OCR H Nov'21 P6

Answer **all** the questions.

1 This table shows the names and areas of five lakes.

Name of Lake	Area in km^2
Ladoga	1.81×10^4
Mweru	5.12×10^3
Tana	3.20×10^3
Topozero	9.86×10^2
Victoria	6.89×10^4

(a) Write the area of Lake Mweru as an ordinary number.

5120 ✓

(a) ..... km^2 **[1]**

(b) Write the lakes in the order of their area, starting with the **smallest**.

✓ ✓

Topozero Tana Mweru Ladoga Victoria **[2]**

smallest *largest*

(c) Calculate the difference between the areas of Lake Ladoga and Lake Tana.
Give your answer in standard form, correct to **2** significant figures.

$1.81 \times 10^4 - 3.2 \times 10^3$ ✓✓

$= 14900$

$= 15000$ ✓

$= 1.5 \times 10^4$ ✓

(c) ..... km^2 **[4]**

2 Azmi, Beth and Callum share a flat.

(a) The monthly rent is £760.
They share the rent in the ratio 2 : 3 : 3.

How much does Beth pay for rent each month?

$\frac{3}{8} \times 760$ ✓

285 ✓

(a) £ ..... **[2]**

(b) Azmi, Beth and Callum also share the fuel bill in the ratio 2 : 3 : 3.
Callum pays £36 for fuel each month.

How much does Azmi pay for fuel each month?

A B C
2 3 3 ×12
36
×12

✓

24 ✓

(b) £ ..... **[2]**

3 Multiply out and simplify.

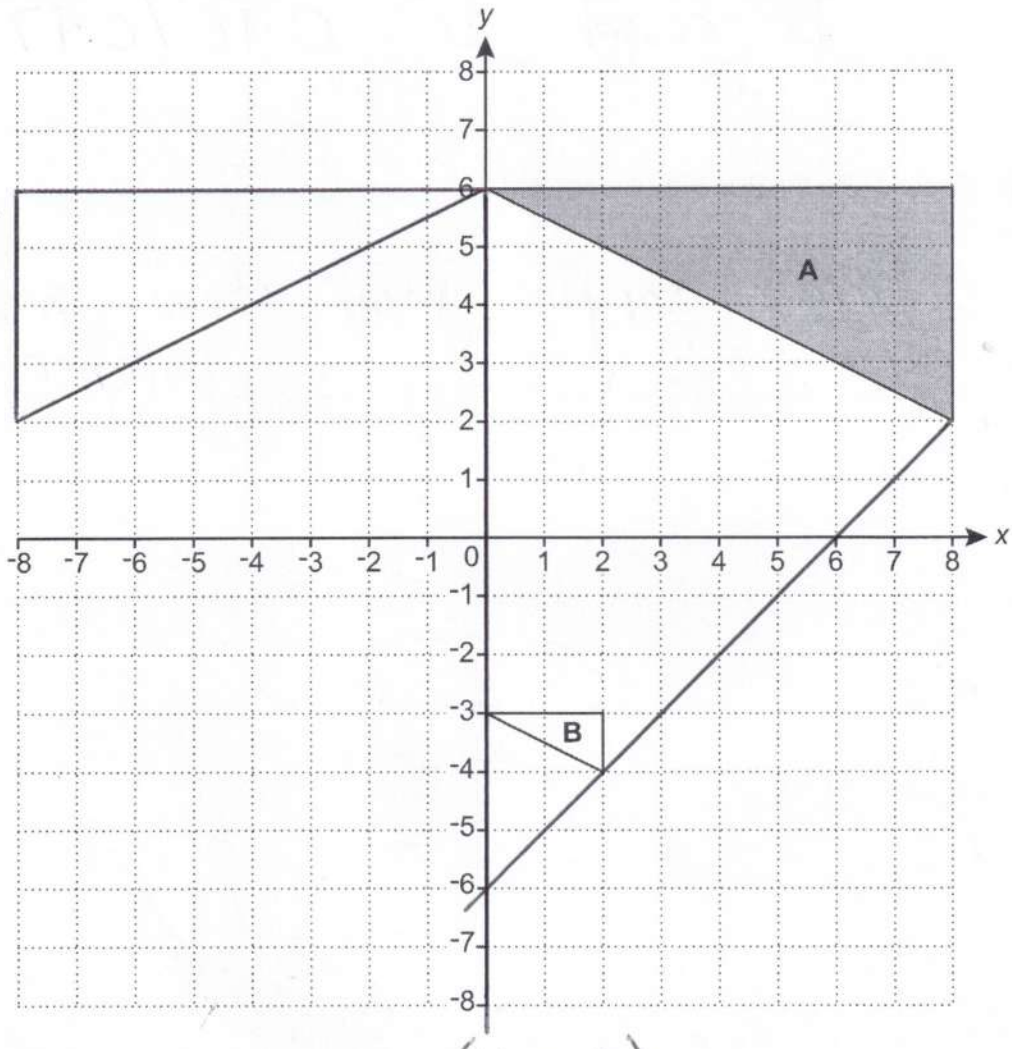
$3(x+2)-(x-1)$

$3x+6 \quad -x+1$ ✓ ✓

$2x+7$

..... **[2]**

4 Triangle **A** and triangle **B** are drawn on the coordinate grid.



✓ ✓

(a) Reflect triangle **A** in the line $x = 0$. (y-axis) **[2]**

(b) Describe fully the **single** transformation that maps triangle **A** onto triangle **B**.

centre (0, -6) ✓

Enlargement, scale factor = 1/4 ✓ ..... **[3]**

✓

5 Ling throws a six-sided dice 300 times.
The table shows the frequencies of their results.

(a) Complete the table to show the relative frequencies.

Number on dice	1	2	3	4	5	6
Frequency	42	27	57	60	39	75
Relative frequency	0.14	0.09	0.19	0.2	0.13	0.25

✓3 ✓5

[2]

(b) Ling thinks that the dice may be biased.

(i) Explain why evidence from the table could support their opinion.

Fair dice probabilities would be closer to 0.16/0.17 ✓

[1]

(ii) Explain why the dice may, in fact, **not** be biased.

Larger sample may show more balance ✓

[1]

6 A bag of sweets contains jellies, mints and toffees.

The ratio of jellies to mints is $n : 2$.
The ratio of mints to toffees is $5 : 3n$.

Work out the ratio of jellies to toffees.
Give your answer in its simplest form.

J M T
n 2
5n 10 6n ✓✓
5 3n

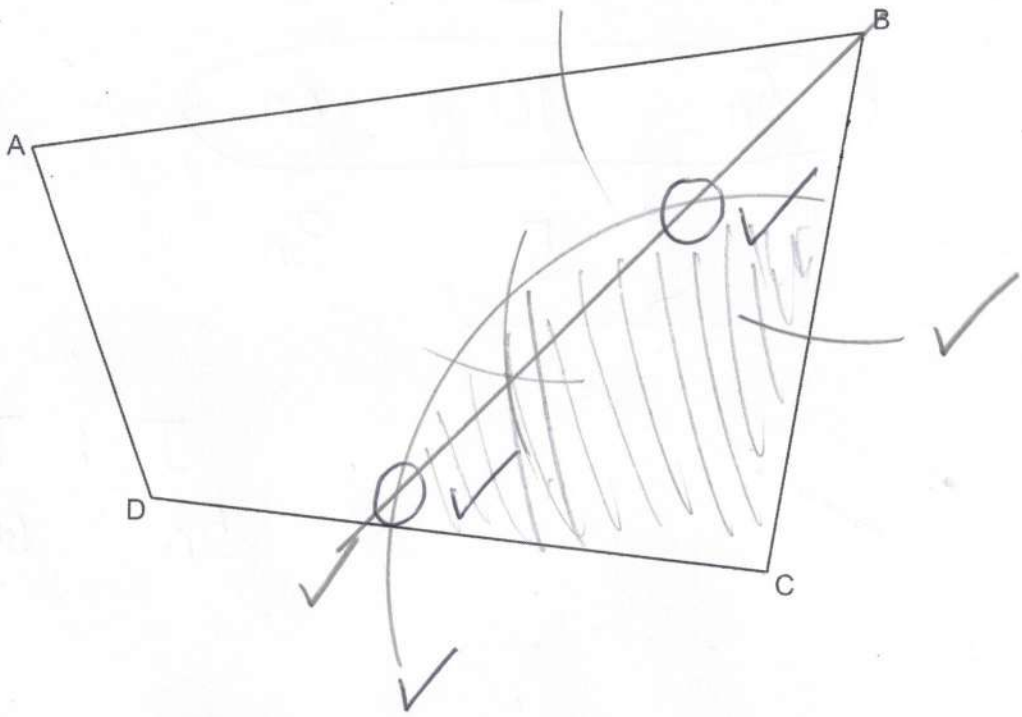
J : T
5n 6n ✓

5 6 ✓

..... : ..... **[4]**

7 The scale drawing represents a park, ABCD.

Scale: 1 cm represents 10 m



A straight path goes across the park from B.
The path is always the same distance from side AB and side BC.

(a) Construct the route followed by the path.
Show all your construction lines. **[2]**

(b) A bench is to be placed on the path.
The bench must be no more than 50 m from C. = 5cm

Construct the locus of the possible positions of the bench.
Indicate clearly on the diagram where the bench can be placed. **[3]**

8 **(a)** Train A travels 120 km at a constant speed of 80 km/h.
Train B travels 120 km at a constant speed of 50 km/h.

How many more minutes does train B take to travel 120 km than train A?

(A) $T = \frac{120}{80} = 1.5 = 1\text{hr } 30\text{m}$ ✓

(B) $T = \frac{120}{50} = 2.4 = 2\text{hr } 24\text{m}$ ✓

$144 - 90$ ✓

54 ✓

(a) ..... minutes **[4]**

(b) Train C has a speed of x km/h.

Write an algebraic expression for train C's speed in metres per second.

x km/hr $\frac{\times 1000}{60 \times 60}$ ✓ ✓

$\frac{1000x}{3600}$ OE

(b) ..... m/s **[2]**

9 The width, w, of a kitchen cupboard is 60 cm, correct to the nearest centimetre.

(a) Complete the error interval for the width, w.

$\pm \frac{1}{2}$

(a) 59.5 $\leqslant w <$ 60.5 **[2]**

(b) Six of these kitchen cupboards are to be placed side by side along a kitchen wall. The wall is 363 cm long, correct to the nearest centimetre.

(i) Show that the six cupboards may **not** fit along the wall. **[3]**

$363 < 363.5$
362.5

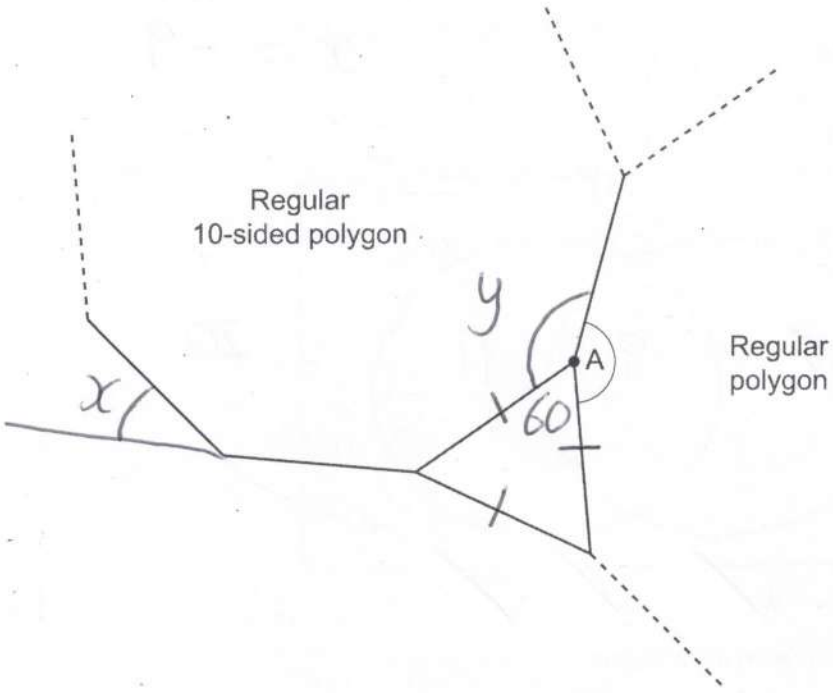
$\frac{362.5}{60.5} = 5.991...$ cupboards
(so not enough for 6)

(ii) Find the upper bound of the space remaining if six cupboards do fit along the wall.

$363.5 - 6 \times 59.5$

(b)(ii) 6.5 cm **[3]**

10 An equilateral triangle, a regular 10-sided polygon and another regular polygon meet at a point.



(a) Show that angle A is 156°. **[3]**

$x = \frac{360}{10} = 36$ ✓

$y = 180 - 36$
$= 144$ ✓

$A = 360 - 60 - 144$
$= 156$ ✓

(b) Work out the number of sides of the other regular polygon.

$180 - 156 = 24$

$\frac{360}{24}$ ✓

15 ✓

(b) ..... **[2]**

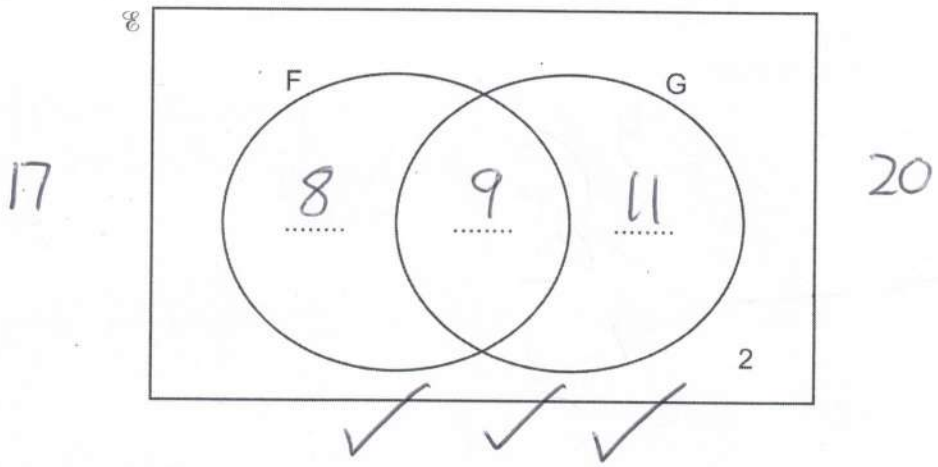
11 In a class of 30 students

- 17 study French (F)
- 20 study German (G)
- 2 do not study either subject.

$20 + 17 + x = 28$

$x = -9$

(a) Complete the Venn diagram.



[3]

(b) Two of the 30 students are chosen at random.

Calculate the probability that one of these two students studies French but not German and the other studies German but not French.
You must show your working.

$\frac{8}{30} \times \frac{11}{29} \times 2$ ✓✓

✓ ✓

$\frac{88}{435}$ ✓

(b) ..... **[5]**

12 A solid metal sphere has mass 235 g.
The density of the metal is 7.78 g/cm^3.

Show that the surface area of this sphere is 46.9 cm^2, correct to **3** significant figures.
You must show your working.

[For a sphere with radius r: Volume $= \frac{4}{3}\pi r^3$ Surface area $= 4\pi r^2$.] **[6]**

$V = \frac{235}{7.78} = \frac{4}{3} \times \pi \times r^3$ ✓✓✓

$7.21\ldots = r^3$

$r = \sqrt[3]{7.21} = 1.9319\ldots$ ✓

$SA = 4 \times \pi \times 1.9319^2$ ✓

$= 46.903\ldots$ ✓

$= 46.9$ (3sf)

13 A straight line passes through the point (8, 1) and is perpendicular to the line $y = 4x - 2$.

Find the equation of the line, giving your answer in the form $y = mx + c$.

$m = 4$

$m_{\perp} = -\frac{1}{4}$ ✓

$y = mx + c$ $\quad m = -\frac{1}{4}$ $\quad x = 8$ $\quad y = 1$

$1 = -\frac{1}{4} \times 8 + c$ ✓

$c = 3$

$y = -\frac{1}{4}x + 3$ ✓✓

..... **[4]**

14 y is inversely proportional to the square root of x.
$y = 5$ when $x = 36$.

(a) Find a formula linking x and y.

$y = \frac{K}{\sqrt{x}}$ ✓

$5 = \frac{K}{6}$

$30 = K$ ✓

$y = \frac{30}{\sqrt{x}}$ ✓

(a) ..... **[3]**

(b) Find the value of x when $y = 20$.

$20 = \frac{30}{\sqrt{x}}$ ✓

$\sqrt{x} = \frac{30}{20}$ ✓

$x = \left(\frac{3}{2}\right)^2$

$\frac{9}{4}$ ✓OE

(b) $x =$ ..... **[3]**

15 **(a)** Show that the equation $x^3 - 5x - 1 = 0$ has a solution between $x = 2$ and $x = 3$. **[3]**

$x = 2 \Rightarrow 2^3 - 5\times2 - 1$
$= 8 - 10 - 1 = -3$ ✓

$x = 3 \Rightarrow 3^3 - 5\times3 - 1$
$= 27 - 15 - 1 = 11$ ✓

Change of sign hence $2 < x < 3$ ✓OE

(b) Find this solution correct to **1** decimal place.
You must show your working.

$x = 2.5$, $2.5^3 - 5\times2.5 - 1 = 2.125$ ✓

$x = 2.3$, $2.3^3 - 5\times2.3 - 1 = -0.333$

$x = 2.4$, $2.4^3 - 5\times2.4 - 1 = 0.824$ ✓

$x = 2.35 \Rightarrow 0.228$ ✓

so $2.3 < x < 2.35$

2.3 (1dp) ✓

(b) $x =$ ..... **[4]**

16 The following kinematics formulas may be used in this question.

$v = u + at$

$s = ut + \frac{1}{2}at^2$

$v^2 = u^2 + 2as$

The initial velocity of a particle is 20 m/s.
The acceleration of the particle is $-8\,m/s^2$.
After t seconds, the particle has travelled 25 m.

$u = 20 \quad a = -8$

$s = 25$

(a) Show that $4t^2 - 20t + 25 = 0$. **[3]**

$s = ut + \frac{1}{2}at^2$ ✓✓

$25 = 20t + \frac{1}{2} \times -8 \times t^2$

$25 = 20t - 4t^2$ ✓

$4t^2 - 20t + 25 = 0$

(b) Solve $4t^2 - 20t + 25 = 0$.

$ac = 100$

$4t^2 - 10t \mid -10t + 25 = 0$ ✓

$2t(2t - 5) \mid -5(2t - 5) = 0$

$(2t - 5)(2t - 5) = 0$ ✓

$t = \frac{5}{2}$ or 2.5 ✓

(b) $t =$ ..... **[3]**

(c) Show that the particle is stationary when it has travelled 25 m.

$v^2 = u^2 + 2as$

$v^2 = 20^2 + 2 \times -8 \times 25$ ✓

$v^2 = 400 - 400$ ✓

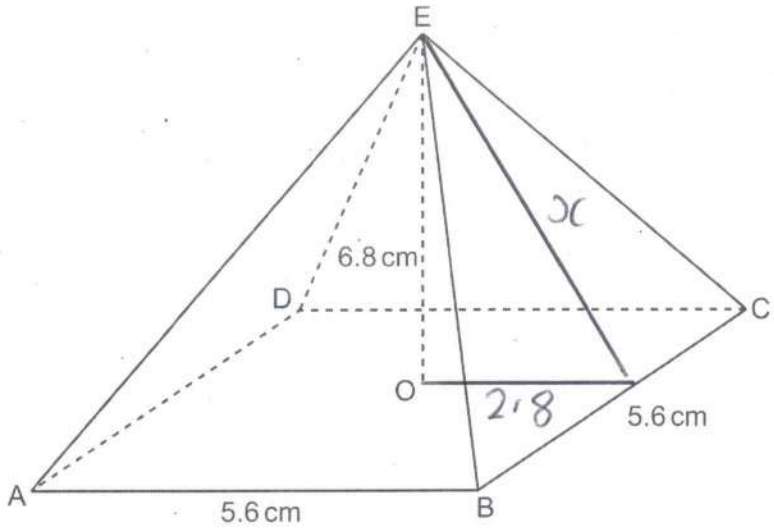
$v^2 = 0$ ✓

$v = 0$

.....

..... **[3]**

17 The diagram shows a pyramid ABCDE.



Not to scale

The pyramid has a square horizontal base ABCD with side 5.6 cm.

The vertex E is vertically above the centre O of the base.
The height OE of the pyramid is 6.8 cm.

Calculate the surface area of the pyramid.
You must show your working.

$x = \sqrt{2.8^2 + 6.8^2} = 7.3539...$

$SA = \square + 4\triangle$

$= 5.6^2 + 4 \times \frac{1}{2} \times 5.6 \times 7.3539$

$= 113.7237...$

113.7

..... cm^2 **[5]**

18 Rearrange this formula to make y the subject.

$$\frac{5y+2}{y} = \frac{3t-7}{2}$$

$2(5y+2) = y(3t-7)$ ✓

$10y + 4 = 3ty - 7y$ ✓

$17y - 3ty = -4$ ✓

$y(17-3t) = -4$ ✓

$y = \frac{-4}{17-3t}$ ✓

OR $\frac{4}{3t-17}$

..... **[5]**

END OF QUESTION PAPER