

**CSEC MATHEMATICS
JANUARY 2014**

SECTION I

Answer ALL questions.

All working must be clearly shown.

1. (a) Calculate the EXACT value of

$$\left(1\frac{3}{4} - \frac{1}{8}\right) + \left(\frac{5}{6} \div \frac{2}{3}\right). \quad \text{(3 marks)}$$

- (b) Using a calculator or otherwise, calculate

$$\sqrt{2.891} + \frac{1.2}{(1.31)^2}$$

giving your answer correct to 2 decimal places. (3 marks)

- (c) A jeweller paid \$6 800 for 165 bracelets bought in China. The Customs Department in his country charged him \$1 360 in duty.

- (i) Calculate the TOTAL cost of the 165 bracelets inclusive of duty. (1 mark)

- (ii) The jeweller sold the 165 bracelets at a selling price of \$68.85 EACH.

- a) Calculate the TOTAL profit he made on the sale of the 165 bracelets. (2 marks)

- b) Calculate the profit as a percentage of the cost price, giving your answer to the nearest whole number. (2 marks)

Total 11 marks

2. (a) (i) Solve for x , where x is a real number

$$2(x - 6) + 3x \leq 8. \quad \text{(3 marks)}$$

- (ii) Using a number line, show your solution to Part (a) (i). (1 mark)

- (b) Factorize completely:

- (i) $3x - 6y + ax - 2ay$ (2 marks)

- (ii) $p^2 - 1$ (1 mark)

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- (c) Expand and simplify

$$(2k - 3)(k - 2). \quad (2 \text{ marks})$$

- (d) The lines whose equations are

$$3x + y = 2 \text{ and } 4x - 2y = 6 \text{ intersect at } (x, y).$$

Show that the point of intersection is $(1, -1)$. (3 marks)

Total 12 marks

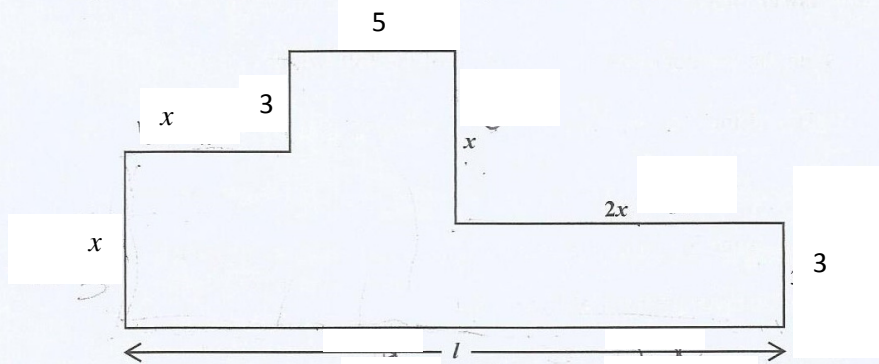
3. (a) In a class of 32 students, ALL the students study Spanish (S) and 20 of the students study French (F).

(i) Represent this information on a Venn diagram. (2 marks)

(ii) Calculate the number of students who study Spanish (S) but NOT French (F). (1 mark)

(iii) Write, using set notation, the relationship between F and S . (1 mark)

- (b) The diagram below is an accurate plan of the floor of a room. All the corners are right angles. All measures shown on the diagram are recorded to the nearest metre.



(i) State, in terms of x , the length l of the floor. (1 mark)

(ii) The perimeter of the floor is 56 metres.

a) Determine the value of x . (3 marks)

b) Calculate the area of the floor. (2 marks)

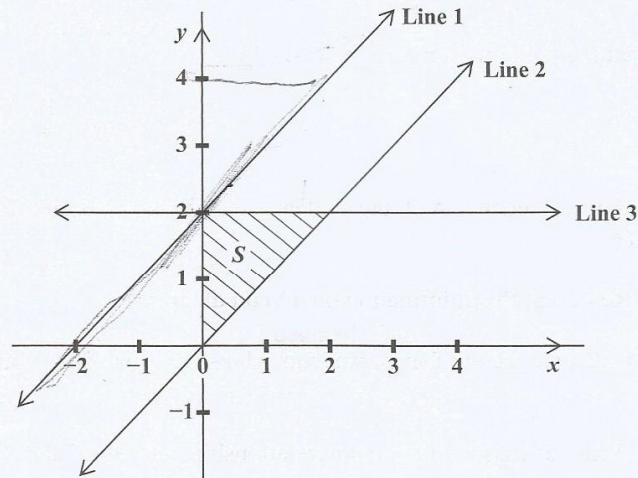
Total 10 marks

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4. An answer sheet is provided for this question.

The diagram below shows the graphs of three straight lines:

$$y = 2, \quad y = x \quad \text{and} \quad y = x + 2.$$



On the answer sheet

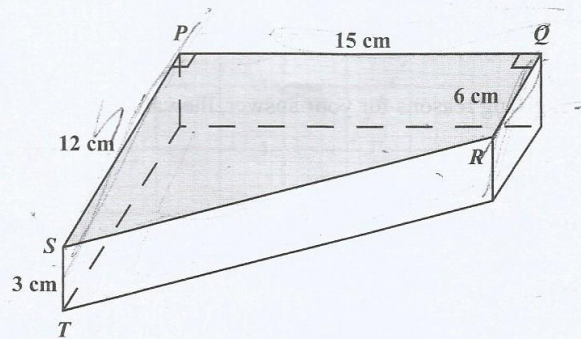
- (a) State the correct equation for EACH of the following:
- (i) Line 1 (1 mark)
 - (ii) Line 2 (1 mark)
 - (iii) Line 3 (1 mark)
- (b) Show that the gradient of Line 2 is 1. (1 mark)
- (c) Shade the region which is described as $y \geq x + 2$. (2 marks)
- (d) Write THREE inequalities that define the shaded region, S , shown in the diagram. (3 marks)
- (e) Write the equation of the straight line which is perpendicular to Line 1 and passes through the origin. (2 marks)

Total 11 marks

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5. (a) (i) Using a ruler, a pencil and a pair of compasses, construct triangle ABC with
 $BC = 10\text{ cm}$, $AB = 6\text{ cm}$ and $AC = 8\text{ cm}$. (3 marks)
- (ii) Measure and state the size of angle ABC . (1 mark)
- (iii) Complete the diagram to show a quadrilateral, $CABD$, such that $CD = CA$ and $BD = BA$. (2 marks)
- (b) The diagram below, **not drawn to scale**, shows a block of metal in the shape of a prism. The cross section of the block is a trapezium, $PQRS$, with parallel sides QR and PS , and PQ , the perpendicular distance between the sides.

$$PQ = 15\text{ cm}, \quad QR = 6\text{ cm}, \quad PS = 12\text{ cm} \text{ and } ST = 3\text{ cm}$$

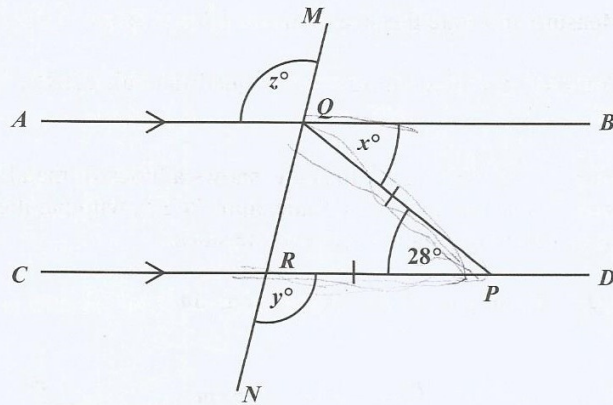


- (i) Calculate the area of the trapezium $PQRS$. (2 marks)
- (ii) Given that $ST = 3\text{ cm}$, calculate the volume of the block of metal. (1 mark)
- (iii) The block of metal has a mass of 1.5 kg . Calculate, in grams, the mass of ONE cubic centimetre of metal. (3 marks)

Total 12 marks

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6. (a) In the figure below, **not drawn to scale**, the lines AQB and $CRPD$ are parallel and $MQRN$ is a transversal. $PQ = PR$ and angle $QPR = 28^\circ$.

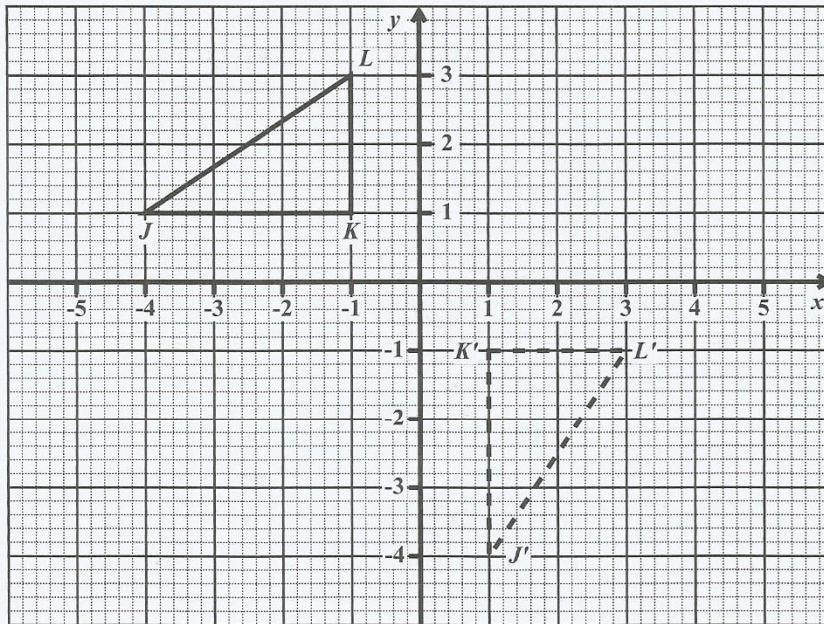


Calculate, giving reasons for your answer, the value of

- (i) x (2 marks)
- (ii) y (2 marks)
- (iii) z (2 marks)

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- (b) The diagram below shows triangle JKL and its image $J'K'L'$ after a transformation.



- (i) State the coordinates of the vertex, J , of triangle JKL . **(1 mark)**
- (ii) State the length of the side $K'L'$ of triangle $J'K'L'$. **(1 mark)**
- (iii) Describe FULLY a **single** transformation that maps triangle JKL onto triangle $J'K'L'$. **(2 marks)**
- (iv) State the coordinates of triangle $J''K''L''$, the image of triangle JKL , under the translation by the vector $\begin{bmatrix} 5 \\ -3 \end{bmatrix}$. **(2 marks)**

Total 12 marks

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7. The heights of a sample of seedlings were measured to the nearest centimetre and then arranged in class intervals as shown in the table below.

Height in cm	Midpoint	Frequency
3–7	5	0
8–12	10	3
13–17	15	12
18–22		16
23–27		22
28–32		18
33–37		14

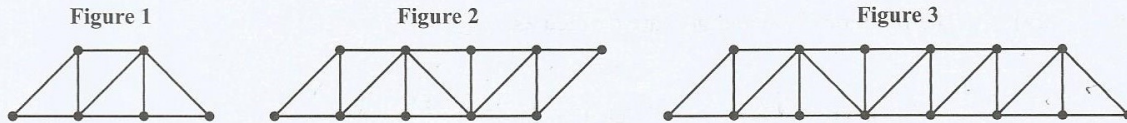
- (a) How many seedlings were in the sample? (1 mark)
- (b) For the class interval written as “8–12” in the table above, write down
- (i) the lower class **limit** (1 mark)
 - (ii) the upper class **boundary** (1 mark)
 - (iii) the class **width**. (1 mark)
- (c) Copy and complete the table by inserting
- (i) the midpoints of EACH class interval (2 marks)
 - (ii) the missing values for the class interval **after** the interval “33–37”. (1 mark)
- (d) Using a scale of **2 cm to represent 5 cm on the horizontal axis** and **2 cm to represent 5 seedlings on the vertical axis**, draw a frequency polygon to represent the data as shown in your table at (c). (5 marks)

Total 12 marks

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8. An answer sheet is provided for this question.

The diagram below shows the first three figures in a sequence of figures. Each figure is made up of one or more trapezia with dots one unit apart on their parallel sides. Each trapezium can be partitioned into four congruent triangles as follows:



- (a) On the answer sheet provided, draw Figure 4, the FOURTH figure in the sequence. (2 marks)
- (b) Study the patterns in the table shown below. Complete the table by inserting the missing values in the rows numbered (i), (ii), (iii) and (iv).

	No. of Trapezia (n)	No. of Triangles	No. of Dots	
	1	4	6	
	2	8	10	
	3	12	14	
(i)	4	_____	_____	(2 marks)
(ii)	10	_____	_____	(2 marks)
(iii)	_____	64	_____	(2 marks)
(iv)	n	_____	_____	(2 marks)

Total 10 marks

SECTION II

Answer TWO questions.

ALGEBRA AND RELATIONS, FUNCTIONS AND GRAPHS

9. (a) The functions $h(x)$ and $g(x)$ are defined as

$$h(x) = \frac{10}{x} - 3 \quad g(x) = 3x - 2.$$

- (i) Evaluate:

a) $g(4)$

(1 mark)

b) $hg(4)$

(2 marks)

- (ii) Write expressions in x for:

a) $h^{-1}(x)$

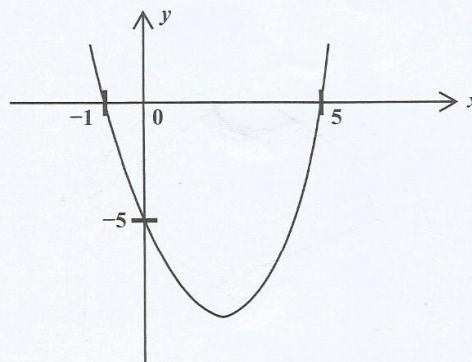
b) $g \circ g(x)$

(4 marks)

- (b) The diagram below shows a sketch of the quadratic function

$$y = x^2 + bx + c, \quad -2 \leq x \leq 6$$

where b and c are constants.



- (i) State the roots of the equation $x^2 + bx + c = 0$. (2 marks)

- (ii) For the function $y = x^2 + bx + c$

a) determine the value of c

(2 marks)

b) show that $b = -4$.

(2 marks)

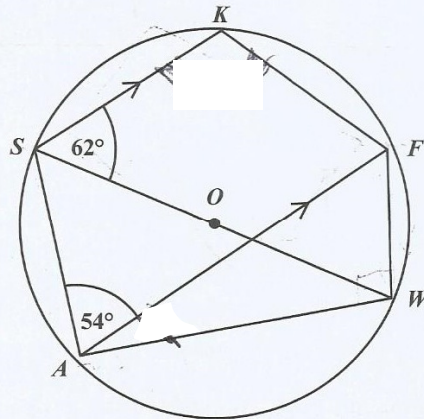
- (iii) State the coordinates of the MINIMUM point on the graph of the function $y = x^2 + bx + c$. (2 marks)

Total 15 marks

GEOMETRY AND TRIGONOMETRY

10. (a) In the diagram below, **not drawn to scale**, O is the centre of the circle. The lines SK and AF are parallel.

$$\angle KSW = 62^\circ \quad \angle SAF = 54^\circ$$

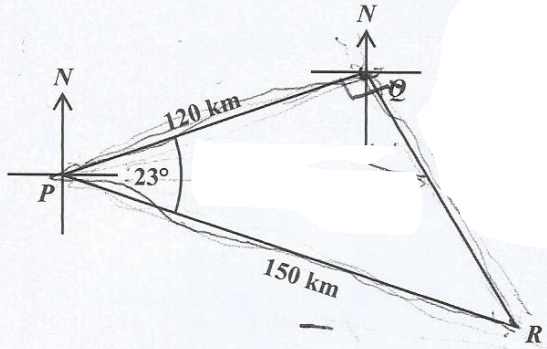


Calculate, **giving reasons for your answer**, the measure of:

- | | | |
|-------|--------------|-----------|
| (i) | $\angle FAW$ | (2 marks) |
| (ii) | $\angle SKF$ | (2 marks) |
| (iii) | $\angle ASW$ | (2 marks) |

- (b) The diagram below, **not drawn to scale**, shows the positions of three points, P , Q and R on a horizontal plane.

$$PQ = 120 \text{ km} \quad PR = 150 \text{ km} \quad \angle QPR = 23^\circ$$



- (i) Calculate, correct to one decimal place
- the distance QR (3 marks)
 - the area of triangle PQR . (2 marks)
- (ii) The bearing of P from Q is 252° . Calculate the bearing of R from P . (4 marks)

Total 15 marks

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VECTORS AND MATRICES

11. (a) The matrix, T , is such that

$$T = \begin{pmatrix} 2 & -1 \\ 1 & 3 \end{pmatrix}.$$

- (i) Determine, T^{-1} , the inverse of T . (3 marks)
- (ii) The matrix T maps the point (a, b) onto the point $(4, 9)$. Determine the values of a and b . (4 marks)

- (b) \vec{OM} and \vec{ON} are position vectors with respect to the origin, O , such that

$$\vec{OM} = \mathbf{m} \quad \text{and} \quad \vec{ON} = \mathbf{n}$$

L is a point on MN such that $ML : LN = 2 : 1$.

- (i) Draw a sketch of the triangle OMN and label the points O, M, N and L . (2 marks)

- (ii) Write in terms of \mathbf{m} and \mathbf{n} an expression for:

a) \vec{MN}

b) \vec{ML}

(3 marks)

- (iii) If $\mathbf{m} = \begin{pmatrix} 3 \\ 6 \end{pmatrix}$ and $\mathbf{n} = \begin{pmatrix} 9 \\ 0 \end{pmatrix}$,

determine the position vector of L .

(3 marks)

Total 15 marks

END OF TEST

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