FORM TP 2022019

TEST CODE 01234020

JANUARY 2022

CARIBBEAN EXAMINATIONS COUNCIL

CARIBBEAN SECONDARY EDUCATION CERTIFICATE® EXAMINATION

MATHEMATICS

Paper 02 – General Proficiency

2 hours 40 minutes

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This paper consists of TWO sections: I and II.
2. Section I has SEVEN questions and Section II has THREE questions.
3. Answer ALL questions.
4. Write your answers in the spaces provided in this booklet.
5. Do NOT write in the margins.
6. All working MUST be clearly shown.
7. **A list of formulae is provided on page 4 of this booklet.**
8. If you need to rewrite any answer and there is not enough space to do so on the original page, you must use the extra page(s) provided at the back of this booklet. **Remember to draw a line through your original answer.**
9. **If you use the extra page(s) you MUST write the question number clearly in the box provided at the top of the extra page(s) and, where relevant, include the question part beside the answer.**

Required Examination Materials

Electronic calculator
Geometry set

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

SECTION I

Answer ALL questions.

All working must be clearly shown.

1. (a) Using a calculator, or otherwise, find

(i) the EXACT value of $\frac{8.9 + 31.6}{0.75 \times 5.4}$

.....

(1 mark)

(ii) the value of $3.9 \tan(18°)$ correct to 1 decimal place.

.....

(1 mark)

GO ON TO THE NEXT PAGE

(b) (i) Ria is paid at the rate of $13.50 per hour. During a certain week she worked 40 hours. How much did she earn that week?

.....

(1 mark)

(ii) Ria worked 4 weeks in the month of August and her gross earnings was $2 463.75.

Her regular week comprised 40 hours and overtime was paid at $1\frac{1}{2}$ times the hourly rate.

Show that Ria worked 15 hours overtime in August.

.....

(2 marks)

(iii) In August, 20% of Ria's gross earnings was deducted as tax. How much money does she have left after the deduction?

.....

(2 marks)

(iv) Ria invested $219 of her earnings for 3 years at a rate of 4.5% per annum simple interest. How much interest does she receive after 3 years?

.....

(2 marks)

Total 9 marks

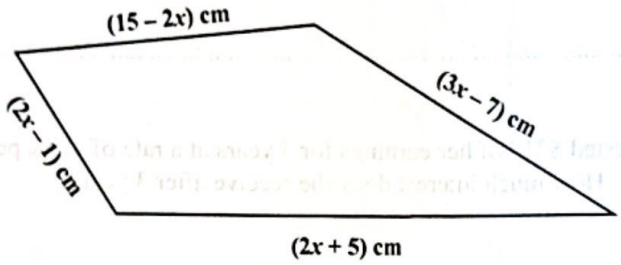
2. (a) Factorize completely

$3n^2 + 15np$.

.....

(2 marks)

(b) The diagram below shows a quadrilateral with the length of its sides written in terms of x.



(i) Write an expression, in terms of x, for the perimeter of the quadrilateral. Express your answer in its simplest form.

.....

(2 marks)

(ii) The perimeter of the quadrilateral is 32 cm.

Find the length of the longest side of the quadrilateral.

.....

(2 marks)

GO ON TO THE NEXT PAGE

(c) Determine ALL the **integer values** of x which satisfy the inequality

$$-1 < \frac{2-4x}{3} < 5.$$

.....

(3 marks)

Total 9 marks

3. (a) The box below contains the names of 5 quadrilaterals.

Trapezium	Rhombus	
Kite	Square	Rectangle

Choose the name of **one** quadrilateral from the box that BEST completes **each** statement.

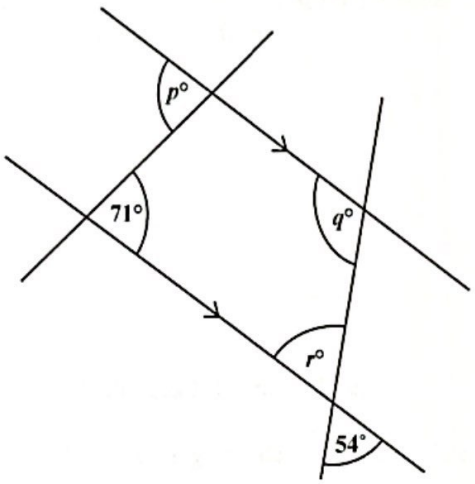
(i) A ..... has no lines of symmetry and has rotational symmetry of order one.

(ii) A ..... has EXACTLY **two** lines of symmetry and 4 right angles.

(iii) A ..... has one line of symmetry but no rotational symmetry.

(3 marks)

(b) The diagram below shows 4 straight lines, 2 of which are parallel.



(i) Determine the values of q and r.

q

.....

(1 mark)

r

.....

(1 mark)

GO ON TO THE NEXT PAGE

(ii) Give a geometrical reason why $\angle p = 71°$.

.....

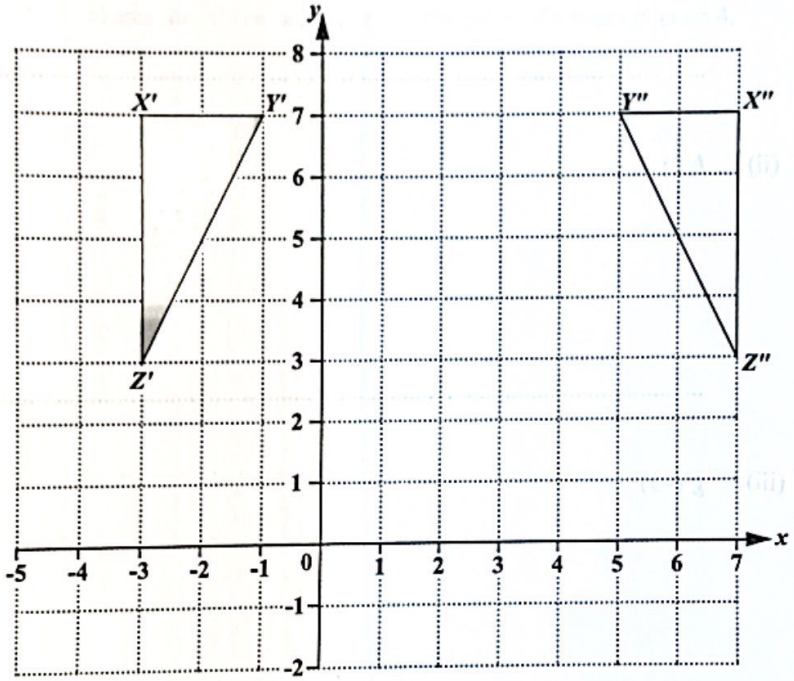
.....

.....

.....

(1 mark)

(c) The diagram below shows triangles $X'Y'Z'$ and $X''Y''Z''$ drawn on a square grid.



(i) Triangle $X'Y'Z'$ is the image of Triangle XYZ after an enlargement of scale factor 2, with centre (5, 1).

Draw triangle XYZ, the **OBJECT** for Triangle $X'Y'Z'$, on the grid above.

(2 marks)

(ii) Triangle $X'Y'Z'$ is mapped onto Triangle $X''Y''Z''$ by a reflection in the line P. State the equation of the mirror line, P.

.....

(1 mark)

Total 9 marks

GO ON TO THE NEXT PAGE

4. Three functions f, g and h are defined as

$f(x) = 2x - 1$; $g(x) = 3x + 2$ and $h(x) = 5^x$.

(a) Find the value of

(i) $f\left(\frac{1}{2}\right)$

.....

(1 mark)

(ii) $h(0)$

.....

(1 mark)

(iii) $g^2(-3)$.

.....

(2 marks)

(b) Find $gf(x)$, giving your answer in its simplest form.

.....

(2 marks)

(c) (i) Find $g^{-1}(x)$.

.....

(2 marks)

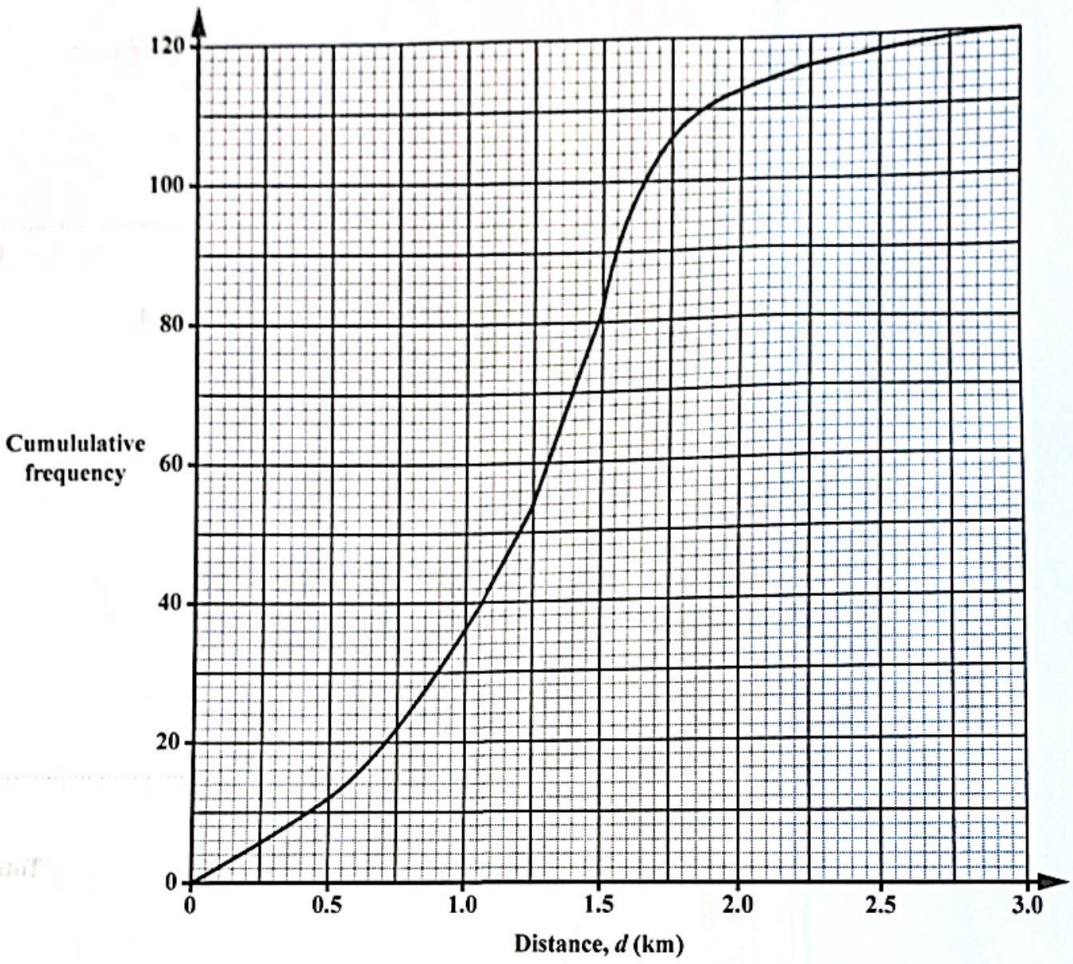
(ii) Hence, or otherwise, determine the value of x when $g^{-1}(x) = 4$.

.....

(1 mark)

Total 9 marks

5. The cumulative frequency diagram below shows information about the distance, d km, that each of 120 students walks to school on a particular day.



(a) How many students walked AT MOST 1 km to school on that day?

.....

(1 mark)

(b) Using the cumulative frequency diagram, determine an estimate of

(i) the median

.....

(1 mark)

(ii) the lower quartile

.....

(1 mark)

(iii) the interquartile range.

.....

(1 mark)

(c) A student is chosen at random. What is the probability that the student walked for **more than** 1.5 km to school that day?

.....

(2 marks)

(d) Complete the table below and use the information to calculate an estimate of the mean distance walked by the students on that day.

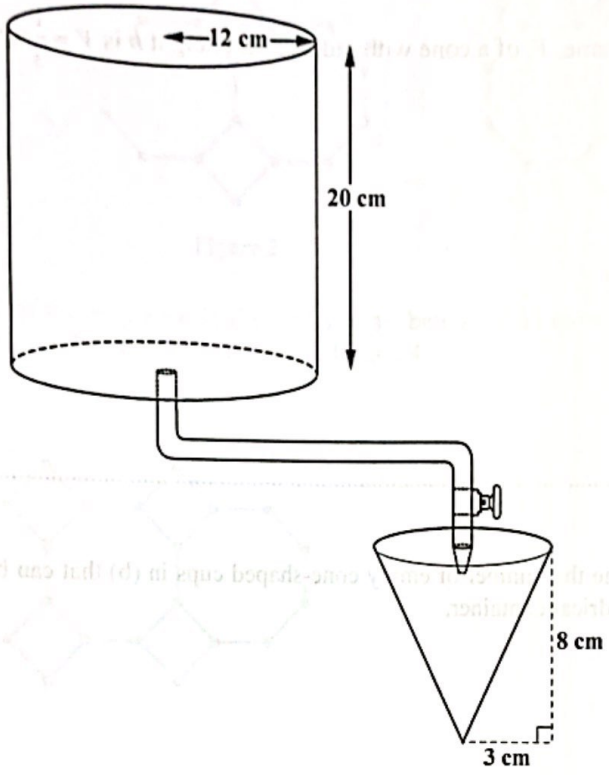
Distance, d (km)	Midpoint (x)	Number of Students (f)	$f \times x$
$0 < d \leq 0.5$	0.25	12	3.0
$0.5 < d \leq 1.0$	0.75	24	18
$1.0 < d \leq 1.5$	1.25	46	57.5
$1.5 < d \leq 2.0$	_____	_____	_____
$2.0 < d \leq 2.5$	2.25	_____	_____
$2.5 < d \leq 3.0$	2.75	2	5.5

.....

(3 marks)

Total 9 marks

6. At a track meet, a cylindrical container, fitted with a pipe as shown in the diagram below, is used to serve water to athletes. The cylindrical container of radius 12 cm and height 20 cm is **completely** filled with water and the pipe fitted at the bottom dispenses water into cone-shaped cups. The cone-shaped cups have a radius of 3 cm and a height of 8 cm.



(a) Calculate the volume of water in the cylindrical container, **in litres**. Write your answer correct to 2 decimal places. [1 000 cm^3 = 1 litre]

.....

(3 marks)

(b) Water flows from the cylindrical container along the pipe into the cone-shaped cups at a rate of 7.8 *ml* per second.

Calculate the time taken to fill ONE of the empty cone-shaped cups. Give your answer correct to the nearest second.

[The volume, V, of a cone with radius r and height h is $V = \frac{1}{3}\pi r^2 h$.]

.....

(3 marks)

(c) Determine the number of empty cone-shaped cups in (b) that can be **completely** filled from the cylindrical container.

.....

(3 marks)

Total 9 marks

7. A sequence of figures is made from lines of unit length and dots. The lines form a series of octagons and squares. The dots are placed at each vertex.

The first 3 figures in the sequence are shown below.

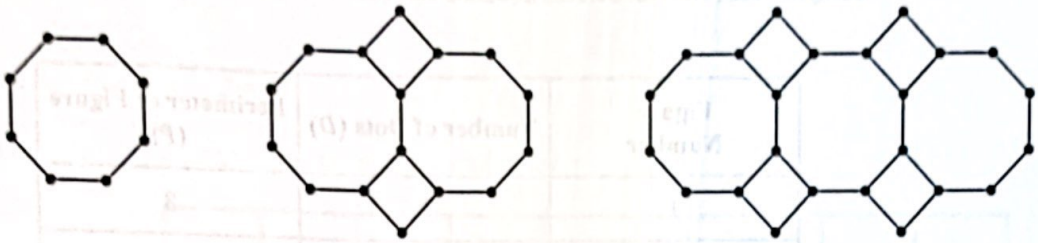
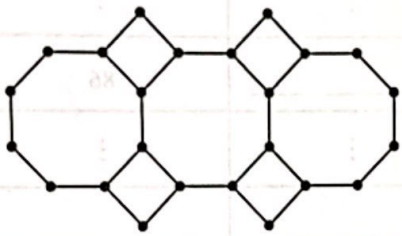


Figure 1 Figure 2 Figure 3

(a) Figure 3 of the sequence is shown by itself below. Add more lines of unit length and dots to Figure 3 to correctly represent Figure 4.



(2 marks)

(b) The number of dots, D, and the number of unit lines that form the perimeter of the shape, P, form a pattern. The values for D and P for the first 3 figures are written in the table below. Study the pattern of numbers in each row of the table.

Complete the rows numbered (i), (ii) and (iii).

	Figure Number	Number of Dots (D)	Perimeter of Figure (P)	
	1	8	8	
	2	16	14	
	3	24	20	
(i)	4	_____	_____	**(2 marks)**
	⋮	⋮	⋮	
(ii)	_____	_____	86	**(2 marks)**
	⋮	⋮	⋮	
(iii)	n	_____	_____	**(2 marks)**

(c) For any figure, $n > 1$, the number of dots, D, is greater than its perimeter, P. Determine the value of n for a figure in which the difference between D and P is 36.

.....

(2 marks)

Total 10 marks

SECTION II

Answer ALL questions.

ALGEBRA, RELATIONS, FUNCTIONS AND GRAPHS

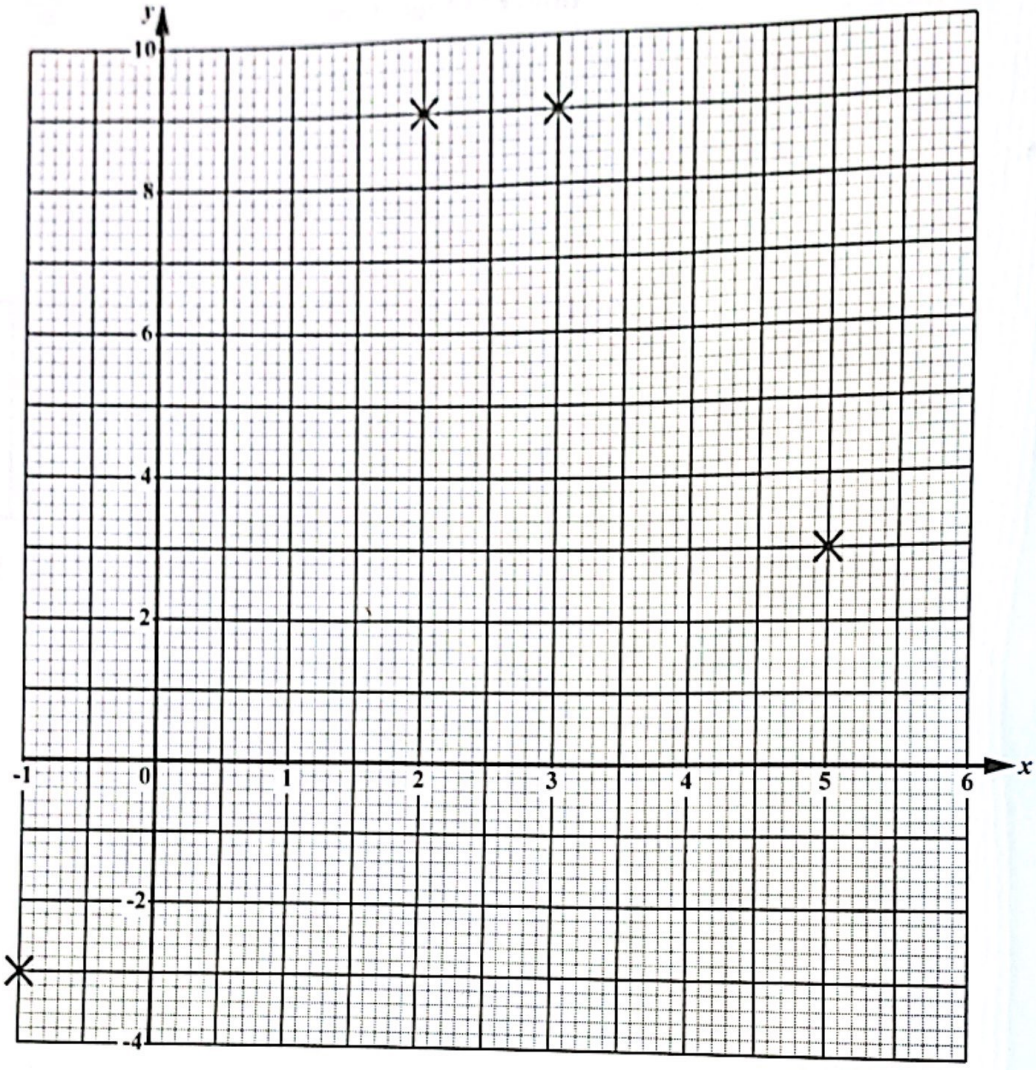
8. The function $f : x \rightarrow 3 + 5x - x^2$.

(a) (i) Complete the table of values for $f(x) = 3 + 5x - x^2$.

x	−1	0	1	2	3	4	5	6
$f(x)$	−3			9	9		3	

(2 marks)

(ii) On the grid below, complete the graph of $f(x) = 3 + 5x - x^2$ for $-1 \leq x \leq 6$.



(3 marks)

(b) (i) Write down the equation of the axis of symmetry of the graph of $f(x) = 3 + 5x - x^2$.

.....

(1 mark)

(ii) State the maximum value of the function.

.....

(1 mark)

(c) Write down the co-ordinates of the point where the line $y = 3 - \frac{1}{2}x$

(i) crosses the x-axis

.....

(1 mark)

(ii) crosses the y-axis.

.....

(1 mark)

(d) On the grid **on page 22**, draw the line $y = 3 - \frac{1}{2}x$.

(1 mark)

(e) Using your graph, determine the solution to the equations

$y = 3 + 5x - x^2$

$y = 3 - \frac{1}{2}x.$

.....

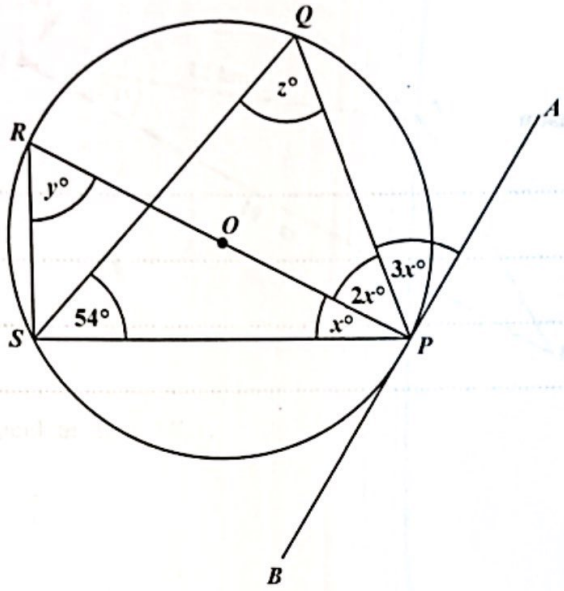
(2 marks)

Total 12 marks

NOTHING HAS BEEN OMITTED.

GEOMETRY AND TRIGONOMETRY

9. (a) The diagram below shows a circle, with the points P, Q, R and S lying on its circumference and its centre marked O. RP is a diameter of the circle and AB is a tangent to the circle at P. Angle $APQ = 3x°$, angle $QPR = 2x°$, angle $RPS = x°$ and angle $QSP = 54°$.



Determine the value of EACH of the following angles. Show detailed working where possible and give a **reason** for your answer.

(i) x

Reason

.....

.....

.....

.....

(2 marks)

(ii) y

Reason

.....

.....

.....

.....

(2 marks)

(ii) z

Reason

.....

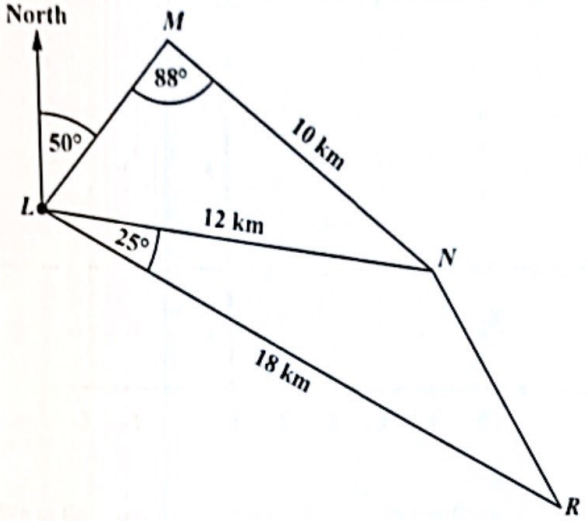
.....

.....

.....

(2 marks)

(b) The diagram below shows straight roads connecting the towns L, M, N and R. $LR = 18$ km, $LN = 12$ km and $MN = 10$ km. Angle $RLN = 25°$ and angle $LMN = 88°$.



(i) Calculate angle MLN.

.....

(3 marks)

(ii) Calculate the distance NR.

.....

(2 marks)

(iii) Determine the bearing of Town *R* from Town *L*.

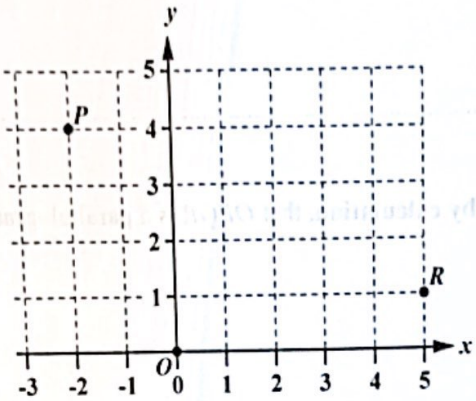
.....

(1 mark)

Total 12 marks

VECTORS AND MATRICES

10. (a) Three points, O, P and R, are shown on the grid below. O is the origin.



(i) Write the position vector of R, $\overrightarrow{OR}$, in the form, $\begin{pmatrix} a \\ b \end{pmatrix}$.

.....

(1 mark)

(ii) Another point, Q, is located in such a way that $\overrightarrow{QR} = \begin{pmatrix} 2 \\ -4 \end{pmatrix}$.

Using this information, plot the point Q on the graph.

.....

(1 mark)

(iii) Determine $|\overrightarrow{QR}|$, the magnitude of $\overrightarrow{QR}$.

.....

(2 marks)

(iv) Show, **by calculation**, that $OPQR$ is a parallelogram.

.....

(3 marks)

(b) Calculate the value of x and the value of y in the matrix equation below.

$$\begin{pmatrix} 1 & 5 \\ 2 & y \end{pmatrix}\begin{pmatrix} -4 & 1 \\ 2 & 9 \end{pmatrix}=\begin{pmatrix} x & 46 \\ 6 & 65 \end{pmatrix}$$

.....

(3 marks)

(c) A transformation, T, represented by the matrix $\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$, maps $S(2, 5)$ onto $S'(5, 2)$.

Describe fully the **single** transformation T.

.....

.....

.....

.....

(2 marks)

Total 12 marks

END OF TEST

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.