Day 34 **A Tier 10-a-day: Model Solutions**

1 Median and interquartile range

Here are the masses, in kg, of 7 parcels.
38 11 45 60 22 28 78
(a) Work out the median.
(b) Work out the interquartile range.

Put in order: 11, 22, 28, 38, 45, 60, 78
(a) The middle value is number 4, so the median is 38
(b) Lower half: 11, 22, 28, so LQ = 22
Upper half: 45, 60, 78, so UQ = 60
IQR = 60 − 22 = 38
Answer: (a) 38 (b) 38

2 Substitution

$E = \frac{1}{2}mv^2$

Work out the value of E when m = 4 and v = −5

$E = \frac{1}{2} \times 4 \times (-5)^2$
$= 2 \times 25$
$= 50$
Answer: 50

3 Tree diagrams

The tree diagram shows probabilities for two events.
(a) Work out the values of a and b.
(b) Work out the probability that a part is rejected at the final check.

(a) Probabilities on pairs of branches add up to 1.
a = 1 − 0.7 = 0.3 and b = 1 − 0.2 = 0.8
(b) P(rejected) = 0.2 × 0.7 + 0.8 × 0.2
= 0.14 + 0.16 = 0.3
Answer: (a) a = 0.3, b = 0.8 (b) 0.3

4 Congruent triangles

Triangle DEF: angle E = 90°, DF = 12 cm, DE = 5 cm.
Triangle JKL: angle L = 90°, JK = 12 cm, JL = 5 cm.
Are the two triangles congruent?
Give a reason for your answer.

Both triangles have a right angle
DF and JK are the hypotenuses: both 12 cm
DE = JL = 5 cm
Right angle, hypotenuse and one other side are equal, so the triangles are congruent (RHS)
Answer: Yes, congruent (RHS)

5 Counting

A cafe menu has 2 starters, 6 main courses and 4 desserts.
(a) How many different three-course meals are possible?
(b) A customer chooses a main course and either a starter or a dessert (not both). How many different meals are possible?

(a) 2 × 6 × 4 = 48
(b) 6 choices of main course × (2 + 4) choices of starter or dessert = 6 × 6 = 36
Answer: (a) 48 (b) 36

Day 34 **A Tier 10-a-day: Model Solutions**

6 Similar shapes: area and volume

Two similar model boats have heights 4 cm and 6 cm.
The smaller one has a volume of 40 cm^3.
Work out the volume of the larger one.

Length scale factor = $6 \div 4 = \frac{3}{2}$

Volume scale factor = $(\frac{3}{2})^3 = \frac{27}{8}$

Volume = $40 \times \frac{27}{8} = 135$

Answer: 135 cm^3

7 Difference of two squares

(a) Factorise $4y^2 - 9z^2$
(b) Use the same idea to work out $69^2 - 31^2$ without a calculator.

(a) $4y^2 - 9z^2 = (2y)^2 - (3z)^2$
$(2y - 3z)(2y + 3z)$
(b) $a^2 - b^2 = (a + b)(a - b)$, so $69^2 - 31^2 = (69 + 31)(69 - 31)$
$= 100 \times 38 = 3800$
Answer: (a) $(2y - 3z)(2y + 3z)$ (b) 3800

8 Wages and overtime

Nadia is paid £12.40 per hour for a basic week of 36 hours. (Calculator)
Overtime is paid at time and a half.
Last week Nadia worked 7 hours of overtime.
Work out Nadia's total pay for the week.

Basic pay = $36 \times$ £12.40 = £446.40
Overtime rate = £12.40 × 1.5 = £18.60 per hour
Overtime pay = $7 \times$ £18.60 = £130.20
Total = £446.40 + £130.20 = £576.60
Answer: £576.60

9 Bounds and accuracy

A cyclist travels 630 metres in 6.2 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 = $635 \div 6.15 = 103.2520$
Lower bound = $625 \div 6.25 = 100.0000$
(b) Both bounds round to 100 to 2 s.f. but not to the same value to 3 s.f.
So the speed is 100 m/s to 2 significant figures.
Answer: (a) 103.2520, 100.0000 (b) 100 m/s (2 s.f.)

10 Loci: area of a region

A horse is tied by a rope of length 10 m to the corner of a rectangular shed.
The shed measures 14 m by 13 m.
The horse can graze on any grass it can reach outside the shed.
Work out the area it can graze. Give your answer in terms of π.
The diagram is not drawn accurately.

The rope can sweep a sector of angle $360° - 90° = 270°$

Area = $\frac{270}{360} \times \pi \times 10^2$

$= \frac{3}{4} \times 100\pi$

$= 75\pi$

Answer: 75π m^2