Day 316 **A Tier 10-a-day: Model Solutions**

1 The quadratic formula

Solve $2x^2 - 5x - 9 = 0$
Give your solutions correct to 2 decimal places. (Calculator)

Use $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ with $a = 2$, $b = -5$, $c = -9$

$x = \frac{5 \pm \sqrt{(-5)^2 - 4 \times 2 \times (-9)}}{4}$

$x = \frac{5 \pm \sqrt{97}}{4}$

$x = 3.71$ or $x = -1.21$

Answer: $x = 3.71$ or $x = -1.21$

2 Two-way tables

The table shows information about 71 people.
One person is chosen at random.
(a) Find the probability that the person chose chicken.
(b) The person is a woman. Find the probability that they chose pasta.

(a) Chicken total = 37 out of 71 = $\frac{37}{71}$

(b) Women total = 47, of whom 27 are in the Pasta column: $\frac{27}{47}$

Answer: (a) $\frac{37}{71}$ (b) $\frac{27}{47}$

3 Isosceles triangles and exterior angles

ABC is an isosceles triangle with AB = AC.
BCD is a straight line.
Angle ACD = 112°.
Work out the size of angle x.
The diagram is not drawn accurately.

Angles on a straight line add up to 180°
Angle ACB = 180 − 112 = 68°
Base angles are equal, so angle ABC = 68°
x = 180 − 68 − 68 = 44
Answer: $x = 44°$

4 Powers and roots in standard form

Work out $\sqrt{1.21 \times 10^{-10}}$
Give your answer in standard form.

$\sqrt{1.21 \times 10^{-10}} = \sqrt{1.21} \times \sqrt{10^{-10}}$
$= 1.1 \times 10^{-5}$
Answer: 1.1×10^{-5}

5 Two dice

Two fair dice are thrown.
The two scores are added together.
Work out the probability that the sum is greater than 6.

Number of ways to get each sum that works (7: 6, 8: 5, 9: 4, 10: 3, 11: 2, 12: 1)
Total = 21 out of 36 outcomes
$\frac{21}{36} = \frac{7}{12}$

Answer: $\frac{7}{12}$

Day 316 **A Tier 10-a-day: Model Solutions**

6 Quadratic sequences

Here are the first five terms of a quadratic sequence.
$-2, -5, -10, -17, -26$
(a) Find an expression for the nth term.
(b) Work out the 8th term.

First differences: $-3, -5, -7$
Second differences: $-2, -2$, so $a = -2 \div 2 = -1$
Subtract $-n^2$ from each term $(-1, -4, -9, -16)$: $-1, -1, -1, -1$
This is linear: -1
nth term = $-n^2 - 1$
(b) Substitute $n = 8$: $-1 \times 8^2 - 1 = -65$
Answer: (a) $-n^2 - 1$ (b) -65

7 Rationalising the denominator

Rationalise the denominator of $\frac{3}{3\sqrt{2}}$
Give your answer in its simplest form.

Multiply top and bottom by $\sqrt{2}$: $\frac{3\sqrt{2}}{3 \times 2}$
$= \frac{3\sqrt{2}}{6} = \frac{\sqrt{2}}{2}$
Answer: $\frac{\sqrt{2}}{2}$

8 Perimeter and area with algebra

An isosceles triangle has two equal sides of length $(4x + 3)$ cm and $(3x + 5)$ cm.
The third side is 7 cm.
Work out the perimeter of the triangle.

The two equal sides give an equation
$4x + 3 = 3x + 5$
$x = 2$
$x = 2$
Equal sides $= 4 \times 2 + 3 = 11$ cm
Perimeter $= 11 + 11 + 7 = 29$
Answer: 29 cm

9 Adding algebraic fractions

Write as a single fraction
$\frac{-5}{(x + 1)} - \frac{4}{(x + 5)}$

Common denominator is $(x + 1)(x + 5)$
$= \frac{-5(x + 5) - 4(x + 1)}{(x + 1)(x + 5)}$
$= \frac{-9x - 29}{(x + 1)(x + 5)}$
Answer: $\frac{-9x - 29}{(x + 1)(x + 5)}$

Day 316 **A Tier 10-a-day: Model Solutions**

10 Bounds and accuracy

A cyclist travels 410 metres in 17.8 seconds. The distance is correct to the nearest 10 metres and the time to the nearest 0.1 second.

(a) Work out the upper bound and the lower bound of the speed in m/s.

(b) Write the speed to a suitable degree of accuracy. Give a reason for your answer.

(a) Upper bound = 415 ÷ 17.75 = 23.3803

Lower bound = 405 ÷ 17.85 = 22.6891

(b) Both bounds round to 23 to 2 s.f. but not to the same value to 3 s.f.

So the speed is 23 m/s to 2 significant figures.

Answer: (a) 23.3803, 22.6891 (b) 23 m/s (2 s.f.)