Day 105 **B Tier 10-a-day: Model Solutions**

1 Two-way tables

The table shows some information about 82 students.
A person is chosen at random.
Find the probability that the person is in the group "Girls" and chose "Walk".

Girls who chose Walk = 82 − 37 − 28 = 17
P = 17 out of 82
Answer: $\frac{17}{82}$

2 Proving a triangle is right-angled

A triangle has sides of length 5 m, 12 m and 14 m.
Is the triangle right-angled?
You must show your working.

The longest side is 14. Check whether $a^2 + b^2 = c^2$
$5^2 + 12^2 = 25 + 144 = 169$
$14^2 = 196$
These are not equal, so the triangle is not right-angled
Answer: No, $5^2 + 12^2 = 169$ but $14^2 = 196$

3 Distance, speed and time

A scooter leaves at 7:40 am.
It travels 108 km at an average speed of 36 km/h.
At what time does it arrive?

Time = 108 ÷ 36 = 3 hours = 3 hours
7:40 am + 3 hours = 10:40 am
Answer: 10:40 am

4 Exchange rates

The exchange rate is £1 = $1.3. (Calculator)
(a) Change £300 to dollars.
(b) Change $130 to pounds (£).

(a) Multiply by 1.3: 300 × 1.3 = $390
(b) Divide by 1.3: 130 ÷ 1.3 = £100
Answer: (a) $390 (b) £100

5 Distance-time graphs

The graph shows Jack's journey.
(a) How far did Jack travel in the first 45 minutes?
(b) Work out Jack's speed in the last 30 minutes. Give your answer in km/h.

(a) Read from the graph at 45 minutes: 18 km
(b) In the last section the distance changes by 2 km in 30 minutes
2 ÷ 0.5 = 4 km/h
Answer: (a) 18 km (b) 4 km/h

6 Negative and zero indices

Work out
(a) 3^{-3}
(b) $11^0 + \sqrt{100}$

(a) A negative power means the reciprocal: $3^{-3} = \frac{1}{3^3} = \frac{1}{27}$

(b) Anything to the power 0 is 1, so $11^0 = 1$
$\sqrt{100} = 10$, so 1 + 10 = 11
Answer: (a) $\frac{1}{27}$ (b) 11

Day 105 **B Tier 10-a-day: Model Solutions**

7 Equations with fractions

Solve $\frac{3x}{2} = 3$

Multiply both sides by 2: 3x = 6
Add 0 to both sides: 3x = 6
Divide both sides by 3
Answer: x = 2

8 Area of a triangle using sine

In triangle ABC, AB = 19 cm, BC = 18 cm and angle ABC = 110°. (Calculator)
Work out the area of the triangle.
Give your answer correct to 1 decimal place.

Area = ½ab sin C
Area = ½ × 19 × 18 × sin 110°
= 160.687...
= 160.7 cm^2 (1 d.p.)
Answer: 160.7 cm^2

9 Trial and improvement

The equation $x^3 + 3x = 105$ has a solution between 4 and 5. (Calculator)
Use trial and improvement to find this solution.
Give your answer correct to 1 decimal place.

x = 4.5: $4.5^3 + 3 \times 4.5 = 104.625$ (too small)
x = 4.7: $4.7^3 + 3 \times 4.7 = 117.923$ (too big)
x = 4.6: $4.6^3 + 3 \times 4.6 = 111.136$ (too big)
x = 4.55: value = 107.846 (too big), so the solution is below 4.55
So x = 4.5 to 1 decimal place
Answer: x = 4.5

10 Bearings with Pythagoras and trigonometry

A boat sails 14 m on a bearing of 270° from P to Q, then 6 m on a bearing of 000° to R. (Calculator)
(a) Work out the distance PR.
(b) Work out the bearing of R from P.
Give your answers correct to 1 decimal place.

(a) Triangle PQR has a right angle at Q
$PR^2 = 14^2 + 6^2 = 232$
$PR = \sqrt{232} = 15.232...$ m

(b) tan (angle QPR) = $\frac{6}{14}$, so angle QPR = 23.199° (to 3 d.p.)

PQ is on a bearing of 270°, and R is a further 23.199° clockwise from PQ
Bearing = 270 + 23.199 = 293.2°
Answer: (a) 15.2 m (b) 293.2°