The City School

Unified Mid-Year Examinations

2018 – 2019

Class 11

SCHOOL NAME:

INDEX NUMBER: | | | | |

DATE:

MATHEMATICS (SYLLABUS D) **4024/22**

Paper 2 **2 hour 30 minutes**

Candidates answer on the Question Paper.

Additional materials: Geometrical Instruments

READ THESE INSTRUCTIONS FIRST

Write your School name, Index number and Date in the spaces provided.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.

Answer all questions.

If working is needed for any question it must be shown in the space below that question.
Omission of essential working will result in loss of marks.
You are expected to use an electronic calculator to evaluate explicit numerical expressions.
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.
For π, use either your calculator value or 3.142, unless the question requires the answer in terms of π.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total of the marks for this paper is 100.

Invigilated By: _____ Checked By: _____ Marks Tallied By: _____

This document consists of **23** printed pages and **1** Blank page.

1. A shopkeeper buys some plates from a manufacturer for $12 each.

(a) The manufacturer makes a profit of 60%.
Calculate the cost of manufacturing each plate.

Answer $..... [2]

(b) The shopkeeper sells each plate for $17.40.
Calculate the percentage profit made by the shopkeeper.

Answer .....% [2]

(c) In a sale, each plate is reduced from $17.40 to $11.31.
Calculate the percentage discount given.

Answer .....% [2]

(d) The shopkeeper buys 100 plates at $12 each.
He sells 60 plates at $17.40 each and x plates at $11.31 each.
The shopkeeper makes a profit of at least 10%.

Find the least possible value of x.

Answer ..... [3]

(e) Theresa takes out a loan.
She repays the loan over one year at a rate of $54 per month,
The total she repays is 8% greater than the value of the original loan.

Work out the value of original loan.

Answer $ .....[3]

2. The table shows the distribution of the masses of 100 babies at birth.

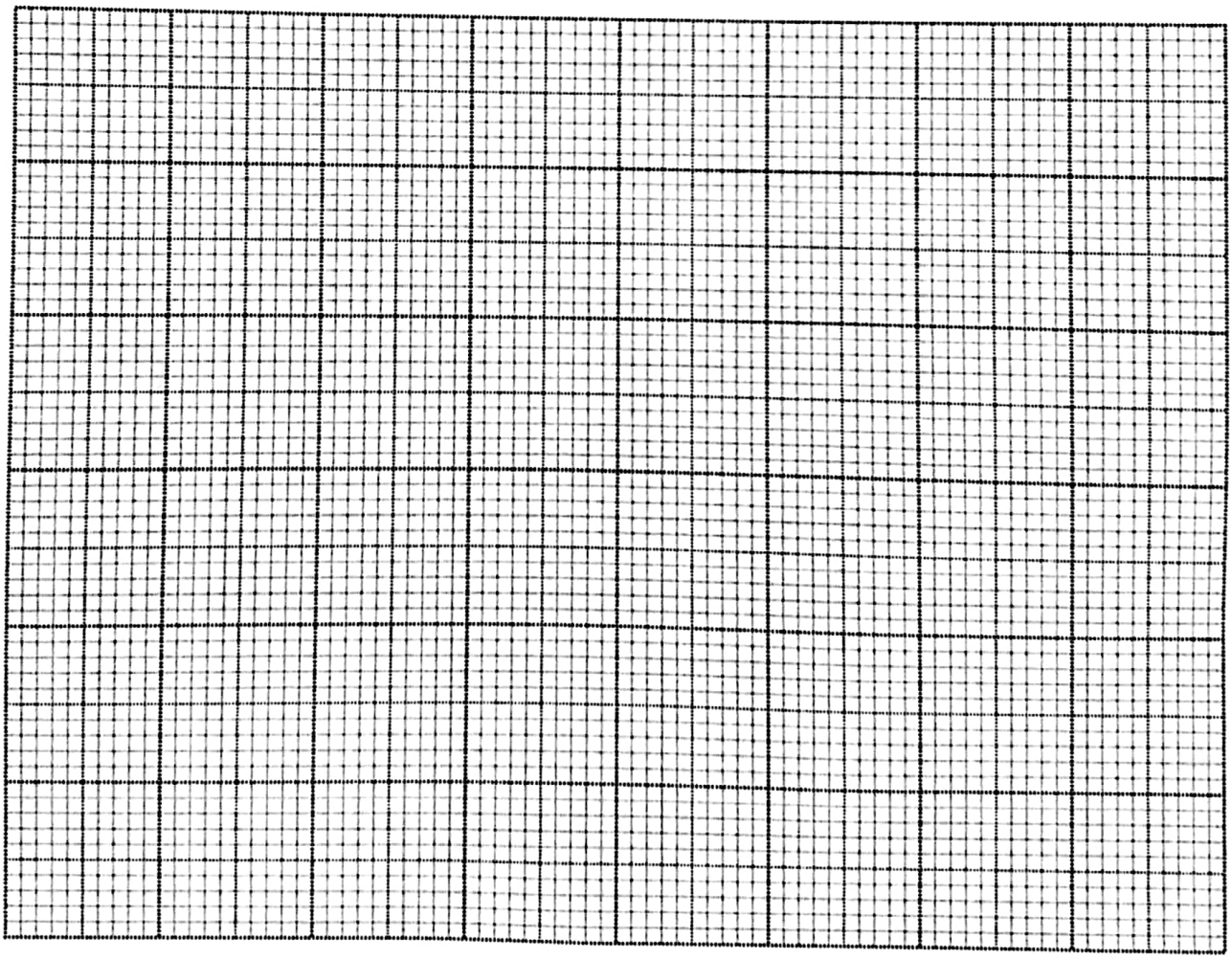
Mass (x kg)	$1.5 < x \leq 2$	$2 < x \leq 2.5$	$2.5 < x \leq 3$	$3 < x \leq 3.5$	$3.5 < x \leq 4$	$4 < x \leq 4.5$	$4.5 < x \leq 5$
Number of babies	3	12	20	24	25	14	2

(a) Write down the modal class

Answer ..... [1]

(b) For this part of the question use the grid below.
Using a scale of 4 cm to represent 1 kg, draw a horizontal x-axis for $1 \leq x \leq 5$
Using a scale of 2 cm to represent 5 babies, draw a vertical axis for frequencies from 0 to 30.

Using your axes, draw a frequency polygon to represent these results.



[2]

(c) The table shows the marks gained by some students in their English test.

Mark	52	75	91
Number of students	x	45	11

The mean mark of these students is 70.3.

Find the value of x.

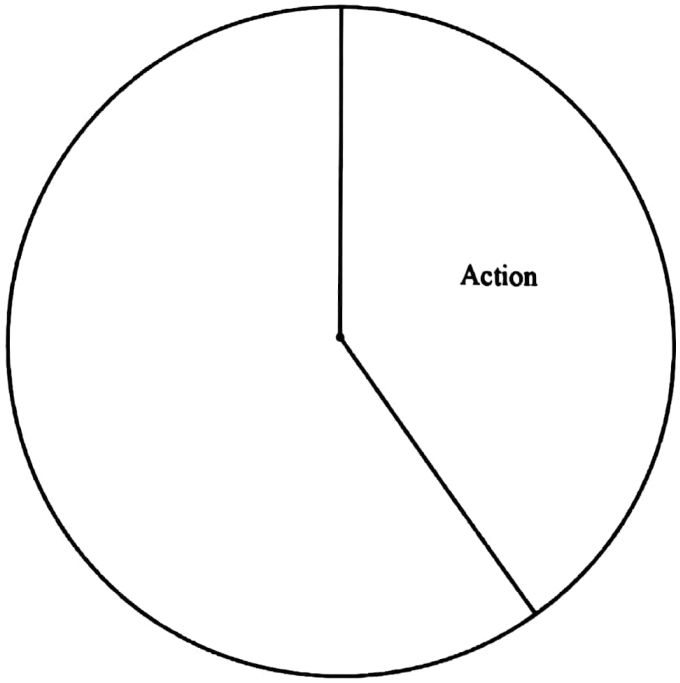
Answer x = ... [2]

(d) Jenny asked 60 people which type of movie each preferred watching last night.

The table summarises her results.

Type of movie	Action	Comedy	Drama	Horror
Frequency	24	15	9	12

(i) Complete the pie chart to represent the results.



[3]

(ii) One of the 60 people is chosen at random.
Find the probability that this person preferred drama or horror movies.

Answer ..... [1]

(iii) Two of the 60 people are chosen at random.
Calculate the probability that they both preferred comedy movies.

Answer ..... [2]

3. **(a)** Solve $4(p-3) = 2p + 7$

Answer p = ... **[2]**

(b) Solve these simultaneous equations.

$$2x - y = 5$$
$$7x + 2y = 1$$

Show your working.

Answer x = ...

y = ...**[3]**

(c) Simplify $\dfrac{m^2+3m}{2m^2+5m-3}$

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

(d) b is directly proportional to the cube of a.
Given that $b = 4$ when $a = 2$, find b when $a = 5$.

Answer b = ... [3]

4. (a) $\varepsilon = \{x: x \text{ is an integer and } 2 \leq x \leq 12\}$
$M = \{x: x \text{ is a multiple of } 3\}$
$P = \{x: x \text{ is a prime number}\}$

(i) $a \in M \cap P$

Find a.

Answer ..... [1]

(ii) Find $(M \cup P)'$

Answer.....[1]

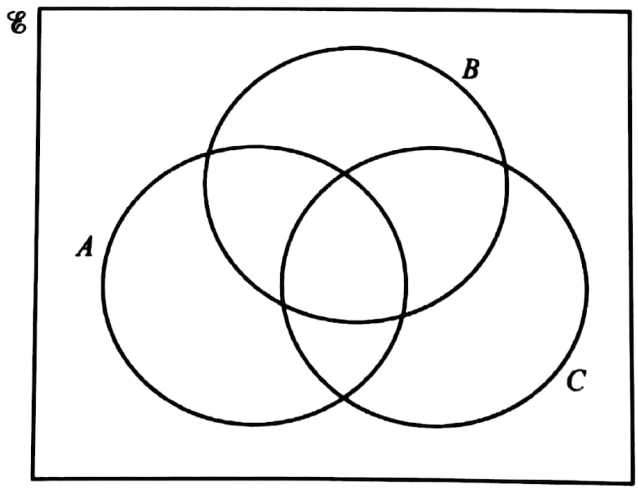
(b) In a survey, 90 people were asked "Do you own a car?" and "Do you own a bicycle?".
A total of 27 people said they owned a bicycle.
Of these, 13 owned **only** a bicycle.
11 people owned neither a car nor a bicycle.

By drawing a Venn diagram, or otherwise, find how many people said that they owned a car.

Answer ..... [2]

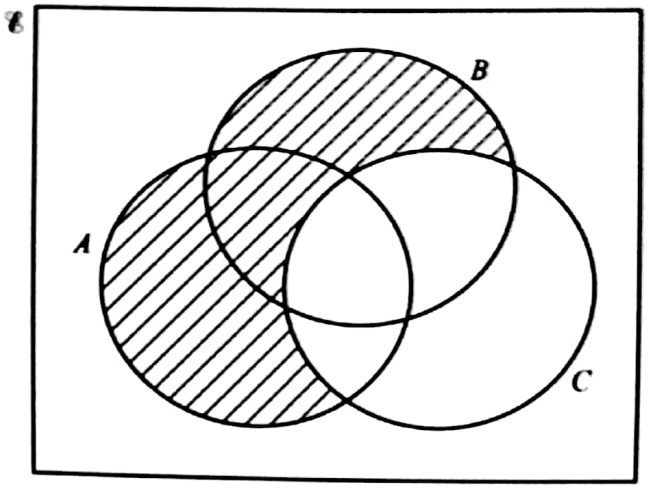
(c) The Venn diagrams show a Universal set and subsets *A, B* and *C*.

(i) Shade the set $(A \cup C)' \cap B$



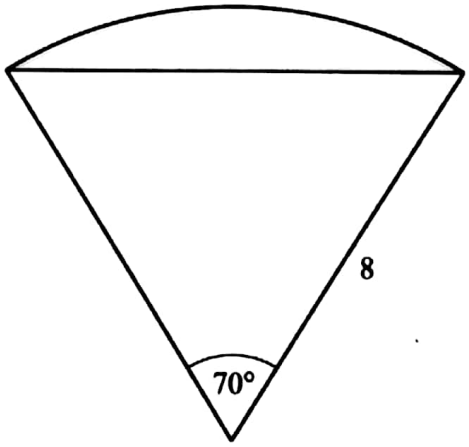
[1]

(ii) Express in set notation the subset shaded in the diagram.



Answer ..... [1]

5.

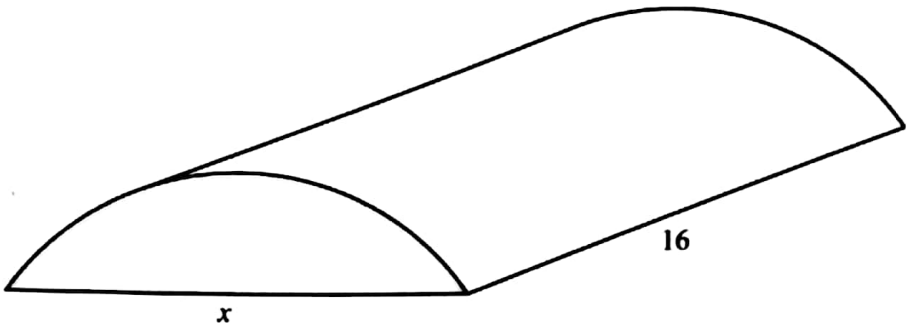


The diagram shows a sector of a circle of radius 8 cm and angle 70°.

(a) Calculate the shaded area.

Answer.....cm^2 [4]

(b)



A piece of chocolate is in the shape of a prism with the shaded area from **part (a)** being its cross section.
The rectangular base of the chocolate is 16 cm by x cm.
The piece of chocolate is to be placed in a box which is a cuboid of size 16 cm by x cm by 1.5 cm.

(i) Show that the chocolate will fit inside the box.

[3]

(ii) These boxes are to be packed in cartons in the shape of a cuboid.
The size of each carton is 48 cm by $4x$ cm by 24 cm.
Find the maximum number of boxes that can be packed inside one carton.

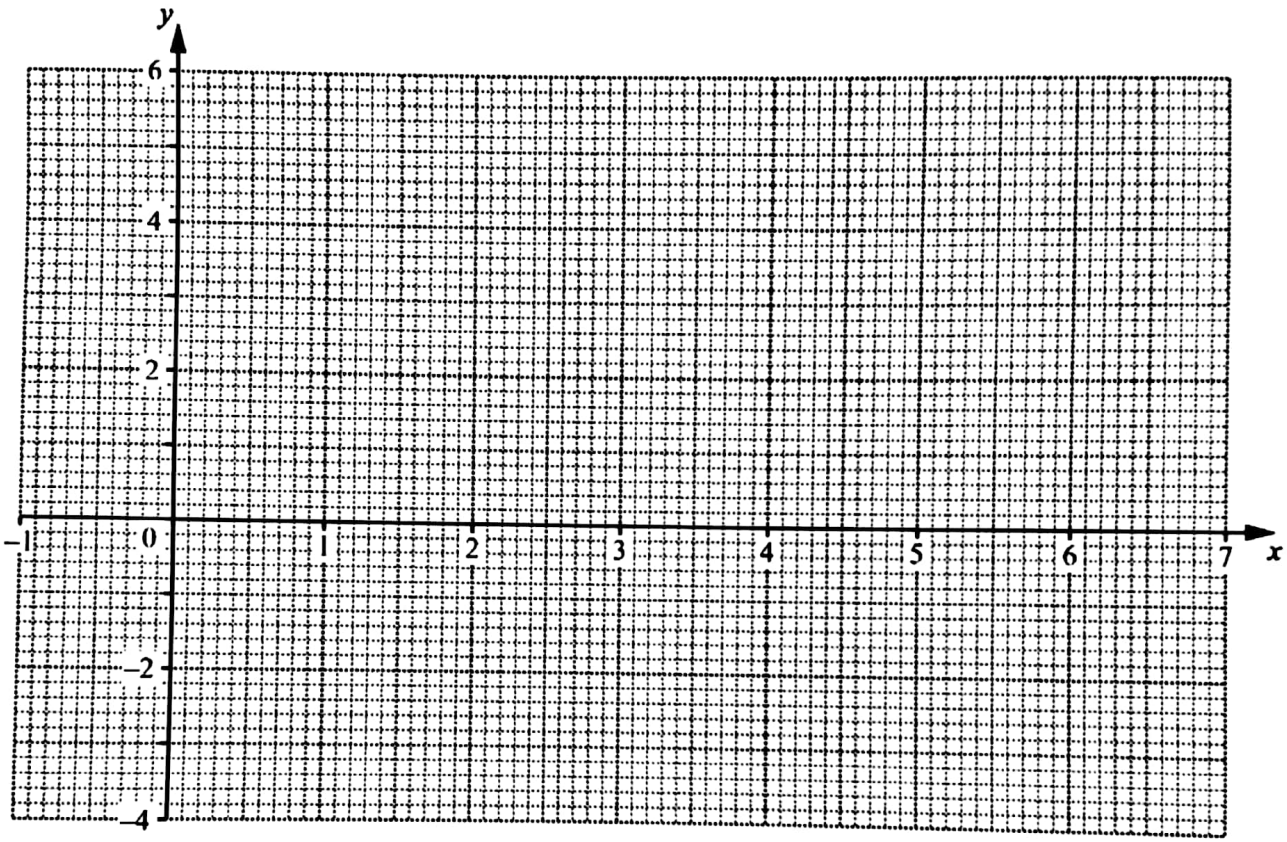
Answer ..... [2]

6. (a) Complete the table for $y = \frac{x^2}{2} - 3x + 2$.

x	-1	0	1	2	3	4	5	6	7
y		2	-0.5	-2	-2.5	-2	-0.5	2	

[1]

(b) Draw the graph of $y = \frac{x^2}{2} - 3x + 2$ for $-1 \leq x \leq 7$.



[3]

(c) By drawing a tangent, estimate the gradient of the curve at $x = 1.5$

Answer .....[2]

(d) Complete these inequalities to describe the range of values of x where $y \geq 0$.

Answer $x \leq$ .....

$x \geq$ ..... [2]

(e) (i) On the same grid, draw the line $4y + 3x = 12$ [2]

(ii) The x-coordinates of the points of intersection of this line and the curve are the solutions of the equation $2x^2 + Ax + B = 0$

Find the value of A and the value of B

Answer A = ...

B = ...[2]

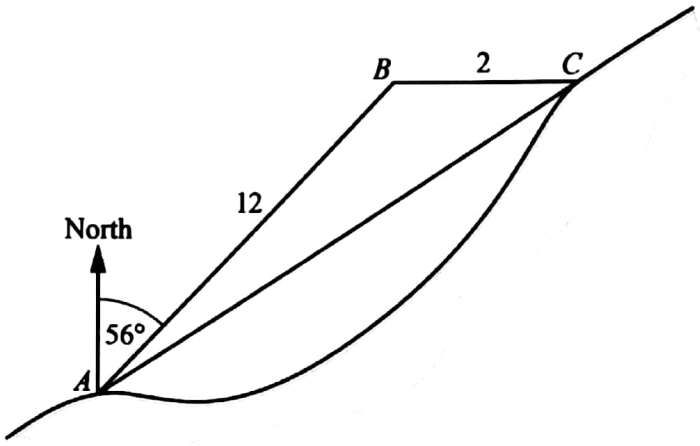
7. A boat leaves *A* and travels 12 km to *B*.

(a) The boat leaves *A* at 10 25 and travels at an average speed of 15 km/h.

At what time does the boat arrive at *B*?

Answer .....[2]

(b)

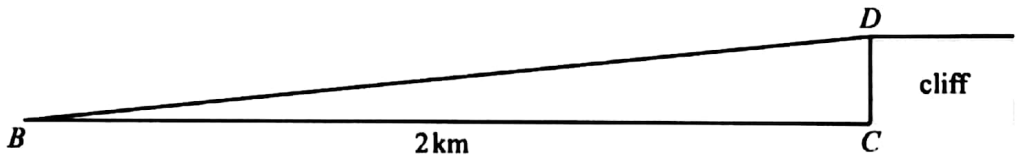


The bearing of *B* from *A* is 056°.
B is 2 km due west of *C*.

Calculate *AC*.

Answer ..... km [4]

(c)



C is the base of a cliff.
The top of the cliff, *D*, is vertically above *C*.
DC is perpendicular to *BC* and *DC* = 105m.

Calculate the angle of elevation of *D* from *B*.

Answer .....[2]

8. Kenwyn plays a board game.
Two cubes (dice) each have faces numbered 1, 2, 3, 4, 5 and 6.
In the game , a **throw** is rolling the **two** fair 6-sided dice and then adding the numbers on their top faces.

This total is the number of spaces to move on the board.
For example, if the numbers are 4 and 3, he moves 7 spaces.

(a) Giving each of your answers as a fraction in its simplest form, find the probability that he moves

(i) two spaces with his next throw,

Answer ..... [2]

(ii) ten spaces with his next throw.

Answer ..... [2]

(b) What is the most likely number of spaces that Kenwyn will move with his next throw? Explain your answer.

Answer ..... *because* .....
.....[2]

(c)

95	96	97	98	99 Go back 3 Spaces	100 WIN

To win the game he must move **exactly** to the 100th space.
Kenwyn is on the 97th space.
If his next throw takes him to 99, he has to move back to 96.
If his next throw takes him over 100, he stays on 97.

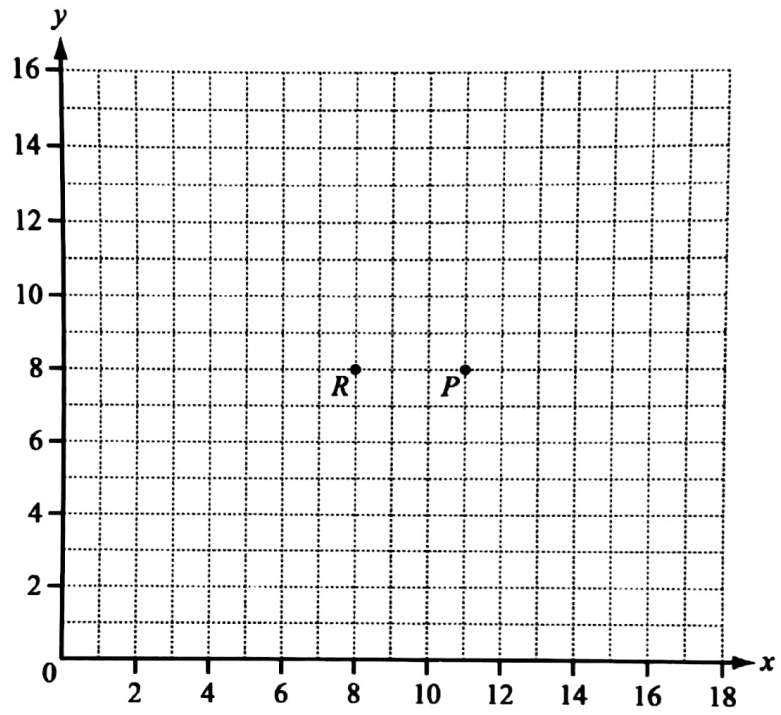
Find the probability that he reaches 100 in either of his next two throws.

Answer .....[5]

9. (a) Calculate the magnitude of the vector $\begin{pmatrix} 3 \\ -5 \end{pmatrix}$.

Answer ..... [2]

(b)



(i) The points *P* and *R* are marked on the grid above.

$\overrightarrow{PQ} = \begin{pmatrix} 3 \\ -5 \end{pmatrix}$. Draw the vector $\overrightarrow{PQ}$ on the grid above. [1]

(ii) Draw the image of the vector $\overrightarrow{PQ}$ after rotation by 90° anticlockwise about *R*

[1]

(c) $\overrightarrow{DE} = 2\boldsymbol{a} + \boldsymbol{b}$ and $\overrightarrow{DC} = 3\boldsymbol{b} - \boldsymbol{a}$.

Find $\overrightarrow{CE}$ in terms of $\boldsymbol{a}$ and $\boldsymbol{b}$. Write your answer in its simplest form.

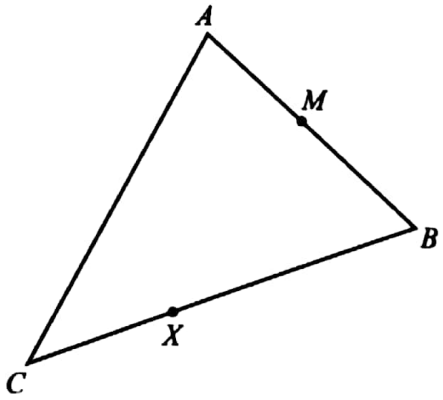
Answer $\overrightarrow{CE}$ = ...[2]

(d) $\overrightarrow{OT} = \begin{pmatrix} -2 \\ 5 \end{pmatrix}$ and $\overrightarrow{OV} = \begin{pmatrix} 5 \\ -1 \end{pmatrix}$

Write $\overrightarrow{TV}$ as a column vector.

Answer $\overrightarrow{TV} = \begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [2]

(e)



NOT TO SCALE

$\overrightarrow{AB} = \mathbf{b}$ and $\overrightarrow{AC} = \mathbf{c}$

(i) Find $\overrightarrow{CB}$ in terms of **b** and **c**.

Answer $\overrightarrow{CB}$ =..... [1]

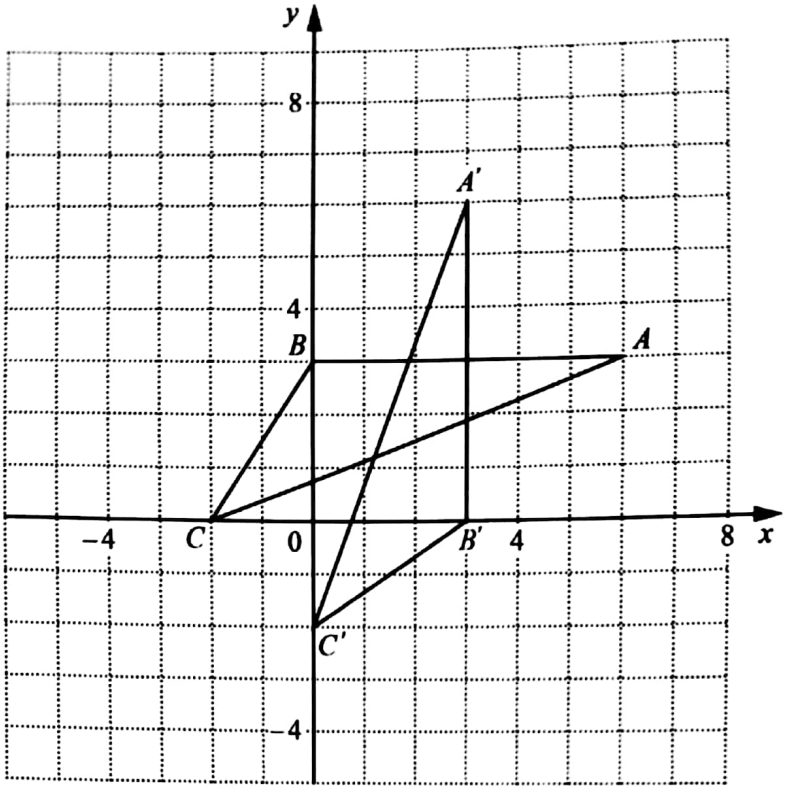
(ii) X divides CB in the ratio 1 : 3
M is the midpoint of AB

Find $\overrightarrow{MX}$ in terms of **b** and **c**.

Show all your working and write your answer in its simplest form.

Answer $\overrightarrow{MX} =$ ..... [4]

10.



(a) The transformation T maps triangle *ABC* onto triangle *A'B'C'*.

(i) Describe fully the transformation T.

Answer.....[2]

(ii) The matrix M represents the transformation T.
Find the matrix M.

Answer.....[2]

(b) Triangle $A'B'C'$ is mapped onto triangle $A''B''C''$ by reflection in the y-axis.

Draw and label the triangle $A''B''C''$ **[1]**

(c) Triangle ABC is mapped onto triangle $A''B''C''$ by rotation about the origin.

State the direction and angle of rotation.

.....

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