Day 15 **B Tier 10-a-day: Model Solutions**

1 Expanding brackets

Expand
(a) 8(3x + 2)
(b) 2x(x + 6)

(a) 8 × 3x = 24x and 8 × 2 = 16
(b) 2x × x = $2x^2$ and 2x × 6 = 12x
Answer: (a) 24x + 16 (b) $2x^2$ + 12x

2 Unitary method

8 apples cost £2.
(a) Work out the cost of 6 apples.
(b) How many apples can be bought for £1.50?

(a) 1 apple costs £2 ÷ 8 = 25p
6 × 25p = £1.50
(b) £1.50 ÷ 25p = 6
Answer: (a) £1.50 (b) 6

3 HCF and LCM

Find the (a) highest common factor (HCF), (b) lowest common multiple (LCM) of 42 and 18.

42 = 2 × 3 × 7 and 18 = 2 × 3^2
(a) HCF: multiply the primes in both lists, using the smaller power: 2 × 3 = 6
(b) LCM: use the larger power of every prime: 2 × 3^2 × 7 = 126
Answer: (a) 6 (b) 126

4 Transformations of a point

(a) The point P(−3, −1) is rotated 180° about the origin. Write down the coordinates of the image.
(b) The point P(−3, −1) is reflected in the line y = −x. Write down the coordinates of the image.

(a) A half turn takes (x, y) to (−x, −y): (3, 1)
(b) Reflecting in y = −x swaps x and y and changes both signs: (1, 3)
Answer: (a) (3, 1) (b) (1, 3)

5 Repeated percentage change

The price of a laptop is £60.
The price is first reduced by 40%, then the new price is reduced by 20%.
(a) Work out the final price.
(b) Work out the overall percentage decrease in the price.

(a) Multipliers: 0.6 and 0.8
60 × 0.6 × 0.8 = £28.80
(b) Overall multiplier = 0.48
Overall decrease = 52%
Answer: (a) £28.80 (b) 52% decrease

6 Ratio and changes

In a room, the ratio of cats to dogs is 3 : 7.
There are 49 dogs.
More cats join so that there are equal numbers of cats and dogs.
How many cats join?

7 parts = 49, so 1 part = 7
Originally there are 3 × 7 = 21 cats
To equal 49, add 49 − 21 = 28
Answer: 28

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7 Area of shaded regions

The diagram shows a square of side 4 m with a circle of radius 2 m cut out. (Calculator)
The circle is in the centre of the square.
Work out the area of the shaded region.
Give your answer correct to 1 decimal place.
The diagram is not drawn accurately.

Area of square = $4 \times 4 = 16$

Area of circle = $\pi \times 2^2 = 4\pi$

Shaded area = $16 - 4\pi = 3.434... = 3.4$ m^2 (1 d.p.)

Answer: 3.4 m^2

8 Trial and improvement

The equation $x^3 - 2x = 24$ has a solution between 3 and 4. (Calculator)
Use trial and improvement to find this solution.
Give your answer correct to 1 decimal place.

$x = 3.5$: $3.5^3 - 2 \times 3.5 = 35.875$ (too big)

$x = 3.2$: $3.2^3 - 2 \times 3.2 = 26.368$ (too big)

$x = 3.1$: $3.1^3 - 2 \times 3.1 = 23.591$ (too small)

$x = 3.15$: value = 24.956 (too big), so the solution is below 3.15

So x = 3.1 to 1 decimal place

Answer: x = 3.1

9 Best buys

Shampoo is sold in two sizes.
Small: 200 ml for 46p
Large: 300 ml for 57p
Which size is better value for money?
You must show your working.

Compare the cost of 600 ml of each

Small: 3×46p = £1.38

Large: 2×57p = £1.14

The large is cheaper for the same amount

Answer: The large size

10 Trigonometry in isosceles triangles

Triangle PQR is isosceles with PQ = PR = 19 m. (Calculator)
The base QR = 30 m.
Work out the size of angle PQR.
Give your answer correct to 1 decimal place.

Split the triangle into two right-angled triangles. Half the base = $30 \div 2 = 15$

$\cos Q = \frac{15}{19}$

Angle PQR = $\cos^{-1}(\frac{15}{19}) = 37.864...$

= 37.9° (1 d.p.)

Answer: 37.9°