Day 288 **S Tier 10-a-day: Model Solutions**

1 Line of best fit

The scatter graph shows age of car (x) and value (y).
The line of best fit passes through (2, 24) and (6, 18).
(a) Find its equation in the form y = mx + c.
(b) Explain what its gradient tells you.

(a) Gradient m = $\frac{18-24}{6-2} = \frac{-6}{4} = -1.5$

y = −1.5x + c: using (2, 24), 24 = −1.5 × 2 + c, so c = 27
y = −1.5x + 27
(b) For each extra year of age, the value of the car (in £100s) goes down by 1.5
Answer: (a) y = −1.5x + 27 (b) For each extra year of age, the value of the car (in £100s) goes down by 1.5

2 Angles in polygons

The sum of the interior angles of a polygon is 3240°.
Work out the number of sides of the polygon.

Sum of interior angles = (n − 2) × 180°
(n − 2) × 180 = 3240
n − 2 = 3240 ÷ 180 = 18
n = 20
Answer: 20

3 Transformations of graphs

The point P(12, −2) lies on the graph of y = f(x).
Write down the coordinates of the image of P on the graph of
(a) y = f(x + 2) (b) y = f(x) + 2

(a) y = f(x + 2) is a translation of 2 to the left: (10, −2)
(b) y = f(x) + 2 is a translation of 2 up: (12, 0)
Answer: (a) (10, −2) (b) (12, 0)

4 LCM problems

A red light flashes every 4 minutes.
A blue light flashes every 6 minutes.
A green light flashes every 14 minutes.
They all flash together at 7:00 am.
How many times do they all flash together between 7:00 am and 3:00 pm, including both 7:00 am and 3:00 pm if they do?

Find the LCM of 4, 6 and 14
$4 = 2^2$, 6 = 2 × 3, 14 = 2 × 7
LCM = $2^2 \times 3 \times 7 = 84$
Total time from 7:00 am to 3:00 pm = 480 minutes
480 ÷ 84 = 5.71, so there are 5 more times after the start
Including the start: 5 + 1 = 6
Answer: 6

5 Laws of indices with algebra

Simplify fully $\frac{3x^{\frac{1}{3}} \times 6x^{\frac{5}{2}}}{2x^{-\frac{1}{2}}}$

Numbers: 3 × 6 ÷ 2 = 9

Add the powers for × and subtract for ÷: $\frac{1}{3} + \frac{5}{2} - (-\frac{1}{2}) = \frac{10}{3}$

$= 9x^{\frac{10}{3}}$

Answer: $9x^{\frac{10}{3}}$

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6 Recurring decimals

Convert the recurring decimal $0.\dot{7}$ to a fraction.
Give your fraction in its simplest form.

Let x = 0.7777...
10x = 7.7777...
Subtract: 9x = 7
$x = \frac{7}{9}$

Answer: $\frac{7}{9}$

7 Cosine rule and area of a triangle

The diagram shows triangle ABC. (Calculator)
(a) Work out the length of AB, marked x, to 1 decimal place.
(b) Work out the area of triangle ABC to 3 significant figures.
The diagram is not drawn accurately.

(a) $x^2 = 12^2 + 14^2 - 2 \times 12 \times 14 \times \cos 110°$
$x^2 = 454.92$
x = 21.3 cm (1 d.p.)

(b) Area = $\frac{1}{2} \times 12 \times 14 \times \sin 110° = 78.9$ cm^2 (3 s.f.)

Answer: (a) 21.3 cm (b) 78.9 cm^2

8 Independent events and probability rules

A and B are two events.
P(A) = 0.4, P(B) = 0.3 and P(A or B) = 0.58
(a) Work out P(A and B).
(b) Are A and B independent? You must show your working.

(a) $P(A \cup B) = P(A) + P(B) - P(A \cap B)$
0.58 = 0.4 + 0.3 − P(A ∩ B), so P(A ∩ B) = 0.12
(b) P(A) × P(B) = 0.4 × 0.3 = 0.12
This equals P(A ∩ B), so A and B are independent
Answer: (a) 0.12 (b) Yes

9 3D problems: pyramids

VABCD is a pyramid on a square base. V is directly above the centre M. (Calculator)
(a) Work out AC as a simplified surd.
(b) Work out the angle between VA and the base, to 1 d.p.
The diagram is not drawn accurately.

(a) $AC^2 = 12^2 + 12^2 = 288$
$AC = \sqrt{288} = 12\sqrt{2}$ cm
(b) AM = AC ÷ 2 = $6\sqrt{2}$ cm. The angle is VAM.
$\tan(VAM) = \frac{VM}{AM} = \frac{3}{\sqrt{72}}$
angle VAM = 19.5° (1 d.p.)
Answer: (a) $12\sqrt{2}$ cm (b) 19.5°

10 HCF and LCM

The HCF of two numbers is 2 and their LCM is 20.
The smaller number is 4.
Work out the larger number.

HCF × LCM = product of the two numbers
2 × 20 = 40
Larger number = 40 ÷ 4 = 10
Answer: 10