Day 309 **B Tier 10-a-day: Model Solutions**

1 Angles on a line and round a point

The diagram shows 4 angles round a point.
Work out the value of c.
The diagram is not drawn accurately.

Angles round a point add up to 360°
(c + 70) + (3c + 90) + (3c + 10) + (3c + 10) = 360
10c + 180 = 360
10c = 180
c = 180 ÷ 10 = 18
Answer: c = 18°

2 Density

A piece of wood has a density of 0.6 g/cm^3 and a volume of 30 cm^3.
Work out its mass.

Mass = density × volume
0.6 × 30 = 18
Answer: 18 g

3 Substitution with negative numbers

Work out the value of 6a + 3b
when a = −3 and b = 4

Substitute: 6 × (−3) + 3 × 4
−18 + 12 = −6
Answer: −6

4 Trigonometry: finding a side

Calculate the length of q. (Calculator)
Give your answer correct to 1 decimal place.
The diagram is not drawn accurately.

Label the sides: q is the opposite and 23 cm is the hypotenuse
We use sin (opposite and hypotenuse)

$\sin 62° = \frac{q}{23}$

q = 23 × sin 62° = 20.308...
q = 20.3 cm (1 d.p.)
Answer: q = 20.3 cm

5 Laws of indices

Write each answer as a single power of 2.
(a) $(2^2)^4$
(b) $2^5 \times 2^4 \div 2^2$

(a) Multiply the powers: 2 × 4 = 8
(b) Add then subtract: 5 + 4 − 2 = 7
Answer: (a) 2^8 (b) 2^7

6 Combining ratios

In a bag of counters, the ratio of blue to red is 1 : 4.
The ratio of red to black is 3 : 4.
Write down the ratio blue : red : black.

Make the red part the same in both ratios: lowest common multiple of 4 and 3 is 12
blue : red = 3 : 12
red : black = 12 : 16
blue : red : black = 3 : 12 : 16
Answer: 3 : 12 : 16

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7 Pythagoras' theorem

Find the length of t. (Calculator)
Give your answer correct to 1 decimal place.
The diagram is not drawn accurately.

Use Pythagoras: $a^2 + b^2 = c^2$, where c is the longest side
$t^2 + 3^2 = 25^2$
$t^2 = 625 - 9 = 616$
$t = \sqrt{616} = 24.819...$
t = 24.8 cm (1 d.p.)
Answer: t = 24.8 cm

8 Standard form calculations

Work out $(1.7 \times 10^6) + (1.3 \times 10^6)$
Give your answer in standard form.

The powers of 10 are the same, so add the numbers: 1.7 + 1.3 = 3
3×10^6
Answer: 3×10^6

9 Iteration

Here is an iteration formula.
$x_{n+1} = \sqrt{2x_n + 14}$
$x_0 = 1$
(a) Work out x_1
(b) Work out x_2. Give your answer correct to 3 decimal places. (Calculator)

(a) $x_1 = \sqrt{2 \times 1 + 14} = \sqrt{16} = 4$
(b) $x_2 = \sqrt{2 \times 4 + 14} = \sqrt{22} = 4.69042...$
= 4.690
Answer: (a) 4 (b) 4.690

10 Prime factors

Write 825 as a product of its prime factors.
Give your answer in index form.

Divide by prime numbers, smallest first:
825 ÷ 3 = 275, 275 ÷ 5 = 55, 55 ÷ 5 = 11, 11 is prime
$825 = 3 \times 5 \times 5 \times 11$
In index form: $825 = 3 \times 5^2 \times 11$
Answer: $3 \times 5^2 \times 11$