Day 316 **B Tier 10-a-day: Model Solutions**

1 Place value

Here are four digit cards.
6 1 3 4
Use all four cards to make the largest possible number.
Work out the difference between the largest and smallest possible numbers.

Largest: put the digits in order, biggest first: 6431
Smallest: put the digits in order, smallest first: 1346
6431 − 1346 = 5085
Answer: 5085

2 Equations with unknowns on both sides

Solve 6n + 14 = 5n + 20

Subtract 5n from both sides: n + 14 = 20
Subtract 14 from both sides: 1n = 6
Divide both sides by 1
Answer: n = 6

3 Probability of not happening

The probability that a bus is late is $\frac{2}{5}$.

Work out the probability that a bus is not late.

Probabilities add up to 1
$1 - \frac{2}{5} = \frac{3}{5}$
Answer: $\frac{3}{5}$

4 Volume of cuboids

A box is a cuboid measuring 30 cm by 10 cm by 10 cm.
Small cubes of side 5 cm are packed into the box.
How many small cubes fit in the box with no gaps?

Along the length: 30 ÷ 5 = 6
Along the width: 10 ÷ 5 = 2
Along the height: 10 ÷ 5 = 2
6 × 2 × 2 = 24
Answer: 24 cubes

5 Error intervals

The mass of a parcel is 82.4 kg, correct to 1 decimal place.
Write down the error interval for the mass.
Use the letter m.

The rounding unit is 0.1, so half of it is 0.05
Lower bound = 82.4 − 0.05 = 82.35
Upper bound = 82.4 + 0.05 = 82.45
Answer: $82.35 \leq m < 82.45$

6 Pressure

A block exerts a force of 48 N and causes a pressure of 6 N/m^2.
Work out the area in contact with the ground.

Area = force ÷ pressure
48 ÷ 6 = 8
Answer: 8 m^2

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7 Factorising

Factorise $x^2 - 9x$

Both terms have x as a factor

$x^2 \div x = x$ and $-9x \div x = -9$

Answer: $x(x - 9)$

8 LCM problems

Two buses leave a bus station at 07:15.
One bus leaves every 12 minutes.
The other bus leaves every 18 minutes.
At what time do both buses next leave together?

Multiples of 12: 12, 24, 36
Multiples of 18: 18, 36
The first common multiple is 36, so the LCM is 36 minutes
07:15 + 36 minutes = 07:51
Answer: 07:51

9 Trigonometry in context

A church spire is 47 m tall. (Calculator)
Mia stands 15 m from the base of the church spire on level ground.
Work out the angle of elevation of the top of the church spire from Mia.
Give your answer correct to 1 decimal place.

The height is the opposite side and the distance is the adjacent side

$\tan\theta = \frac{47}{15}$

$\theta = \tan^{-1}(\frac{47}{15}) = 72.300...$

$\theta = 72.3°$ (1 d.p.)
Answer: 72.3°

10 Quadratic equation problem

A rectangle has length $(x + 4)$ cm and width $(x - 3)$ cm.
The area of the rectangle is 30 cm^2.
(a) Show that $x^2 + x - 42 = 0$
(b) Hence work out the length of the rectangle.

(a) Area = length × width: $(x + 4)(x - 3) = 30$
Expand: $x^2 + x - 12 = 30$
Subtract 30 from both sides: $x^2 + x - 42 = 0$
(b) Factorise: $(x - 6)(x + 7) = 0$, so $x = 6$ or $x = -7$
A length cannot be negative, so $x = 6$. Length = 6 + 4 = 10
Answer: (b) 10 cm