

Leaving Certificate Examination, 2018

Sample paper prepared by Leamy Maths Community

Mathematics

Paper 2

Ordinary Level

29 April 2018

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Name _____

Solutions

300 marks

Sample Instructions

There are two sections in this examination paper:

Section A	Concepts and Skills	150 marks	6 questions
Section B	Contexts and Applications	150 marks	2 questions

Answer questions as follows:

In Section A, answer all six questions.

In Section B, answer both questions.

Write your answers in the spaces provided in this booklet. There is space for extra work at the back of the booklet. You may also ask the superintendent for more paper. Label any extra work clearly with the question number and part.

The superintendent will give you a copy of the booklet of *Formulae and Tables*. You must return it at the end of the examination.

You are not allowed to bring your own copy into the examination.

Marks will be lost if all necessary work is not clearly shown.

Answers should include the appropriate units of measurement, where relevant.

Answers should be given in simplest form, where relevant.

Write the make and model of your calculator(s) here:

Answer **all six** questions from this section.

Question 1

(25 Marks)

The Munster rugby team has the following win/loss statistics over the last few years.

	Win	Loss	Draw
Home	80	32	1
Away	50	47	2

- (a) How many games did Munster play in total?

$$80 + 50 + 32 + 47 + 1 + 2 = 212$$

Marks: 0, 3, 5

- (b) Calculate the proportion of overall wins for Munster. Give your result in percentage form accurate to 2 decimal places.

$$p = \frac{130}{212} = 61.32\%$$

Marks: 0, 3, 5

- (c) What is the probability that Munster wins their next three games. Give your result in percentage form accurate to 2 decimal places.

$$p = (0.6132)^3 = 23.06\%$$

Marks: 0, 3, 5

- (d) What is the probability that Munster wins their first two games and then does not win their third game? Give your result in percentage form accurate to 2 decimal places.

$$p = (0.6132)^2 \times (1 - 0.6132) = 14.54\%$$

Marks: 0, 3, 5

- (e) A game is chosen randomly. What is the probability that this is an away game? Give your result in percentage form accurate to 2 decimal places.

$$p = \frac{99}{212} = 46.7\%$$

Marks: 0, 3, 5

Question 2

(25 Marks)

Circle $\mathcal{C}$ has the following characteristics:

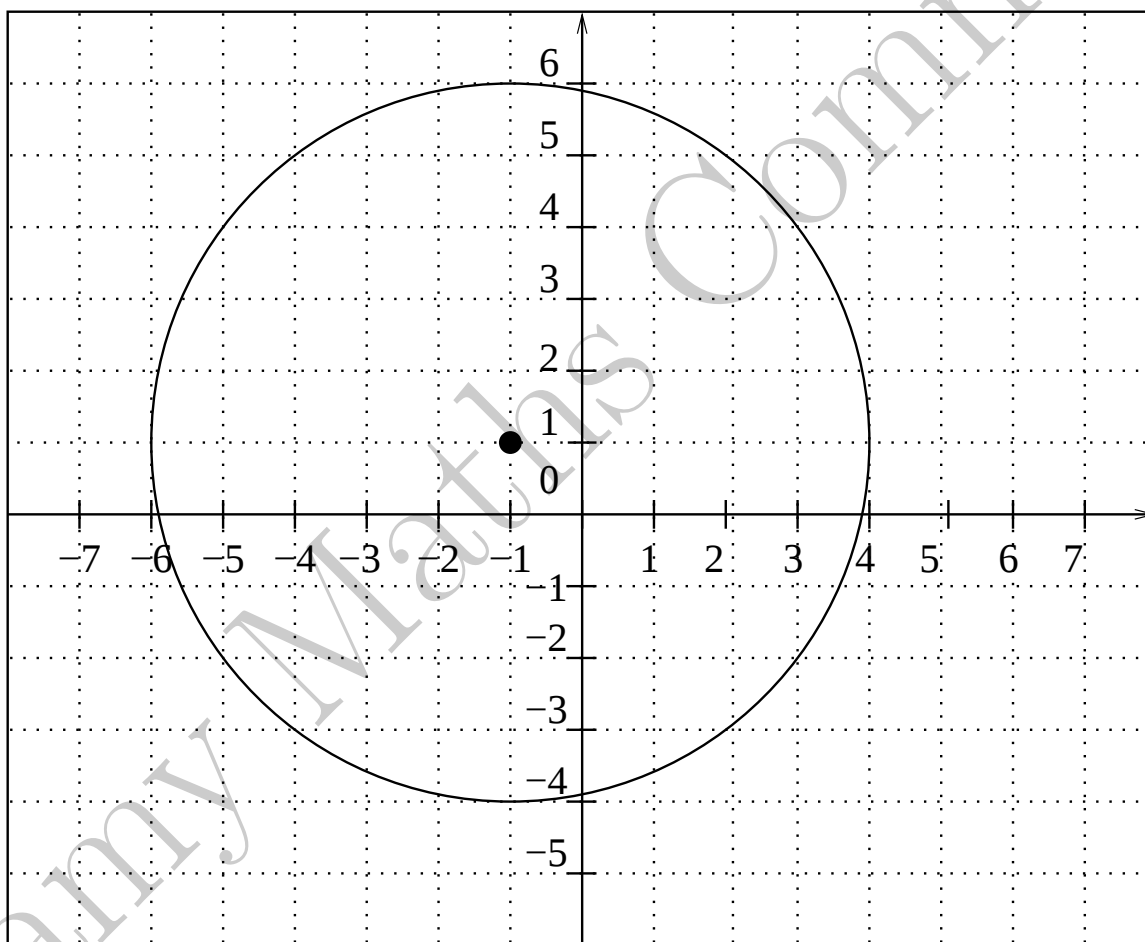
- Centre with coordinates $(-1,1)$
- Radius 5

(a) Write the equation of circle $\mathcal{C}$.

$$(x+1)^2 + (y-1)^2 = 25 \implies x^2 + 2x + y^2 - 2y = 23$$

Marks: 0, 3, 5

(b) Draw circle $\mathcal{C}$ on the grid below. Marks: 0, 3, 5



(c) Verify that the points $A(-4,-3)$ and $B(2,5)$ are on the circle. Plot the points on the figure.

$$(-4+1)^2 + (-3-1)^2 = 9 + 16 = 25$$

$$(2+1)^2 + (5-1)^2 = 9 + 16 = 25$$

The two points are on the circle. Marks: 0, 3, 5

fgggggggg

- (d) Calculate the distance AB and hence show that [AB] is a diameter of the circles.

$$d = \sqrt{(2+4)^2 + (5+3)^2} = 10 = 2R$$

The distance is twice the radius so this is a diameter. Marks: 0, 3, 5

- (e) Two points of the form (3, k) belong to the circle. Find the two possible values of k

$$(3+1)^2 + (k-1)^2 = 25 \implies (k-1)^2 = 9 \implies k = -4 \quad k = 2$$

The two points are (3,2) and (3,-4) Marks: 0, 3, 5

Question 3

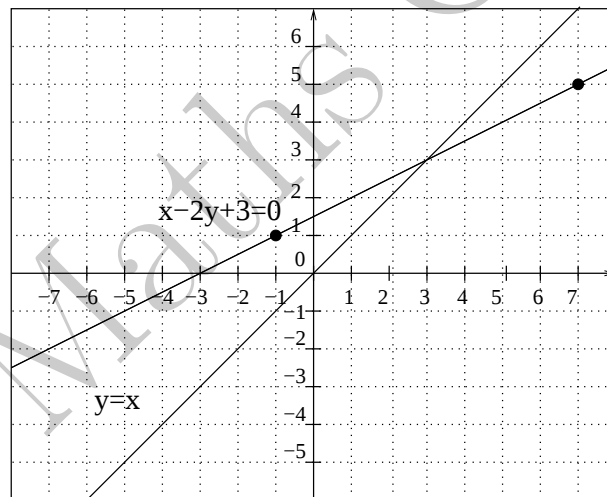
(25 Marks)

The line $\mathcal{L}$ contains the points A(-1,1) and B(7,5). Find the equation of $\mathcal{L}$. Give your answer in the form $ax+by+c=0$ where $a,b,c \in \mathbb{Z}$.

- (a) Plot the line on the grid below.

$$\text{slope} = \frac{5-1}{7+1} = \frac{1}{2} \implies y = 1 + \frac{1}{2}(x+1) \implies x - 2y + 3 = 0$$

Marks: 0, 3, 5



Marks: 0, 3, 5

- (b) Use the graph to identify the line $y=x$ and line $\mathcal{L}$ cross.

$$(3,3)$$

Marks: 0, 3, 5

- (c) Verify your answer using an algebraic method.

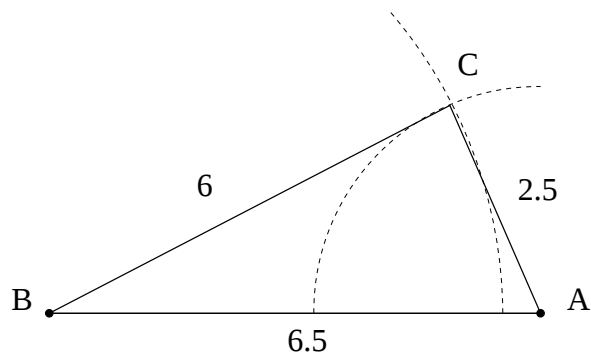
$$x - 2y + 3 = 0 \quad x = y \implies -x + 3 = 0 \implies x = 3 \quad y = 3$$

Marks: 0, 3, 5, 8

Question 4

(25 Marks)

- (a) Construct the triangle ABC, where $|AB| = 6.5\text{cm}$, $|BC| = 6\text{cm}$ and $|AC| = 2.5\text{cm}$.



Marks: 0, 3, 5, 7

- (b) Show that ABC is a right angle triangle.

$$6.5^2 = 42.25 \quad 6^2 + 2.5^2 = 36 + 6.25 = 42.25$$

This is a right angle triangle. Marks: 0, 3, 5

- (c) Hence calculate the area of the triangle

$$\text{Area} = \frac{1}{2} \times 6 \times 2.5 = 7.5$$

Marks: 0, 3, 5, 8

- (d) Calculate the angle $\angle ACB$ in degrees correct to 2 decimal places.

$$\text{Angle} = 90^\circ$$

Marks: 0, 3, 5

Question 5

(25 Marks)

- (a) Find the distance x on the in the diagram below (not to scale). Give your answer correct to two decimal places.

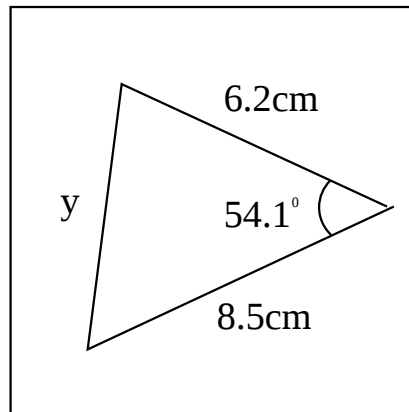
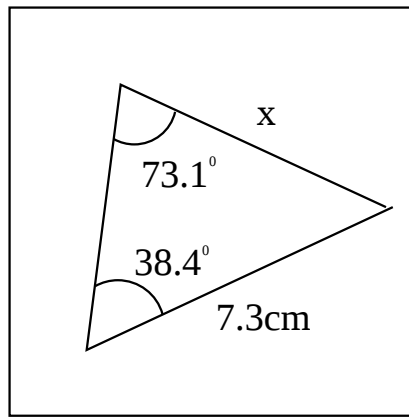
$$\frac{x}{\sin 38.4} = \frac{7.3}{\sin 73.1} \Rightarrow x = 4.74$$

Marks: 0, 3, 5, 8, 10

- (b) Find the distance y on the in the diagram below (not to scale). Give your answer correct to two decimal places.

$$y = \sqrt{8.5^2 + 6.2^2 - 2(8.5)(6.2) \cos 54.1} = 6.99$$

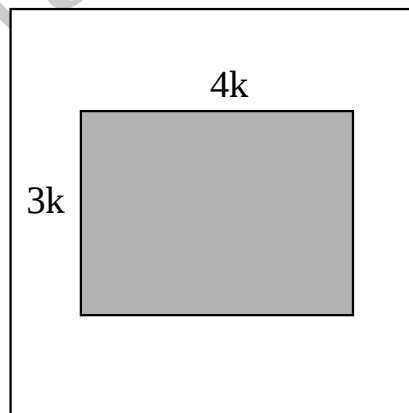
Marks: 0, 3, 5, 8, 10, 15



Question 6

(25 Marks)

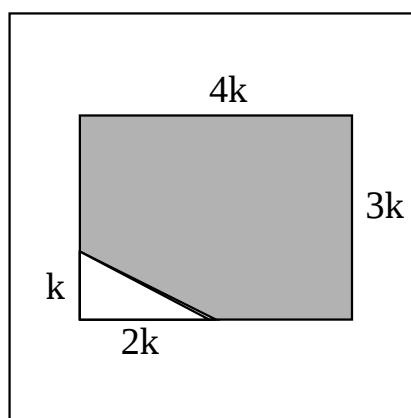
- (a) Express the area of the rectangle in terms of k .



$$\text{Area} = (3k)(4k) = 12k^2$$

Marks: 0, 3, 5, 7

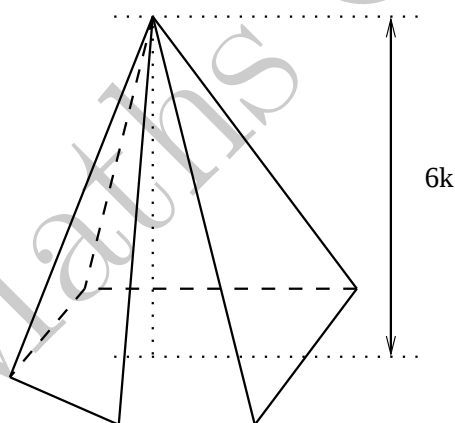
- (b) A triangle is removed from the rectangle as indicated on the figure. Find the area of the shaded section in terms of k .



$$Area = 12k^2 - \frac{1}{2}(k)(2k) = 11k^2$$

Marks: 0, 3, 5, 8

- (c) The shaded area is used to form the bottom of a pyramid of height $h=6k$. Express the volume of the pyramid in terms of k .



$$V = \frac{1}{3}(6k)(11k^2) = 22k^3$$

Marks: 0, 3, 5

- (d) What value of k leads to a volume of 176cm^3 for the pyramid?

$$22k^3 = 176 \implies k^3 = 8 \implies k = 2$$

Answer **all three** questions from this section.

Question 7

(75 Marks)

A phone company wants to know how many contacts leaving cert students have on their mobile phones. They collect the following data in a class in Limerick:

- Girls: 151, 148, 149, 183, 145, 149, 151, 161, 153, 129.
- Boys: 166, 146, 141, 164, 147, 154, 171, 149, 149, 137.

(a) Construct a back to back stem and leaf plot of the above data. Marks: 0, 3, 5, 8, 10, 15

Girls		Boys
9	12	
	13	7
9 9 8 5	14	1 6 7 9 9
3 1 1	15	4
1	16	4 6
	17	1
3	18	

(b) Calculate the mean and median for both groups.

Median: B=149, G=150

Marks: 0, 3, 5, 8, 10

Mean: B 152.4, G 151.9

Marks: 0, 3, 5, 8, 10, 13, 15

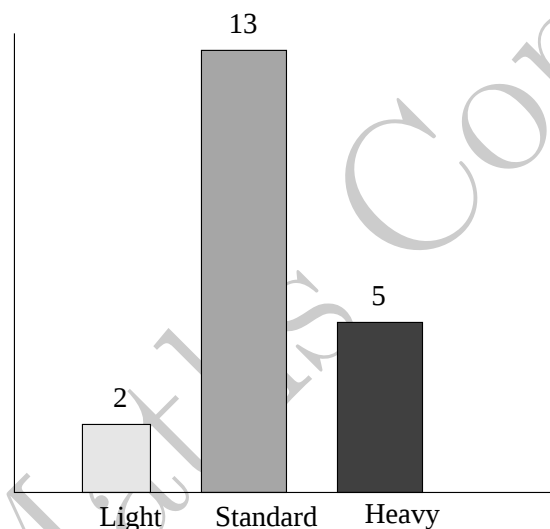
- (c) Comment on the similarities and differences between the two groups.
same shapes, same averages and medians. Most are between 140 and 149. Only 2 girl outliers

Marks: 0, 3, 5, 8, 10

- (d) The phone company splits users into three categories:

- Light users have below 140 contacts,
- Standard users have between 140 and 160 contacts
- Heavy users have above 160 contacts.

- (i) Using the data above, construct a histogram representing the type of users according to the phone company. Marks: 0, 3, 5, 8, 10



- (ii) If a user is selected randomly in the class, what is the probability that this is a standard user?

$$p = \frac{13}{20} = 65\%$$

Marks: 0, 3, 5

- (iii) If a user is selected randomly, what is the probability that this is a girl light user?

$$p = \frac{1}{20} = 5\%$$

Marks: 0, 3, 5

- (iv) If a user is selected randomly, what is the probability that this is a boy light user or a boy heavy user?

$$p = \frac{4}{20} = 20\%$$

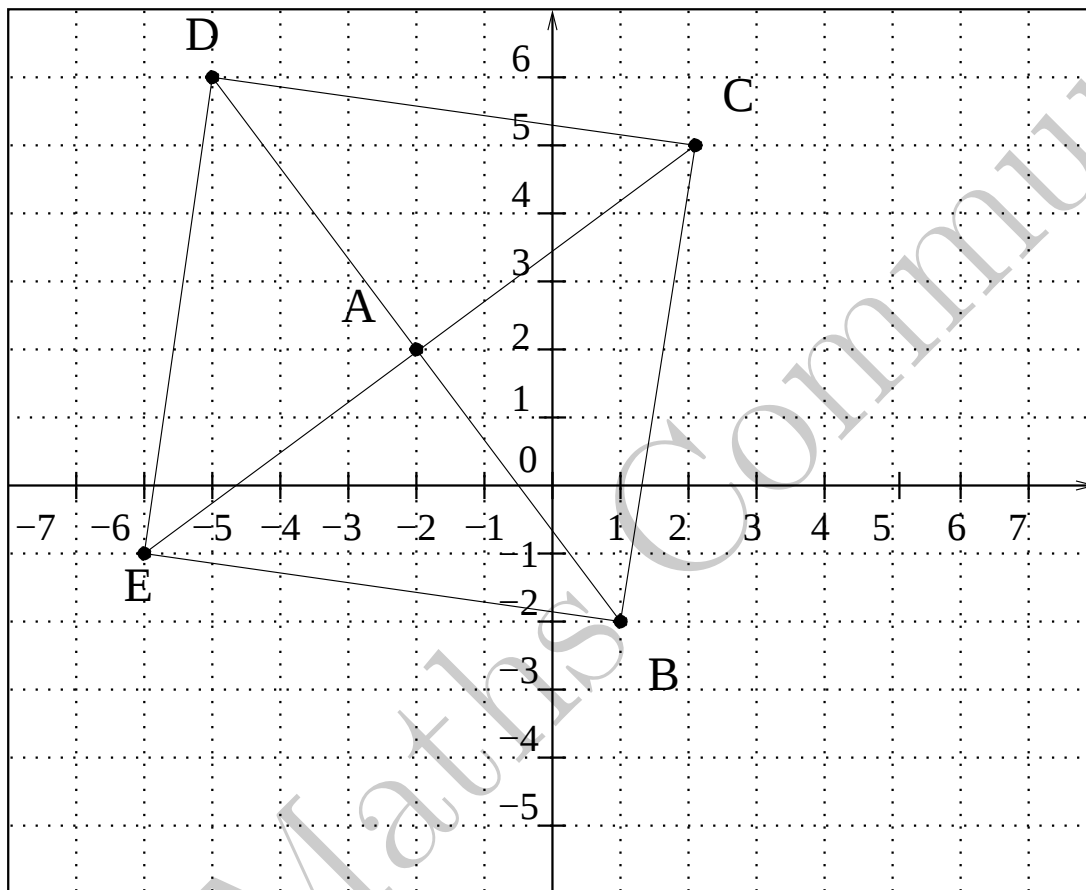
Marks: 0, 3, 5

Question 8

(75 Marks)

The diagram on the next page shows the triangles ABC, ACD, ADE, ABE.

- (a) Using the diagram on the next page, find the coordinates of points A, B, C, D, E
 A(-2,2), B(1,-2), C(2,5), D(-5,6), E(-6,-1) Marks: 0, 3, 5



- (b) Show that A is the midpoint of [BD] and the midpoint of [CE].

$$\left(\frac{-5+1}{2}, \frac{6-2}{2} \right) = (-2, 2) = A$$

$$\left(\frac{-6+2}{2}, \frac{5-1}{2} \right) = (-2, 2) = A$$

Marks: 0, 3, 5, 7

- (c) Using slopes, show that the lines (BC) and (DE) are parallel and that the lines (BE) and (CD) are parallel.

$$sl_{BC} = \frac{5+2}{2-1} = 7 \quad sl_{DE} = \frac{6+1}{-5+6}$$

$$sl_{CD} = \frac{6-5}{-5-2} = -\frac{1}{7} \quad sl_{BE} = \frac{-2+1}{1+6} = -\frac{1}{7}$$

Since the slopes are equal, the lines are parallel.

Marks: 0, 3, 5, 8, 10

- (d) Using slopes, show that lines (BD) and (CE) are perpendicular.

$$sl_{BD} = \frac{6+2}{-5-1} = -\frac{4}{3} \quad sl_{CE} = \frac{5+1}{2+6} = \frac{3}{4}$$

The two slopes multiply to -1 so the two lines are perpendicular. Marks: 0, 3, 5, 8

- (e) Calculate the distances $|AB|$ and $|AC|$

$$AB = \sqrt{3^2 + 4^2} = 5 \quad AC = \sqrt{4^2 + 3^2} = 5$$

Marks: 0, 3, 5, 8, 10

- (f) Using the results of the previous questions, show that the four triangles are similar.

$AB=AC$

A is the midpoint of BD and CE so $AB=AC=AD=AE$

AD and DE are perpendicular

SSA so the triangles ABC, ACD, ADE and ABE are similar. Marks: 0, 5, 10, 15, 20

- (g) Calculate the area of triangle ABC.

$$Area = \frac{1}{2} AB \times AC = 12.5$$

Marks: 0, 3, 5, 7

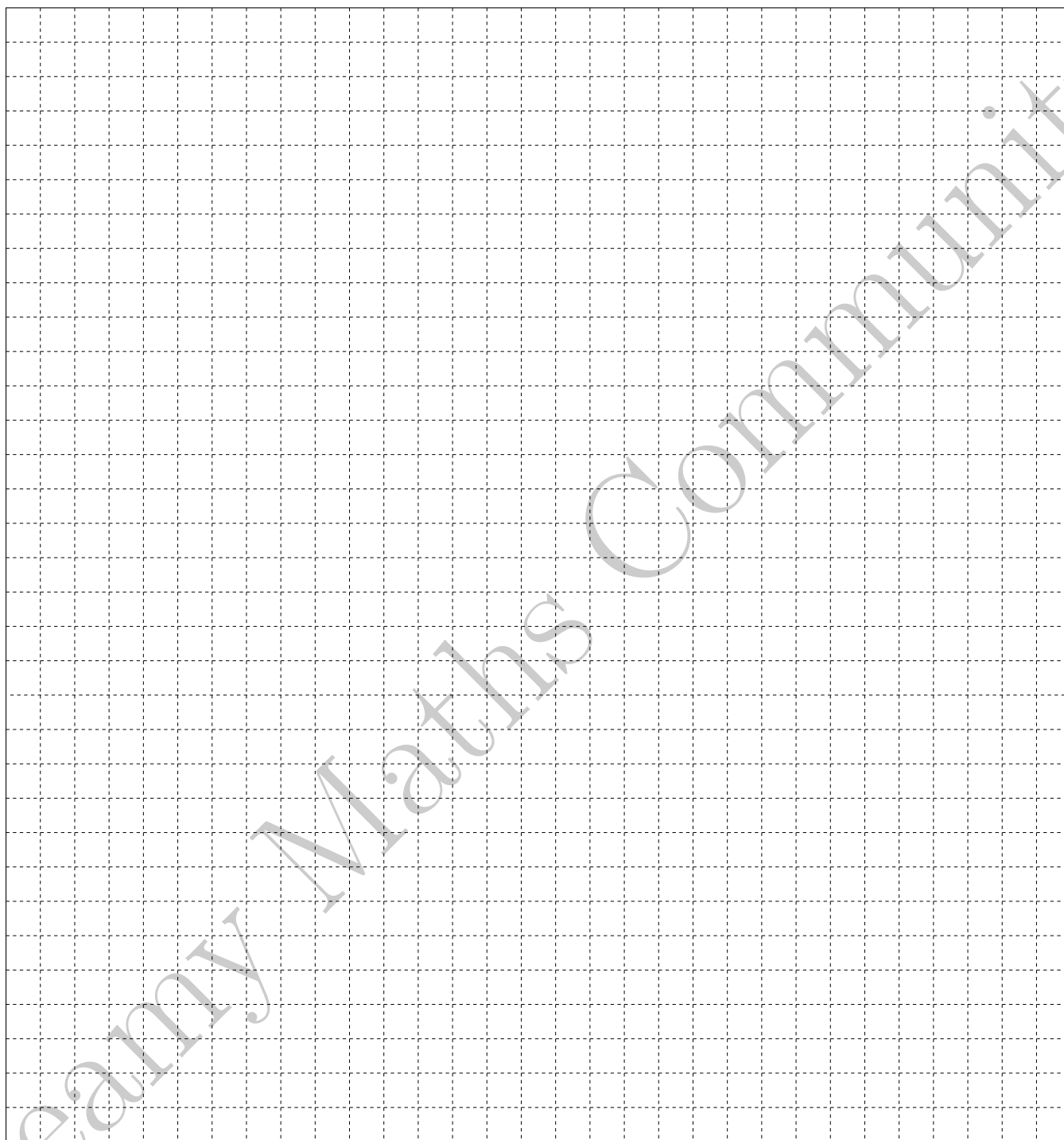
- (h) Hence or otherwise, calculate the area of BCDE.

Since the 4 triangles are similar, they all have the same area as ABC so

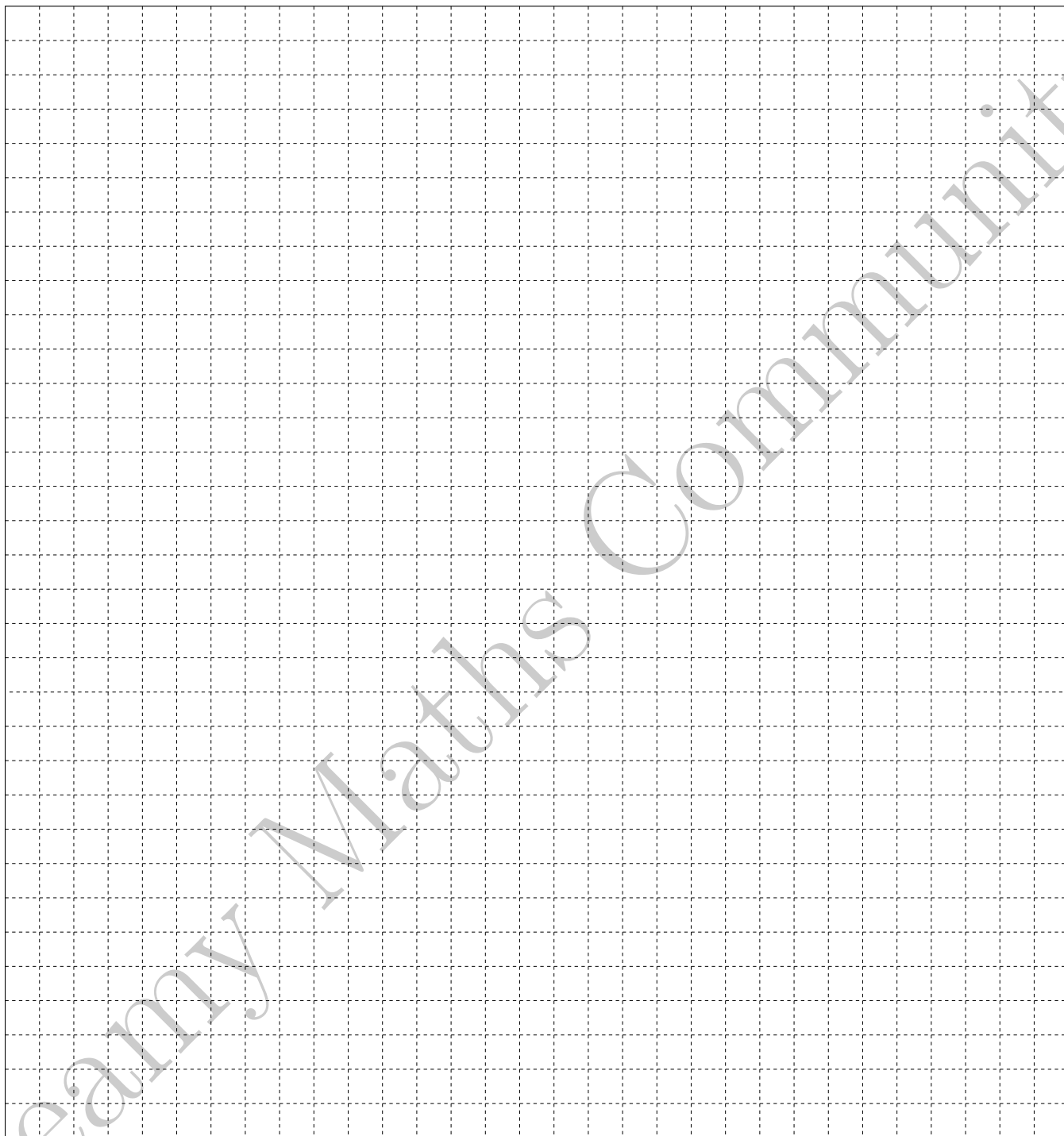
$$Area = 4 \times 12.5 = 50$$

Marks: 0, 3, 5, 8

Rough Work



Rough Work



Rough Work

