Day 263 **B Tier 10-a-day: Model Solutions**

1 Laws of indices

Simplify fully

(a) $(x^4)^2$

(b) $x^3 \times x^5$

(a) Multiply the powers: $4 \times 2 = 8$

(b) Add the powers: $3 + 5 = 8$

Answer: (a) x^8 (b) x^8

2 Fractions in simplest form

What fraction of £1.50 is 45p?

Give your answer in its simplest form.

£1.50 = 150 pence

$\frac{45}{150} = \frac{3}{10}$

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

3 Angles in parallel lines

In the diagram, KL is parallel to MN.

(a) Work out the size of angle q.

(b) Give a reason for your answer.

The diagram is not drawn accurately.

Angle q and the 121° angle are alternate angles (Z shape)

q = 121°

Alternate angles are equal

Answer: (a) q = 121° (b) Alternate angles are equal

4 Perimeter expressions

A triangle has sides of length (3x + 5) cm, (3x − 2) cm and (5x + 5) cm.

Write down an expression, in terms of x, for the perimeter of the triangle.

Give your answer in its simplest form.

Add the three sides: (3x + 5) + (3x − 2) + (5x + 5)

x terms: 3x + 3x + 5x = 11x. Numbers: 5 − 2 + 5 = 8

Answer: 11x + 8 cm

5 Standard form

Write each number as an ordinary number.

(a) 2×10^4

(b) 3.9×10^{-4}

(a) Multiply by 10, 4 times: move the decimal point 4 places right

$2 \times 10^4 = 20{,}000$

(b) $10^{-4} = 0.0001$, so move the decimal point 4 places left

$3.9 \times 10^{-4} = 0.00039$

Answer: (a) 20,000 (b) 0.00039

6 Independent events

The probability that Amy is late for school on any day is 0.8.

The probability that Ben is late on any day is 0.9.

Whether each is late is independent of the other.

Work out the probability that at least one of them is late on Monday.

P(neither late) = (1 − 0.8) × (1 − 0.9) = 0.2 × 0.1 = 0.02

P(at least one late) = 1 − 0.02 = 0.98

Answer: 0.98

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7 Trigonometry: finding a side

Find the length of d. (Calculator)
Give your answer correct to 1 decimal place.
The diagram is not drawn accurately.

Label the sides: d is the opposite and 21 m is the hypotenuse
We use sin (opposite and hypotenuse)

$\sin 38° = \frac{d}{21}$

$d = 21 \times \sin 38° = 12.929...$
$d = 12.9$ m (1 d.p.)
Answer: d = 12.9 m

8 Cumulative frequency

The cumulative frequency graph shows the times taken by 40 students to complete a puzzle.
(a) Use the graph to estimate the median.
(b) Work out an estimate for the interquartile range.

(a) Median is at $40 \div 2 = 20$: read across from 20 on the vertical axis to the curve, then down: 40
(b) Lower quartile at 10: 27.5. Upper quartile at 30: 50
IQR = 50 − 27.5 = 22.5
Answer: (a) 40 minutes (b) 22.5 minutes

9 Iteration

Here is an iteration formula.
$x_{n+1} = \sqrt{3x_n + 3}$
$x_0 = 2$
(a) Work out x_1
(b) Work out x_2. Give your answer correct to 3 decimal places. (Calculator)

(a) $x_1 = \sqrt{3 \times 2 + 3} = \sqrt{9} = 3$
(b) $x_2 = \sqrt{3 \times 3 + 3} = \sqrt{12} = 3.4641...$
$= 3.464$
Answer: (a) 3 (b) 3.464

10 Reverse repeated percentages

In a sale, the price of a sofa is reduced by 25%. (Calculator)
Two weeks later it is reduced by a further 20% of the new price.
The final price is £75.
Work out the original price of the sofa.

Multipliers: 0.75 and 0.8
Overall multiplier = $0.75 \times 0.8 = 0.6$
Original price = £75 ÷ 0.6 = £125
Answer: £125