Day 194 **A Tier 10-a-day: Model Solutions**

1 Isosceles triangles and exterior angles

ABC is an isosceles triangle with AB = AC.
BCD is a straight line.
Angle BAC = 52°.
Work out the size of angle x.
The diagram is not drawn accurately.

Base angles of an isosceles triangle are equal
Angle ABC = (180 − 52) ÷ 2 = 64°
Exterior angle of a triangle = sum of the two opposite interior angles
x = 52 + 64 = 116
Answer: x = 116°

2 Substitution

Work out the value of $2x^2 + 2x + 1$ when $x = -5$

Substitute $x = -5$: $2 \times (-5)^2 + 2 \times (-5) + 1$
$= 50 - 10 + 1$
$= 41$
Answer: 41

3 Inverse proportion

8 workers take 9 days to build a wall.
All the workers work at the same rate.
How many workers are needed to build a wall in 4 days?

Total work = 8 × 9 = 72 worker-day
Number needed = 72 ÷ 4 = 18
Answer: 18

4 Equations with fractions

Solve $\frac{4x + 2}{5} = \frac{3x + 3}{3}$

Multiply both sides by 15
3(4x + 2) = 5(3x + 3)
12x + 6 = 15x + 15
−3x = 9
x = −3
Answer: x = −3

5 Two-way tables

The table shows information about 74 people.
One person is chosen at random.
(a) Find the probability that the person is a child and chose coffee.
(b) The person chose tea. Find the probability that they are an adult.

(a) Children who chose coffee: 9 out of 74 = $\frac{9}{74}$

(b) Tea total = 45, of whom 29 are in the Adults row: $\frac{29}{45}$

Answer: (a) $\frac{9}{74}$ (b) $\frac{29}{45}$

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6 Bounds

A plank is 21 mm long and a pipe is 17 mm long.
Each length is correct to the nearest mm.
Work out the lower bound for the difference in their lengths.

To make the difference as small as possible, use the lower bound of the plank and the upper bound of the pipe.
20.5 − 17.5 = 3 mm
Answer: 3 mm

7 Perimeter and area with algebra

A rectangle has length (4x + 3) cm and width (x − 2) cm.
The perimeter of the rectangle is 112 cm.
(a) Work out the value of x.
(b) Work out the area of the rectangle.

(a) 2 × [(4x + 3) + (x − 2)] = 112
(4x + 3) + (x − 2) = 56
5x + 1 = 56
5x = 55
x = 11
(b) Length = 47 cm and width = 9 cm
Area = 47 × 9 = 423
Answer: (a) x = 11 (b) 423 cm^2

8 Recurring decimals to fractions

Write the recurring decimal $0.\dot{9}\dot{3}$ as a fraction in its simplest form.

Let x = 0.939393...
Multiply by 100: 100x = 93.9393...
Subtract: 99x = 93
$x = \frac{93}{99} = \frac{31}{33}$
Answer: $\frac{31}{33}$

9 Simultaneous equations (one quadratic)

Solve the simultaneous equations
$x^2 + y^2 = 25$
$y = -3x + 5$

Substitute $y = -3x + 5$ into $x^2 + y^2 = 25$
$x^2 + (-3x + 5)^2 = 25$
$10x^2 - 30x = 0$
Divide by 10: $x^2 - 3x = 0$
(x + 0)(x − 3) = 0
x = 0 or x = 3
Use $y = -3x + 5$ to find y: when x = 0, y = 5; when x = 3, y = −4
Answer: x = 0, y = 5 and x = 3, y = −4

10 Compound interest

Femi invests £4,500 in a savings account. (Calculator)
The account pays compound interest at 1.5% per year.
Work out the total interest earned after 5 years.

Multiplier = 1 + 1.5 ÷ 100 = 1.015
£4,500 × 1.015^5 = £4,847.78
Interest = £4,847.78 − £4,500 = £347.78
Answer: £347.78