Day 111 **A Tier 10-a-day: Model Solutions**

1 Primes

(a) Write down all the prime numbers between 70 and 84.
(b) Write 221 as the product of two prime numbers.

(a) A prime number has exactly two factors. Checking each number between 70 and 84 gives: 71, 73, 79, 83
(b) 221 ÷ 13 = 17, and both 13 and 17 are prime.
Answer: (a) 71, 73, 79, 83 (b) 13 × 17

2 Sharing in a ratio

Ravi and Ben share 104 football cards in the ratio 5 : 8.
How many more football cards does Ben get than Ravi?

Total number of parts = 5 + 8 = 13
One part = 104 ÷ 13 = 8
Ben gets 8 × 8 = 64 and Ravi gets 5 × 8 = 40
Difference = 64 − 40 = 24
Answer: 24

3 Functions

$f(x) = -3x - 1$
$g(x) = x^2 + 2$
(a) Find g(4)
(b) Find gf(x). Expand and simplify your answer.

(a) $g(4) = 4^2 + 2 = 18$
(b) gf(x) means g(f(x)), so replace x in g with $-3x - 1$
$gf(x) = (-3x - 1)^2 + 2$
$= 9x^2 + 6x + 3$
Answer: (a) 18 (b) $9x^2 + 6x + 3$

4 Converting units of area and volume

Convert 2.75 m^2 into cm^2.

1 m = 100 cm, so 1 m^2 = 100 × 100 = 10 000 cm^2
2.75 × 10 000 = 27500
Answer: 27500 cm^2

5 Converting area and volume units

Change 200 mm^2 to cm^2.

1 cm^2 = 100 mm^2
200 ÷ 100 = 2
Answer: 2 cm^2

6 Adding and subtracting in standard form

Work out $(4.8 \times 10^6) - (9.1 \times 10^3)$
Give your answer in standard form.

Write both numbers using 10^3: $4.8 \times 10^6 = 4800 \times 10^3$
$(4800 - 9.1) \times 10^3 = 4790.9 \times 10^3$
In standard form: 4.7909×10^6
Answer: 4.7909×10^6

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7 Tree diagrams

The tree diagram shows probabilities for two events.
(a) Work out the values of a and b.
(b) Work out the probability that Sam is absent from school.

(a) Probabilities on pairs of branches add up to 1.
a = 1 − 0.8 = 0.2 and b = 1 − 0.9 = 0.1
(b) P(absent) = 0.8 × 0.9 + 0.2 × 0.3
= 0.72 + 0.06 = 0.78
Answer: (a) a = 0.2, b = 0.1 (b) 0.78

8 Iteration

$x_{n+1} = \sqrt{4x_n + 10}$
$x_0 = 2$
Work out the values of x_1, x_2 and x_3.
Give your answers correct to 3 decimal places. (Calculator)

Substitute $x_0 = 2$ into the formula, then use each answer in the next step (keep the full calculator display)
$x_1 = 4.24264$
$x_2 = 5.19332$
$x_3 = 5.54737$
Answer: $x_1 = 4.243$, $x_2 = 5.193$, $x_3 = 5.547$

9 Angles in regular polygons around a point

A regular hexagon and a square share the side AB and are on opposite sides of it.
The two shapes meet at the point A.
Work out the size of the angle at A that is not inside either shape.

Interior angle of the regular hexagon = 180 − 360 ÷ 6 = 120°
Interior angle of the square = 180 − 360 ÷ 4 = 90°
Angles round a point add up to 360°
360 − 120 − 90 = 150
Answer: 150°

10 Quadratic inequalities

Solve $x^2 + x - 12 \geq 0$

Solve $x^2 + x - 12 = 0$: $(x + 4)(x - 3) = 0$
$x = -4$ or $x = 3$
Sketch the U-shaped curve $y = x^2 + x - 12$, crossing the x-axis at −4 and 3
The curve is above the x-axis outside the roots
$x \leq -4$ or $x \geq 3$
Answer: $x \leq -4$ or $x \geq 3$