Day 150 **B Tier 10-a-day: Model Solutions**

1 Order of operations

Work out
(a) $5 \times (5 + 30) \div 5$
(b) $7^2 - (17 - 9) \times 2$

(a) Brackets first: $5 + 30 = 35$
Multiply: $5 \times 35 = 175$
Divide: $175 \div 5 = 35$
(b) Brackets: $17 - 9 = 8$
Powers: $7^2 = 49$
Multiply: $8 \times 2 = 16$
Subtract: $49 - 16 = 33$
Answer: (a) 35 (b) 33

2 Bearings

The bearing of Q from P is 171°.
Work out the bearing of P from Q.

171 is less than 180, so add 180°
171 + 180 = 351
Answer: 351°

3 Laws of indices

Simplify fully
(a) $y^6 \div y^4$
(b) $a^2 \times a^4$

(a) Subtract the powers: $6 - 4 = 2$
(b) Add the powers: $2 + 4 = 6$
Answer: (a) y^2 (b) a^6

4 Growth in standard form

There are 8.1×10^3 cells in a sample.
The number triples every day.
How many are there after 4 days?
Give your answer in standard form.

Each day multiply by 3, so multiply by $3^4 = 81$
$8.1 \times 10^3 \times 81 = 656.1 \times 10^3$
In standard form: 6.561×10^5
Answer: 6.561×10^5

5 Term-to-term rules

The first term of a sequence is 2.
The term-to-term rule is: multiply by 3 and then add 2.
Work out the 4th term.

2nd term: $2 \times 3 + 2 = 8$
3rd term: $8 \times 3 + 2 = 26$
4th term: $26 \times 3 + 2 = 80$
Answer: 80

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6 Compound percentages

A new van costs £6000. (Calculator)
Its value falls by 2% each year.
Work out its value after 3 years.
Give your answer to the nearest pound.

Multiplier = 100% − 2% = 0.98
Value = 6000×0.98^3
= £5647.15, which is £5647 to the nearest pound
Answer: £5647

7 Relative frequency

Sam tests a biased coin landing on tails.
In 500 trials it happens 180 times.
Estimate how many times it will happen in 600 trials.

Relative frequency = 180 ÷ 500 = 0.36
0.36 × 600 = 216
Answer: 216

8 Trial and improvement

The equation $x^3 + 2x = 58$ 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: $3.5^3 + 2 \times 3.5 = 49.875$ (too small)
x = 3.7: $3.7^3 + 2 \times 3.7 = 58.053$ (too big)
x = 3.6: $3.6^3 + 2 \times 3.6 = 53.856$ (too small)
x = 3.65: value = 55.927 (too small), so the solution is above 3.65
So x = 3.7 to 1 decimal place
Answer: x = 3.7

9 Trigonometry: finding a side

Find the length of x. (Calculator)
Give your answer correct to 1 decimal place.
The diagram is not drawn accurately.

Label the sides: x is the adjacent and 16 m is the opposite
We use tan (opposite and adjacent)

$\tan 42° = \frac{16}{x}$

$x = \frac{16}{\tan 42°} = 17.770...$

x = 17.8 m (1 d.p.)
Answer: x = 17.8 m

10 Tree diagrams

A bag contains 4 mint sweets and 6 toffee sweets.
Dev takes one at random and does not replace it, then takes a second.
Work out the probability that both are mint.

P(first mint) = $\frac{2}{5}$

P(second mint) = $\frac{1}{3}$

P(both mint) = $\frac{2}{5} \times \frac{1}{3} = \frac{2}{15}$

Answer: $\frac{2}{15}$