Day 82 **A Tier 10-a-day: Model Solutions**

1 The cosine rule: finding a side

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

$x^2 = 17^2 + 16^2 - 2 \times 17 \times 16 \times \cos 83°$

$x^2 = 289 + 256 - 544 \cos 83°$

$x^2 = 478.70$

$x = 21.9$

Answer: x = 21.9 cm

2 Addition and multiplication rules

For two events A and B:
P(A) = 0.75, P(B) = 0.4 and P(A or B) = 0.8.
(a) Work out P(A and B).
(b) Work out the probability that neither A nor B happens.

(a) P(A and B) = P(A) + P(B) − P(A or B) = 0.75 + 0.4 − 0.8 = 0.35
(b) 1 − P(A or B) = 1 − 0.8 = 0.2
Answer: (a) 0.35 (b) 0.2

3 Substitution

$s = ut + \frac{1}{2}at^2$

Work out the value of s when u = 8, a = 8 and t = 3

$s = 8 \times 3 + \frac{1}{2} \times (8) \times 3^2$

$= 24 + (36)$

$= 60$

Answer: 60

4 Is it a right-angled triangle?

A triangle has sides of length 28 cm, 20 cm and 21 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 = $20^2 + 21^2 = 400 + 441 = 841$

$784 \neq 841$, so the triangle is not right-angled

Answer: No, it is not right-angled

5 LCM in context

Bus A leaves a bus station every 16 minutes.
Bus B leaves the same station every 14 minutes.
Both buses leave together at 7:10 am.
At what time will they next leave together?

We need the LCM of 16 and 14.
Multiples of 16: 16, 32, 48, 64, 80, 96, 112
Multiples of 14: 14, 28, 42, 56, 70, 84, 98, 112
LCM = 112, so they leave together again 112 minutes later, at 9:02 am
Answer: 9:02 am

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6 Double inequalities

(a) Solve $-11 < 5x - 1 \leq 14$
(b) Write down all the integer values of x that satisfy this inequality.

(a) Add 1 to every part: $-10 < 5x \leq 15$
Divide every part by 5: $-2 < x \leq 3$
(b) The integers are $-1, 0, 1, 2, 3$
Answer: (a) $-2 < x \leq 3$ (b) $-1, 0, 1, 2, 3$

7 Error intervals

m = 400 is rounded to 1 significant figure.
Write down the error interval for m.

The rounding unit is 100, so the value could be up to half of this, 50, either side.
Lower bound = 400 − 50 = 350, upper bound = 400 + 50 = 450
Answer: $350 \leq m < 450$

8 Angles in regular polygons around a point

A regular pentagon and a regular decagon share the side AB and are on opposite sides of it.
The two shapes meet at the point A.
Work out the size of the angle at A that is not inside either shape.

Interior angle of the regular pentagon = 180 − 360 ÷ 5 = 108°
Interior angle of the regular decagon = 180 − 360 ÷ 10 = 144°
Angles round a point add up to 360°
360 − 108 − 144 = 108
Answer: 108°

9 Inverse proportion formulae

y is inversely proportional to x.
When x = 2, y = 8.
(a) Find a formula for y in terms of x.
(b) Work out the value of y when x = 25.

(a) $y = \frac{k}{x}$. Substitute: $8 = \frac{k}{2}$, so $k = 8 \times 2 = 16$

$y = \frac{16}{x}$

(b) $y = \frac{16}{25} = 0.64$

Answer: (a) $y = \frac{16}{x}$ (b) 0.64

10 Finding a rate of compound change

Hassan invests £4,000 in a savings account. (Calculator)
Compound interest is paid at a fixed rate each year.
After 3 years the investment is worth £6,912.
Work out the annual rate of interest.

Overall multiplier = £6,912 ÷ £4,000 = 1.728
Take the cube root: $\sqrt[3]{1.728} = 1.2$
Rate = (1.2 − 1) × 100 = 20%
Answer: 20%