Day 300 **A Tier 10-a-day: Model Solutions**

1 Area of a trapezium

The area of this trapezium is 81 cm^2.
Work out the value of x.
The diagram is not drawn accurately.

$\frac{1}{2} \times (x + 11) \times 9 = 81$

$(x + 11) \times 9 = 162$
$x + 11 = 162 \div 9 = 18$
$x = 7$
Answer: x = 7

2 Finding a percentage change

The number of visitors to a museum was 220 and is now 352.
Work out the percentage increase.

Change = 352 − 220 = 132

Percentage increase = $\frac{132}{220} \times 100 = 60\%$

Answer: 60% increase

3 Isosceles triangles and exterior angles

ABC is an isosceles triangle with AB = AC.
BCD is a straight line.
Angle BAC = 92°.
Work out the size of angle x.
The diagram is not drawn accurately.

Base angles of an isosceles triangle are equal
Angle ABC = (180 − 92) ÷ 2 = 44°
Exterior angle of a triangle = sum of the two opposite interior angles
x = 92 + 44 = 136
Answer: x = 136°

4 Functions

f(x) = 3x − 3
$g(x) = x^2 - 9$
Find fg(5)

$g(5) = 5^2 - 9 = 16$
f(16) = 3 × 16 − 3 = 45
Answer: 45

5 Combining ratios

p : q = 2 : 5
q : r = 7 : 2
(a) Work out the ratio p : q : r
(b) p, q and r add up to 472. Work out the value of r.

(a) Make the q parts equal: lowest common multiple of 5 and 7 is 35
p : q = 14 : 35 and q : r = 35 : 10
p : q : r = 14 : 35 : 10
(b) 14 + 35 + 10 = 59 parts, so 1 part = 472 ÷ 59 = 8
r = 10 × 8 = 80
Answer: (a) 14 : 35 : 10 (b) 80

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6 The quadratic formula

Solve $5x^2 + 7x - 3 = 0$
Give your solutions correct to 2 decimal places. (Calculator)

Use $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ with $a = 5$, $b = 7$, $c = -3$

$x = \frac{-7 \pm \sqrt{7^2 - 4 \times 5 \times (-3)}}{10}$

$x = \frac{-7 \pm \sqrt{109}}{10}$

$x = 0.34$ or $x = -1.74$

Answer: $x = 0.34$ or $x = -1.74$

7 Is it a right-angled triangle?

A triangle has sides of length 7 cm, 24 cm and 26 cm.
Is the triangle right-angled?
You must show your working.

Longest side$^2 = 26^2 = 676$

Sum of the squares of the other two sides $= 7^2 + 24^2 = 49 + 576 = 625$
$676 \neq 625$, so the triangle is not right-angled

Answer: No, it is not right-angled

8 Cumulative frequency graphs

The cumulative frequency graph shows information about the age of 60 visitors.
Use the graph to find an estimate for
(a) the median,
(b) the number of visitors with a age greater than 50 years.

(a) Median at cumulative frequency $60 \div 2 = 30$
Read across from 30 to the graph, then down to the axis
Median = 38 years
(b) At 50 years the cumulative frequency is 58
$60 - 58 = 2$

Answer: (a) 38 years (b) 2

9 Simplifying algebraic fractions

Simplify fully

$$\frac{4x^2 + 21x - 18}{2x^2 + 13x + 6}$$

Factorise the top: $(4x - 3)(x + 6)$
Factorise the bottom: $(2x + 1)(x + 6)$
Cancel the common factor $(x + 6)$

Answer: $\frac{4x - 3}{2x + 1}$

10 Bounds and accuracy

A cyclist travels 400 metres in 14.3 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 $= 405 \div 14.25 = 28.4211$
Lower bound $= 395 \div 14.35 = 27.5261$
(b) Both bounds round to 28 to 2 s.f. but not to the same value to 3 s.f.
So the speed is 28 m/s to 2 significant figures.

Answer: (a) 28.4211, 27.5261 (b) 28 m/s (2 s.f.)