Day 96 **B Tier 10-a-day: Model Solutions**

1 Prime factors

Write 132 as a product of its prime factors.
Give your answer in index form.

Divide by prime numbers, smallest first:
132 ÷ 2 = 66, 66 ÷ 2 = 33, 33 ÷ 3 = 11, 11 is prime
132 = 2 × 2 × 3 × 11
In index form: 132 = 2^2 × 3 × 11
Answer: 2^2 × 3 × 11

2 Distance-time graphs

The graph shows Jack's journey.
(a) For how many minutes did Jack stop?
(b) Work out Jack's speed in the first 60 minutes. Give your answer in km/h.

(a) The horizontal section runs from 60 to 75 minutes: 15 minutes
(b) 24 km in 60 minutes = 1 hours
Speed = 24 ÷ 1 = 24 km/h
Answer: (a) 15 minutes (b) 24 km/h

3 Angles in triangles

The angles in a triangle are x°, 2x° and (x + 20)°.
(a) Work out the value of x.
(b) Work out the size of the largest angle.

(a) x + 2x + x + 20 = 180
4x + 20 = 180
4x = 160, so x = 40
(b) The angles are 40°, 80° and 60°
Answer: (a) x = 40 (b) 80°

4 Equations with brackets

Solve 4(2x + 5) = 52

Divide both sides by 4: 2x + 5 = 13
Subtract 5 from both sides: 2x = 8
Divide both sides by 2
Answer: x = 4

5 Trigonometry in isosceles triangles

Triangle XYZ is isosceles with XY = XZ = 9 cm. (Calculator)
The base YZ = 8 cm.
Work out the size of angle XYZ.
Give your answer correct to 1 decimal place.

Split the triangle into two right-angled triangles. Half the base = 8 ÷ 2 = 4

$\cos Y = \frac{4}{9}$

Angle XYZ = $\cos^{-1}(\frac{4}{9})$ = 63.612...

= 63.6° (1 d.p.)
Answer: 63.6°

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6 Negative and zero indices

Work out

(a) 2^{-1}

(b) $11^0 + \sqrt{25}$

(a) A negative power means the reciprocal: $2^{-1} = \frac{1}{2^1} = \frac{1}{2}$

(b) Anything to the power 0 is 1, so $11^0 = 1$

$\sqrt{25} = 5$, so $1 + 5 = 6$

Answer: (a) $\frac{1}{2}$ (b) 6

7 Isosceles triangles and Pythagoras

Triangle XYZ is isosceles with XY = XZ = 10 cm.
The base YZ = 16 cm.
(a) Work out the perpendicular height of the triangle.
(b) Work out the area of the triangle.

(a) The height splits the base in half: $16 \div 2 = 8$

$h^2 = 10^2 - 8^2 = 100 - 64 = 36$, so $h = 6$

(b) Area = ½ × 16 × 6 = 48

Answer: (a) 6 cm (b) 48 cm^2

8 Simultaneous equations

Solve the simultaneous equations

$2x - 4y = 24$

$2x + 2y = 6$

Multiply the second equation by 2: $4x + 4y = 12$

The y terms have opposite signs, so add the equations: $6x = 36$

$x = 6$

Substitute x = 6 into the first equation: $-4y = 24 - 12 = 12$

$y = -3$

Answer: x = 6, y = −3

9 Reverse repeated percentages

In a sale, the price of a sofa is reduced by 10%. (Calculator)
Two weeks later it is reduced by a further 10% of the new price.
The final price is £121.50.
Work out the original price of the sofa.

Multipliers: 0.9 and 0.9

Overall multiplier = 0.9 × 0.9 = 0.81

Original price = £121.50 ÷ 0.81 = £150

Answer: £150

10 Ratio and changes

In a room, the ratio of boys to girls is 5 : 8.
There are 64 girls.
More boys join so that there are equal numbers of boys and girls.
How many boys join?

8 parts = 64, so 1 part = 8

Originally there are 5 × 8 = 40 boys

To equal 64, add 64 − 40 = 24

Answer: 24