FORM TP 2017017

TEST CODE **01234020**

JANUARY 2017

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 EIGHT questions and Section II has THREE questions.
3. Answer ALL questions in Section I and any TWO questions from Section II.
4. Write your answers in the booklet provided.
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.

LIST OF FORMULAE

Volume of a prism: $V = Ah$ where A is the area of a cross-section and h is the perpendicular length.

Volume of cylinder: $V = \pi r^2 h$ where r is the radius of the base and h is the perpendicular height.

Volume of a right pyramid: $V = \frac{1}{3}Ah$ where A is the area of the base and h is the perpendicular height.

Circumference: $C = 2\pi r$ where r is the radius of the circle.

Arc length: $S = \frac{\theta}{360} \times 2\pi r$ where θ is the angle subtended by the arc, measured in degrees.

Area of a circle: $A = \pi r^2$ where r is the radius of the circle.

Area of a sector: $A = \frac{\theta}{360} \times \pi r^2$ where θ is the angle of the sector, measured in degrees.

Area of trapezium: $A = \frac{1}{2}(a + b)\,h$ where a and b are the lengths of the parallel sides and h is the perpendicular distance between the parallel sides.

Roots of quadratic equations: If $ax^2 + bx + c = 0$,

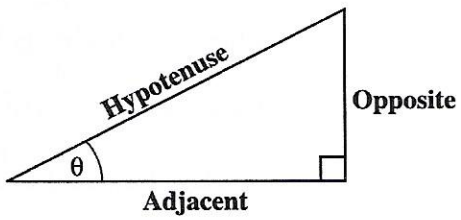
$$\text{then } x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Trigonometric ratios:

$$\sin\theta = \frac{\text{opposite side}}{\text{hypotenuse}}$$

$$\cos\theta = \frac{\text{adjacent side}}{\text{hypotenuse}}$$

$$\tan\theta = \frac{\text{opposite side}}{\text{adjacent side}}$$

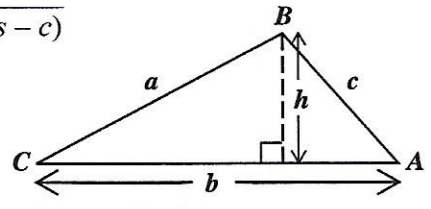


Area of triangle: Area of $\Delta = \frac{1}{2}bh$ where b is the length of the base and h is the perpendicular height.

$$\text{Area of } \Delta ABC = \frac{1}{2}ab\sin C$$

$$\text{Area of } \Delta ABC = \sqrt{s(s-a)(s-b)(s-c)}$$

$$\text{where } s = \frac{a+b+c}{2}$$



Sine rule: $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

Cosine rule: $a^2 = b^2 + c^2 - 2bc\cos A$

GO ON TO THE NEXT PAGE

SECTION I

Answer ALL questions in this section.

All working must be clearly shown.

1. (a) Using a calculator, or otherwise, calculate the EXACT value of:

(i) $\dfrac{3\frac{1}{2} \times 1\frac{2}{3}}{4\frac{1}{5}}$

(2 marks)

(ii) $5.47 - \sqrt{\dfrac{0.1014}{1.5}}$

(2 marks)

(b) The table below shows the number of tickets sold for a bus tour. Some items in the table are missing.

Tickets Sold for Bus Tour			
Category	**Number of Tickets Sold**	**Cost per Ticket in $**	**Total Cost in $**
Juvenile	5	P	130.50
Youth	14	44.35	Q
Adult	R		2483.60

(i) Calculate the value of P.

(1 mark)

(ii) Calculate the value of Q.

(1 mark)

(iii) An adult ticket is TWICE the cost of a youth ticket. Calculate the value of R.

(2 marks)

(iv) The bus company pays taxes of 15% on each ticket sold. Calculate the taxes paid by the bus company.

(3 marks)

Total 11 marks

2. (a) Write as a single fraction:

$$\frac{2x+3}{3} + \frac{x-4}{4}$$

(2 marks)

(b) Write the following statement as an algebraic expression.

The sum of a number and its multiplicative inverse is five times the number.

(2 marks)

(c) Factorize completely:

(i) $x^2 - 36$

(2 marks)

(ii) $2x^2 + 5x - 12$

(2 marks)

(d) The formula for the volume of a cylinder is given as $V = \pi r^2 h$.

Make r the subject of the formula.

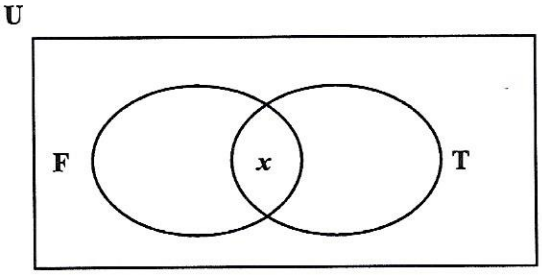
(2 marks)

(e) Given that $x^2 + ax + b = (x + 2)^2 - 3$, work out the values of a and b.

(2 marks)

Total 12 marks

3. (a) The incomplete Venn diagram below shows the number of students in a class of 28 who play football and tennis.



U = {all students in the class}
F = {students who play football}
T = {students who play tennis}

Additional information about the class is that
12 students play tennis
15 students play football
8 students play neither football nor tennis
x students play BOTH football and tennis.

(i) Complete the Venn diagram above to represent the information, showing the number of students in EACH subset. **(3 marks)**

(ii) Calculate the value of x.

(2 marks)

(b) Using **a ruler, a pencil and a pair of compasses**, construct the trapezium ABCD with AB = 8 cm, $B\hat{A}D = 60°$, AD = 6 cm, $A\hat{B}C = 90°$ and AB parallel to CD.
(Credit will be given for clearly drawn construction lines.)

(7 marks)

Total 12 marks

4. (a) Given that $f(x) = 4x - 7$ and $g(x) = \dfrac{3x+1}{2}$, determine the values of:

(i) $g(0) + g(5)$

(2 marks)

(ii) $fg(5)$

(2 marks)

(iii) $f^{-1}(1)$

(2 marks)

(b) P(6, –1) and Q(2, 7) are the end points of a line segment PQ. Determine

(i) the gradient of PQ

(2 marks)

(ii) the coordinates of the midpoint of PQ

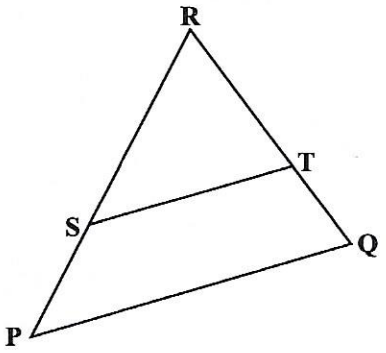
(2 marks)

(iii) the equation of the perpendicular bisector of PQ.

(2 marks)

Total 12 marks

5. (a)



Triangles PQR and STR are similar triangles.

(i) Complete the following statement:

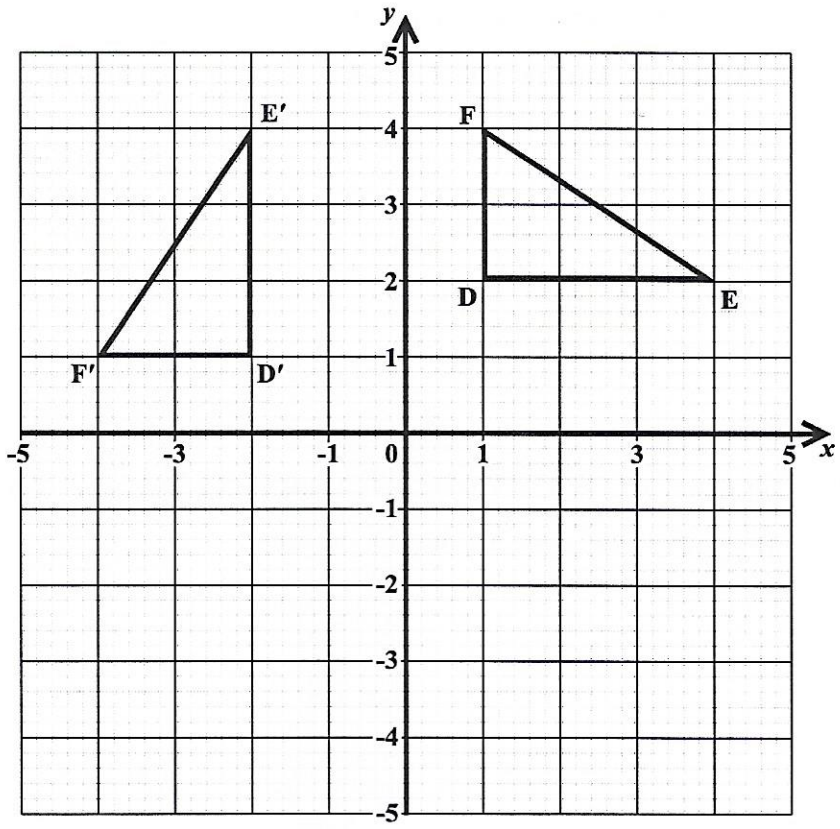
In the diagram above, the corresponding angles of Δ PQR and Δ STR are ..... and the ..... of their corresponding sides are the same.
(2 marks)

In the diagram above, **not drawn to scale**, RS = 15 cm, SP = 9 cm and ST = 12 cm.

(ii) Determine the length of PQ.

(3 marks)

(b) The graph below shows triangle DEF and its image D′E′F′ after a transformation.



(i) State the coordinates of the point E.

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(1 mark)

(ii) Describe fully the transformation that maps triangle DEF to its image, D′E′F′.

.....

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.....

.....

.....

.....

(3 marks)

(iii) On the grid above, draw triangle D″E″F″, the reflection of triangle D′E′F′ in the *x*-axis. **(2 marks)**

Total 11 marks

6. (a) The scale on a map is 1:25 000.

(i) Anderlin and Jersey are 31.8 cm apart on the map.

Determine, in km, the actual distance between Anderlin and Jersey.

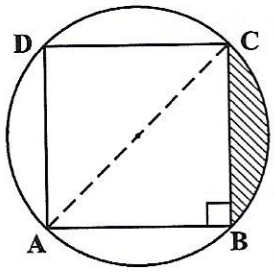
(2 marks)

(ii) The actual distance between Clifton and James Town is 2.75 km.

How many units apart are they on the map?

(2 marks)

(b) The diagram below shows a square ABCD drawn inside a circle. The vertices of the square lie on the circumference of the circle. The length of a side of the square is 11 cm.



(i) Show that the diameter of the circle is $11\sqrt{2}$ cm.

(2 marks)

Write your answers correct to 2 decimal places.

Calculate

(ii) the area of the circle

(2 marks)

(iii) the area of the square

(1 mark)

(iv) the area of the shaded section.

(2 marks)

Total 11 marks

7. The table below shows the number of bananas, to the nearest tonne, produced annually on a farm over a period of 6 years.

Year	2010	2011	2012	2013	2014	2015
Production (tonnes)	150	275	100	40	125	210

(a) **On the graph paper provided on page 21**, draw a bar chart to represent the data given in the table above using a scale of 1 cm to represent 1 year on the x-axis and 1 cm to represent 25 tonnes on the y-axis. **(4 marks)**

(b) Determine the range of the number of bananas produced between 2010 and 2015.

.....

.....

(2 marks)

(c) (i) During which year was there the greatest production of bananas?

.....

(1 mark)

(ii) How is this information shown on the bar chart?

.....

.....

.....

(1 mark)

(d) (i) Between which two consecutive years was there the greatest **change** in the production of bananas?

.....

(1 mark)

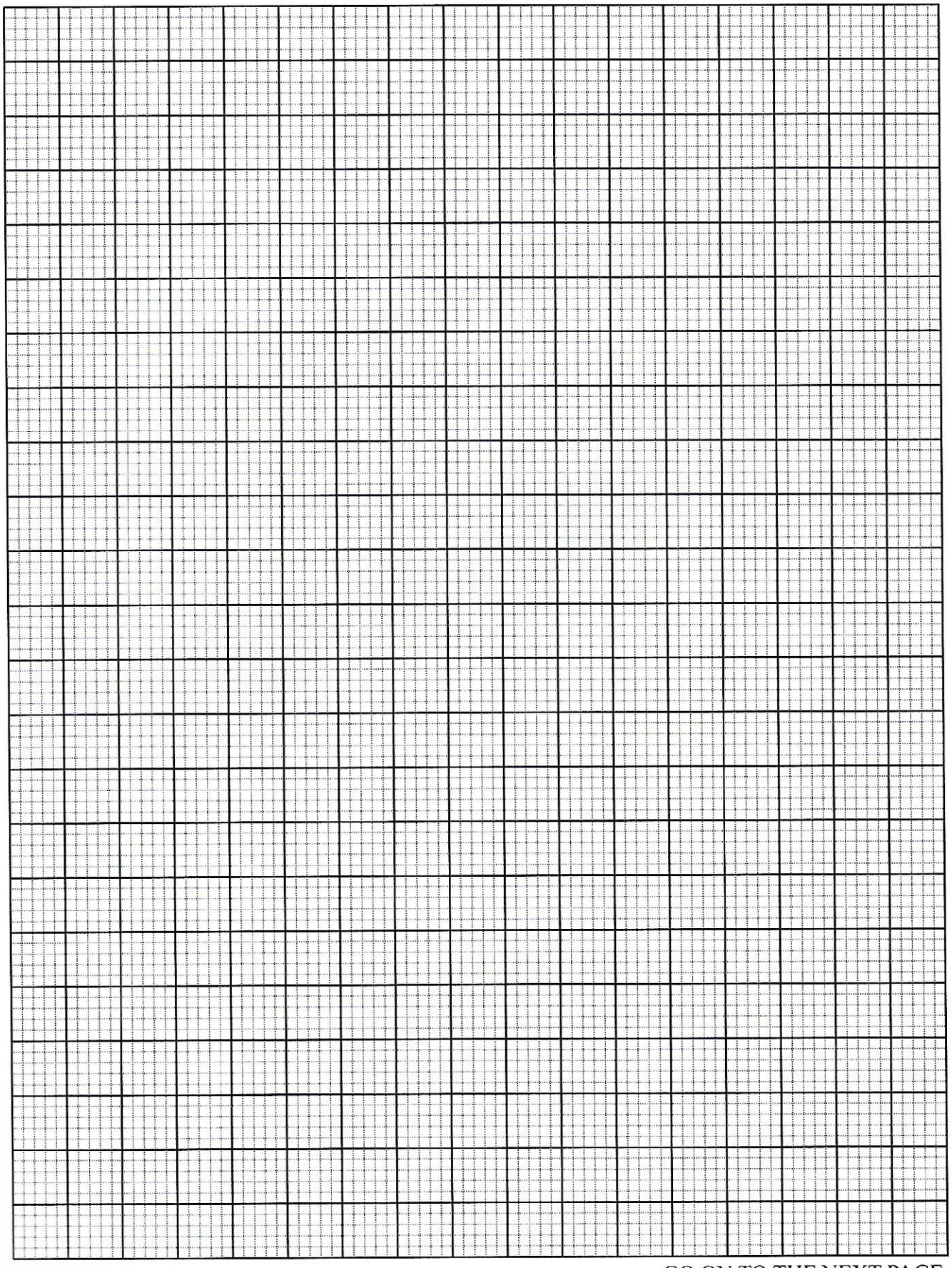
(ii) How is this information shown on the bar chart?

.....

.....

.....

(1 mark)



(e) Give ONE reason why the bar chart is unsuitable for predicting the number of bananas produced in 2016.

.....

.....

.....

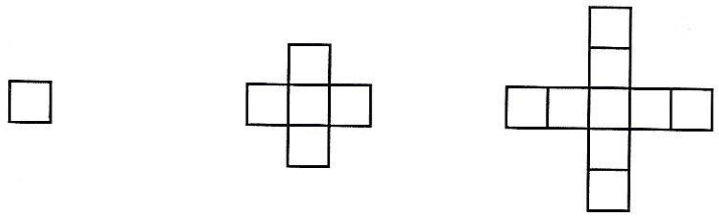
(1 mark)

Total 11 marks

NOTHING HAS BEEN OMITTED.

8. A sequence of figures is made up of unit squares with unit sides. The first three figures in the sequence are shown below.

Figure 1 **Figure 2** **Figure 3** **Figure 4**



n = 1 **n = 2** **n = 3**

(a) Draw Figure 4 of the sequence in the space provided above. **(2 marks)**

(b) Study the pattern of numbers in each row of the table below. Each row relates to one of the figures in the sequence. Some rows have not been included in the table.

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

	Figure	Number of Unit Squares	Perimeter of Figure	
	1	1	4	
	2	5	12	
	3	9	20	
(i)	4			**(2 marks)**
(ii)		45		**(2 marks)**
(iii)	30			**(2 marks)**
(iv)	n			**(2 marks)**

Total 10 marks

SECTION II

Answer TWO questions in this section.

ALGEBRA AND RELATIONS, FUNCTIONS AND GRAPHS

9. (a) The table below shows pairs of values for x and y, where y is inversely proportional to x.

x	3	4	a	20
y	2	1.5	1.2	b

(i) Express y in terms of x and a constant k.

(1 mark)

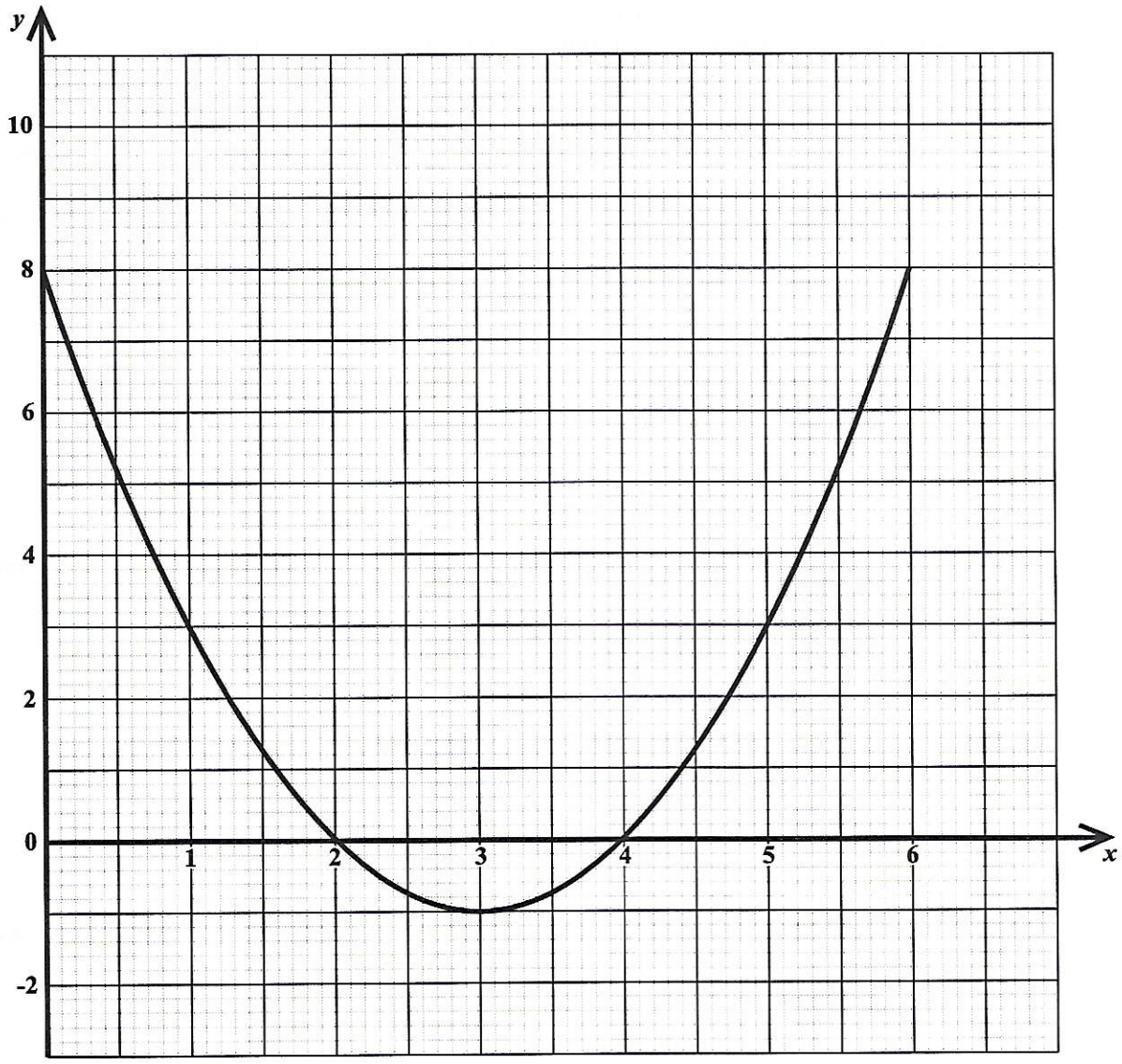
(ii) Calculate the value of the constant k.

(1 mark)

(iii) Determine the values of a and b.

(2 marks)

(b) The diagram below shows the graph of the function $f(x) = x^2 - 6x + 8$ for values of x from 0 to 6.



(i) Use the graph to solve the equation $x^2 - 6x + 8 = 0$.

(2 marks)

(ii) Write down the coordinates of the minimum point in the form (x, y).

.....

(1 mark)

GO ON TO THE NEXT PAGE

(iii) Write $x^2 - 6x + 8$ in the form $a(x + h)^2 + k$ where a, h and k are constants.

(3 marks)

(iv) On the same axes, draw the graph of the straight line $g(x) = x - 2$.

(3 marks)

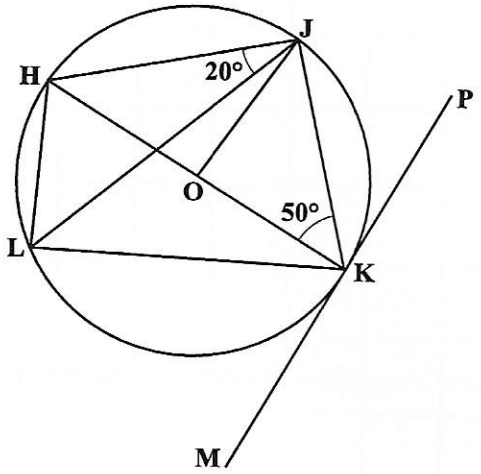
(v) Hence, solve the equation $x^2 - 6x + 8 = x - 2$.

(2 marks)

Total 15 marks

MEASUREMENT, GEOMETRY AND TRIGONOMETRY

10. (a) The diagram below, **not drawn to scale**, shows a circle with centre O. The vertices H, J, K and L of a quadrilateral lie on the circumference of the circle and PKM is a tangent to the circle at K. The measure of angle $H\hat{J}L = 20^\circ$ and $J\hat{K}H = 50^\circ$.



Calculate, **giving reasons for each step of your answer**, the measure of

(i) $H\hat{K}L$

(ii) $J\hat{O}K$

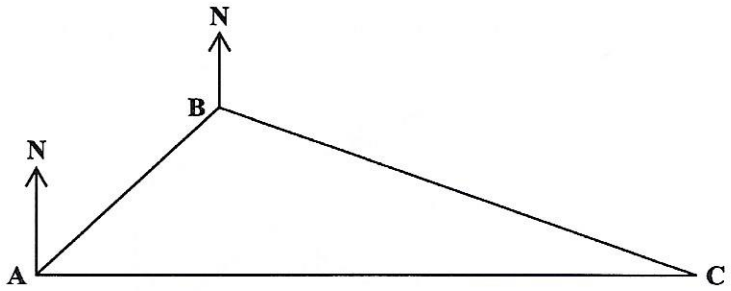
(2 marks)

(2 marks)

(iii) $J\hat{H}K$.

(2 marks)

(b) A ship travels from Akron (A) on a bearing of 030° to Bellville (B), 90 km away. It then travels to Comptin (C) which is 310 km due east of Akron (A), as shown in the diagram below.



(i) Indicate on the diagram the bearing 030° and the distances 90 km and 310 km.

(2 marks)

(ii) Calculate, to the nearest km, the distance between Bellville (B) and Comptin (C).

(2 marks)

(iii) Calculate, to the nearest degree, the measure of $A\hat{B}C$.

(2 marks)

(iv) Determine the bearing of Comptin (C) from Bellville (B).

(3 marks)

Total 15 marks

VECTORS AND MATRICES

11. (a) The matrix $T = \begin{pmatrix} c & 0 \\ 0 & d \end{pmatrix}$ maps the point P(2, 3) onto the point Q(2, –3).

(i) Determine the values of c and d.

(2 marks)

(ii) Determine the image of (–5, 4) under the transformation T.

(1 mark)

(iii) Describe fully the transformation T.

.....

.....

.....

.....

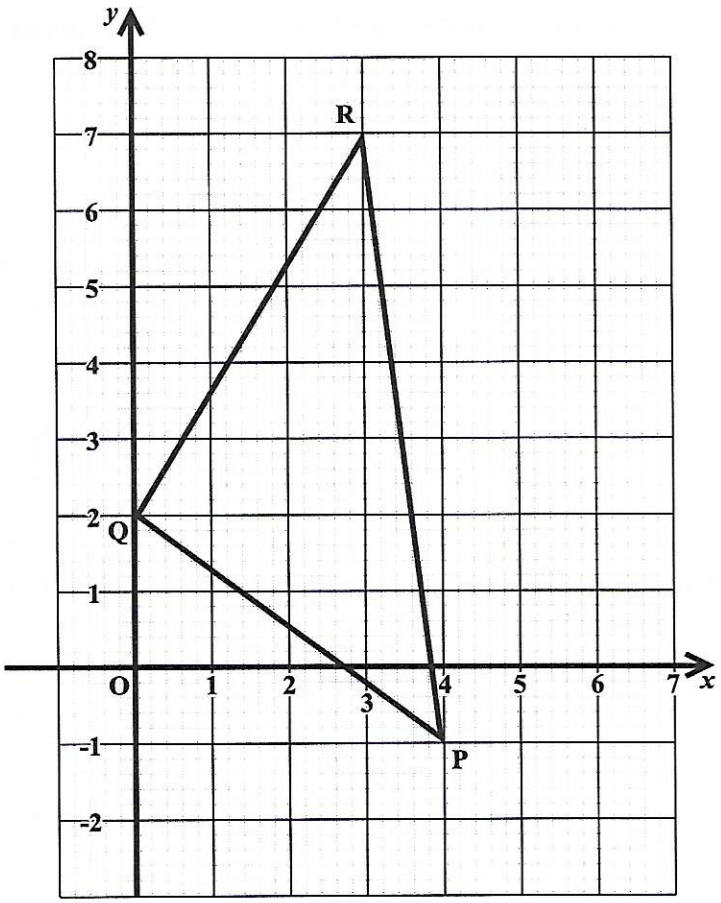
.....

(2 marks)

(iv) Find the matrix that maps the point Q back onto the point P.

(2 marks)

(b) The graph below shows three points, P, Q and R, relative to the origin, O.



(i) Write as a column vector in the form $\begin{pmatrix} x \\ y \end{pmatrix}$

- the vector $\overrightarrow{OP}$

(1 mark)

- the vector $\overrightarrow{QR}$.

(2 marks)

(ii) Determine the magnitude of the vector $\overrightarrow{QR}$.

(2 marks)

(iii) On the graph provided on page 33, draw the vector $\overrightarrow{OS} = \begin{pmatrix} 7 \\ 4 \end{pmatrix}$. Show that PQRS is a parallelogram.

(3 marks)

Total 15 marks

END OF TEST

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