Day 153 **A Tier 10-a-day: Model Solutions**

1 Substitution

$s = ut + \frac{1}{2}at^2$

Work out the value of s when $u = -1$, $a = 4$ and $t = 5$

$s = (-1) \times 5 + \frac{1}{2} \times (4) \times 5^2$

$= -5 + (50)$

$= 45$

Answer: 45

2 Loci and constructions

Angle MNC is drawn on a piece of paper.
A point P moves so that it is always the same distance from line NM and line NC.
Describe the locus of P.

Points the same distance from two intersecting lines lie on the angle bisector
The line through N that cuts angle MNC in half
Answer: The bisector of angle MNC

3 Estimation

By rounding each number to 1 significant figure, estimate the value of

$\frac{59 + 9.9}{0.41}$

Round each number to 1 significant figure: 60, 10, 0.4

$\frac{60 + 10}{0.4} = 175$

Answer: 175

4 Factorising

Factorise $4x^2 + 4x - 3$

Multiply $4 \times -3 = -12$. Find two numbers that multiply to -12 and add to 4: -2 and 6

$4x^2 + 4x - 3 = 4x^2 - 2x + 6x - 3$

Factorise in pairs to get $(2x + 3)(2x - 1)$

Answer: $(2x + 3)(2x - 1)$

5 Volume of a pyramid

The diagram shows a pyramid with a square base of side 4 cm.
The volume of the pyramid is 16 cm^3.
Work out the perpendicular height, h, of the pyramid.
The diagram is not drawn accurately.

$\frac{1}{3} \times 4 \times 4 \times h = 16$

$\frac{16}{3} h = 16$

$h = 16 \div \frac{16}{3} = 3$

Answer: h = 3

6 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 80 and the interquartile range is 20.
(b) Compare the distributions of the two deliveries.

(a) Median = 70
Interquartile range = $80 - 55 = 25$
(b) The median for Delivery B is higher (80 compared with 70), so it has the higher values on average
The IQR for Delivery B is smaller (20 compared with 25), so its values are more consistent
Answer: (a) Median 70, IQR 25 (b) Delivery B has the higher median; Delivery B has the smaller IQR so is more consistent

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7 Bounds in measurement

A circle has a radius of 5 cm, correct to the nearest cm. (Calculator)
Work out the lower bound for the area of the circle.
Give your answer to 3 significant figures.

Lower bound of radius = 4.5 cm

Area = $\pi \times 4.5^2 = 63.6$

Answer: 63.6 cm^2

8 Mixing in a ratio

Jug A contains 12 litres of a mixture of orange juice and lemonade in the ratio 1 : 5.
Jug B contains 42 litres of a mixture of orange juice and lemonade in the ratio 4 : 3.
The contents of both jugs are mixed together.
Work out the ratio of orange juice to lemonade in the mixture. Give your answer in its simplest form.

Jug A: orange juice = $1 \times 12 \div 6 = 2$ litres, lemonade = 10 litres
Jug B: orange juice = 24 litres, lemonade = 18 litres
Total: orange juice = 26 litres, lemonade = 28 litres
Ratio = 26 : 28 = 13 : 14

Answer: 13 : 14

9 Exchange rates

£1 = $1.4.
(a) Change £380 to dollars.
(b) Change $364 to pounds.

(a) $380 \times 1.4 = 532$
(b) $364 \div 1.4 = 260$

Answer: (a) $532 (b) £260

10 Square and cube numbers

n is the smallest positive integer such that 160 × n is a square number.
Find the value of n.

Write 160 as a product of prime factors: $160 = 2^5 \times 5$
For a square number every prime must have a power that is a multiple of 2.
Extra primes needed: 2 (needs 1 more), 5 (needs 1 more)
n = 10

Answer: n = 10