Day 325 **A Tier 10-a-day: Model Solutions**

1 Expanding and simplifying

Expand and simplify

$(3x - 6)(x - 4) + (x + 3)^2$

$(3x - 6)(x - 4) = 3x^2 - 18x + 24$

$(x + 3)^2 = x^2 + 6x + 9$

Add and collect like terms: $4x^2 - 12x + 33$

Answer: $4x^2 - 12x + 33$

2 Percentage change

Ali buys a bookcase for £40.

He sells it for £16.

Work out his percentage loss.

Loss = £40.00 − £16.00 = £24.00

Percentage loss = $\frac{£24.00}{£40.00} \times 100 = 60\%$

Answer: 60%

3 Angles in parallel lines

The diagram shows two parallel lines crossed by a straight line.

(a) Work out the value of x.

(b) Work out the size of the angle marked $(4x - 15)°$.

The diagram is not drawn accurately.

(a) Alternate angles are equal

$4x - 15 = 3x - 5$

$x = 10$

$x = 10$

(b) $4 \times 10 - 15 = 25$

Answer: (a) x = 10 (b) 25°

4 Estimation

Estimate the value of $\sqrt{99.8} \times 3.9$, by rounding 99.8 to the nearest square number and 3.9 to 1 significant figure.

Round to values we can work with: $99.8 \approx 100$ and $3.9 \approx 4$

$\sqrt{100} \times 4 = 10 \times 4 = 40$

Answer: 40

5 The quadratic formula

Solve $x^2 + 8x + 5 = 0$

Give your solutions correct to 2 decimal places. (Calculator)

Use $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ with a = 1, b = 8, c = 5

$x = \frac{-8 \pm \sqrt{8^2 - 4 \times 1 \times 5}}{2}$

$x = \frac{-8 \pm \sqrt{44}}{2}$

$x = -0.68$ or $x = -7.32$

Answer: x = −0.68 or x = −7.32

6 Converting units

(a) Change 3 km^2 to m^2.

(b) Change 7 litres to cm^3.

(a) 3 $km^2 \times 1{,}000{,}000 = 3{,}000{,}000$ m^2

(b) 7 litres × 1,000 = 7,000 cm^3

Answer: (a) 3,000,000 m^2 (b) 7,000 cm^3

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7 Combined means

The mean mark of 20 boys in a test is 54.
The mean mark of 5 girls in the same test is 75.
Work out the mean mark of all 25 people.

Total for boys = 20 × 54 = 1080
Total for girls = 5 × 75 = 375
Total = 1455, and number of students = 25
Mean = 1455 ÷ 25 = 58.2
Answer: 58.2

8 Arc length and perimeter of a sector

The diagram shows a sector of a circle of radius 7 cm.
Work out the perimeter of the sector.
Give your answer in terms of π.
The diagram is not drawn accurately.

Arc length = $\frac{270}{360} \times 2 \times \pi \times 7 = \frac{21}{2}\pi$
Perimeter = arc + two radii
$= \frac{21}{2}\pi + 14$
Answer: $\mathbf{\frac{21}{2}\pi + 14}$ **cm**

9 Transformations of graphs

The graph of y = f(x) has a maximum point at (0, 4).
Write down the coordinates of the turning point of the graph of
(a) y = 2f(x)
(b) y = f(x) + 1

(a) 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 (0, 8)
(b) Adding 1 to f(x) moves the graph 1 unit up
The maximum point is (0, 5)
Answer: (a) (0, 8) (b) (0, 5)

10 Mixing in a ratio

Jug A contains 39 litres of a mixture of concentrate and water in the ratio 7 : 6.
Jug B contains 3 litres of a mixture of concentrate and water in the ratio 2 : 1.
The contents of both jugs are mixed together.
Work out the ratio of concentrate to water in the mixture. Give your answer in its simplest form.

Jug A: concentrate = 7 × 39 ÷ 13 = 21 litres, water = 18 litres
Jug B: concentrate = 2 litres, water = 1 litres
Total: concentrate = 23 litres, water = 19 litres
Ratio = 23 : 19 = 23 : 19
Answer: 23 : 19