Day 7 **B Tier 10-a-day: Model Solutions**

1 LCM problems

Two buses leave a bus station at 11:00.
One bus leaves every 14 minutes.
The other bus leaves every 20 minutes.
At what time do both buses next leave together?

Multiples of 14: 14, 28, 42, 56, 70, 84, 98, 112, 126, 140
Multiples of 20: 20, 40, 60, 80, 100, 120, 140
The first common multiple is 140, so the LCM is 140 minutes
11:00 + 140 minutes = 13:20
Answer: 13:20

2 Laws of indices

Simplify fully
(a) $(2y^3)^3$
(b) $2p^2 \times 4p^4$

(a) $2^3 = 8$ and the powers multiply: $3 \times 3 = 9$
(b) Multiply the numbers: $2 \times 4 = 8$. Add the powers: $2 + 4 = 6$
Answer: (a) $8y^9$ (b) $8p^6$

3 Angles in quadrilaterals

PQRS is an isosceles trapezium with PQ parallel to SR.
Angle SPQ = 66°.
(a) Write down the size of angle PQR.
(b) Work out the size of angle PSR.

(a) In an isosceles trapezium the base angles are equal, so angle PQR = 66°
(b) Co-interior angles add up to 180°
180 − 66 = 114
Answer: (a) 66° (b) 114°

4 Density

A piece of wood has a density of 0.6 g/cm^3 and a volume of 200 cm^3.
Work out its mass.

Mass = density × volume
0.6 × 200 = 120
Answer: 120 g

5 Standard form calculations

Work out $(6 \times 10^6) \div (4 \times 10^5)$
Give your answer in standard form.

Divide the numbers: 6 ÷ 4 = 1.5
Subtract the powers: 6 − 5 = 1
1.5×10^1
Answer: 1.5×10^1

6 Missing value from a mean

The mean of 5 numbers is 10.
Four of the numbers are 6, 14, 9, 11.
Work out the fifth number.

Total = 5 × 10 = 50
Given total = 40
Fifth = 50 − 40 = 10
Answer: 10

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7 Growth in standard form

There are 6.6×10^3 cells in a sample.
The number triples every day.
How many are there after 4 days?
Give your answer in standard form.

Each day multiply by 3, so multiply by $3^4 = 81$
$6.6 \times 10^3 \times 81 = 534.6 \times 10^3$
In standard form: 5.346×10^5
Answer: 5.346×10^5

8 Congruent triangles

Triangle ABC has sides 7 mm, 8 mm and 14 mm.
Triangle XYZ has sides 14 mm, 7 mm and 8 mm.
Are the two triangles congruent?
Give a reason for your answer.

Both triangles have sides 7, 8 and 14
Three pairs of equal sides, so they are congruent (SSS)
Answer: Yes, SSS (three pairs of equal sides)

9 Disproving statements

Ali says, "The value of $n^2 - 3n + 9$ is a prime number for every positive whole number n."
Show that Ali is wrong.

Try n = 1, 2, 3, ... and check each answer
When n = 3: $3^2 + (-3) \times 3 + 9 = 9$
9 is not prime because it has other factors
Answer: n = 3 gives 9, which is not prime

10 Algebraic proof

Show that $(n + 10)^2 - (n - 10)^2$ is a multiple of 40 for any whole number n.

Expand: $(n + 10)^2 = n^2 + 20n + 100$ and $(n - 10)^2 = n^2 - 20n + 100$
Subtract: the n^2 terms and the 100s cancel, leaving 40n
40n is a multiple of 40
Answer: 40n is a multiple of 40