Day 141 **A Tier 10-a-day: Model Solutions**

1 Stem and leaf diagrams

The stem and leaf diagram shows the ages of 15 people.
Key: 3 | 3 represents 33 years
(a) Work out the median age.
(b) Work out the interquartile range.

(a) 15 values, so the median is the 8th value
Counting along the leaves gives 47
(b) LQ is the middle of the lower 7 values = 38
UQ is the middle of the upper 7 values = 56
IQR = 56 − 38 = 18
Answer: (a) 47 years (b) 18 years

2 Loci and constructions

PQ is a straight line.
A point T moves so that it is always 5 cm from the line PQ, on one side of it.
Describe the locus of T.

Points a fixed distance from a straight line, on one side, form a parallel line
It is parallel to PQ and 5 cm from it
Answer: A straight line parallel to PQ, 5 cm away from it

3 Wages and overtime

Chloe is paid £15.60 per hour for a basic week of 38 hours. (Calculator)
Overtime is paid at double time.
Last week Chloe worked 7 hours of overtime.
Work out Chloe's total pay for the week.

Basic pay = 38 × £15.60 = £592.80
Overtime rate = £15.60 × 2 = £31.20 per hour
Overtime pay = 7 × £31.20 = £218.40
Total = £592.80 + £218.40 = £811.20
Answer: £811.20

4 Rearranging formulae (powers and roots)

Make l the subject of $T = 2\pi\sqrt{\frac{l}{g}}$

Divide by 2π: $\frac{T}{2\pi} = \sqrt{\frac{l}{g}}$

Square both sides: $\frac{T^2}{4\pi^2} = \frac{l}{g}$

Multiply both sides by g

Answer: $\mathbf{l = \frac{gT^2}{4\pi^2}}$

5 Volume of a pyramid

The diagram shows a pyramid with a square base of side 6 cm.
The volume of the pyramid is 72 cm^3.
Work out the perpendicular height, h, of the pyramid.
The diagram is not drawn accurately.

$\frac{1}{3} \times 6 \times 6 \times h = 72$
$12\ h = 72$
$h = 72 \div 12 = 6$
Answer: h = 6

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6 Probability without replacement

A bag contains 3 red, 3 blue and 2 green counters.
Two counters are taken at random without replacement.
Work out the probability that the two counters are the same colour.

P(red, red) = $\frac{3}{8} \times \frac{2}{7} = \frac{6}{56}$

P(blue, blue) = $\frac{3}{8} \times \frac{2}{7} = \frac{6}{56}$

P(green, green) = $\frac{2}{8} \times \frac{1}{7} = \frac{2}{56}$

Add: $\frac{6}{56} + \frac{6}{56} + \frac{2}{56} = \frac{1}{4}$

Answer: $\frac{1}{4}$

7 Surd fractions

Show that $\frac{\sqrt{72} - \sqrt{32}}{\sqrt{2}}$ is an integer, and find its value.

$\sqrt{72} = 6\sqrt{2}$ and $\sqrt{32} = 4\sqrt{2}$
Numerator = $6\sqrt{2} - 4\sqrt{2} = 2\sqrt{2}$
$\frac{2\sqrt{2}}{\sqrt{2}} = 2$
Answer: 2

8 Rearranging to solve quadratics

Solve $x^2 = -2x + 24$

Move everything to one side: $x^2 + 2x - 24 = 0$
Factorise: $(x + 6)(x - 4) = 0$
$x = -6$ or $x = 4$
Answer: x = −6 or x = 4

9 The cosine rule: finding a side

Work out the value of x. (Calculator)
Give your answer to 3 significant figures.
The diagram is not drawn accurately.

$x^2 = 12^2 + 17^2 - 2 \times 12 \times 17 \times \cos 120°$
$x^2 = 144 + 289 - 408 \cos 120°$
$x^2 = 637.00$
$x = 25.2$
Answer: x = 25.2 m

10 Finding a rate of compound change

Ben invests £3,000 in a savings account. (Calculator)
Compound interest is paid at a fixed rate each year.
After 3 years the investment is worth £5,184.
Work out the annual rate of interest.

Overall multiplier = £5,184 ÷ £3,000 = 1.728
Take the cube root: $\sqrt[3]{1.728} = 1.2$
Rate = $(1.2 - 1) \times 100 = 20\%$
Answer: 20%