled

Answer: No, $3^2 + 4^2 = 25$ but $6^2 = 36$

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7 Negative and zero indices

Work out

(a) 2^{-1}

(b) $11^0 + \sqrt{64}$

(a) A negative power means the reciprocal: $2^{-1} = \frac{1}{2^1} = \frac{1}{2}$

(b) Anything to the power 0 is 1, so $11^0 = 1$

$\sqrt{64} = 8$, so $1 + 8 = 9$

Answer: (a) $\frac{1}{2}$ (b) 9

8 Venn diagrams

The Venn diagram shows information about 25 people in a street.
One of them is chosen at random.
Find the probability that the person chose neither Cats nor Dogs.

Outside both circles = 7
Total = 25
P = 7 out of 25

Answer: $\frac{7}{25}$

9 Simultaneous equations problem

A shop sells pens and pencils. All pens cost the same and all pencils cost the same.
2 pens and 2 pencils cost 330p.
4 pens and 2 pencils cost 550p.
Work out the cost of one pen and the cost of one pencil.

Let a = cost of one pen and b = cost of one pencil
$2a + 2b = 330$ and $4a + 2b = 550$
Subtract: $2a = 550 - 330 = 220$, so $a = 110$
Substitute: $2 \times 110 + 2b = 330$, so $2b = 110$ and $b = 55$
Answer: One pen costs 110p and one pencil costs 55p

10 Growth in standard form

There are 9×10^3 fish in a lake.
The number triples every day.
How many are there after 6 days?
Give your answer in standard form.

Each day multiply by 3, so multiply by $3^6 = 729$
$9 \times 10^3 \times 729 = 6561 \times 10^3$
In standard form: 6.561×10^6
Answer: 6.561×10^6