Day 74 **A Tier 10-a-day: Model Solutions**

1 Ordering numbers

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

42% $\frac{7}{8}$ 0.93 37%

Change each to a decimal: 42% = 0.42, $\frac{7}{8}$ = 0.875, 0.93 = 0.93, 37% = 0.37

Order the decimals: 0.37 < 0.42 < 0.875 < 0.93

Answer: 37%, 42%, $\frac{7}{8}$, 0.93

2 Circle area and circumference

A circle has radius 6 cm.
Work out, in terms of π,
(a) the circumference,
(b) the area.

(a) Circumference = $\pi d = \pi \times 12 = 12\pi$

(b) Area = $\pi r^2 = \pi \times 6^2 = 36\pi$

Answer: (a) 12π cm (b) 36π cm^2

3 Direct and inverse proportion

y is directly proportional to the cube of x.
When x = 3, y = 162.
(a) Find a formula for y in terms of x.
(b) Work out the value of y when x = 5.

(a) $y = kx^3$. Substitute x = 3 and y = 162: 162 = k × 27, so k = 6

$y = 6x^3$

(b) $y = 6 \times 5^3 = 6 \times 125 = 750$

Answer: (a) $y = 6x^3$ (b) 750

4 LCM in context

Bus A leaves a bus station every 18 minutes.
Bus B leaves the same station every 12 minutes.
Both buses leave together at 6:00 am.
At what time will they next leave together?

We need the LCM of 18 and 12.
Multiples of 18: 18, 36
Multiples of 12: 12, 24, 36
LCM = 36, so they leave together again 36 minutes later, at 6:36 am

Answer: 6:36 am

5 Equations with fractions

Solve $\frac{5x - 4}{4} = \frac{4x - 5}{5}$

Multiply both sides by 20
5(5x − 4) = 4(4x − 5)
25x − 20 = 16x − 20
9x = 0
x = 0

Answer: x = 0

Day 74 **A Tier 10-a-day: Model Solutions**

6 Terminating and recurring decimals

Here are four fractions: $\frac{4}{5}$ $\frac{3}{11}$ $\frac{3}{8}$ $\frac{21}{24}$

Which one of these fractions is equal to a recurring decimal?

Simplify each fraction: $\frac{4}{5}, \frac{3}{11}, \frac{3}{8}, \frac{21}{24} = \frac{7}{8}$

A fraction in simplest form is a terminating decimal only if its denominator has no prime factors other than 2 and 5.

$\frac{3}{11}$ has denominator 11, which includes a factor other than 2 and 5.

Answer: $\frac{3}{11}$

7 Perpendicular bisector

A is the point $(-5, 4)$ and B is the point $(-1, 6)$.

Find the equation of the perpendicular bisector of AB.

Midpoint of AB = $(\frac{(-5) + (-1)}{2}, \frac{4 + 6}{2}) = (-3, 5)$

Gradient of AB = $\frac{2}{4} = \frac{1}{2}$

Perpendicular gradient = $-1 \div \frac{1}{2} = -2$

$y = -2x + c$ through $(-3, 5)$: $5 = -2 \times (-3) + c$, so $c = -1$

$y = -2x - 1$

Answer: $y = -2x - 1$

8 Box plots

The box plot shows the masses, in kg, of the parcels in delivery A.

(a) Write down the median and the interquartile range.

For delivery B the median is 70 and the interquartile range is 45.

(b) Compare the distributions of the two deliveries.

(a) Median = 55

Interquartile range = $80 - 40 = 40$

(b) The median for Delivery B is higher (70 compared with 55), so it has the higher values on average

The IQR for Delivery A is smaller (40 compared with 45), so its values are more consistent

Answer: (a) Median 55, IQR 40 (b) Delivery B has the higher median; Delivery A has the smaller IQR so is more consistent

9 Bearings with the cosine rule

Boat P sails 21 miles from a harbour on a bearing of 145°.

Boat Q sails 23 miles from the same harbour on a bearing of 200°. (Calculator)

Work out the distance between the two boats.

Give your answer to 3 significant figures.

The angle between the two paths = $|145° - 200°| = 55°$

$d^2 = 21^2 + 23^2 - 2 \times 21 \times 23 \times \cos 55°$

$d^2 = 415.93$

$d = 20.4$

Answer: 20.4 miles

Day 74 **A Tier 10-a-day: Model Solutions**

10 Changing a ratio

A bag contains red counters and blue counters in the ratio 5 : 6.
6 more blue counters are added to the bag.
The ratio of red counters to blue counters is now 2 : 3.
How many counters were in the bag at the start?

Let red = 5x and blue = 6x. After adding: 5x : (6x + 6) = 2 : 3

$\frac{5x}{6x + 6} = \frac{2}{3}$, so $3 \times 5x = 2(6x + 6)$

15x = 12x + 12, so 3x = 12, x = 4

Start: 5x + 6x = 11 × 4 = 44 counters

Answer: 44