



LIMPOPO

PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF EDUCATION

NATIONAL SENIOR CERTIFICATE

GRADE/GRAAD 12

MATHEMATICS PRE-PREPARATORY P2

AUGUST 2026

MARKS: 150

DURATION: 3 HOURS

This question paper consists of 12 pages, two diagram sheets and information sheet .

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of 10 questions.
2. Answer ALL the questions.
3. Clearly show ALL calculations, diagrams, graphs, etc., which you have used in determining your answers.
4. Answers only will NOT necessarily be awarded full marks.
5. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.
6. If necessary, round off answers to TWO decimal places unless stated otherwise.
7. Diagrams are NOT necessarily drawn to scale.
8. Number the answers correctly according to the numbering system used in this question paper.
9. An information sheet with formulae is included at the end of the question paper.
10. Write neatly and legibly.

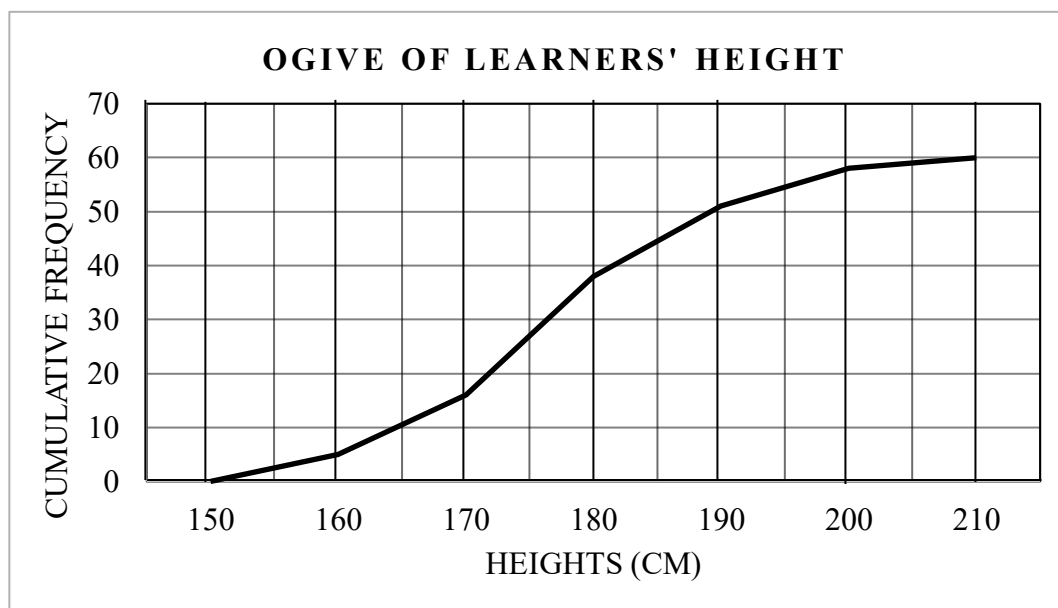
QUESTION 1

The height of 60 Grade 12 learners are represented in the table below:

Height in cm	Frequency	Cumulative frequency
$140 \leq x < 150$	0	0
$150 \leq x < 160$	5	5
$160 \leq x < 170$	11	16
$170 \leq x < 180$	a	38
$180 \leq x < 190$	13	51
$190 \leq x < 200$	7	b
$200 \leq x < 210$	2	60

1.1 Determine the value of a and b . (2)

1.2 The ogive of the learners' height is given below. Use the ogive to find the value of the median. (1)



1.3 Use the table provided to find the estimated mean and the standard deviation. (4)

1.4 Using the ogive, determine what percentage of the learners lie within one standard deviation of the mean. (4)

[11]

QUESTION 2

A lecturer at university conducted an investigation to determine whether there was a correlation between students' class attendance and test results.

The data obtained is shown in the table below. (The test results are out of 50)

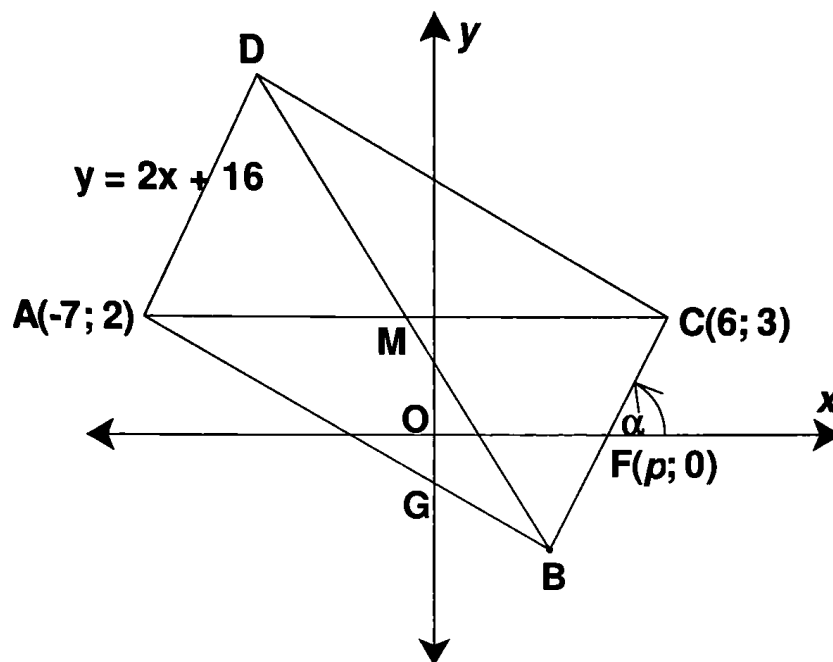
Number of classes missed	2	5	3	2	1	7	9	6	4
Test results	41	32	39	46	47	23	17	25	35

- 2.1 Represent the data by means of a scatter plot on the grid provided (DIAGRAM SHEET 1) (3)
- 2.2 Find the equation of the regression line. (3)
- 2.3 Calculate the correlation coefficient. (1)
- 2.4 What conclusion can you draw regarding the connection between students' attendance and test results? (2)

[9]

QUESTION 3

In the diagram below, A $(-7; 2)$, B, C $(6; 3)$ and D are the vertices of rectangle ABCD. The equation of AD is $y = 2x + 16$. Line AB cuts the y -axis at G. The x -intercept of line BC is $F(p; 0)$ and the angle of inclination of BC with the positive x -axis is α . The diagonals of the rectangle intersect at M.



- 3.1 Calculate the coordinates of M. (2)
- 3.2 Write down the gradient of BC in terms of p . (2)
- 3.3 Hence, calculate the value of p . (3)
- 3.4 Calculate the length of DB. (2)
- 3.5 Calculate the size of α . (2)
- 3.6 Calculate the size of $\angle OGB$. (3)
- 3.7 Determine the equation of the circle passing through points D, B and C in the form $(x - a)^2 + (y - b)^2 = r^2$ (3)
- 3.8 If AD is shifted so that ABCD becomes a square, BC will be a tangent to the circle passing through points A, M and B, where M is now the intersection of the diagonals of the square ABCD. Explain why this is true. (2)

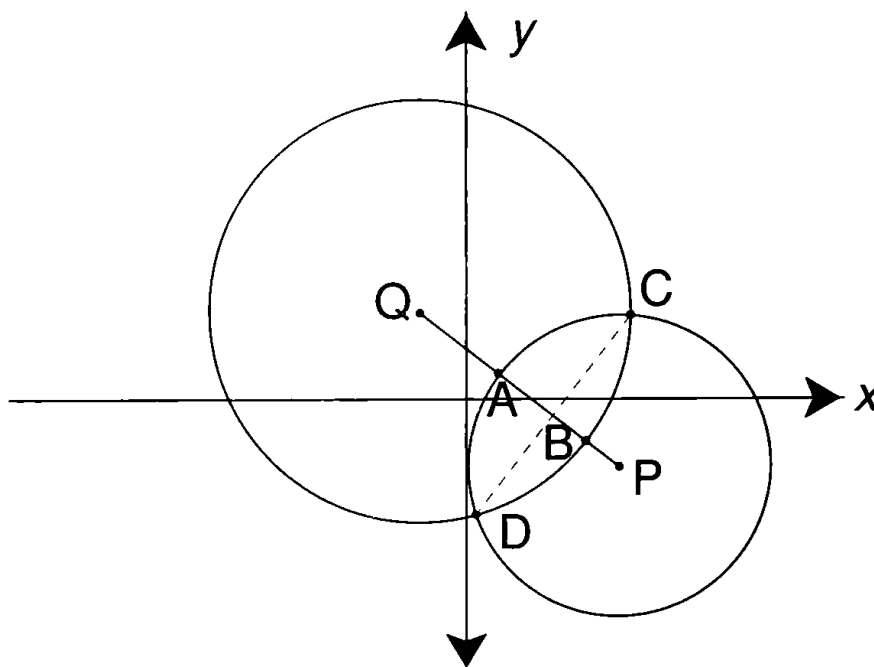
[19]

QUESTION 4

In the diagram below, P and Q are the centres of circles having equations:

$$(x - 7)^2 + (y + 2)^2 = 49 \quad \text{and}$$

$$x^2 + y^2 + 10x - 6y = 30 \quad \text{respectively.}$$



- 4.1 Determine the radius of the circle having centre Q. (3)
- 4.2 Calculate the length of PQ. (3)
- 4.3 Show that the equation of PQ is $5x + 12y = 11$. (4)
- 4.4 Determine the coordinates of A. (5)
- 4.5 Determine the equation of the chord CD. (3)
- 4.6 Prove that $CD \perp PQ$. (2)

[20]

QUESTION 5

- 5.1 Given that $\sin 23^\circ = \sqrt{k}$, determine, in the simplest form, the value of each of the following in terms of k , WITHOUT using a calculator:

5.1.1 $\sin 203^\circ$ (2)

5.1.2 $\cos 23^\circ$ (2)

5.1.3 $\tan(-23^\circ)$ (3)

- 5.2 Simplify the following without using a calculator:

$$\frac{\frac{\sin(-300^\circ)}{\cos 720^\circ} + \tan 135^\circ \cdot \cos 3(30^\circ)}{\cos^2 35^\circ - 2 \sin^2 15^\circ + \sin^2 35^\circ} \quad (8)$$

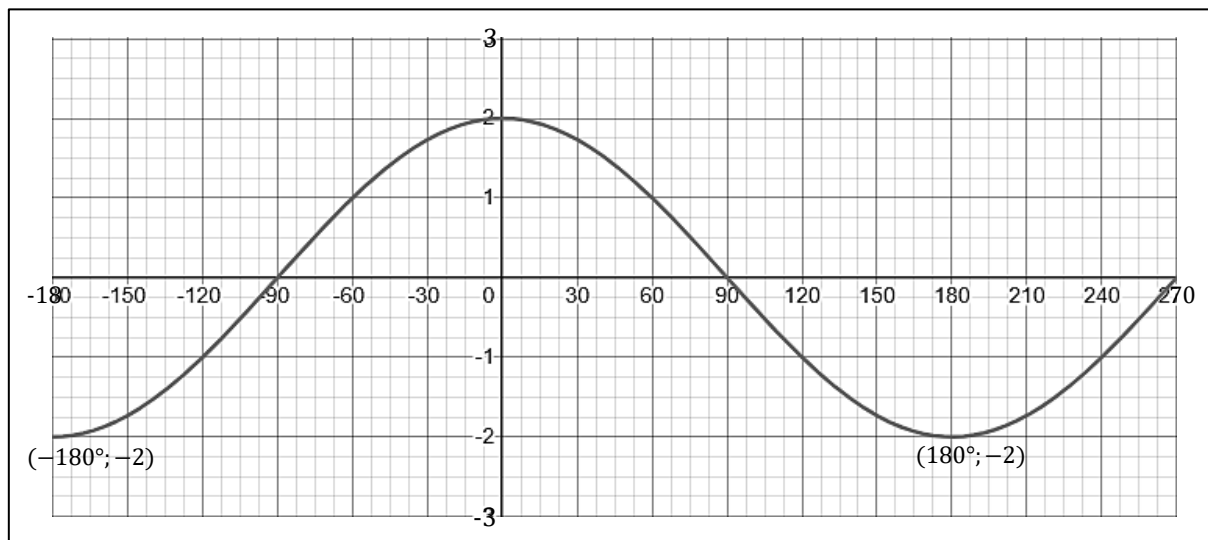
5.3 Prove the identity: $\frac{3 \sin \theta - \sin 2\theta}{\cos \theta - \cos 2\theta + 2} = \frac{\sin \theta}{1 + \cos \theta}$ (5)

- 5.4 Find the value of $\tan \theta$, if the distance between $A(\cos \theta ; \sin \theta)$ and $B(6 ; 7)$ is $\sqrt{86}$. (4)

[24]

QUESTION 6

In the diagram below, the graph of $f(x) = 2 \cos x$ is given in the interval $x \in [-180^\circ; 270^\circ]$

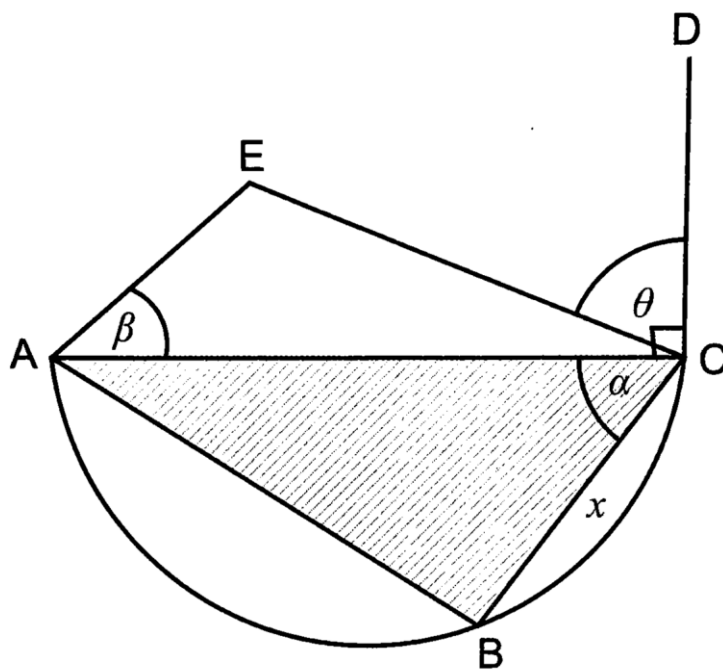


- 6.1 Write down the range of f . (1)
- 6.2 Sketch the graph of $g(x) = \sin 2x$, on the same set of axes provided in **DIANGRAM SHEET 1**, showing all intercepts with the axes as well as the turning points. (3)
- 6.3 Find the coordinates of the points of intersection of f and g , in the interval $x \in [-180^\circ; 270^\circ]$, algebraically. (5)
- 6.4 For which values of x will $f(x) > g(x)$? (2)
- 6.5 Find the values of x for which $\frac{g(x)}{f'(x)}$ will be undefined. (2)

[13]

QUESTION 7

A, B and C are three points on the circumference of a semi-circle in a horizontal plane. AC is a diameter of the semi-circle. EC is a slanted pole anchored at C, forming an angle θ with a vertical line DC. The angle of elevation of E from A is β . In addition, $BC = x$ and $\hat{ACB} = \alpha$.



7.1 Express AC in terms of x and α . (3)

7.2 Determine an expression for $\hat{AEC}$ in terms of θ and β . (3)

7.3 Prove that $EC = \frac{x \sin \beta}{\cos \alpha \cdot \cos(\beta - \theta)}$ (3)

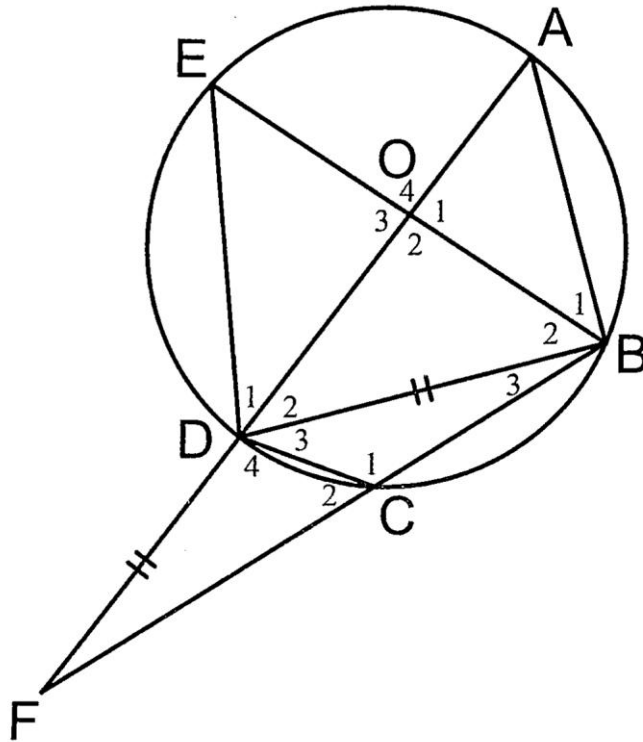
7.4 Calculate the length of EC, without using a calculator, if $\alpha = 30^\circ$, $x = 15$, $\beta = 45^\circ$ and $\theta = 15^\circ$. (3)

[12]

Give reasons for your statements in QUESTIONS 8, 9 and 10.

QUESTION 8

In the diagram, O is the centre of the circle and $DB = DF$. AF, BE and BF are straight lines and $\hat{F} = 20^\circ$.



Find the magnitude of the following angles, giving reasons:

8.1 $\hat{D}_2$ (3)

8.2 $\hat{A}$ (3)

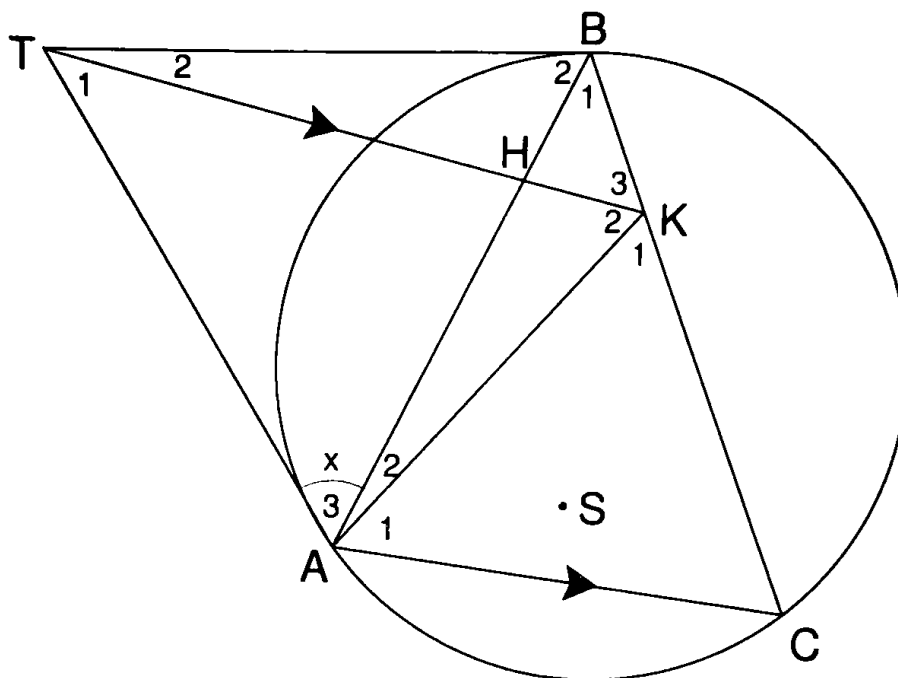
8.3 $\hat{O}_2$ (2)

8.4 $\hat{C}_1$ (2)

[10]

QUESTION 9

In the diagram below, $\triangle ABC$ is drawn in the circle. TA and TB are tangents to the circle. The straight line THK is parallel to AC with H on BA and K on BC . AK is drawn. Let $\hat{A}_3 = x$.

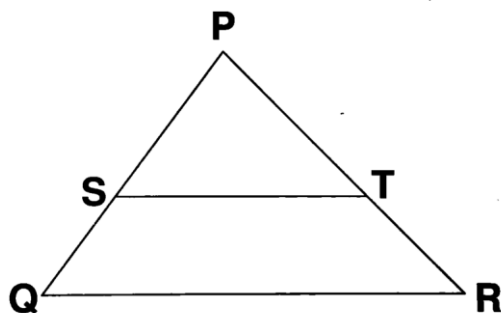


- 9.1 Prove that $\hat{K}_3 = x$. (4)
- 9.2 Prove that $AKBT$ is a cyclic quadrilateral. (2)
- 9.3 Prove that TK bisects $\hat{AKB}$. (4)
- 9.4 Prove that TA is a tangent to the circle passing through the points A , K and H . (2)
- 9.5 S is a point in the circle such that the points A , S , K and B are concyclic. Explain why A , S , B and T are also concyclic. (2)

[14]

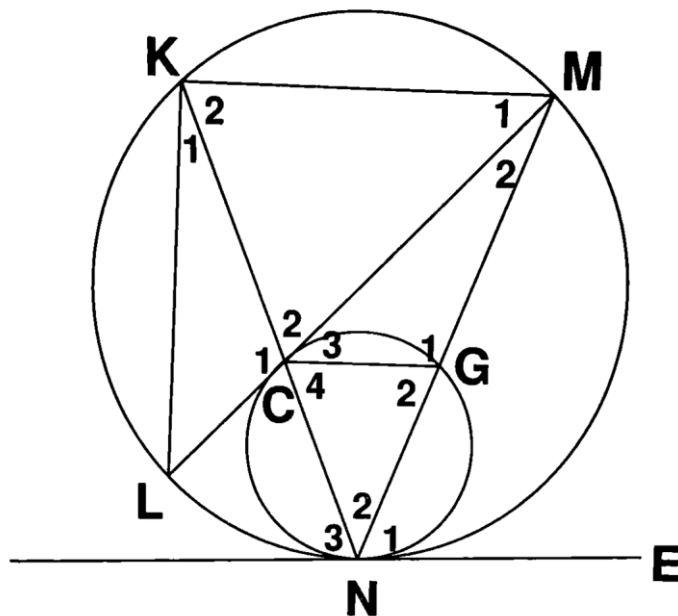
QUESTION 10

- 10.1 Use the diagram provided in **DIAGRAM SHEET 2**, to prove the theorem which states that if $ST \parallel QR$, then $\frac{PS}{SQ} = \frac{PT}{TR}$. Show all construction lines.



(5)

- 10.2 In the diagram below, NE is a common tangent to the two circles. NCK and NGM are double chords. Chord LM of the larger circle is a tangent to the smaller circle at point C. KL, KM and CG are drawn.



Prove that:

10.2.1 $\frac{KC}{KN} = \frac{MG}{MN}$ (4)

10.2.2 KMGC is a cyclic quadrilateral if $CN = NG$. (3)

10.2.3 $\Delta MCG \parallel \Delta MNC$ (3)

10.2.4 $\frac{MC^2}{MN^2} = \frac{KC}{KN}$ (3)

[18]**TOTAL: 150**

INFORMATION SHEET:

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

$$A = P(1 + ni)$$

$$A = P(1 - ni)$$

$$A = P(1 - i)^n$$

$$A = P(1 + i)^n$$

$$T_n = a + (n - 1)d$$

$$S_n = \frac{n}{2}[2a + (n - 1)d]$$

$$T_n = ar^{n-1}$$

$$S_n = \frac{a(r^n - 1)}{r - 1}; r \neq 1$$

$$S_\infty = \frac{a}{1 - r}; -1 < r < 1$$

$$F = \frac{x[(1 + i)^n - 1]}{n}$$

$$P = \frac{x[1 - (1 + i)^{-n}]}{i}$$

$$f'(x) = \lim_{h \rightarrow 0} \frac{f(x + h) - f(x)}{h}$$

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \quad M\left(\frac{x_1 + x_2}{2}; \frac{y_1 + y_2}{2}\right)$$

$$y = mx + c$$

$$\begin{aligned} y - y_1 \\ = m(x - x_1) \end{aligned}$$

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

$$m = \tan \theta$$

$$(x - a)^2 + (y - b)^2 = r^2$$

$$\text{In } \Delta ABC: \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

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

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

$$\sin(\alpha + \beta) = \sin \alpha \cdot \cos \beta + \cos \alpha \cdot \sin \beta$$

$$\sin(\alpha - \beta) = \sin \alpha \cdot \cos \beta - \cos \alpha \cdot \sin \beta$$

$$\cos(\alpha + \beta) = \cos \alpha \cdot \cos \beta - \sin \alpha \cdot \sin \beta$$

$$\cos(\alpha - \beta) = \cos \alpha \cdot \cos \beta + \sin \alpha \cdot \sin \beta$$

$$\cos 2\alpha = \begin{cases} \cos^2 \alpha - \sin^2 \alpha \\ 1 - 2 \sin^2 \alpha \\ 2 \cos^2 \alpha - 1 \end{cases}$$

$$\sin 2\alpha = 2 \sin \alpha \cdot \cos \alpha$$

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

$$\sigma^2 = \frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n}$$

$$P(A) = \frac{n(A)}{n(S)}$$

$$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$

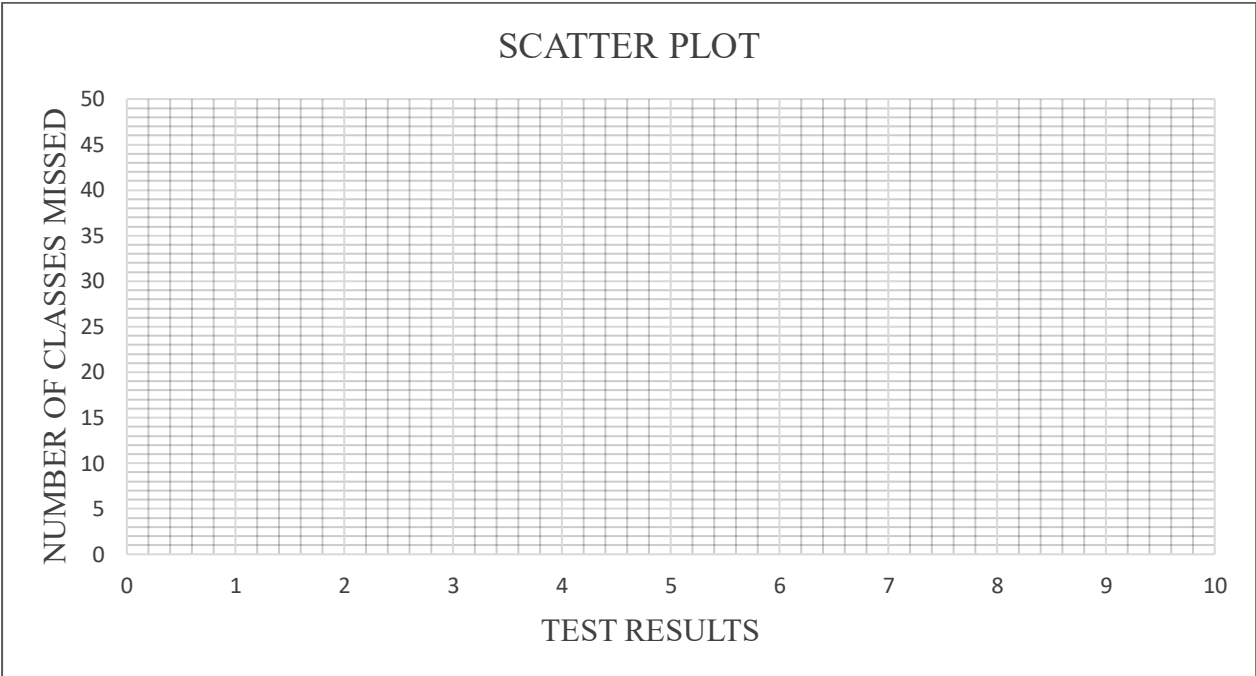
$$\hat{y} = a + bx$$

$$b = \frac{\sum (x - \bar{x})(y - \bar{y})}{\sum (x - \bar{x})^2}$$

DIAGRAM SHEET 1:

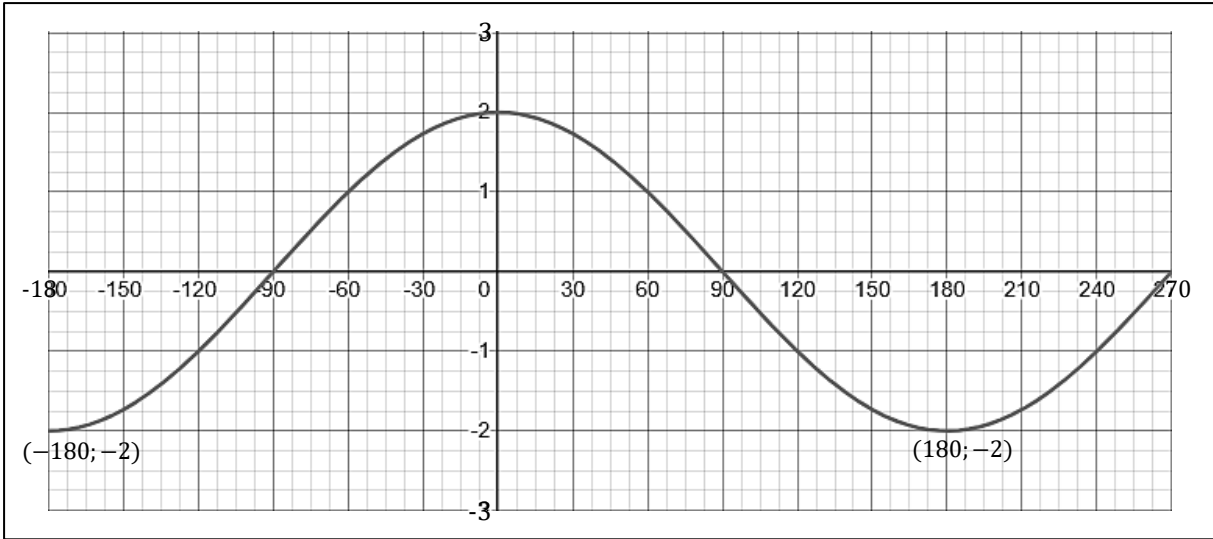
NAME: _____

2.1



(3)

6.2



(3)

DIAGRAM SHEET 2:

NAME: _____

10.1

