Day 217 **A Tier 10-a-day: Model Solutions**

1 Recurring decimals to fractions

Write the recurring decimal $0.\dot{7}1\dot{2}$ as a fraction in its simplest form.

Let x = 0.712712712...
Multiply by 1000: 1000x = 712.712712...
Subtract: 999x = 712
$x = \frac{712}{999}$

Answer: $\frac{712}{999}$

2 Expanding double brackets

Expand and simplify
$(2x + 1)^2$

Multiply every term in the first bracket by every term in the second
$= (2x + 1)(2x + 1) = 4x^2 + 2x + 2x + 1$
$= 4x^2 + 4x + 1$
Answer: $4x^2 + 4x + 1$

3 Bearings

The bearing of B from A is 335°.
Work out the bearing of A from B.
The diagram is not drawn accurately.

The north lines at A and B are parallel
Back bearing = 335° − 180° = 155°
Answer: 155°

4 Combined means

The mean of 10 numbers is 53.
Another number is added. The mean of the 11 numbers is now 57.
Work out the number that was added.

Total of the first 10 numbers = 10 × 53 = 530
Total of the 11 numbers = 11 × 57 = 627
Number added = 627 − 530 = 97
Answer: 97

5 Index equations

Solve $2^x = \frac{1}{16}$

Write the right-hand side as a power of 2: $\frac{1}{16} = 2^{-4}$
So x = −4
Answer: x = −4

6 Area of shaded regions with circles

3 identical circles of radius 5 cm fit exactly inside a rectangle.
The circles touch each other and the sides of the rectangle. (Calculator)
Work out the area of the shaded region.
Give your answer to 3 significant figures.

Rectangle: 30 × 10 = 300 cm^2
3 circles: $3 \times \pi \times 5^2 = 75\pi$
Shaded area = $300 - 75\pi = 64.4$
Answer: 64.4 cm^2

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7 Venn diagram probability

The Venn diagram shows information about 23 people.
One person is chosen at random.
(a) Find the probability that the person is in Netball only.
(b) Find the probability that the person is in neither set.

(a) Netball only: 5 out of 23 = $\frac{5}{23}$

(b) Neither: 2 out of 23 = $\frac{2}{23}$

Answer: (a) $\frac{5}{23}$ (b) $\frac{2}{23}$

8 Quadratic inequalities

Solve $x^2 + x - 6 \geq 0$

Solve $x^2 + x - 6 = 0$: $(x + 3)(x - 2) = 0$
$x = -3$ or $x = 2$
Sketch the U-shaped curve $y = x^2 + x - 6$, crossing the x-axis at -3 and 2
The curve is above the x-axis outside the roots
$x \leq -3$ or $x \geq 2$
Answer: $x \leq -3$ or $x \geq 2$

9 Expanding three brackets

Expand and simplify
$(x + 5)(3x - 3)(x - 4)$

Expand the first two brackets: $(x + 5)(3x - 3) = 3x^2 + 12x - 15$
Multiply by the third bracket: $(3x^2 + 12x - 15)(x - 4)$
$= 3x^3 + 12x^2 - 15x - 12x^2 - 48x + 60$
$= 3x^3 - 63x + 60$
Answer: $3x^3 - 63x + 60$

10 Volume of composite solids

A solid is made from a cylinder and a cone.
The cylinder has radius 3 cm and height 6 cm.
The cone has the same radius as the cylinder and perpendicular height 4 cm.
Work out the total volume. Give your answer in terms of π.

Cylinder = $\pi \times 3^2 \times 6 = 54\pi$

Cone = $\frac{1}{3} \times \pi \times 3^2 \times 4 = 12\pi$

Total = $54\pi + 12\pi = 66\pi$

Answer: 66π cm^3