FORM TP 2018087

TEST CODE **01234020**

MAY/JUNE 2018

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

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Sequential Bar Code

LIST OF FORMULAE

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

Volume of a 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 a 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 $ax^2 + bx + c = 0$,

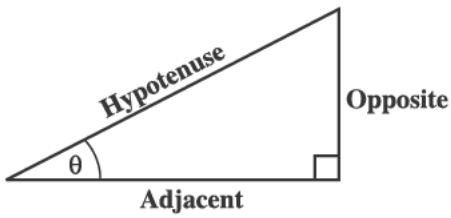
then $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Trigonometric ratios

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

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

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

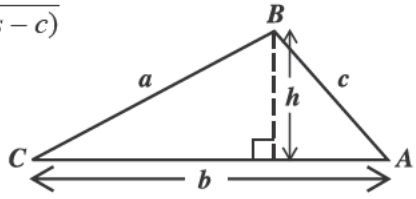


Area of a triangle — Area of $\Delta = \frac{1}{2}bh$ where b is the length of the base and h is the perpendicular height.

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

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

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



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

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

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SECTION I

Answer ALL questions in this section.

All working must be clearly shown.

1. (a) Using a calculator, or otherwise, evaluate EACH of the following, giving your answers to two decimal places.

(i) $73.18 - 5.23 \times 9.34$

.....

(1 mark)

(ii) $\frac{3.1^2}{6.17} + 1.12$

.....

(1 mark)

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(b) Jenny works at Sammy's Restaurant and is paid according to the rates in the following table.

Jenny's weekly wage agreement
Basic wage \$600.00 PLUS \$0.90 for each customer served

In a week when Jenny serves n customers, her weekly wage, W_J, in dollars, is given by the formula

$$W_J = 600 + 0.90n.$$

(i) Determine Jenny's weekly wage if she served 230 customers.

.....

(1 mark)

(ii) In a **good** week, Jenny's wage is \$1 000.00 or more. What is the LEAST number of customers that Jenny must serve in order to have a **good** week?

.....

(2 marks)

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(iii) At the same restaurant, Shawna is paid a weekly wage of $270.00 plus $1.50 for each customer she serves.

If W_S is Shawna's weekly wage, in dollars, write a formula for calculating Shawna's weekly wage when she serves m customers.

.....

(1 mark)

(iv) In a certain week, Jenny and Shawna received the same wage for serving the same number of customers.

How many customers did they EACH serve?

.....

(3 marks)

Total 9 marks

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2. (a) Factorize, completely, EACH of the following expressions.

(i) $1 - 4h^2$

.....

(1 mark)

(ii) $pq - q^2 - 3p + 3q$

.....

(2 marks)

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(b) Solve EACH of the following equations.

(i) $\frac{3}{2}y = 12$

.....

(1 mark)

(ii) $2x^2 + 5x - 3 = 0$

.....

(2 marks)

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(c) The quantities F, m, u, v and t are related according to the formula

$$F = \frac{m(v - u)}{t}.$$

(i) Find the value of F when $m = 3$, $u = -1$, $v = 2$ and $t = 1$.

.....

(1 mark)

(ii) Make v the subject of the formula.

.....

(2 marks)

Total 9 marks

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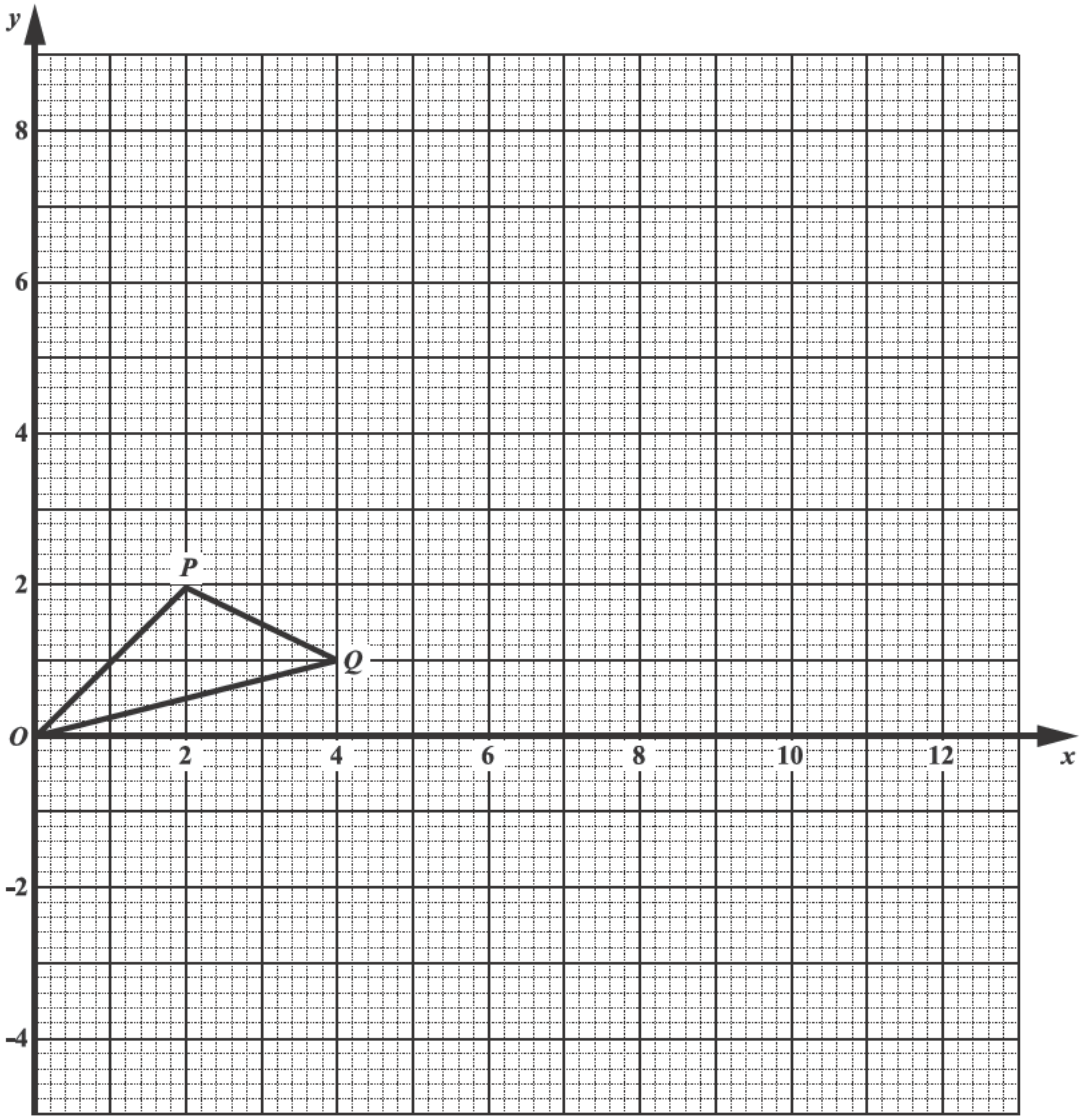
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3. (a) Using a ruler, a pencil and a pair of compasses, construct the triangle ABC, such that $AB = 8$ cm, $\angle BAC = 30°$ and $AC = 10$ cm.

(4 marks)

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(b) The diagram below shows the triangle OPQ.



(i) State the coordinates of the point Q.

.....

(1 mark)

(ii) The line PQ is mapped to $P'Q'$ by an enlargement, centre O and scale factor 3.
On the diagram above, draw the line $P'Q'$. **(2 marks)**

(iii) The ΔOPQ undergoes a reflection in the line $y = 0$ to produce the image $O''P''Q''$.
On the diagram above, draw the $\Delta O''P''Q''$. **(2 marks)**

Total 9 marks

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4. (a) The function f with domain, $A = \{1, 2, 3\}$ is given by

$$f(x) = \frac{1}{2}x - 3.$$

(i) What is the value of $f(1)$?

.....

(1 mark)

(ii) Find the value of x for which $f(x) = -2$.

.....

(1 mark)

(iii) An ordered pair for the function is expressed in the form (a, b). Using your answers to (a) (i) and (a) (ii), or otherwise, list the ordered pairs for the function, f.

.....

(2 marks)

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(iv) Explain why $f(x) \neq 5$ for the function specified **on page 13**.

.....

(1 mark)

(b) (i) Solve the inequalities

a) $3x - 1 < 11$

.....

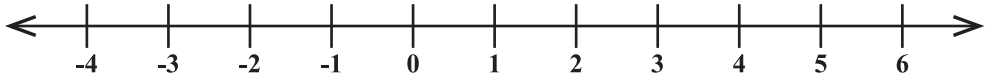
(1 mark)

b) $2 \leq 3x - 1$

.....

(1 mark)

(ii) Represent the solution to $2 \leq 3x - 1 < 11$ on the number line shown below.



(2 marks)

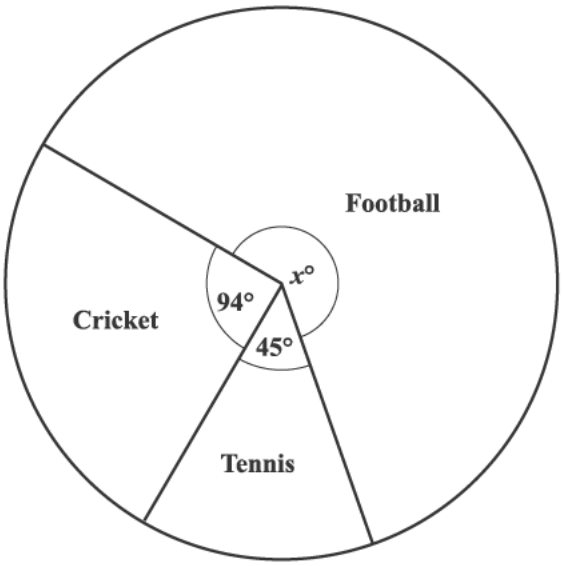
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5. (a) Students in a group were asked to name their favourite sport. Their responses are shown on the pie chart below.



(i) Calculate the value of x.

.....

(1 mark)

(ii) What percentage of the students chose cricket?

.....

(1 mark)

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(iii) Given that 40 students chose tennis, calculate the TOTAL number of students in the group.

.....

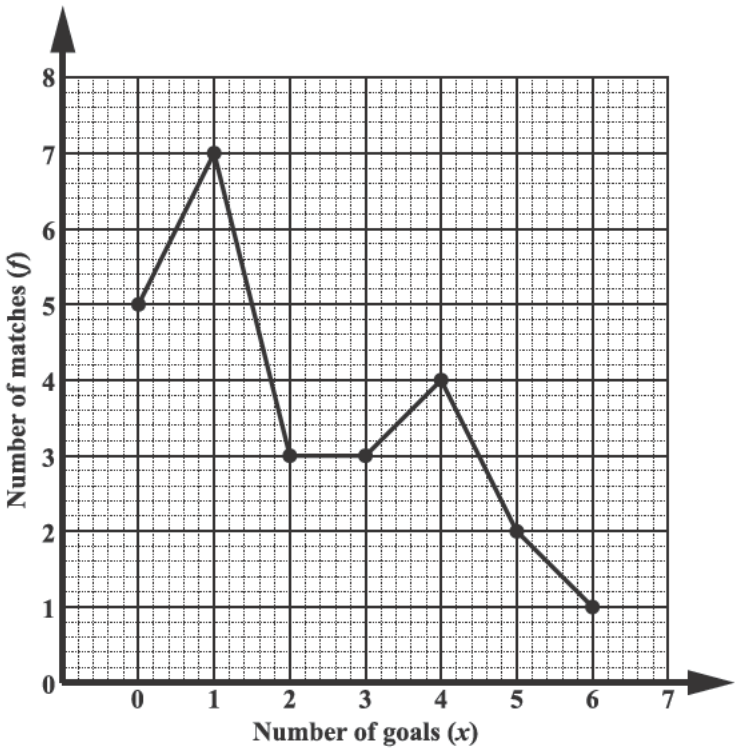
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(b) The diagram below shows a frequency polygon of the number of goals scored by a football team in 25 matches.



(i) Complete the following table using the information in the diagram.

Number of matches (f)	5	7		3	4		1
Number of goals scored (x)	0	1	2	3	4	5	6

(1 mark)

(ii) What is the modal number of goals scored by the team?

.....

(1 mark)

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(iii) Determine the median number of goals scored by the team.

.....

(1 mark)

(iv) Calculate the mean number of goals scored by the team.

.....

(2 marks)

Total 9 marks

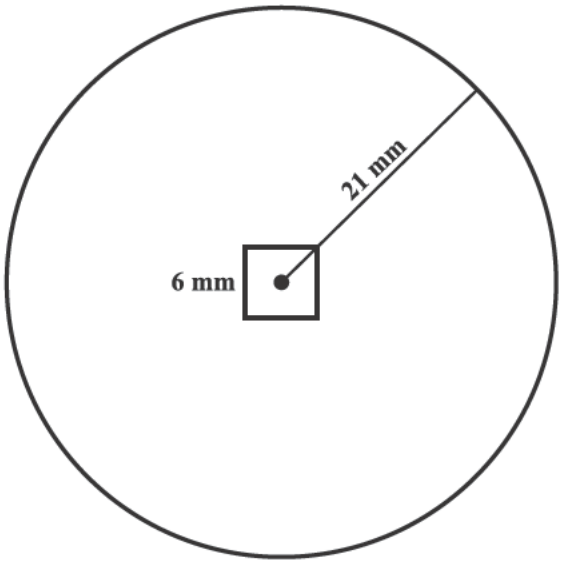
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6. (a) **In this question, take the value of π to be $\frac{22}{7}$.**

The diagram below, **not drawn to scale**, shows the cross-section of a circular metal disc of radius 21 mm. A square hole with sides 6 mm is located at the centre of the disc.



Calculate

(i) the circumference of the disc

.....

(1 mark)

(ii) the area, in mm^2, of the cross-section of the disc.

.....

(2 marks)

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(iii) Given that the thickness of the disc is 2 mm, calculate the **maximum** number of discs that can be constructed from 1 000 cm^3 of available metal.

($1\ cm^3 = 1\ 000\ mm^3$)

.....

(3 marks)

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(b) A globe is a scaled spherical representation of the earth. The actual length of the equator (*LL*) is 40 000 km and is represented on the globe by a piece of string of length 160 cm.

(i) What length of string would represent an actual distance of 500 km on the globe?

.....

(1 mark)

(ii) The distance between Palmyra (*P*) and Quintec (*Q*) is represented on the globe by a string of length 25 cm. Calculate the value of *PQ*, the actual distance, in km, between *P* and *Q*.

.....

(2 marks)

Total 9 marks

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7. A sequence of figures is made from squares of unit length. The first three figures in the sequence are shown below.

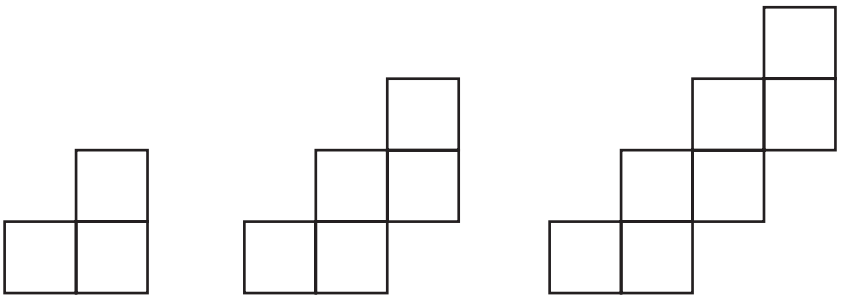


Figure 1 **Figure 2** **Figure 3**

(a) Draw Figure 4 of the sequence.

(2 marks)

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(b) Study the pattern of numbers in each row of the table below. Each row relates to one of the figures in the sequence of figures **on page 22**. Some rows have not been included in the table.

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

	Figure	Number of Squares in Figure (*S*)	Perimeter of Figure (*P*)	
	1	3	8	
	2	5	12	
	3	7	16	
(i)	4			**(2 marks)**
	⋮	⋮	⋮	
(ii)		43		**(2 marks)**
(iii)	*n*			**(2 marks)**

(c) Determine the relationship between the number of squares, *S*, and the perimeter, *P*, of a figure.

.....

(2 marks)

Total 10 marks

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SECTION II

Answer ALL questions in this section.

RELATIONS, FUNCTIONS AND GRAPHS

8. (a) The diagram **on page 25** shows six points of the function $y = 3x + \frac{1}{x}$. The coordinates of these six points are given in the table below.

x	0.1	0.2	0.5	1	1.5	2	2.2	2.5
y	10.3	5.6		4	5.2		7.1	7.9

(i) Complete the table above by calculating and inserting the missing values of y. **(2 marks)**

(ii) On the diagram **on page 25**, the ordered pairs shown in the table have been plotted except for the missing ones. Using your answers in (a) (i), plot the missing points and connect all the points with a smooth curve. **(2 marks)**

(iii) By drawing an appropriate straight line on the diagram **on page 25**, find approximate solutions to the equation

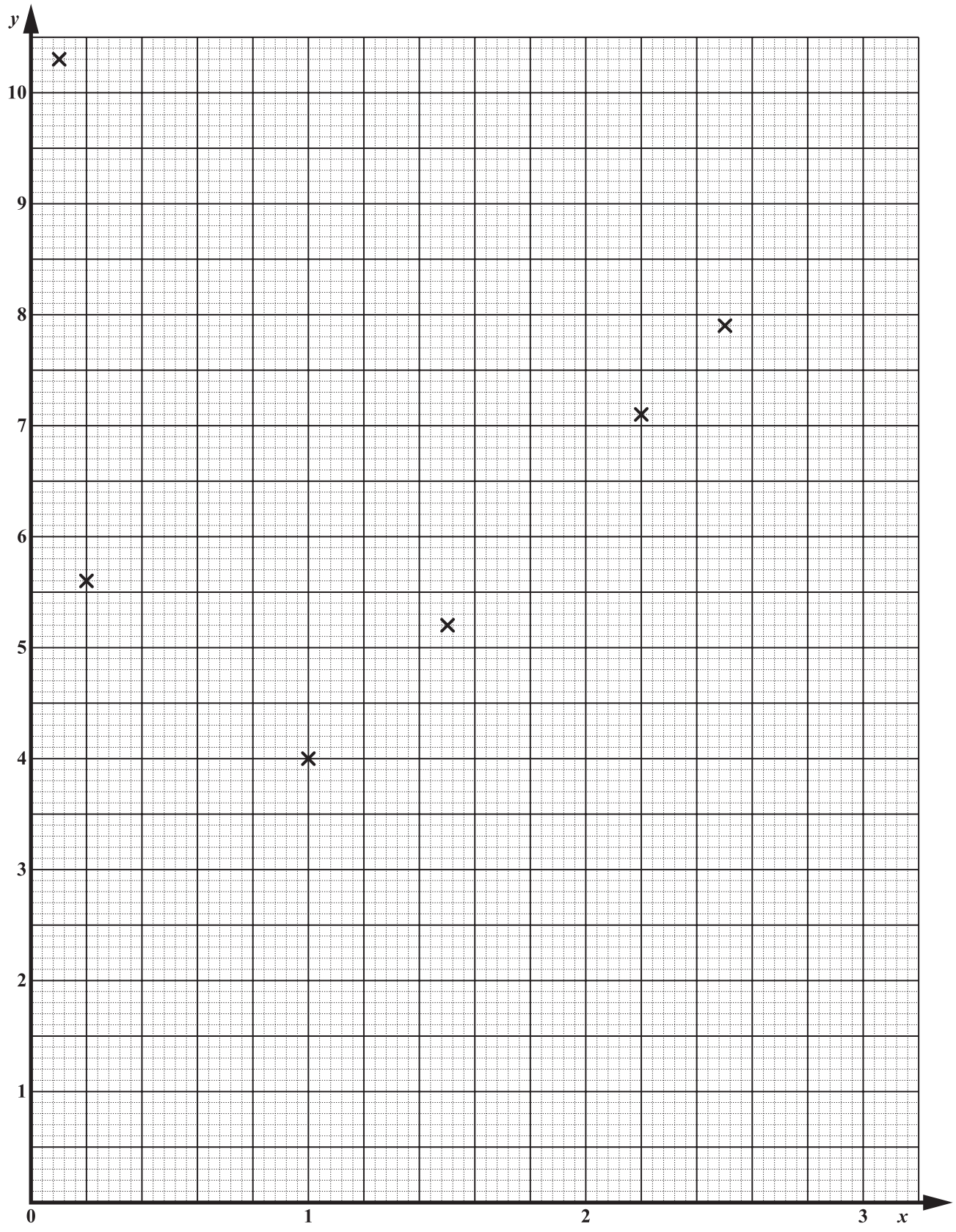
$$3x + \frac{1}{x} = 6.$$

.....

(3 marks)

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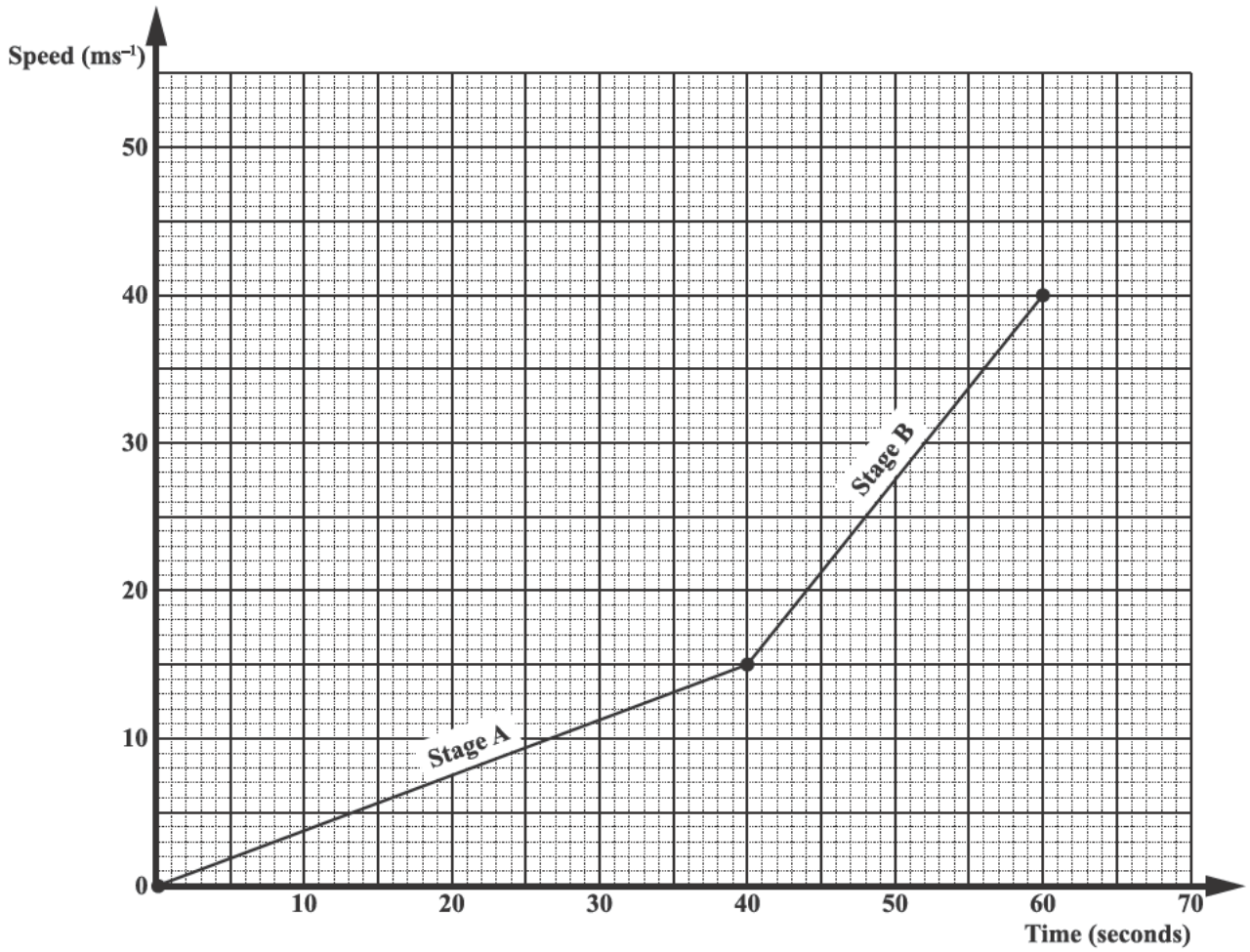
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(b) The speed–time graph below shows information on the first 60 seconds of a car's journey.



(i) Calculate the acceleration, in ms^{-2}, of the car during Stage B.

.....

(1 mark)

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(ii) Calculate the average speed of the car during Stage B.

.....

(3 marks)

(iii) At time $t = 60$ seconds, the car starts to slow down with a uniform deceleration of 2.5 ms^{-2}.

Determine how long it will take the car to come to rest.

.....

(1 mark)

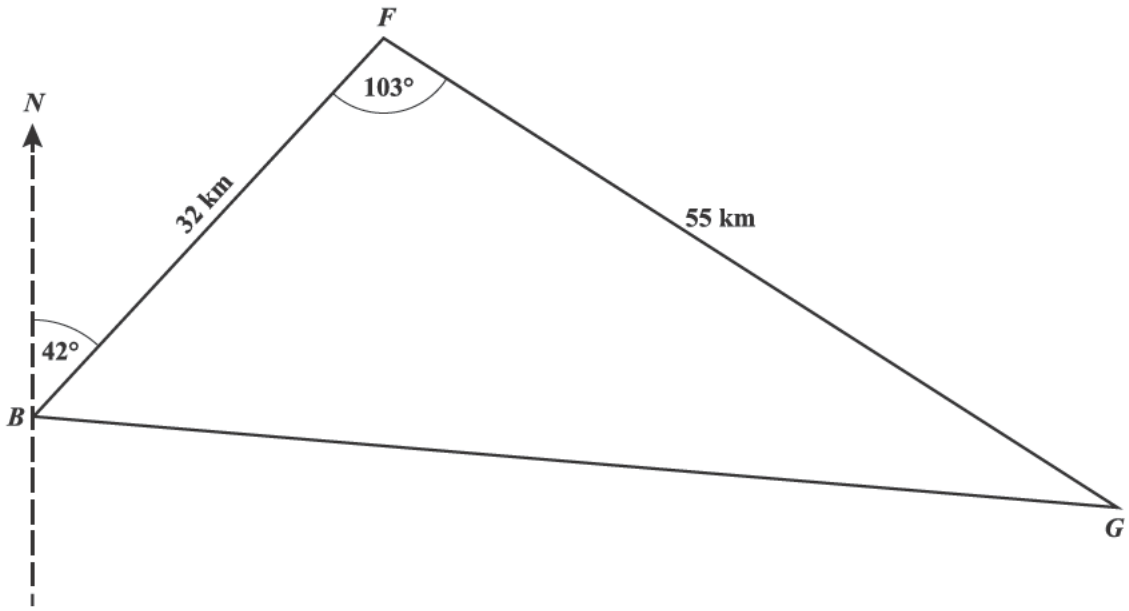
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GEOMETRY AND TRIGONOMETRY

9. (a) The diagram below, **not drawn to scale**, shows the relative positions of three reservoirs B, F and G, all on level ground. The distance $BF = 32$ km, $FG = 55$ km, $\angle BFG$ is 103° and F is on a bearing of 042° from B.



(i) Determine the bearing of B from F.

.....

(1 mark)

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(ii) Calculate the distance *BG*, giving your answer to one decimal place.

.....

(2 marks)

(iii) Calculate, to the nearest degree, the bearing of *G* from *B*.

.....

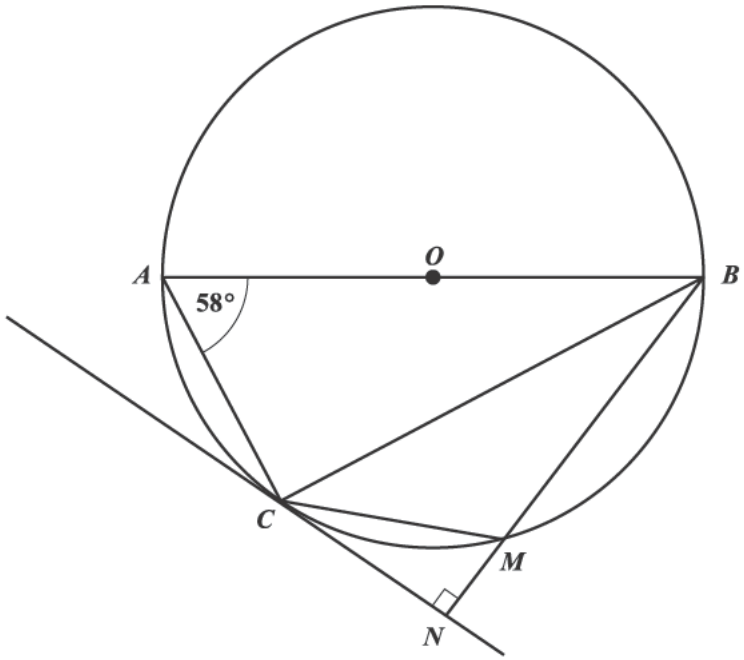
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(b) The diagram below, **not drawn to scale**, shows a circle, with centre O. The points A, B, C and M are on the circumference. The straight line CN is a tangent to the circle at the point C and is perpendicular to BN.



Determine, giving a reason for your answer,

(i) $A\hat{B}C$

.....

(2 marks)

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(ii) $C\hat{M}B$

.....

(2 marks)

(iii) $N\hat{C}M$

.....

(2 marks)

Total 12 marks

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VECTORS AND MATRICES

10. (a) A transformation, T, is defined by the matrix

$$T = \begin{pmatrix} 2 & -1 \\ 2 & 0 \end{pmatrix}.$$

The point A $(-2, 3)$ is mapped on to the point A' (a, b) under T.

(i) Find the value of a and of b.

.....

(2 marks)

(ii) Determine the transformation matrix that maps A' to A.

.....

(2 marks)

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(iii) Another transformation, P, is defined by the matrix $P = \begin{pmatrix} 0 & 1 \\ 1 & -2 \end{pmatrix}$.

a) Find the single 2×2 matrix that represents the combined transformation of T followed by P.

.....

(2 marks)

b) Hence, find the image of the point (1, 4) under this combined transformation.

.....

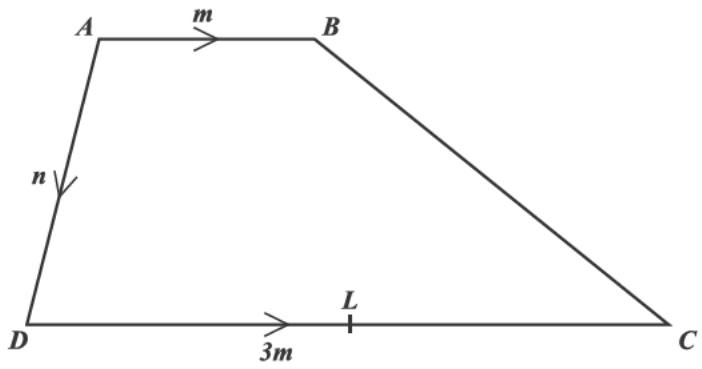
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(b) The diagram below, **not drawn to scale**, shows a quadrilateral $ABCD$ in which

$\overrightarrow{AB} = m$, $\overrightarrow{DC} = 3m$ and $\overrightarrow{AD} = n$.



(i) Complete the statement below on the geometric properties of the following vectors.

$\overrightarrow{AB}$ and $\overrightarrow{DC}$ are ..... and

$|\overrightarrow{AB}|$ is ..... times $|\overrightarrow{CD}|$. **(2 marks)**

(ii) Express $\overrightarrow{BC}$ in terms of m and n.

.....

(1 mark)

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(iii) L is the midpoint of $\overrightarrow{CD}$. Find $\overrightarrow{BL}$ in terms of m and n.

.....

(2 marks)

Total 12 marks

END OF TEST

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