Day 20 **B Tier 10-a-day: Model Solutions**

1 Sequences from patterns

Matchsticks are used to make a row of pentagons.
1 pentagon needs 5 matchsticks, 2 pentagons need 9 and 3 pentagons need 13.
(a) Find an expression, in terms of n, for the number of matchsticks needed for n pentagons.
(b) Dan uses 65 matchsticks to make a row. How many pentagons are in his row?

(a) The number of matchsticks goes up by 4 each time, so the rule starts with 4n
When n = 1 we need 5, and 4 × 1 = 4, so add 1: 4n + 1
(b) 4n + 1 = 65
4n = 64
n = 64 ÷ 4 = 16
Answer: (a) 4n + 1 (b) 16

2 Angles in triangles

Triangle XYZ is isosceles with XY = XZ.
Angle XYZ = 31°.
Work out the size of angle YXZ.

Angle XZY is also 31° because the base angles are equal
31 + 31 = 62
180 − 62 = 118
Answer: 118°

3 Estimation

Estimate the value of

$$\frac{2.63 \times 4.35}{0.374}$$

Show your rounding to 1 significant figure.

Round each number to 1 significant figure: 2.63 → 3, 4.35 → 4, 0.374 → 0.4
Estimate = 3 × 4 ÷ 0.4 = 30
Answer: 30

4 Exterior angles of polygons

Each interior angle of a regular polygon is 90°.
Work out the number of sides of the polygon.

Exterior angle = 180° − 90° = 90°
Number of sides = 360 ÷ 90 = 4
Answer: 4 sides

5 Pressure

A block exerts a force of 750 newtons on the floor.
The area in contact with the floor is 25 m^2.
Work out the pressure on the floor.
Give your answer in N/m^2.

Pressure = force ÷ area
750 ÷ 25 = 30
Answer: 30 N/m^2

6 Surface area of cuboids

A cube has side length 4 cm.
Work out the total surface area of the cube.

A cube has 6 identical square faces
Area of one face = 4 × 4 = 16
6 × 16 = 96
Answer: 96 cm^2

Day 20 **B Tier 10-a-day: Model Solutions**

7 Negative and zero indices

Work out

(a) 3^{-3}

(b) $11^0 + \sqrt{4}$

(a) A negative power means the reciprocal: $3^{-3} = \frac{1}{3^3} = \frac{1}{27}$

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

$\sqrt{4} = 2$, so $1 + 2 = 3$

Answer: (a) $\frac{1}{27}$ (b) 3

8 Ratio and changes

In a room, the ratio of Year 10 students to Year 11 students is 3 : 7.
There are 14 Year 11 students.
More Year 10 students join so that there are equal numbers of Year 10 students and Year 11 students.
How many Year 10 students join?

7 parts = 14, so 1 part = 2
Originally there are 3 × 2 = 6 Year 10 students
To equal 14, add 14 − 6 = 8
Answer: 8

9 Real-life graphs

A plumber charges a call-out fee plus a cost for each hour of work.
The graph shows the total cost.
(a) Write down the fixed charge.
(b) Work out the cost for each hour.

(a) The fixed charge is the cost when nothing has been used, where the line meets the vertical axis
(b) Take two points on the line, for example (0, 7) and (4, 15)
Cost for each hour = (15 − 7) ÷ 4 = 2
Answer: (a) £7 (b) £2

10 Population density

Town A has a population density of 25 people per km^2.
Its area is 4 km^2.
Work out its population.

Population = density × area
25 × 4 = 100
Answer: 100