Day 336 **A Tier 10-a-day: Model Solutions**

1 Area of a segment

The diagram shows a circle with centre O and radius 5 cm.
Angle AOB = 90°. (Calculator)
Work out the area of the shaded segment.
Give your answer to 3 significant figures.

Area of sector = $\frac{90}{360} \times \pi \times 5^2 = 19.635$

Area of triangle OAB = $\frac{1}{2} \times 5 \times 5 \times \sin 90° = 12.500$

Segment = 19.635 − 12.500 = 7.13

Answer: 7.13 cm^2

2 Rearranging formulae

Make r the subject of $k = \frac{r + 5}{4}$

Multiply both sides by 4: 4k = r + 5
Subtract 5 from both sides
r = 4k − 5
Answer: r = 4k − 5

3 LCM in context

On a stage, a lighthouse flashes every 14 seconds.
A blue beacon flashes every 10 seconds.
They flash together at the start.
After how many seconds will they next flash together?

Find the LCM of 14 and 10.
14 = 2 × 7 and 10 = 2 × 5
LCM = 70
They flash together again after 70 seconds.
Answer: 70 seconds

4 Direct and inverse proportion

y is directly proportional to the cube of x.
When x = 2, y = 32.
(a) Find a formula for y in terms of x.
(b) Work out the value of y when x = 7.

(a) $y = kx^3$. Substitute x = 2 and y = 32: 32 = k × 8, so k = 4
$y = 4x^3$

(b) $y = 4 \times 7^3 = 4 \times 343 = 1372$

Answer: (a) $y = 4x^3$ (b) 1372

5 Profit and loss

Isla buys a sofa for £200 and sells it making a profit of 25%.
Work out the selling price.

Selling price = 125% of the cost price
£200 × 1.25 = £250
Answer: £250

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6 Functions

f(x) = 5x + 6
g(x) = x^2 + 2
(a) Find g(1)
(b) Find gf(x). Expand and simplify your answer.

(a) g(1) = 1^2 + 2 = 3
(b) gf(x) means g(f(x)), so replace x in g with 5x + 6
gf(x) = $(5x + 6)^2$ + 2
= $25x^2$ + 60x + 38
Answer: (a) 3 (b) $25x^2$ + 60x + 38

7 Combined means

The mean age of 6 workers is 40 years.
One of them, aged 62, leaves.
Work out the mean age of the remaining workers.

Total age = 6 × 40 = 240
Total after one leaves = 240 − 62 = 178
Mean = 178 ÷ 5 = 35.6
Answer: 35.6 years

8 Reverse compound change

The value of a car falls by 20% each year. (Calculator)
After 3 years it is worth £19,200.
Work out its value at the start.

Yearly multiplier = 0.8
Overall multiplier = 0.8^3 = 0.512
Original value = £19,200 ÷ 0.512 = £37,500
Answer: £37,500

9 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.

$x^2 = 6^2 + 10^2 - 2 \times 6 \times 10 \times \cos 108°$
$x^2 = 36 + 100 - 120 \cos 108°$
$x^2 = 173.08$
x = 13.2
Answer: x = 13.2 cm

10 Combining ratios

p : q = 4 : 3
q : r = 6 : 7
(a) Work out the ratio p : q : r
(b) p, q and r add up to 126. Work out the value of r.

(a) Make the q parts equal: lowest common multiple of 3 and 6 is 6
p : q = 8 : 6 and q : r = 6 : 7
p : q : r = 8 : 6 : 7
(b) 8 + 6 + 7 = 21 parts, so 1 part = 126 ÷ 21 = 6
r = 7 × 6 = 42
Answer: (a) 8 : 6 : 7 (b) 42