**Day 272** **B Tier 10-a-day: Model Solutions**

## 1 Order of operations

Work out

(a) $8^2 - (30 - 23) \times 3$

(b) $(9 + 11) \times 4 - 2$

(a) Brackets: $30 - 23 = 7$

Powers: $8^2 = 64$

Multiply: $7 \times 3 = 21$

Subtract: $64 - 21 = 43$

(b) Brackets first: $9 + 11 = 20$

Multiply: $20 \times 4 = 80$

Subtract: $80 - 2 = 78$

**Answer: (a) 43 (b) 78**

## 2 Counting outcomes

A club has 8 members.

They choose a head girl and a deputy head girl from the members.

The two jobs must be done by different people.

How many different ways can the jobs be given out?

8 choices for the head girl

7 choices left for the deputy head girl

$8 \times 7 = 56$

**Answer: 56**

## 3 Bearings

Q is north-east of P.

(a) Write down the bearing of Q from P.

(b) Work out the bearing of P from Q.

(a) Bearings are measured clockwise from north: north-east is 045°

(b) The bearing is less than 180°, so add 180°: $45 + 180 = 225$

**Answer: (a) 045° (b) 225°**

## 4 Substitution with negative numbers

Work out the value of $38 - x^2$ when $x = -3$

$x^2 = (-3)^2 = 9$

$38 - 9 = 29$

**Answer: 29**

## 5 Prisms and density

A block of ice is a cuboid measuring 5 cm by 6 cm by 2 cm.

The density of ice is 0.9 g/cm$^3$.

Work out the mass of the block.

Volume $= 5 \times 6 \times 2 = 60$ cm$^3$

Mass = density × volume

$0.9 \times 60 = 54$ g

**Answer: 54 g**

## 6 Direct proportion

C is directly proportional to t.

When t = 4, C = 28.

Find the value of C when t = 20.

$C = kt$

$28 = k \times 4$, so $k = 28 \div 4 = 7$

$C = 7 \times 20 = 140$

**Answer: C = 140**

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## 7 Percentage as a fraction of

(a) Farah scores 47 out of 50 in a test. Write this as a percentage.
(b) Write £1 as a percentage of £2.

(a) $\frac{47}{50} \times 100 = 94\%$

(b) Change both to pence: 100p and 200p

$\frac{100}{200} \times 100 = 50\%$

**Answer: (a) 94% (b) 50%**

## 8 Forming and solving equations

A triangle has sides of length x cm, (x + 6) cm and (2x − 3) cm.
The perimeter of the triangle is 23 cm.
(a) Work out the value of x.
(b) Work out the length of the longest side.

(a) $x + (x + 6) + (2x - 3) = 23$
$4x + 3 = 23$
$4x = 20$, so $x = 5$
(b) The sides are 5 cm, 11 cm and 7 cm
**Answer: (a) x = 5 (b) 11 cm**

## 9 Volume of cones and pyramids

A cone has base radius 5 m and vertical height 7 m. (Calculator)

Volume of a cone = $\frac{1}{3}\pi r^2 h$

Work out the volume of the cone.
Give your answer correct to 1 decimal place.

Volume = $\frac{1}{3} \times \pi \times 5^2 \times 7$
$= 183.260...$
$= 183.3\ m^3$ (1 d.p.)
**Answer: 183.3 $m^3$**

## 10 Quadratic equation problem

A rectangle has length (x + 4) cm and width (x − 2) cm.
The area of the rectangle is 91 $cm^2$.
(a) Show that $x^2 + 2x - 99 = 0$
(b) Hence work out the length of the rectangle.

(a) Area = length × width: $(x + 4)(x - 2) = 91$
Expand: $x^2 + 2x - 8 = 91$
Subtract 91 from both sides: $x^2 + 2x - 99 = 0$
(b) Factorise: $(x - 9)(x + 11) = 0$, so $x = 9$ or $x = -11$
A length cannot be negative, so x = 9. Length = 9 + 4 = 13
**Answer: (b) 13 cm**