Day 174 **A Tier 10-a-day: Model Solutions**

1 Reading a histogram

The histogram shows information about the age of some items.
(a) Work out the number of items with a age in the class 40 to 50 years.
(b) Work out an estimate for the number with a age greater than 45 years.

(a) Frequency = frequency density × class width
1.8 × 10 = 18
(b) 45 to 50: 1.8 × 5 = 9
Class 50 to 80: 2.8 × 30 = 84
Total = 9 + 84 = 93
Answer: (a) 18 (b) 93

2 Midpoints and length of a line segment

P is the point (−5, 3) and Q is the point (−11, 11).
(a) Find the midpoint of PQ.
(b) Work out the length of PQ. Give your answer as a whole number.

(a) Midpoint = $(\frac{-5 + (-11)}{2}, \frac{3 + 11}{2}) = (-8, 7)$

(b) Length = $\sqrt{(-6)^2 + (8)^2}$
= $\sqrt{100} = 10$
Answer: (a) (−8, 7) (b) 10

3 Powers and roots in standard form

Work out $(2.5 \times 10^6)^3$
Give your answer in standard form.

$(2.5 \times 10^6)^3 = 2.5^3 \times (10^6)^3$
$= 15.625 \times 10^{18}$
$= 1.5625 \times 10^{19}$
Answer: 1.5625×10^{19}

4 Trigonometry: finding a side

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

x is the opposite and 21 m is the adjacent, so use tan

$\tan 63° = \frac{x}{21}$
$x = 21 \times \tan 63°$
$x = 41.2$
Answer: x = 41.2 m

5 Simplifying algebraic fractions

Simplify fully

$$\frac{4x^2 + 15x - 25}{x^2 + 3x - 10}$$

Factorise the top: (4x − 5)(x + 5)
Factorise the bottom: (x − 2)(x + 5)
Cancel the common factor (x + 5)
Answer: $\frac{4x - 5}{x - 2}$

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6 Enlargements and coordinates

Triangle PQR has vertices P(−2, −2), Q(5, −2), R(1, −3).
The triangle is enlarged with scale factor 3 and centre (3, 2).
Write down the coordinates of the vertices of the image.

Each vertex moves to: centre + scale factor × (vertex − centre)
P: (−2, −2) → (−12, −10)
Q: (5, −2) → (9, −10)
R: (1, −3) → (−3, −13)
Answer: P'(−12, −10), Q'(9, −10), R'(−3, −13)

7 Index equations

Solve $3^{x+2} = 9^x$

$9 = 3^2$, so $9^x = (3^2)^x = 3^{2x}$
$x + 2 = 2x$
$2 = 2x - x$
$x = 2$
Answer: x = 2

8 Simple and compound interest

Noah and Femi each invest £1000 for 2 years. (Calculator)
Noah's account pays 5% simple interest per year.
Femi's account pays 5% compound interest per year.
Work out how much more interest Femi earns than Noah.

Simple interest = £1000 × 5% × 2 = £100
Compound: £1000 × 1.05^2 = £1102.50, so interest = £102.50
Difference = 102.50 − 100 = £2.50 (to the nearest penny)
Answer: £2.50

9 Recurring decimals to fractions

Write the recurring decimal $0.\dot{6}4\dot{6}$ as a fraction in its simplest form.

Let x = 0.646646646...
Multiply by 1000: 1000x = 646.646646...
Subtract: 999x = 646
$x = \frac{646}{999}$
Answer: $\frac{646}{999}$

10 Equations with algebraic fractions

Solve $\frac{5}{(x-4)} + \frac{6}{(x+4)} = 1$

Multiply every term by (x − 4)(x + 4)
$5(x + 4) + 6(x - 4) = (x - 4)(x + 4)$
$11x - 4 = x^2 - 16$
$x^2 - 11x - 12 = 0$
$(x + 1)(x - 12) = 0$
$x = -1$ or $x = 12$
Answer: x = −1 or x = 12