Day 87 **A Tier 10-a-day: Model Solutions**

1 Isosceles triangles and exterior angles

LMN is an isosceles triangle with LM = LN.
MNK is a straight line.
Angle MLN = 108°.
Work out the size of angle x.
The diagram is not drawn accurately.

Base angles of an isosceles triangle are equal
Angle LMN = (180 − 108) ÷ 2 = 36°
Exterior angle of a triangle = sum of the two opposite interior angles
x = 108 + 36 = 144
Answer: x = 144°

2 Laws of indices

Write $(10^7)^3 \div 10^5$ as a single power of 10.

Multiply the powers: $(10^7)^3 = 10^{21}$
Subtract when dividing: 21 − 5 = 16
$= 10^{16}$
Answer: 10^{16}

3 Pressure

A block rests on an area of 0.5 m^2 of the floor.
The pressure on the floor is 20 N/m^2.
Work out the force exerted by the block.

Force = pressure × area
= 20 × 0.5 = 10
Answer: 10 N

4 Equation of a line from a graph

Work out the equation of the straight line.
Give your answer in the form y = mx + c

The line crosses the y-axis at (0, 0), so c = 0
Gradient = $\frac{\text{change in y}}{\text{change in x}}$: from (0, 0) to (−4, 2), y changes by 2 and x changes by −4
$m = -\frac{1}{2}$
$y = -\frac{1}{2}x$
Answer: $y = -\frac{1}{2}x$

5 Surface area of a cuboid

A cuboid has length 13 cm and width 9 cm.
Its total surface area is 454 cm^2.
Work out the height of the cuboid.

2 × (13 × 9 + 13 h + 9 h) = 454
117 + 22h = 227
22h = 110
h = 110 ÷ 22 = 5
Answer: 5 cm

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6 Density

A stone has a volume of 140 cm^3.
The density of the material is 2.7 g/cm^3.
Work out the mass of the stone.

Mass = density × volume
= 2.7 × 140 = 378 g
Answer: 378 g

7 Iteration

$x_{n+1} = \sqrt{5x_n + 11}$
$x_0 = 3$
Work out the values of x_1, x_2 and x_3.
Give your answers correct to 3 decimal places. (Calculator)

Substitute $x_0 = 3$ into the formula, then use each answer in the next step (keep the full calculator display)
$x_1 = 5.09902$
$x_2 = 6.04112$
$x_3 = 6.41916$
Answer: $x_1 = 5.099$, $x_2 = 6.041$, $x_3 = 6.419$

8 Enlargements and coordinates

Triangle LMN has vertices L(1, 0), M(5, −4), N(3, 0).
The triangle is enlarged with scale factor $\frac{1}{2}$ and centre (1, −2).
Write down the coordinates of the vertices of the image.

Each vertex moves to: centre + scale factor × (vertex − centre)
L: (1, 0) → (1, −1)
M: (5, −4) → (3, −3)
N: (3, 0) → (2, −1)
Answer: L'(1, −1), M'(3, −3), N'(2, −1)

9 Rationalising the denominator

Rationalise the denominator of $\frac{14}{\sqrt{7}}$
Give your answer in its simplest form.

Multiply top and bottom by $\sqrt{7}$: $\frac{14}{\sqrt{7}} \times \frac{\sqrt{7}}{\sqrt{7}} = \frac{14\sqrt{7}}{7}$

$= 2\sqrt{7}$
Answer: $2\sqrt{7}$

10 Transformations of graphs

The graph of y = f(x) has a maximum point at (5, −2).
Write down the coordinates of the turning point of the graph of
(a) y = f(x) − 2
(b) y = 2f(x)

(a) Subtracting 2 from f(x) moves the graph 2 units down
The maximum point is (5, −4)
(b) Multiplying f(x) by 2 stretches the graph vertically by a factor of 2, so the y-coordinate is multiplied by 2
The maximum point is (5, −4)
Answer: (a) (5, −4) (b) (5, −4)