Day 102 **A Tier 10-a-day: Model Solutions**

1 Two-way tables

The table shows information about 77 people.
One person is chosen at random.
(a) Find the probability that the person is a girl and studies Spanish.
(b) The person studies French. Find the probability that they are a boy.

(a) Girls who studies Spanish: 10 out of 77 = $\frac{10}{77}$

(b) French total = 44, of whom 14 are in the Boys row: $\frac{7}{22}$

Answer: (a) $\frac{10}{77}$ (b) $\frac{7}{22}$

2 Isosceles triangles and exterior angles

LMN is an isosceles triangle with LM = LN.
MNK is a straight line.
Angle MLN = 82°.
Work out the size of angle x.
The diagram is not drawn accurately.

Base angles of an isosceles triangle are equal
Angle LMN = (180 − 82) ÷ 2 = 49°
Exterior angle of a triangle = sum of the two opposite interior angles
x = 82 + 49 = 131
Answer: x = 131°

3 Median and interquartile range

Here are the times, in seconds, taken by 11 runners.
6 75 9 73 26 16 18 57 11 12 78
(a) Work out the median.
(b) Work out the interquartile range.

Put in order: 6, 9, 11, 12, 16, 18, 26, 57, 73, 75, 78
(a) The middle value is number 6, so the median is 18
(b) Lower half: 6, 9, 11, 12, 16, so LQ = 11
Upper half: 26, 57, 73, 75, 78, so UQ = 73
IQR = 73 − 11 = 62
Answer: (a) 18 (b) 62

4 Factorising quadratics

Factorise $x^2 + 12x + 35$

Find two numbers that multiply to 35 and add to 12
The numbers are 5 and 7
(x + 5)(x + 7)
Answer: (x + 5)(x + 7)

5 Reverse fractions

$\frac{2}{5}$ of the books in a library are fiction.
There are 36 fiction books.
Work out the total number of books in the library.

$\frac{2}{5}$ of the total = 36

$\frac{1}{5}$ of the total = 36 ÷ 2 = 18

Whole = 18 × 5 = 90
Answer: 90

Day 102 **A Tier 10-a-day: Model Solutions**

6 Area of a sector

The diagram shows a sector of a circle of radius 12 cm.
Work out the area of the sector.
Give your answer in terms of π.
The diagram is not drawn accurately.

Area = $\frac{45}{360} \times \pi \times 12^2$

= $\frac{1}{8} \times 144\ \pi$

= 18π

Answer: 18π cm^2

7 Finding an interest rate

Sam invests £500 in a savings account. (Calculator)
The account pays compound interest at a fixed rate each year.
After 2 years there is £627.20 in the account.
Work out the annual rate of interest.

Let the yearly multiplier be m. Then $500 \times m^2 = 627.2$

$m^2 = 627.2 \div 500 = 1.2544$

$m = \sqrt{1.2544} = 1.12$

Rate = $(1.12 - 1) \times 100 = 12\%$

Answer: 12%

8 Bearings and distances

A boat leaves a port and travels 48 miles on a bearing of 195°. (Calculator)
It then travels 14 miles on a bearing of 105°.
(a) Work out how far it is now from the port.
(b) Work out the bearing of its final position from the port. Give your answer to the nearest degree.

The two bearings differ by 90°, so the path makes a right angle

(a) Distance$^2 = 48^2 + 14^2 = 2500$, so distance = 50 miles

(b) The angle at the port between the first leg and the line to the end: $\tan^{-1}(\frac{14}{48}) = 16.3°$

Bearing = $195° - 16.3° = 178.7°$

Bearing = 179°

Answer: (a) 50 miles (b) 179°

9 Finding a rate of compound change

Femi invests £19,000 in a savings account. (Calculator)
Compound interest is paid at a fixed rate each year.
After 3 years the investment is worth £32,832.
Work out the annual rate of interest.

Overall multiplier = £32,832 ÷ £19,000 = 1.728

Take the cube root: $\sqrt[3]{1.728} = 1.2$

Rate = $(1.2 - 1) \times 100 = 20\%$

Answer: 20%

Day 102 **A Tier 10-a-day: Model Solutions**

10 Composite functions

f(x) = 4x − 3

g(x) = x^2 − 3

Solve gf(x) = 13

gf(x) = $(4x - 3)^2 - 3$

$(4x - 3)^2 - 3 = 13$, so $(4x - 3)^2 = 16$

$4x - 3 = \pm 4$

$4x - 3 = 4$ or $4x - 3 = -4$

$x = \frac{7}{4}$ or $x = -\frac{1}{4}$

Answer: $x = \frac{7}{4}$ or $x = -\frac{1}{4}$