

MATHEMATICS: SEPTEMBER EXAMINATION

GRADE 11 · MATHEMATICS · TERM 3 · 2026

STATISTICS · ANALYTICAL GEOMETRY · TRIGONOMETRY

TOTAL: 100 MARKS

TIME: 2 HOURS

EXAMINER: MR SIMONS

INSTRUCTIONS AND INFORMATION

1. This question paper consists of SIX questions. Answer ALL the questions in your ANSWER BOOK.
2. Clearly show ALL calculations, diagrams and graphs that you have used in determining your answers.
3. Answers only will NOT necessarily be awarded full marks.
4. An approved scientific calculator (non-programmable and non-graphical) may be used, unless stated otherwise.
5. If necessary, round off answers to TWO decimal places, unless stated otherwise.
6. Diagrams are NOT necessarily drawn to scale.
7. An information sheet is included on the first page, and an ANNEXURE of grids at the back.
8. Answer QUESTION 1.5, QUESTION 2.3 and QUESTION 5.1.2 on the ANNEXURE at the back of this question paper. Write your name on the ANNEXURE and hand it in with your ANSWER BOOK.
9. Write neatly and legibly.

INFORMATION SHEET

ANALYTICAL GEOMETRY

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$M\left(\frac{x_1 + x_2}{2} ; \frac{y_1 + y_2}{2}\right)$$

$$y = mx + c \quad y - y_1 = m(x - x_1)$$

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$m = \tan \theta$$

TRIGONOMETRY (in $\triangle ABC$)

$$\frac{a}{\sin \hat{A}} = \frac{b}{\sin \hat{B}} = \frac{c}{\sin \hat{C}}$$

$$a^2 = b^2 + c^2 - 2bc \cdot \cos \hat{A}$$

$$\text{area } \triangle ABC = \frac{1}{2} \cdot ab \cdot \sin \hat{C}$$

STATISTICS

$$\bar{x} = \frac{\Sigma x}{n}$$

$$\sigma^2 = \frac{\Sigma(x - \bar{x})^2}{n}$$

QUESTION 1 [17 MARKS]

The times, in minutes, taken by 12 Grade 11 learners to complete a technical drawing task were recorded. The times are given below, arranged in ascending order.

12 ; 15 ; 16 ; 18 ; 20 ; 21 ; 23 ; 24 ; 26 ; 28 ; 31 ; 66

- 1.1 Calculate the mean time. (2)
- 1.2 Calculate the standard deviation of the times. (2)
- 1.3 Determine the interval $(\bar{x} - \sigma ; \bar{x} + \sigma)$, and hence write down how many of the times lie OUTSIDE this interval. (3)
- 1.4 Write down the five-number summary of the data. (3)
- 1.5 Draw a box and whisker diagram for the data on the number line on the ANNEXURE. (2)
- 1.6 A data value is an outlier if it lies more than $1,5 \times \text{IQR}$ beyond a quartile. Show, with calculations, that 66 is an outlier. (3)
- 1.7 Comment on the skewness of the data. Give a reason for your answer. (2)

[17]

QUESTION 2 [13 MARKS]

The distance, d , in kilometres, that each of the 80 Grade 11 learners at a school travels to school was recorded. The results are summarised in the table below.

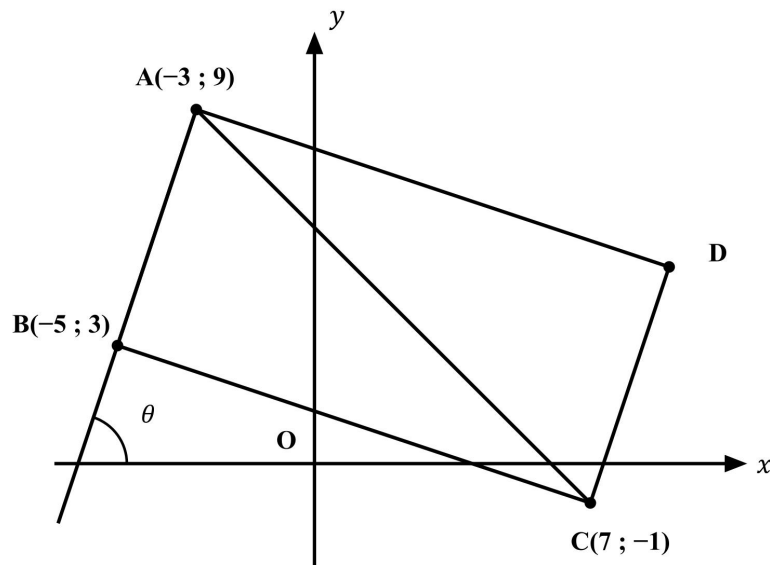
Distance (km)	Number of learners	Cumulative frequency
$0 \leq d < 10$	12	
$10 \leq d < 20$	18	
$20 \leq d < 30$	24	
$30 \leq d < 40$	14	
$40 \leq d < 50$	8	
$50 \leq d < 60$	4	

- 2.1 Write down the modal class. (1)
- 2.2 Complete the cumulative frequency column of the table. (2)
- 2.3 Draw an ogive (cumulative frequency curve) for the data on the grid on the ANNEXURE. (4)
- 2.4 Estimate the mean distance travelled. (3)
- 2.5 Use your ogive to estimate the interquartile range of the data. (3)

[13]

QUESTION 3 [20 MARKS]

In the diagram below, $A(-3 ; 9)$, $B(-5 ; 3)$, $C(7 ; -1)$ and D are the vertices of quadrilateral $ABCD$. The diagonal AC is drawn. AB is produced to cut the x -axis, forming an angle of θ with the positive x -axis.

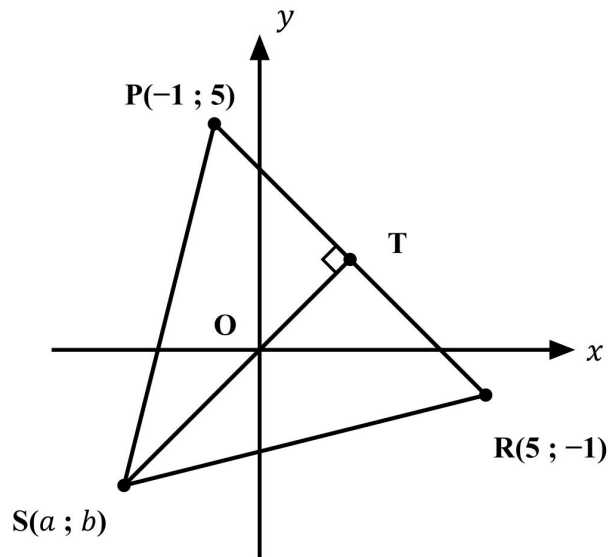


- 3.1 Calculate the length of AB . Leave your answer in simplest surd form. (2)
- 3.2 Calculate the coordinates of M , the midpoint of AC . (2)
- 3.3 Show that $AB \perp BC$. (3)
- 3.4 Determine the coordinates of D if $ABCD$ is a parallelogram. (3)
- 3.5 Hence prove that $ABCD$ is a rectangle. (2)
- 3.6 Determine the equation of AC in the form $y = mx + c$. (3)
- 3.7 Calculate the size of θ , the angle of inclination of AB . (2)
- 3.8 Hence, or otherwise, calculate the size of $\hat{BAC}$. (3)

[20]

QUESTION 4 [13 MARKS]

In the diagram below, $P(-1 ; 5)$, $R(5 ; -1)$ and $S(a ; b)$ are the vertices of $\triangle PRS$. T is the midpoint of PR , and $ST \perp PR$.



- 4.1 Calculate the coordinates of T , the midpoint of PR . (2)
- 4.2 Calculate the length of PR . Leave your answer in simplest surd form. (2)
- 4.3 Determine the equation of ST . (3)
- 4.4 Hence show that $a = b$. (1)
- 4.5 If the area of $\triangle PRS = 30$ square units and $a < 0$, determine the coordinates of S . (5)

[13]

QUESTION 5 [17 MARKS]

5.1

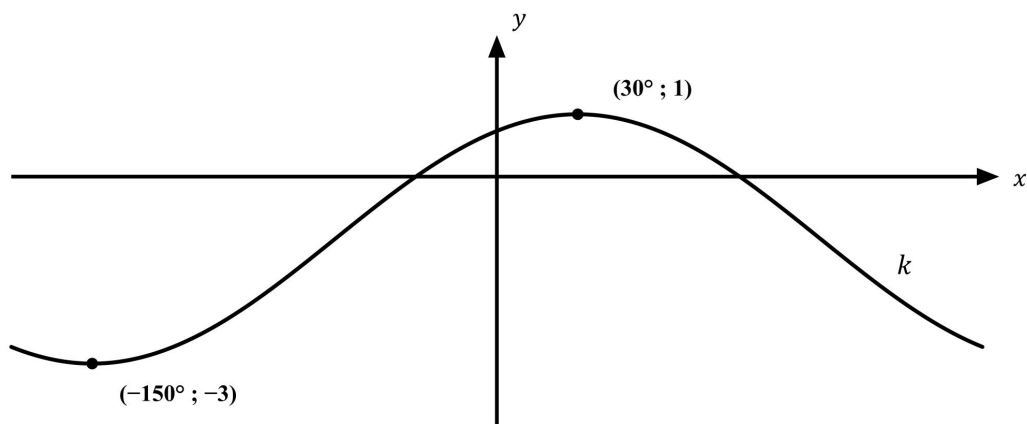
Given: $f(x) = \sin 2x$ and $g(x) = \cos x$, for $x \in [-180^\circ; 180^\circ]$.

The graph of f is drawn on the system of axes on the ANNEXURE.

- 5.1.1 Write down the period of f . (1)
- 5.1.2 Draw the graph of g on the same system of axes on the ANNEXURE. Clearly show ALL intercepts with the axes, the turning points and the end points. (4)
- 5.1.3 Use your graphs to write down the values of x for which $f(x) = g(x)$. (2)
- 5.1.4 For which values of $x \in [-180^\circ; 180^\circ]$ is $f(x) \cdot g(x) < 0$? (3)
- 5.1.5 The graph of h is obtained by shifting the graph of f down by 3 units. Write down the range of h . (2)

5.2

The sketch below shows the graph of $k(x) = a \cos(x - p) + q$ for $x \in [-180^\circ; 180^\circ]$. The turning points $(30^\circ; 1)$ and $(-150^\circ; -3)$ are shown on the sketch.



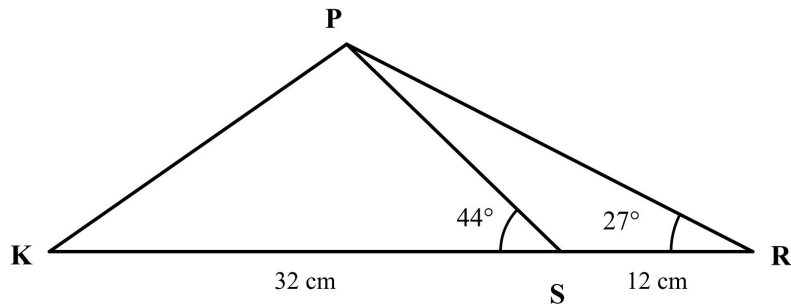
- 5.2.1 Write down the values of a , p and q . (3)
- 5.2.2 Calculate the x -intercepts of k . (2)

[17]

QUESTION 6 [20 MARKS]

6.1

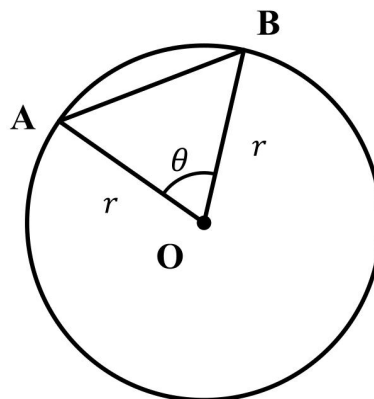
In the diagram below, K, S and R lie on the same straight line, with S between K and R. P is a point that does not lie on KR, and PK, PS and PR are drawn. It is given that $\angle PSK = 44^\circ$, $\angle PRS = 27^\circ$, $KS = 32$ cm and $SR = 12$ cm.



- 6.1.1 Determine, with a reason, the size of $\angle SPR$. (2)
- 6.1.2 Calculate the length of PS. (3)
- 6.1.3 Hence calculate the length of PK. (3)
- 6.1.4 Calculate the size of $\angle KPS$. (2)

6.2

In the diagram below, O is the centre of a circular reservoir of radius r metres. A and B are two points on the edge of the reservoir and $\angle AOB = \theta$. A straight pipe is laid along the chord AB.



- 6.2.1 Show that: (3)
$$AB = r \sqrt{2 - 2 \cos \theta}$$
- 6.2.2 Calculate the length of the pipe AB if $r = 25$ m and $\theta = 68^\circ$. (2)
- 6.2.3 Calculate the area of $\triangle AOB$. (2)
- 6.2.4 Hence calculate the shortest distance from O to the pipe AB. (3)

[20]

TOTAL: 100 MARKS

ANNEXURE

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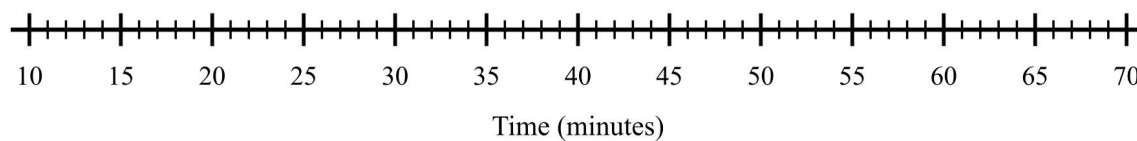
HAND THIS ANNEXURE IN WITH YOUR ANSWER BOOK

NAME: _____

CLASS: _____

QUESTION 1.5

Draw a box and whisker diagram for the data on the number line below.



ANNEXURE

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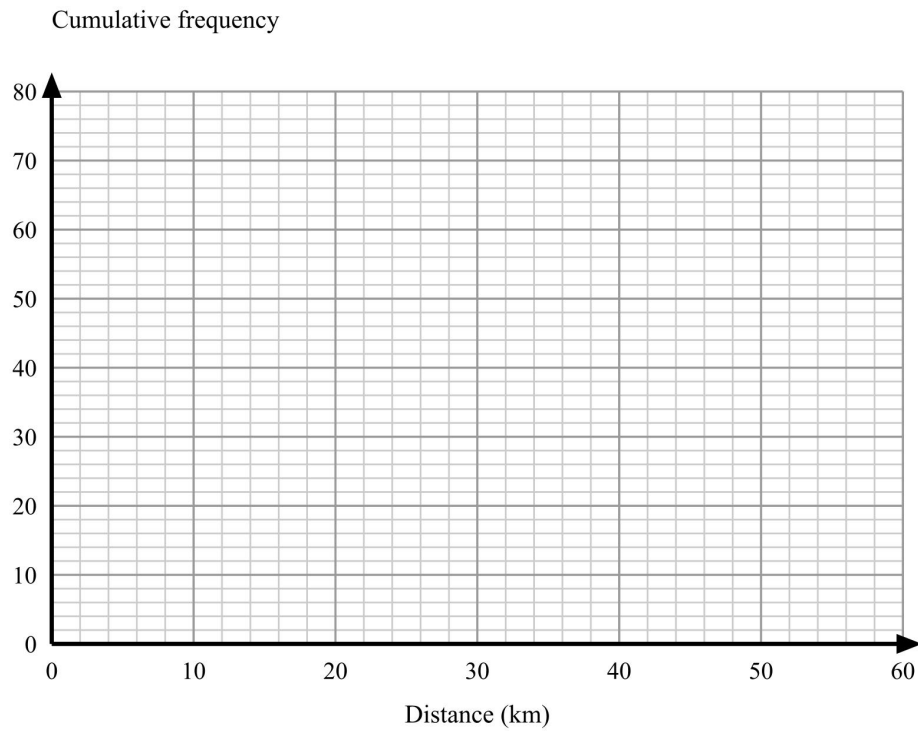
HAND THIS ANNEXURE IN WITH YOUR ANSWER BOOK

NAME: _____

CLASS: _____

QUESTION 2.3

Draw an ogive (cumulative frequency curve) for the data on the grid below.



ANNEXURE

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HAND THIS ANNEXURE IN WITH YOUR ANSWER BOOK

NAME: _____

CLASS: _____

QUESTION 5.1.2

Given: $f(x) = \sin 2x$ and $g(x) = \cos x$, for $x \in [-180^\circ; 180^\circ]$. Draw the graph of g on the same system of axes below. Clearly show ALL intercepts with the axes, the turning points and the end points.

