Day 282 **A Tier 10-a-day: Model Solutions**

1 Isosceles triangles and exterior angles

PQR is an isosceles triangle with PQ = PR.
QRS is a straight line.
Angle PRS = 126°.
Work out the size of angle x.
The diagram is not drawn accurately.

Angles on a straight line add up to 180°
Angle PRQ = 180 − 126 = 54°
Base angles are equal, so angle PQR = 54°
x = 180 − 54 − 54 = 72
Answer: x = 72°

2 Direct proportion

Here are the ingredients for 4 pancakes.
Butter: 60 g
Water: 300 ml
Milk: 100 ml
(a) Work out how much butter is needed for 18 pancakes.
(b) Hannah has 2756 ml of water. What is the greatest number of pancakes she can make?

(a) butter for one: 60 ÷ 4 = 15 g
For 18: 15 × 18 = 270 g
(b) water for one: 300 ÷ 4 = 75 ml
2756 ÷ 75 = 36 remainder 56, so she can make 36
Answer: (a) 270 g (b) 36

3 Is it a right-angled triangle?

A triangle has sides of length 15 m, 9 m and 12 m.
Is the triangle right-angled?
You must show your working.

Longest side^2 = 15^2 = 225
Sum of the squares of the other two sides = $9^2 + 12^2$ = 81 + 144 = 225
225 = 225, so the triangle is right-angled
Answer: Yes, it is right-angled

4 Pressure

A machine exerts a force of 300 N on the floor.
The pressure on the floor is 150 N/m^2.
Work out the area of the machine in contact with the floor.

Area = force ÷ pressure
= 300 ÷ 150 = 2 m^2
Answer: 2 m^2

5 Compound interest

Chloe invests £8,000 in a savings account. (Calculator)
The account pays compound interest at 2% per year.
Work out the value of the investment after 5 years.

Multiplier = 1 + 2 ÷ 100 = 1.02
£8,000 × 1.02^5 = £8,832.65
Answer: £8,832.65

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6 Two dice

Two fair dice are thrown.
The two scores are multiplied together.
Work out the probability that the product is greater than 15.

Number of ways to get each product that works (16: 1, 18: 2, 20: 2, 24: 2, 25: 1, 30: 2, 36: 1)
Total = 11 out of 36 outcomes
$\frac{11}{36}$

Answer: $\mathbf{\frac{11}{36}}$

7 Quadratic inequalities

Solve $x^2 - 9x > 0$

Solve $x^2 - 9x = 0$: $x(x - 9) = 0$
$x = 0$ or $x = 9$
Sketch the U-shaped curve $y = x^2 - 9x$, crossing the x-axis at 0 and 9
The curve is above the x-axis outside the roots
$x < 0$ or $x > 9$
Answer: $x < 0$ or $x > 9$

8 The cosine rule: finding an angle

Work out the size of angle x. (Calculator)
Give your answer to 1 decimal place.
The diagram is not drawn accurately.

$\cos x = \frac{7^2 + 16^2 - 12^2}{2 \times 7 \times 16}$

$\cos x = \frac{161}{224}$

$x = \cos^{-1}(0.7188)$
$x = 44.0°$
Answer: $x = 44.0°$

9 Transformations of graphs

The graph of $y = f(x)$ has a maximum point at $(-1, 4)$.
Write down the coordinates of the turning point of the graph of
(a) $y = f(x + 1)$
(b) $y = 3f(x)$

(a) Replacing x by $(x + 1)$ moves the graph 1 unit left
The maximum point is $(-2, 4)$
(b) Multiplying f(x) by 3 stretches the graph vertically by a factor of 3, so the y-coordinate is multiplied by 3
The maximum point is $(-1, 12)$
Answer: (a) $(-2, 4)$ (b) $(-1, 12)$

10 Finding a rate of compound change

Ryan invests £4,500 in a savings account. (Calculator)
Compound interest is paid at a fixed rate each year.
After 3 years the investment is worth £7,776.
Work out the annual rate of interest.

Overall multiplier = £7,776 ÷ £4,500 = 1.728
Take the cube root: $\sqrt[3]{1.728} = 1.2$
Rate = $(1.2 - 1) \times 100 = 20\%$
Answer: 20%