Day 275 **A Tier 10-a-day: Model Solutions**

1 Prime factors

Write 1100 as a product of prime factors, in index form.

Divide by prime numbers in turn: 1100 ÷ 2 = 550, 550 ÷ 2 = 275, 275 ÷ 5 = 55, 55 ÷ 5 = 11, 11 ÷ 11 = 1

1100 = 2 × 2 × 5 × 5 × 11

In index form: $1100 = 2^2 \times 5^2 \times 11$

Answer: $1100 = 2^2 \times 5^2 \times 11$

2 Expanding and simplifying

Expand and simplify

$(3x - 2)(x + 6) + (x + 1)^2$

$(3x - 2)(x + 6) = 3x^2 + 16x - 12$

$(x + 1)^2 = x^2 + 2x + 1$

Add and collect like terms: $4x^2 + 18x - 11$

Answer: $4x^2 + 18x - 11$

3 Stem and leaf diagrams

The stem and leaf diagram shows the ages of 11 people.

Key: 2 | 4 represents 24 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 46

(b) LQ is the middle of the lower 5 values = 38

UQ is the middle of the upper 5 values = 49

IQR = 49 − 38 = 11

Answer: (a) 46 years (b) 11 years

4 Dividing fractions in context

A roll of ribbon is $12\frac{1}{2}$ metres long. Pieces of $\frac{5}{6}$ metre are cut from it.

How many pieces can be cut?

Divide: $12\frac{1}{2} \div \frac{5}{6}$

As improper fractions and multiplying by the reciprocal: $\frac{25}{2} \times \frac{6}{5}$

= 15

Answer: 15

5 Growth and decay

A culture starts with 2500 bacteria. (Calculator)

The number of bacteria increases by 8% every hour.

Work out the number of bacteria after 2 hours.

Give your answer to the nearest whole number.

Multiplier = 100% + 8% = 1.08

$2500 \times 1.08^2 = 2916.00$

= 2916 to the nearest whole number

Answer: 2916

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6 Similar triangles with parallel lines

In triangle ABC, DE is parallel to BC.
D is on AB and E is on AC.
Work out the value of x.
The diagram is not drawn accurately.

Triangles ADE and ABC are similar (DE is parallel to BC)

Scale factor = AB ÷ AD = 13 ÷ 6 = $\frac{13}{6}$

x = 6 × $\frac{13}{6}$ = 13

Answer: x = 13

7 Simplifying algebraic fractions

Simplify fully

$$\frac{x^2 - 3x + 2}{x^2 - 1}$$

Factorise the top: (x − 1)(x − 2)
Factorise the bottom: (x − 1)(x + 1)
Cancel the common factor (x − 1)

Answer: $\frac{x - 2}{x + 1}$

8 Angles in regular polygons around a point

A regular pentagon and a regular dodecagon share the side AB and are on opposite sides of it.
The two shapes meet at the point A.
Work out the size of the angle at A that is not inside either shape.

Interior angle of the regular pentagon = 180 − 360 ÷ 5 = 108°
Interior angle of the regular dodecagon = 180 − 360 ÷ 12 = 150°
Angles round a point add up to 360°
360 − 108 − 150 = 102
Answer: 102°

9 Recurring decimals (mixed)

Write $0.2\dot{9}\dot{3}$ as a fraction in its simplest form.

Let x = 0.29393...
Multiply by 10: 10x = 2.9393...
Multiply by 1000: 1000x = 293.9393...
Subtract: 990x = 293 − 2 = 291
x = $\frac{291}{990}$ = $\frac{97}{330}$

Answer: $\frac{97}{330}$

10 Forming and solving equations

Priya is x years old.
Her aunt is 4 times as old as Priya, plus 5 years.
The sum of their ages is 80 years.
Work out how old her aunt is.

Let Priya's age be x, so her aunt's age is 4x + 5
x + (4x + 5) = 80
5x = 75
x = 15
Her aunt's age = 4 × 15 + 5 = 65
Answer: 65 years