Day 7 **A Tier 10-a-day: Model Solutions**

1 Substitution

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

Work out the value of s when u = 8, a = 6 and t = 6

$s = 8 \times 6 + \frac{1}{2} \times (6) \times 6^2$

$= 48 + (108)$

$= 156$

Answer: 156

2 Angles in parallel lines

The diagram shows two parallel lines crossed by a straight line.
(a) Work out the value of x.
(b) Work out the size of the angle marked (3x + 30)°.
The diagram is not drawn accurately.

(a) Corresponding angles are equal

$3x + 30 = 2x + 48$

$x = 18$

$x = 18$

(b) $3 \times 18 + 30 = 84$

Answer: (a) x = 18 (b) 84°

3 Stem and leaf diagrams

The stem and leaf diagram shows the ages of 11 people.
Key: 3 | 0 represents 30 years
(a) Work out the median age.
(b) Work out the interquartile range.

(a) 11 values, so the median is the 6th value
Counting along the leaves gives 44
(b) LQ is the middle of the lower 5 values = 33
UQ is the middle of the upper 5 values = 55
IQR = 55 − 33 = 22

Answer: (a) 44 years (b) 22 years

4 Converting units

(a) Change 9,000 cm^3 to litres.
(b) Change 3,500,000 cm^3 to m^3.

(a) 9,000 $cm^3 \div 1000 = 9$ litres
(b) 3,500,000 $cm^3 \div 1\,000\,000 = 3.5\ m^3$

Answer: (a) 9 litres (b) 3.5 m^3

5 Addition and multiplication rules

A spinner can land on red, blue or green.
P(red) = 0.25 and P(blue) = 0.45.
(a) Work out the probability that it lands on red or blue.
(b) Work out the probability that it lands on green.

(a) Mutually exclusive, so add: 0.25 + 0.45 = 0.7
(b) 1 − 0.7 = 0.3

Answer: (a) 0.7 (b) 0.3

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6 Expanding with surds

Expand and simplify $(1 - \sqrt{7})(2 + 2\sqrt{7})$

Expand: $2 + 2\sqrt{7} - 2\sqrt{7} - 14$
(using $\sqrt{7} \times \sqrt{7} = 7$)
Collect: -12
Answer: -12

7 Bounds in measurement

A rectangle measures 14 cm by 8 cm, each correct to the nearest cm. (Calculator)
Work out the upper bound for the length of a diagonal of the rectangle.
Give your answer to 3 significant figures.

Upper bounds of the sides are 14.5 cm and 8.5 cm
Diagonal = $\sqrt{14.5^2 + 8.5^2} = \sqrt{282.5}$
= 16.8
Answer: 16.8 cm

8 Forming quadratic equations

A rectangle has width x cm and length (x + 5) cm.
The area of the rectangle is 66 cm^2.
(a) Show that $x^2 + 5x - 66 = 0$
(b) Work out the value of x.

(a) Area = length × width, so $x(x + 5) = 66$
$x^2 + 5x = 66$
$x^2 + 5x - 66 = 0$
(b) Factorise: $(x - 6)(x + 11) = 0$
$x = 6$ or $x = -11$
A length cannot be negative, so $x = 6$
Answer: (a) Shown (b) x = 6

9 Inverse functions

$f(x) = \frac{x - 4}{6}$

(a) Find $f^{-1}(x)$
(b) Work out $f^{-1}(-2)$

Let $y = \frac{x - 4}{6}$
Multiply by 6: $6y = x - 4$, so $x = 6y + 4$
Swap y for x: $f^{-1}(x) = 6x + 4$
(b) $f^{-1}(-2) = -8$
Answer: (a) $f^{-1}(x) = 6x + 4$ (b) -8

10 Bounds and accuracy

A cyclist travels 190 metres in 17.2 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 = 195 ÷ 17.15 = 11.3703
Lower bound = 185 ÷ 17.25 = 10.7246
(b) Both bounds round to 11 to 2 s.f. but not to the same value to 3 s.f.
So the speed is 11 m/s to 2 significant figures.
Answer: (a) 11.3703, 10.7246 (b) 11 m/s (2 s.f.)