Day 221 **A Tier 10-a-day: Model Solutions**

1 Best buys

A shop sells coffee in 2 different sizes.
Small bag: 400 g for £1.80
Large bag: 1000 g for £4.35
Which bag is the best value for money? You must show your working.

Small bag: 180p ÷ 4 = 45p per 100 g
Large bag: 435p ÷ 10 = 43.5p per 100 g
The large bag has the lowest price per 100 g, so it is the best value
Answer: The large bag

2 Ordering numbers

Write these numbers in order of size, starting with the smallest.

10% 0.06 $\frac{6}{20}$ 24%

Change each to a decimal: 10% = 0.1, 0.06 = 0.06, $\frac{6}{20}$ = 0.3, 24% = 0.24

Order the decimals: 0.06 < 0.1 < 0.24 < 0.3

Answer: 0.06, 10%, 24%, $\frac{6}{20}$

3 Circle theorems: angle in a semicircle

XY is a diameter of the circle.
Angle YXZ = 30°.
Work out the size of angle x.
Give a reason for each step of your working.

The angle in a semicircle is 90°, so angle XZY = 90°
Angles in a triangle add up to 180°
x = 180 − 90 − 30 = 60
Answer: x = 60°

4 Addition and multiplication rules

For two events A and B:
P(A) = 0.55, P(B) = 0.6 and P(A or B) = 0.7.
(a) Work out P(A and B).
(b) Work out the probability that neither A nor B happens.

(a) P(A and B) = P(A) + P(B) − P(A or B) = 0.55 + 0.6 − 0.7 = 0.45
(b) 1 − P(A or B) = 1 − 0.7 = 0.3
Answer: (a) 0.45 (b) 0.3

5 The quadratic formula

Solve $5x^2 + 2x - 5 = 0$
Give your solutions correct to 2 decimal places. (Calculator)

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

$x = \frac{-2 \pm \sqrt{2^2 - 4 \times 5 \times (-5)}}{10}$

$x = \frac{-2 \pm \sqrt{104}}{10}$

x = 0.82 or x = −1.22
Answer: x = 0.82 or x = −1.22

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6 Expanding with surds

Expand and simplify $(5 - \sqrt{11})(6 - \sqrt{11})$
Give your answer in the form $a + b\sqrt{c}$

Expand: $30 - 5\sqrt{11} - 6\sqrt{11} + 11$
(using $\sqrt{11} \times \sqrt{11} = 11$)
Collect: $41 - 11\sqrt{11}$
Answer: $41 - 11\sqrt{11}$

7 Perimeter and area with algebra

A rectangle has length $(3x + 3)$ cm and width $(2x - 3)$ cm.
The perimeter of the rectangle is 100 cm.
(a) Work out the value of x.
(b) Work out the area of the rectangle.

(a) $2 \times [(3x + 3) + (2x - 3)] = 100$
$(3x + 3) + (2x - 3) = 50$
$5x = 50$
$5x = 50$
$x = 10$
(b) Length = 33 cm and width = 17 cm
Area = $33 \times 17 = 561$
Answer: (a) x = 10 (b) 561 cm^2

8 Reverse compound change

The value of a car falls by 20% each year. (Calculator)
After 2 years it is worth £1,920.
Work out its value at the start.

Yearly multiplier = 0.8
Overall multiplier = $0.8^2 = 0.64$
Original value = £1,920 ÷ 0.64 = £3,000
Answer: £3,000

9 The cosine rule: finding a side

Work out the value of x. (Calculator)
Give your answer to 3 significant figures.
The diagram is not drawn accurately.

$x^2 = 19^2 + 7^2 - 2 \times 19 \times 7 \times \cos 91°$
$x^2 = 361 + 49 - 266 \cos 91°$
$x^2 = 414.64$
$x = 20.4$
Answer: x = 20.4 cm

10 Quadratic inequalities

Solve $x^2 \geq 9$

$x^2 = 9$ at $x = \pm 3$
The curve $y = x^2$ is above 9 outside the roots
$x \leq -3$ or $x \geq 3$
Answer: $x \leq -3$ or $x \geq 3$