

# THE KENYA NATIONAL EXAMINATIONS COUNCIL

Kenya Certificate of Secondary Education

121/1 MATHEMATICS Alt. A

Nov. 2023 – 2 ½ hours



**Paper 1**

Serial No.

**13229834**

Name:..... Index Number: .....

Candidate's signature: ..... Date: .....

Instructions to candidates:

- a) Write your name and index number in the spaces provided above.
- b) Sign and write the date of examination in the spaces provided above.
- c) This paper consists of two sections: Section I and Section II.
- d) Answer all the questions in Section I and only five questions from Section II.
- e) Show all the steps in your calculation, giving your answers at each stage in the spaces provided below each question.
- f) Marks may be given for correct working even if the answer is wrong.
- g) Non-programmable silent electronic calculators and KNEC mathematical tables may be used, except where stated otherwise.
- h) This paper consists of 18 printed pages.
- i) Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.
- j) Candidates should answer the questions in English.

*Examiner's Use Only*

Section I

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total

Section II

17	18	19	20	21	22	23	24	Total

Grand Total

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**SECTION 1 (50 marks)**

Answer **all** the questions in this section in the spaces provided

1. Without using a calculator, evaluate  $\frac{-13+5-70\div 5}{9-14x-13\div 21}$  (3 marks)

2. Simplify the expression  $\frac{3a^2b^{-3}}{2^{-1}a^{-2}b^2}$  (2 marks)

3. A triangle ABC is such that AB=11cm, BC=8cm and  $\angle ABC = 53^\circ$ . Calculate the area of the triangle correct to 2 decimal places (2 marks)

4. A cylindrical solid of radius 7 cm has a conical top of the same radius. The height of the cylindrical part of the solid is 17 cm. The conical top has a vertical height of 9 cm. Calculate the volume of the solid. (Take  $\pi = \frac{22}{7}$ ) (3 marks)

5. Two light bulbs are set to light after every 40 seconds and 60 seconds respectively. If they light exactly at the same time initially, calculate:

(a) The time, in minutes, they will take to light together again. (2 marks)

(b) The number of times they would light together in the first half an hour. (1 mark)

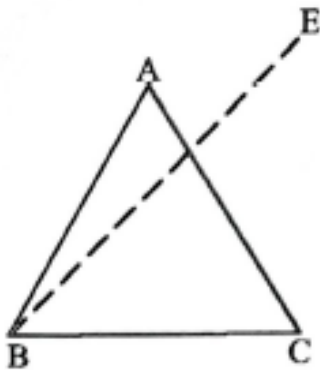
6. Solve the equation  $\cos 2\theta = \sin \theta$  for  $0^\circ \leq \theta \leq \frac{\pi}{4}$ . Leave the answer in terms of  $\pi$ . (3 marks)

7. Simplify and hence factorize the expression  $(5x-4y)(4x+5y)-9xy$ . (3 marks)

8. From a point on top of a cliff 40m high, two boats A and B are observed due East. The angle of depression of boat A is  $32^\circ$  and that of boat B is  $52^\circ$ .

Determine the distance between the two boats, correct to 2 decimal places. (4 marks)

9. In the following figure, triangle ABC is a uniform cross section of a solid ABCDEF. Given that BE is one of the edges of the solid, complete the sketch showing hidden edges with broken lines. (3 marks)

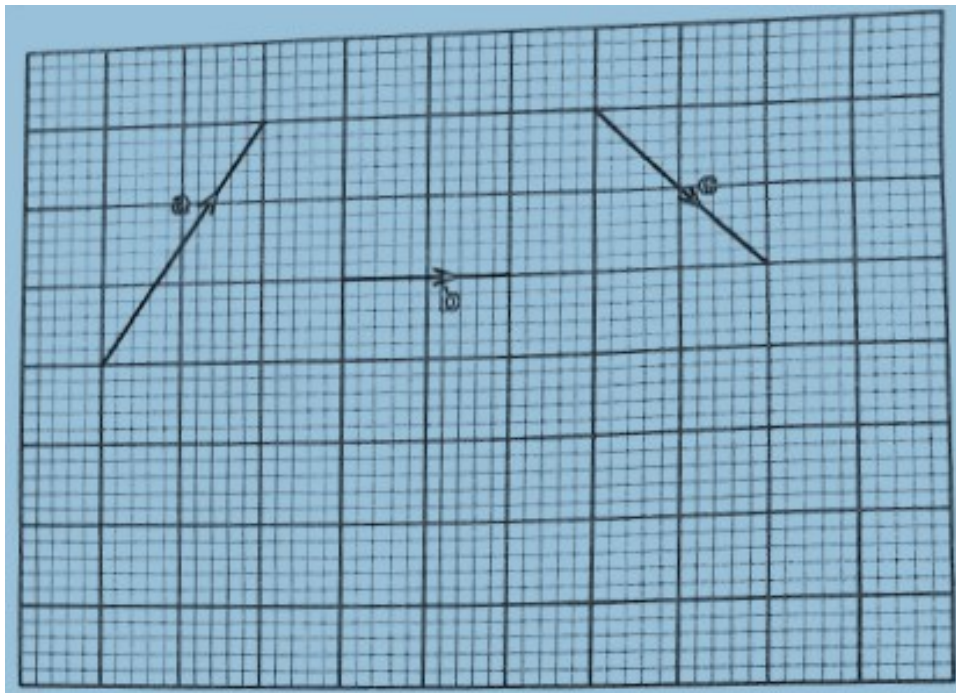


10. A salesman sells story books and textbooks. The cost price of a story book is shs 600 while that of a textbook is shs 900, the salesman is paid a commission of 10% on the cost of any book sold. One day, the salesman sold twice as many story books as textbooks. He earned a commission of shs 8 400.

Determine the total number of story books sold. (3 marks)

11. The equation of a curve is given by  $y=x^2$ . Using the trapezium rule with 4 strips, estimate the area enclosed by the curve  $y = x^2$ , the lines  $x=1$ ,  $x=5$  and the  $x$ -axis. (4 marks)

12. Vectors  $a$ ,  $b$  and  $c$  are represented on the following grid.



On the following grid, represent:

- The resultant vector  $\mathbf{a + b}$
- The resultant vector  $(\mathbf{a + b}) + \mathbf{c}$



13. Given matrix  $P = \begin{pmatrix} 4 & 2 \\ -7 & -1 \end{pmatrix}$ ,  $Q = \begin{pmatrix} -1 & 5 \\ 6 & -3 \end{pmatrix}$  and  $R = 20P^{-1} + Q$ , determine matrix R.  
(3 marks)

14. In a sub county, the number of children per family was recorded from 30 families. The data recorded is as follows:

2	3	2	3	4	1	4	3	0	3
2	2	1	3	4	5	2	7	6	3
6	2	2	3	3	3	5	1	3	2

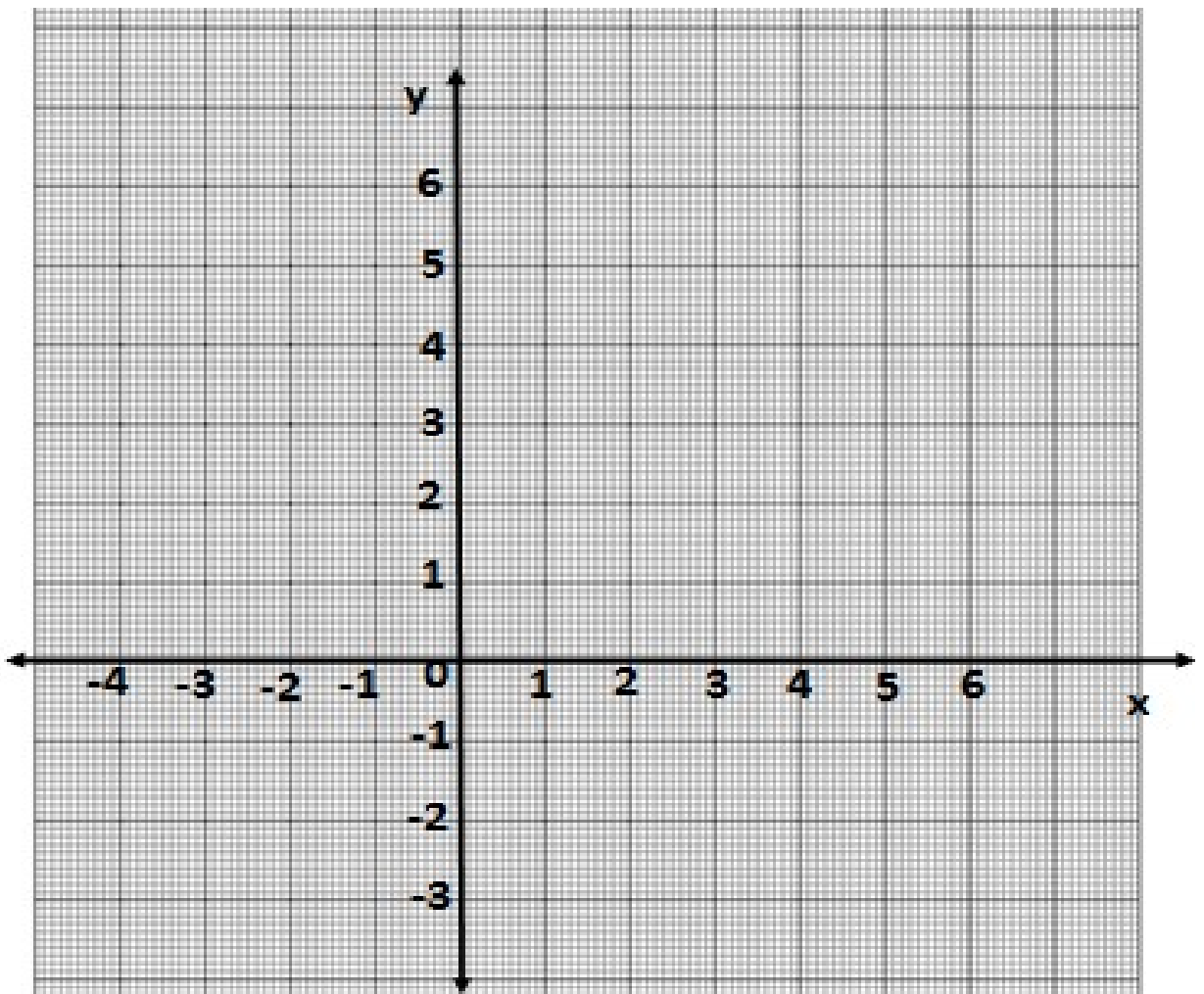
- (a) Represent the data in a frequency distribution table. (1 mark)
- (b) Calculate the mean number of children per family (2 marks)

15. The equation of a curve is given by  $y = 3x^2 - 2x$ . Determine the equation of a normal line to the curve at  $x = 2$ . (4 marks)

16. On the following Cartesian plane provided, solve the simultaneous equations.

$$y = \frac{4}{3}x + 2$$

$$3y = x - 3$$



**SECTION II (50 marks)**

*Answer only five questions in this section in the spaces provided.*

17. Two towns, A and B are 400 km apart. A motor cyclist travelling at an average speed of 60 km/h left town A for town B at 1.20 p.m. A matatu travelling at an average speed of 80 km/h also left town A for town B at 2.00 p.m.

**(a) Calculate, the:**

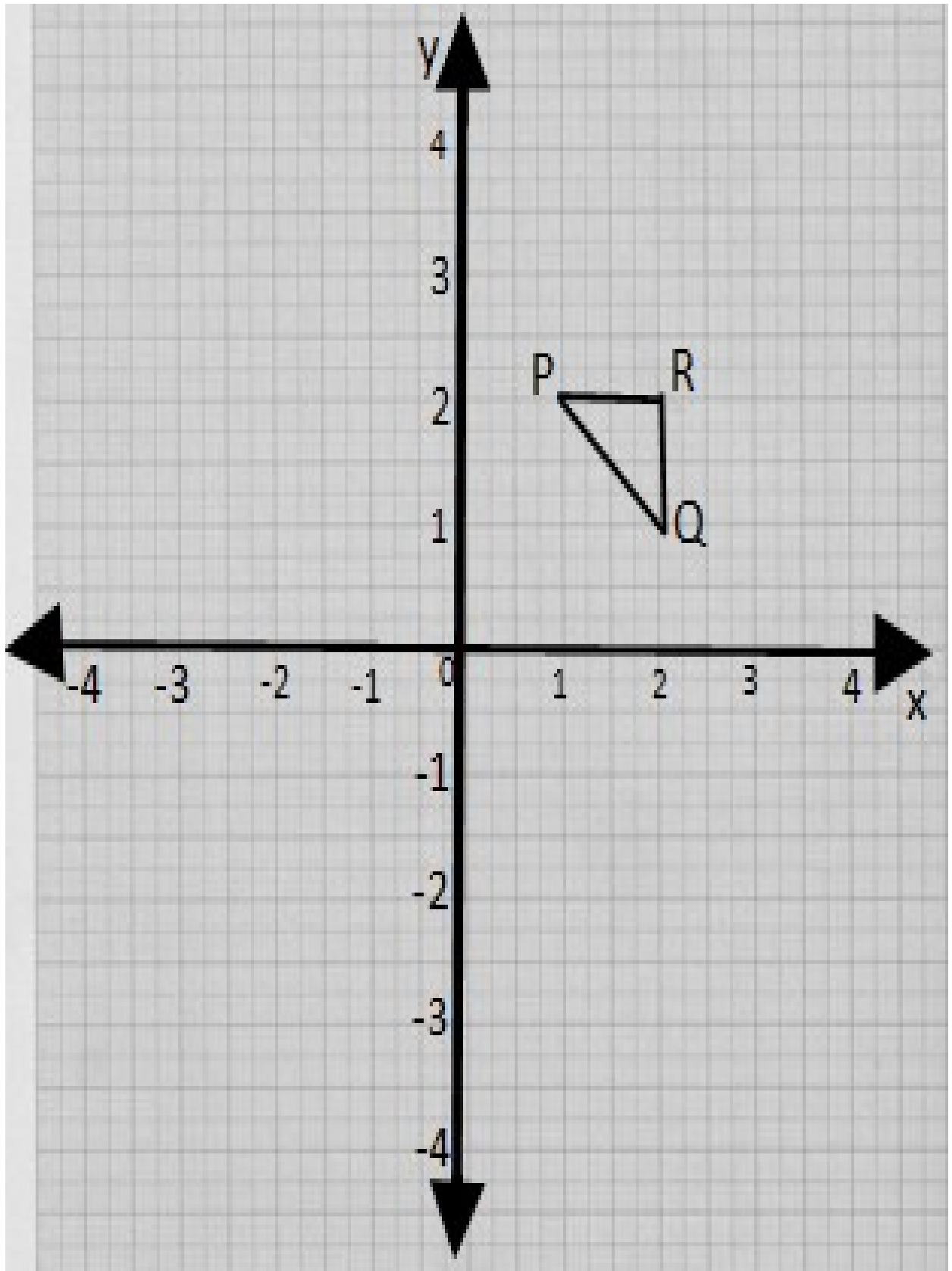
**(i) distance covered by the motor cyclist by 2.00 p.m. (2 marks)**

**(ii) Distance from town A in km, where the matatu caught up with the motor cyclist. (3 marks)**

**(iii) Time when the matatu caught up with the motor cyclist. (2 marks)**

(b) A lorry travelling at an average speed of 40km/h left town B for town A at 2.00pm. Determine the time when the lorry and the matatu met. (3 marks)

18. On the following, triangle PQR is drawn.



(a) On the grid, draw:

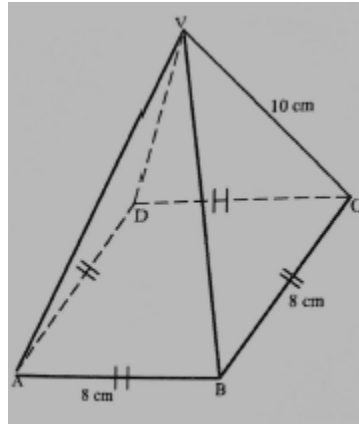
(i) Triangle  $P'Q'R'$ , the image of  $\Delta PQR$  under a reflection in the line  $y=0$ . (2 marks)

(ii) Triangle  $p''Q''R''$ , the image of  $\Delta P'Q'R'$  under an enlargement scale factor  $-1.5$ , center  $O$ . (3 marks)

(iii) Triangle  $P'''Q'''R'''$ , the image of  $\Delta p''Q''R''$  under a half turn about  $O$ . (2 marks)

(b) Describe a single transformation that maps  $\Delta P'Q'R'$  onto  $\Delta P'''Q'''R'''$ . (3 marks)

19. The following figure shows a right pyramid  $VABCD$ . The base  $ABCD$  of the pyramid is a square of side  $8\text{cm}$ . The length of the slanting edges  $VA = VB = VC = VD = 10\text{cm}$ .



Calculate:

- (a) The vertical height of the pyramid correct to 2 decimal places. (4 marks)

- (b) Surface area of the pyramid (4 marks)

- (c) Volume of the pyramid (2 marks)

20. Neema went to the market to buy bananas worth Ksh 2100 for a school. The seller offered a discount of Ksh 3 per banana which enabled Neema to buy 35 more bananas.

(a) Taking Kshs  $x$  as the price per banana before discount, write an expression for the:

(i) Number of bananas that Neema would have bought before discount (1 mark)

(ii) Actual number of bananas that Neema bought after the discount (1 mark)

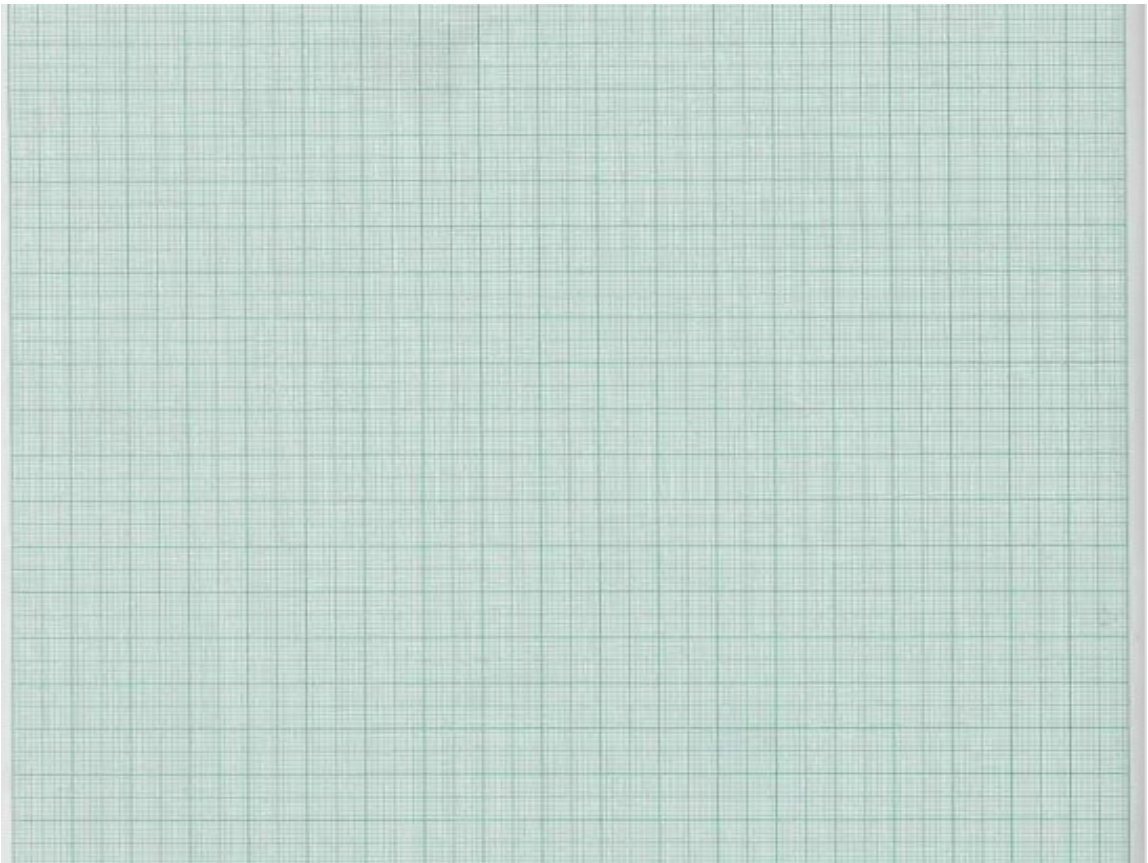
(b) Form an equation in terms of  $x$  and hence determine the actual number of bananas Neema bought (6 marks)

(c) The bananas were given to students in a school. Two fifths of the students got 2 bananas each while the rest got a banana each. Determine the number of students in the school. (2 marks)

21. The end of term test scores of 100 students was recorded as shown in the following table.

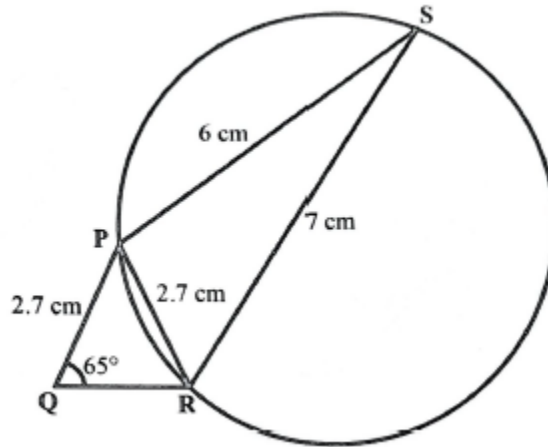
Scores	30-39	40-49	50-59	60-69	70-79	80-98
No. of Students	8	10	28	32	12	10

- (a) State the modal class. (1 mark)
- (b) Calculate the median score (3 marks)
- (c) On the grid provided, represent the above data using a histogram.



- (d) Use the histogram to determine the number of students who scored from 71.5 to 76.5 (2 marks)

22. The following figure shows a quadrilateral PQRS and a circle passing through the vertices P, R and S. Lines  $PQ = PR = 2.7$  cm,  $PS = 6$  cm,  $SR = 7$  cm and  $\angle PQR = 65^\circ$ .



(a) Calculate:

(i) Length QR. (3 marks)

(ii)  $\angle PRS$  (3 marks)

(iii) Determine the area of the circle (4 marks)

23. The displacement,  $x$  metres, of a particle moving a long straight line after  $t$  seconds is given by  $x = \frac{t^3}{3} - 3t^2 + 9$ .

(a) Determine:

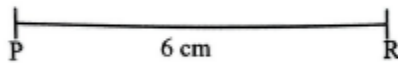
(i) The values of  $t$  when the particle is momentarily at rest (3 marks)

(ii) The values of displacement  $x$  metres by the time the particles comes to rest. (2 marks)

(b) Determine the values of  $t$  when the velocity of the particle is  $-5$  m/s. (3 marks)

(c) Determine the acceleration of the particle at  $t = 2$  seconds. (2 marks)

24. In this question, use a ruler and a pair of compass only.  
Line PR is a diagonal of a quadrilateral PQRS.  $PR = 6\text{cm}$ .



- (a) Locate vertex Q of the quadrilateral PQRS such that  $\angle RPQ = 60^\circ$  and  $RQ = 45^\circ$ .  
Complete triangle PQR and hence measure length PQ. (4 marks)
- (b) Diagonal QS, which is 10 cm long, intersects with diagonal PR at right angle.  
Complete the quadrilateral PQRS. (3 marks)
- (c) Calculate the area of the quadrilateral PQRS. (3 marks)