Day 360 **A Tier 10-a-day: Model Solutions**

1 Is it a right-angled triangle?

A triangle has sides of length 21 cm, 28 cm and 20 cm.
Is the triangle right-angled?
You must show your working.

Longest side^2 = 28^2 = 784

Sum of the squares of the other two sides = $20^2 + 21^2$ = 400 + 441 = 841

784 ≠ 841, so the triangle is not right-angled

Answer: No, it is not right-angled

2 Time

(a) A film starts at 6:20 pm. The film lasts 1 hours 48 minutes. Work out the time it ends.
(b) Change 3.7 hours into hours and minutes.

(a) 6:20 pm + 1 hours = 7:20 pm, then + 48 minutes = 8:08 pm

(b) 0.7 hours = 0.7 × 60 = 42 minutes, so 3.7 hours = 3 hours 42 minutes

Answer: (a) 8:08 pm (b) 3 hours 42 minutes

3 Angles in parallel lines

The diagram shows two parallel lines crossed by a straight line.
(a) Work out the value of x.
(b) Work out the size of the angle marked (2x + 20)°.
The diagram is not drawn accurately.

(a) Alternate angles are equal

2x + 20 = 3x + 7

x = 13

x = 13

(b) 2 × 13 + 20 = 46

Answer: (a) x = 13 (b) 46°

4 Equation of a line from a graph

Work out the equation of the straight line.
Give your answer in the form y = mx + c

The line crosses the y-axis at (0, 2), so c = 2

Gradient = $\frac{\text{change in y}}{\text{change in x}}$: from (0, 2) to (−4, 4), y changes by 2 and x changes by −4

m = $-\frac{1}{2}$

y = $-\frac{1}{2}$x + 2

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

5 Compound interest

Jack invests £2500 in a savings account. (Calculator)
The account pays 2% compound interest per year.
Work out the amount in the account after 4 years.

Multiplier = 100% + 2% = 1.02

£2500 × 1.02^4 = £2706.080

= £2706.08 to the nearest penny

Answer: £2706.08

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6 Bounds

A plank is 18.4 m long and a pipe is 11.7 m long.
Each length is correct to the nearest 0.1 m.
Work out the upper bound for the difference in their lengths.

To make the difference as large as possible, use the upper bound of the plank and the lower bound of the pipe.
18.45 − 11.65 = 6.8 m
Answer: 6.8 m

7 Area of shaded regions with circles

4 identical circles of radius 2 cm fit exactly inside a rectangle.
The circles touch each other and the sides of the rectangle. (Calculator)
Work out the area of the shaded region.
Give your answer to 3 significant figures.

Rectangle: $16 \times 4 = 64$ cm^2
4 circles: $4 \times \pi \times 2^2 = 16\pi$
Shaded area = $64 - 16\pi = 13.7$
Answer: 13.7 cm^2

8 Square and cube numbers

n is the smallest positive integer such that 400 × n is a cube number.
Find the value of n.

Write 400 as a product of prime factors: $400 = 2^4 \times 5^2$
For a cube number every prime must have a power that is a multiple of 3.
Extra primes needed: 2 (needs 2 more), 5 (needs 1 more)
n = 20
Answer: n = 20

9 Algebraic proof

Prove that the sum of two consecutive multiples of 3 is always an odd multiple of 3.

Let the multiples be 3n and 3(n + 1)
Sum = 3n + 3n + 3 = 6n + 3
= 3(2n + 1)
2n + 1 is odd, so the sum is an odd multiple of 3
Answer: Proved

10 Distance-time graphs

A van driver makes a journey. The distance-time graph shows the journey.
(a) For how many minutes did the van driver stop?
(b) Work out the speed during the first part of the journey. Give your answer in km/h.

(a) The graph is horizontal from 40 to 55 minutes, so the stop is 55 − 40 = 15 minutes
(b) First part: distance 24 km in 40 minutes

Speed = distance ÷ time = $24 \div \frac{40}{60} = 36$ km/h

Answer: (a) 15 minutes (b) 36 km/h