



basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

**NATIONAL
SENIOR CERTIFICATE**

GRADE 11

MATHEMATICS P2

EXEMPLAR 2013

MARKS: 150

TIME: 3 hours

This question paper consists of 12 pages and 3 diagram sheets.

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of 11 questions.
2. Answer ALL the questions.
3. Clearly show ALL calculations, diagrams, graphs, et cetera which you have used in determining the 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. THREE diagram sheets for QUESTION 2.1, QUESTION 2.2, QUESTION 9.2, QUESTION 10.1, QUESTION 10.2 and QUESTION 11.2 are attached at the end of this question paper. Write your name on these diagram sheets in the spaces provided and insert them inside the back cover of your ANSWER BOOK.
8. Number the answers correctly according to the numbering system used in this question paper.
9. Write neatly and legibly.

QUESTION 1

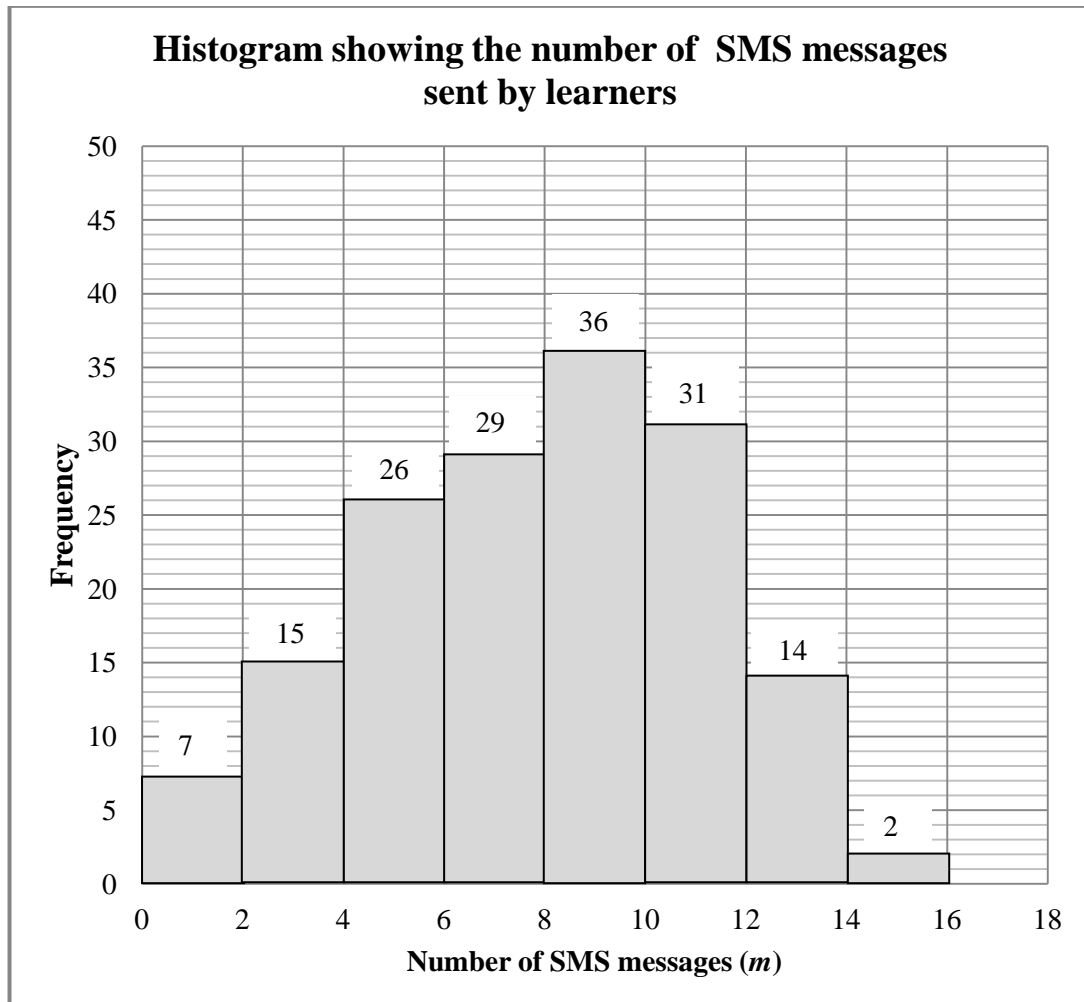
The data below shows the number of people visiting a local clinic per day to be vaccinated against measles.

| | | | |
|----|----|----|----|
| 5 | 12 | 19 | 29 |
| 35 | 23 | 15 | 33 |
| 37 | 21 | 26 | 18 |
| 23 | 18 | 13 | 21 |
| 18 | 22 | 20 | |

- 1.1 Determine the mean of the given data. (2)
- 1.2 Calculate the standard deviation of the data. (2)
- 1.3 Determine the number of people vaccinated against measles that lies within ONE standard deviation of the mean. (2)
- 1.4 Determine the interquartile range for the data. (3)
- 1.5 Draw a box and whisker diagram to represent the data. (3)
- 1.6 Identify any outliers in the data set. Substantiate your answer. (2)
- [14]**

QUESTION 2

A group of Grade 11 learners were interviewed about using a certain application to send SMS messages. The number of SMS messages, m , sent by each learner was summarised in the histogram below.

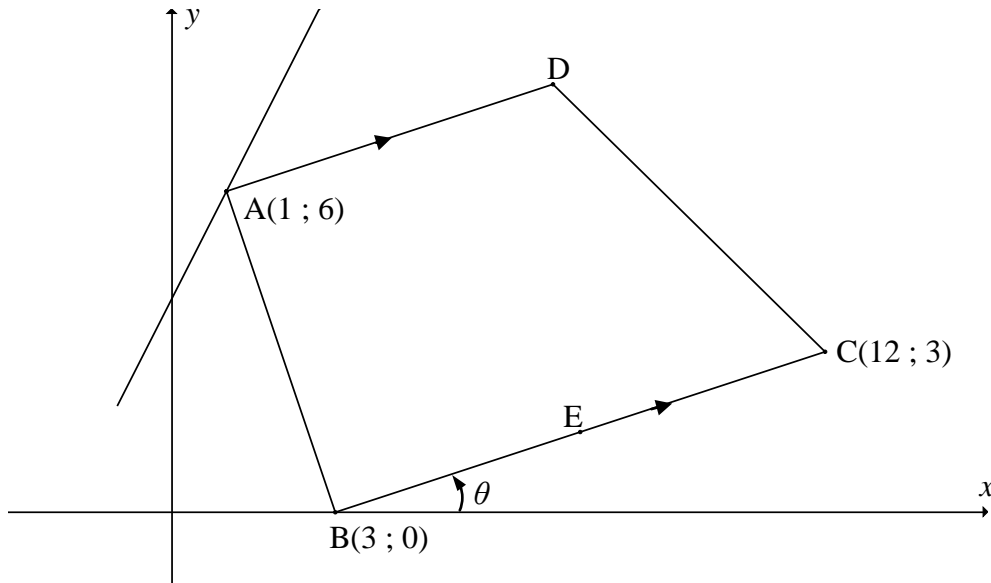


- 2.1 Complete the cumulative frequency table provided in DIAGRAM SHEET 1. (2)
- 2.2 Use the grid provided in DIAGRAM SHEET 2 to draw an ogive (cumulative frequency curve) to represent the data. (3)
- 2.3 Use the ogive to identify the median for the data. (1)
- 2.4 Estimate the percentage of the learners who sent more than 11 messages using this application. (2)
- 2.5 In which direction is the data skewed? (1)

[9]

QUESTION 3

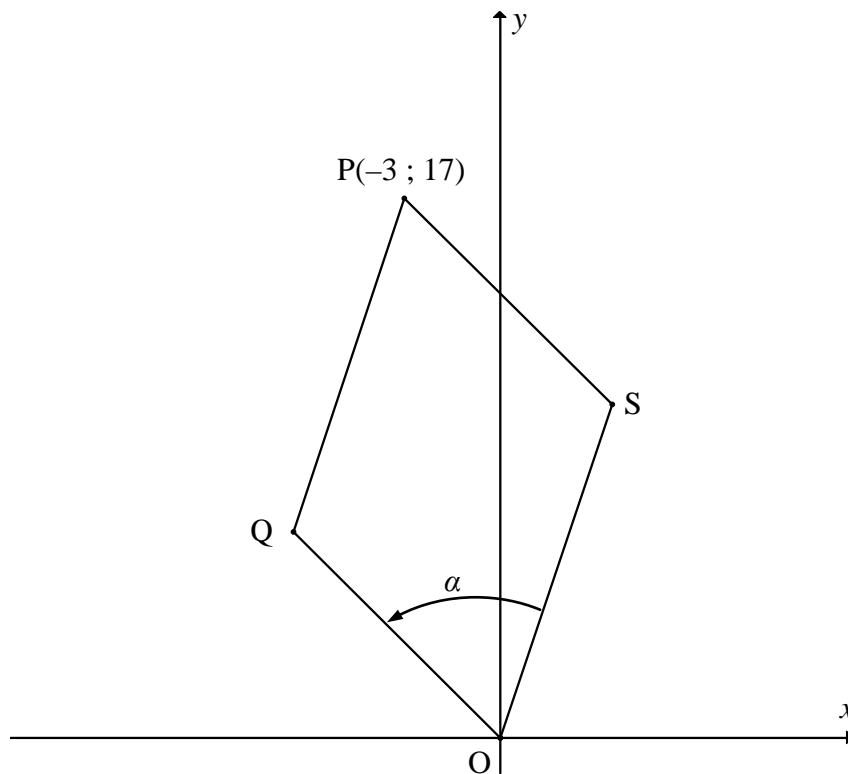
$A(1 ; 6)$, $B(3 ; 0)$, $C(12 ; 3)$ and D are the vertices of a trapezium with $AD \parallel BC$. E is the midpoint of BC . The angle of inclination of the straight line BC is θ , as shown in the diagram.



- 3.1 Calculate the coordinates of E . (2)
- 3.2 Determine the gradient of the line BC . (2)
- 3.3 Calculate the magnitude of θ . (2)
- 3.4 Prove that AD is perpendicular to AB . (3)
- 3.5 A straight line passing through vertex A does not pass through any of the sides of the trapezium. This line makes an angle of 45° with side AD of the trapezium. Determine the equation of this straight line. (5)
- [14]**

QUESTION 4

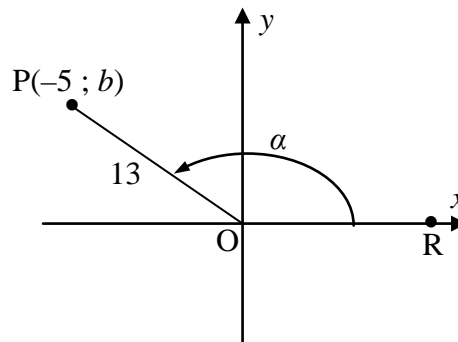
In the diagram below, $P(-3 ; 17)$, Q , O and S are the vertices of a parallelogram. The sides OS and OQ are defined by the equations $y = 6x$ and $y = -x$ respectively. $\widehat{QOS} = \alpha$.



- 4.1 Determine the equation of QP in the form $y = mx + c$. (3)
- 4.2 Hence, determine the coordinates of Q . (4)
- 4.3 Calculate the length of OQ . Leave your answer in simplified surd form. (2)
- 4.4 Calculate the size of α . (3)
- 4.5 If $OS = \sqrt{148}$ units, calculate the length of QS . (3)
- [15]**

QUESTION 5

- 5.1 In the figure below, the point $P(-5 ; b)$ is plotted on the Cartesian plane. $OP = 13$ units and $\widehat{ROP} = \alpha$.



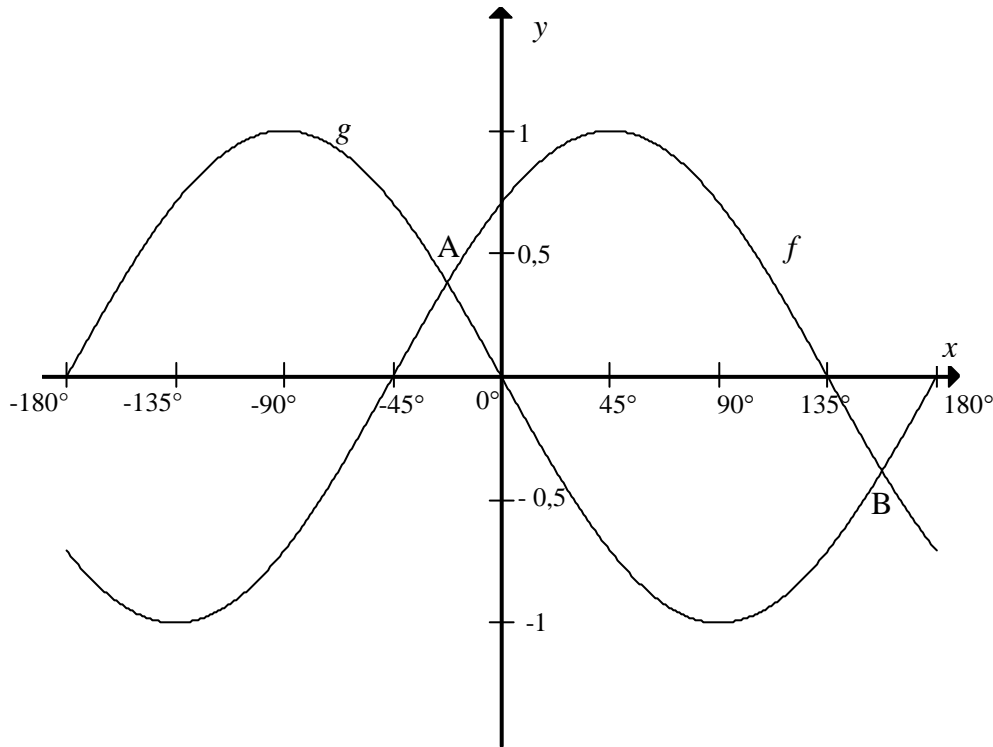
Without using a calculator, determine the value of the following:

- 5.1.1 $\cos \alpha$ (1)
- 5.1.2 $\tan(180^\circ - \alpha)$ (3)
- 5.2 Consider: $\frac{\sin(\theta - 360^\circ) \sin(90^\circ - \theta) \tan(-\theta)}{\cos(90^\circ + \theta)}$
- 5.2.1 Simplify $\frac{\sin(\theta - 360^\circ) \sin(90^\circ - \theta) \tan(-\theta)}{\cos(90^\circ + \theta)}$ to a single trigonometric ratio. (5)
- 5.2.2 Hence, or otherwise, **without using a calculator**, solve for θ if $0^\circ \leq \theta \leq 360^\circ$:
- $$\frac{\sin(\theta - 360^\circ) \sin(90^\circ - \theta) \tan(-\theta)}{\cos(90^\circ + \theta)} = 0,5$$
- (3)
- 5.3 5.3.1 Prove that $\frac{8}{\sin^2 A} - \frac{4}{1 + \cos A} = \frac{4}{1 - \cos A}$. (5)
- 5.3.2 For which value(s) of A in the interval $0^\circ \leq A \leq 360^\circ$ is the identity in QUESTION 5.3.1 undefined? (3)
- 5.4 Determine the general solution of $8 \cos^2 x - 2 \cos x - 1 = 0$. (6)

[26]

QUESTION 6

In the diagram below, the graphs of $f(x) = \cos(x + p)$ and $g(x) = q \sin x$ are shown for the interval $-180^\circ \leq x \leq 180^\circ$.

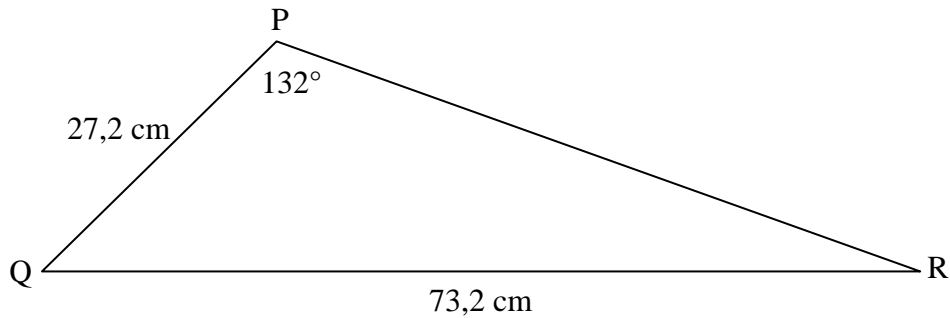


- 6.1 Determine the values of p and q . (2)
- 6.2 The graphs intersect at $A(-22,5^\circ ; 0,38)$ and B. Determine the coordinates of B. (2)
- 6.3 Determine the value(s) of x in the interval $-180^\circ \leq x \leq 180^\circ$ for which $f(x) - g(x) < 0$. (2)
- 6.4 The graph f is shifted 30° to the left to obtain a new graph h .
- 6.4.1 Write down the equation of h in its simplest form. (2)
- 6.4.2 Write down the value of x for which h has a minimum in the interval $-180^\circ \leq x \leq 180^\circ$. (1)
- [9]**

QUESTION 7

7.1 Prove that in any acute-angled $\triangle ABC$, $\frac{\sin A}{a} = \frac{\sin C}{c}$. (5)

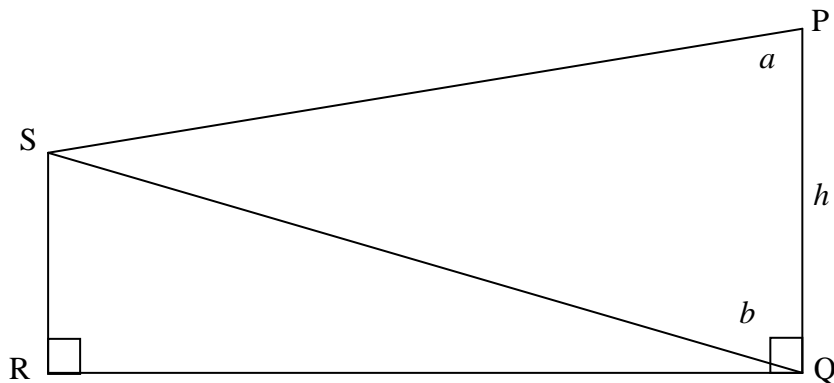
7.2 In $\triangle PQR$, $\hat{P} = 132^\circ$, $PQ = 27,2$ cm and $QR = 73,2$ cm.



7.2.1 Calculate the size of \hat{R} . (3)

7.2.2 Calculate the area of $\triangle PQR$. (3)

7.3 In the figure below, $\hat{SPQ} = a$, $\hat{PQS} = b$ and $PQ = h$. PQ and SR are perpendicular to RQ .



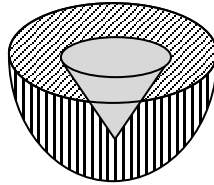
7.3.1 Determine the distance SQ in terms of a , b and h . (3)

7.3.2 Hence show that $RS = \frac{h \sin a \cos b}{\sin(a+b)}$. (3)

[17]

QUESTION 8

A solid metallic hemisphere has a radius of 3 cm. It is made of metal A. To reduce its weight a conical hole is drilled into the hemisphere (as shown in the diagram) and it is completely filled with a lighter metal B. The conical hole has a radius of 1,5 cm and a depth of $\frac{8}{9}$ cm.



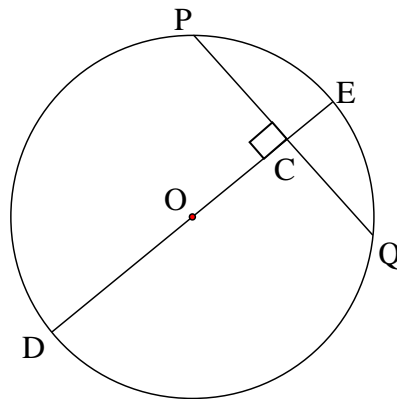
Calculate the ratio of the volume of metal A to the volume of metal B. [6]

QUESTION 9

9.1 Complete the statement so that it is valid:

The line drawn from the centre of the circle perpendicular to the chord ... (1)

9.2 In the diagram, O is the centre of the circle. The diameter DE is perpendicular to the chord PQ at C. DE = 20 cm and CE = 2 cm.



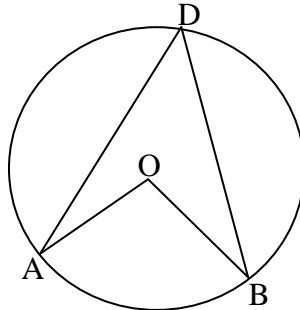
Calculate the length of the following with reasons:

9.2.1 OC (2)

9.2.2 PQ (4)
[7]

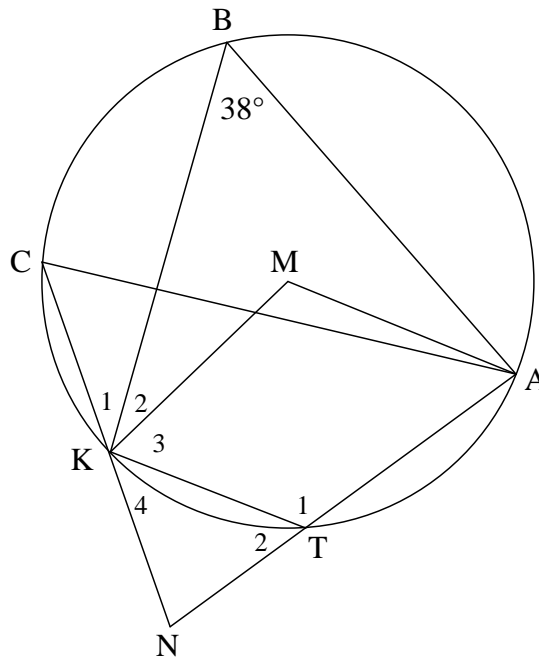
QUESTION 10

- 10.1 In the diagram, O is the centre of the circle and A, B and D are points on the circle. Use Euclidean geometry methods to prove the theorem which states that $\hat{A}OB = 2\hat{A}DB$.



(5)

- 10.2 In the diagram, M is the centre of the circle. A, B, C, K and T lie on the circle. AT produced and CK produced meet in N. Also $NA = NC$ and $\hat{B} = 38^\circ$.



- 10.2.1 Calculate, with reasons, the size of the following angles:

- (a) $\hat{K}MA$ (2)
- (b) \hat{T}_2 (2)
- (c) \hat{C} (2)
- (d) \hat{K}_4 (2)

- 10.2.2 Show that $NK = NT$. (2)

- 10.2.3 Prove that $AMKN$ is a cyclic quadrilateral. (3)

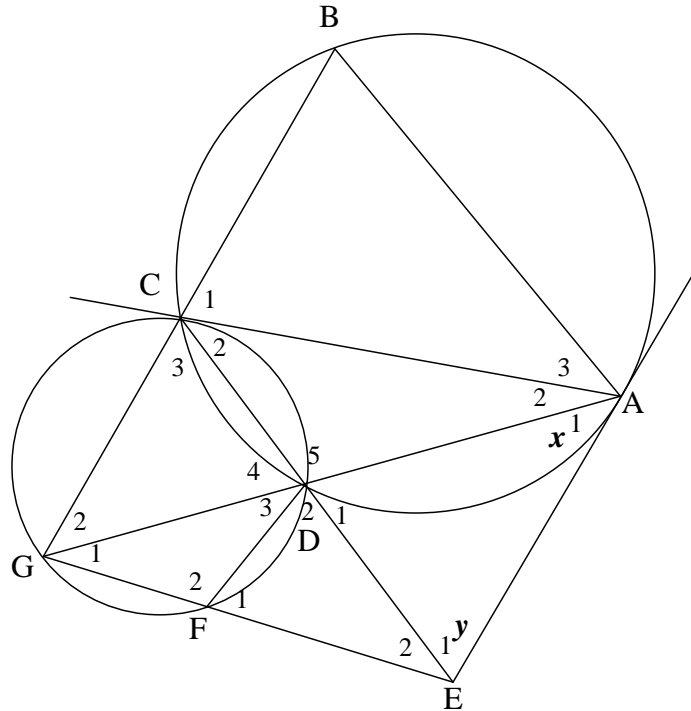
[18]

QUESTION 11

11.1 Complete the following statement so that it is valid:

The angle between a chord and a tangent at the point of contact is ... (1)

11.2 In the diagram, EA is a tangent to circle ABCD at A.
AC is a tangent to circle CDFG at C.
CE and AG intersect in D.



If $\hat{A}_1 = x$ and $\hat{E}_1 = y$, prove the following with reasons:

- 11.2.1 BCG \parallel AE (5)
 - 11.2.2 AE is a tangent to circle FED (5)
 - 11.2.3 AB = AC (4)
- [15]**

TOTAL: 150

NAME OF LEARNER:

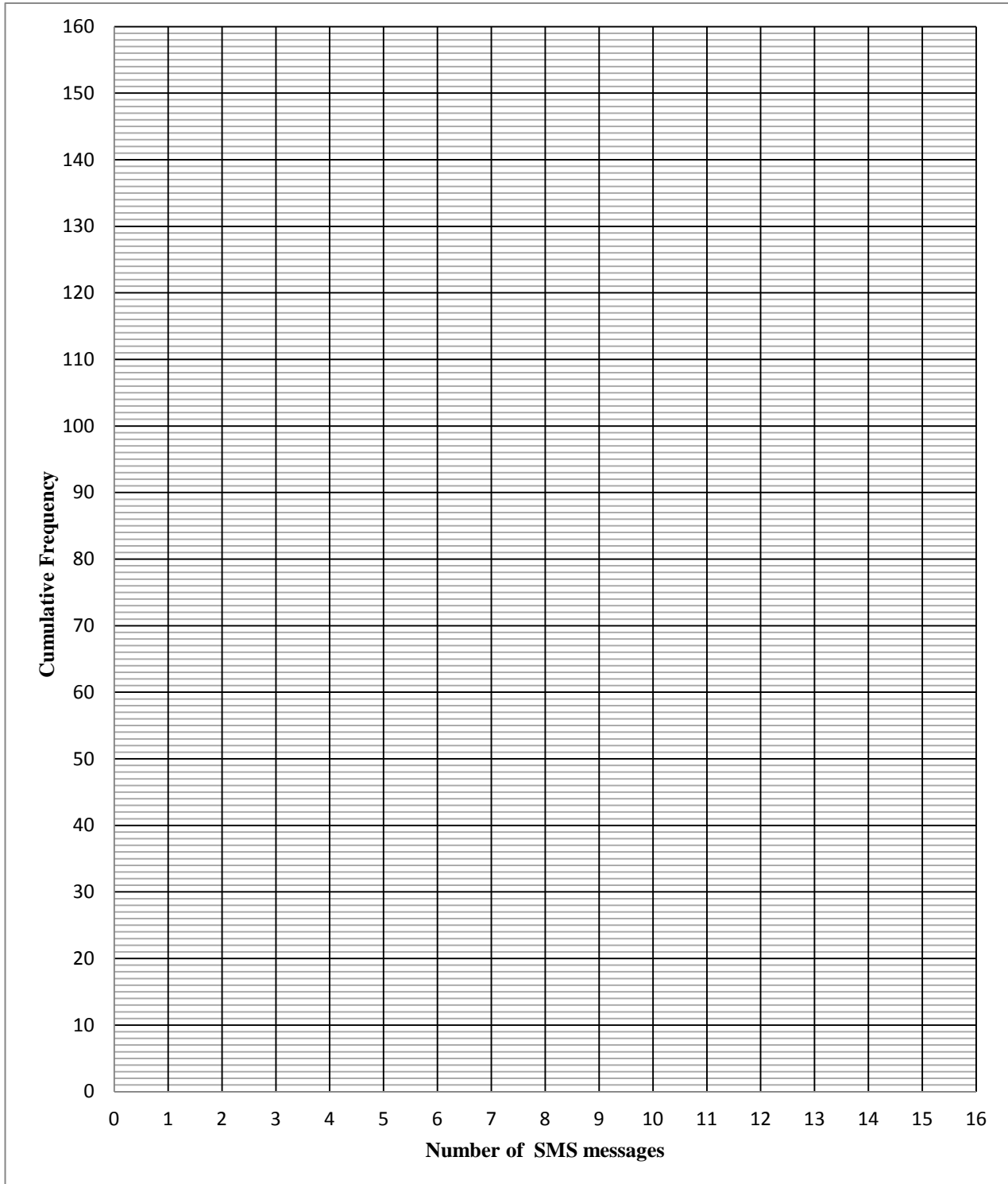
DIAGRAM SHEET 1**QUESTION 2.1**

| CLASS | FREQUENCY | CUMULATIVE FREQUENCY |
|------------------|------------------|---------------------------------|
| $0 \leq m < 2$ | | |
| $2 \leq m < 4$ | | |
| $4 \leq m < 6$ | | |
| $6 \leq m < 8$ | | |
| $8 \leq m < 10$ | | |
| $10 \leq m < 12$ | | |
| $12 \leq m < 14$ | | |
| $14 \leq m < 16$ | | |

NAME OF LEARNER:

DIAGRAM SHEET 2

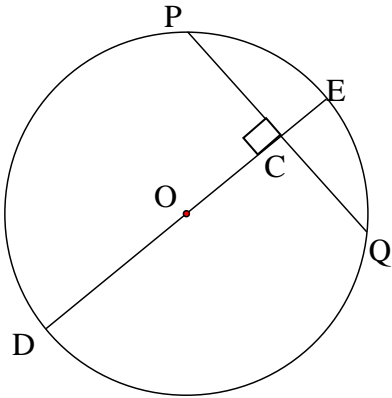
QUESTION 2.2



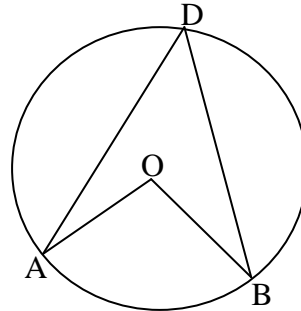
NAME OF LEARNER:

DIAGRAM SHEET 3

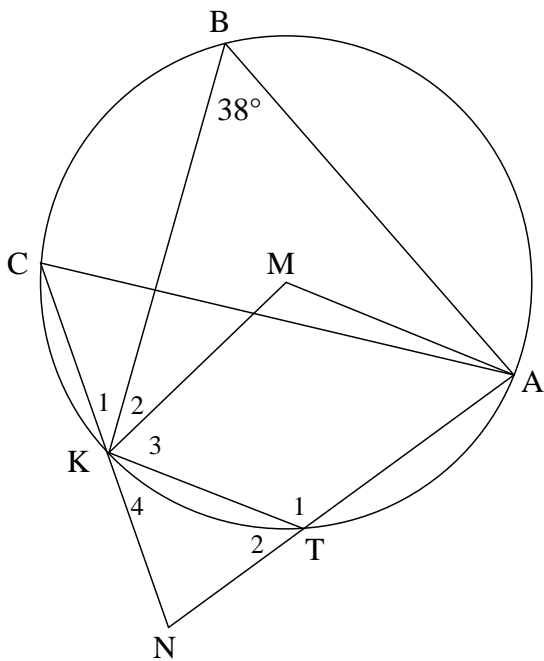
QUESTION 9.2



QUESTION 10.1



QUESTION 10.2



QUESTION 11.2

