**NATIONAL
SENIOR CERTIFICATE**

GRADE 11

NOVEMBER 2013

MATHEMATICS P2

MARKS: 150

TIME: 3 hours

This question paper consists of 12 pages, including 2 diagram sheets.

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1.   This question paper consists of 12 questions. Answer ALL the questions.

2.   Clearly show ALL calculations, diagrams, graphs, et cetera, which you have used in determining the 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.   Round off your answers to TWO decimal places if necessary, unless stated otherwise.

6.   Diagrams are not necessarily drawn to scale.

7.   TWO diagram sheets for answering QUESTION 3.1, QUESTION 3.2, QUESTION 10.2 and QUESTION 12.1 are attached at the end of this question paper. Write your name and surname in the appropriate spaces and insert it in your answer book.

8.   Number the answers correctly according to the numbering system used in this question paper.

9.   It is in your own interest to write legibly and to present your work neatly.

QUESTION 1

The following are the heights (in centimetres) of the first 11 people who went to the National Stadium to watch the first game of the AFCON 2013 in South Africa:

143   171   182   155   171   150   188   164   180   100   190

1.1   Draw a box and whisker diagram. (4)

1.2   Hence, state whether the distribution of the data is symmetrical, skewed to the left or skewed to the right. (1)

1.3   Write down any outlier(s). (1)

[6]

QUESTION 2

The following data shows the ages of 10 people who donated blood in December 2012.

25   47   40   34   28 x 37   28   55   30

2.1   Determine the mean in terms of x. (1)

2.2   Determine the value of x if the mean is 36. Show ALL calculations. (2)

2.3   Hence, determine the standard deviation. (2)

2.4   How many people have ages which differ from the mean by more than one standard deviation? (2)

[7]

QUESTION 3

The following table shows the marks (out of 50) of 40 grade 11 learners in Life Orientation:

Interval	Frequency	Cumulative frequency
$0 \leq x < 10$	2	
$10 \leq x < 20$	7	
$20 \leq x < 30$	14	
$30 \leq x < 40$	12	
$40 \leq x < 50$	5	

3.1   Complete the cumulative frequency column. Use DIAGRAM SHEET 1. (2)

3.2   Draw the ogive (cumulative frequency graph) for the above data.
Use DIAGRAM SHEET 1. (3)

3.3   Learners require 30% to pass the test. Use the ogive curve to determine how many learners passed. (2)

[7]

QUESTION 4

In the following diagram, C(k; 5), A(-4; 1), and F(k; p) are the vertices of ΔCAF.
B(-1; -2) is the midpoint of AF and CF is parallel to the y-axis.
The inclination of AF is θ.
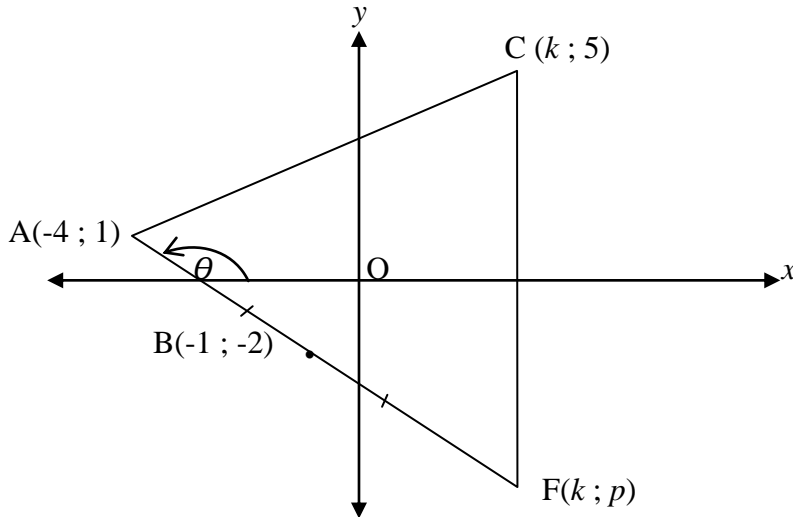
4.1   Determine:

      4.1.1   the values of k and p.   (3)

      4.1.2   the gradient of AF.   (3)

      4.1.3   the equation of the perpendicular bisector of AF.   (4)

4.2   Determine whether ΔCAF is equilateral, isosceles or scalene. Show all working.   (6)

4.3   Determine the value of θ and hence of AF̂C.   (4)

4.4   Explain why the perpendicular bisector of AF cannot pass through C.   (2)

4.5   If D(k; y) is a point on CF such that BD ∥ AC, determine the value of y.   (2)
                                                                                        [24]

QUESTION 5

5.1   Determine the equation of the straight line passing through (-2; 5) and parallel to the
      line $x + 2y - 6 = 0$.   (4)

5.2   Determine whether K(-3; 5), L(2; -3) and N(5; -9) are collinear.   (4)
                                                                                         [8]

QUESTION 6

6.1   Given $5\tan\alpha + 4 = 0$ and $\alpha \in [180° ; 360°]$. Use a suitable diagram to determine the following, without using a calculator:

      6.1.1 $2\cos (180° - \alpha)$ (4)

      6.1.2 $\sin^2 (\alpha - 90°) - \sin^2\alpha$ (3)

6.2   Determine the value of x if:
$4\cos^2 x - \tan 45° = 0$ for $x \in [0°;360°]$ (4)

                                                                        [11]

QUESTION 7

7.1   Simplify without using a calculator:

$$\frac{\sin 117°}{\cos 27°} + \cos(-x) . \tan(180° - x). \sin(360° + x)$$ (6)

7.2   Given the identity:
$$\frac{\cos x}{1 - \sin x} - \frac{\cos x}{1 + \sin x} = 2\tan x$$

      7.2.1   Prove the identity.   (5)

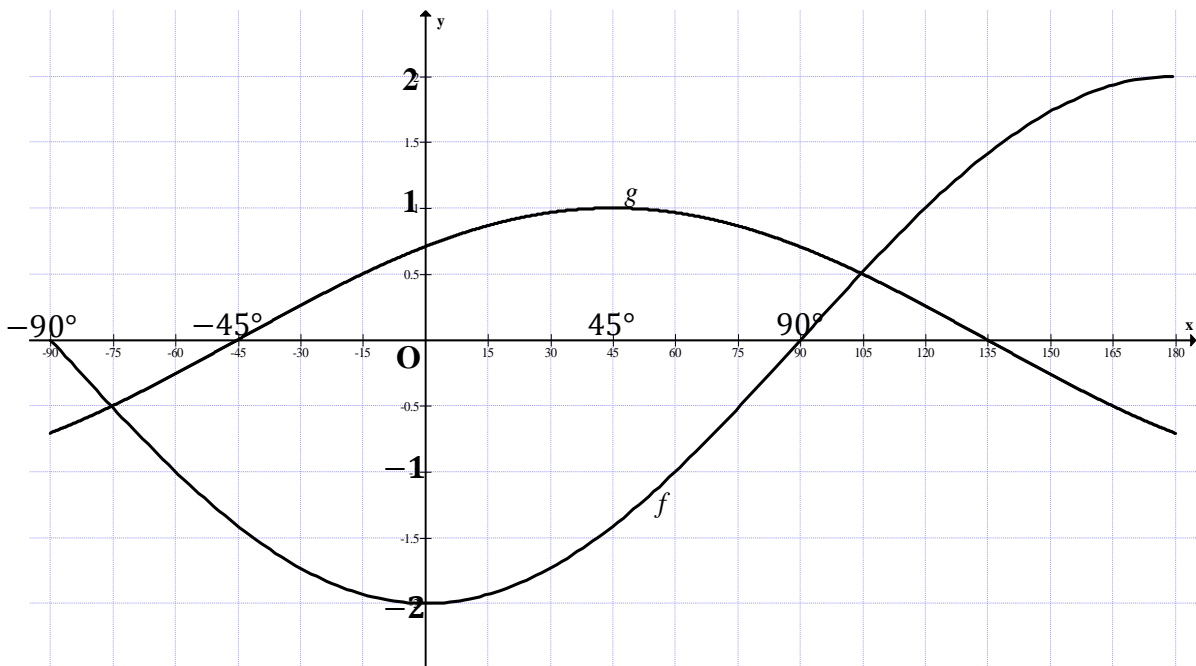   7.2.2   If $x \in [-180°; 180°]$, give 2 values of x for which the identity is undefined.   (2)

7.3   Determine the general solution of:

$$\sqrt{\tan \theta} = x + \frac{1}{x} \quad \text{if} \quad x^2 + \frac{1}{x^2} = 1$$ (6)

   **[19]**

QUESTION 8

The diagram below shows the sketch graphs of $f(x) = a \cos bx$ and $g(x) = p \sin (x + r)$ for $x \in [-90°; 180°]$

8.1   Write down the values of a, b, p and r.   (4)

8.2   Use the graph to determine the values of x for which $f(x) - g(x) = 0$.   (2)

8.3   Write down the period of f.   (1)

8.4   Write down the equation of h if h is obtained by first moving the graph of g 45° to the right and then doubling its period.   (2)

[9]

QUESTION 9

In the diagram below, $L\hat{K}N = \alpha$, $K\hat{L}N = \beta$ and $KL = x$ metres. KL and MN are perpendicular to LM.
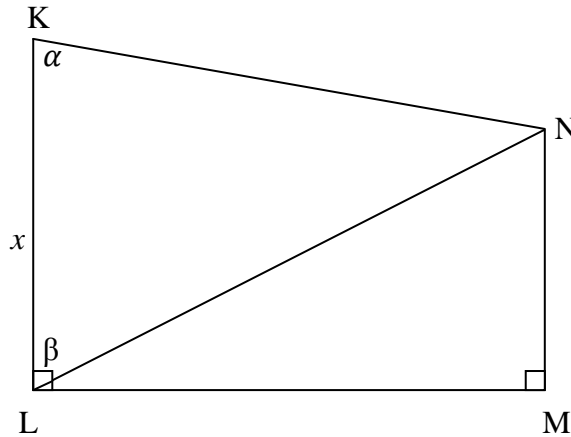
9.1   Show that MN $= \dfrac{x \sin \alpha \, . \, cos\beta}{\sin(\alpha + \beta)}$ (6)

9.2   Given $\alpha = 76°$, $\beta = 72°$ and $x = 48$ metres:

       9.2.1   Calculate the length of MN.   (2)

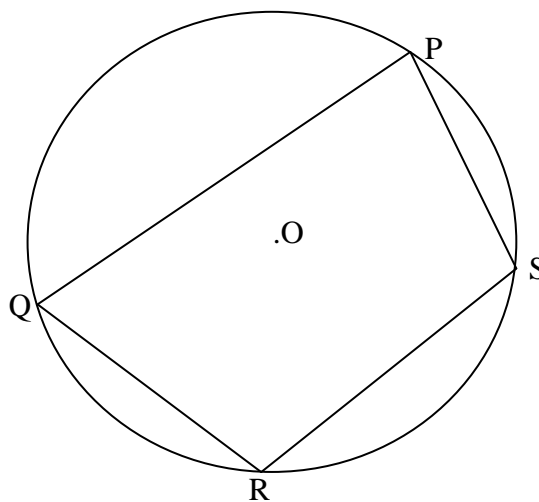   9.2.2   Calculate the area of ΔKLN if LN = 88 m.   (3)

                                                                     [11]

QUESTION 10

10.1   Complete the statements below by filling in the missing word(s) to make the statements correct.

   10.1.1   The angle between a tangent and a chord is …   (1)

       10.1.2   The exterior angle of a cyclic quadrilateral is equal to …   (1)

10.2   In the diagram below O is the centre of the circle. PQRS is cyclic quadrilateral.

       Redraw the diagram or use the diagram on DIAGRAM SHEET 2 to prove the theorem which states that $\hat{P} + \hat{R} = 180°$.   (5)

10.3   In the diagram below, AST is a tangent to a circle O at S.
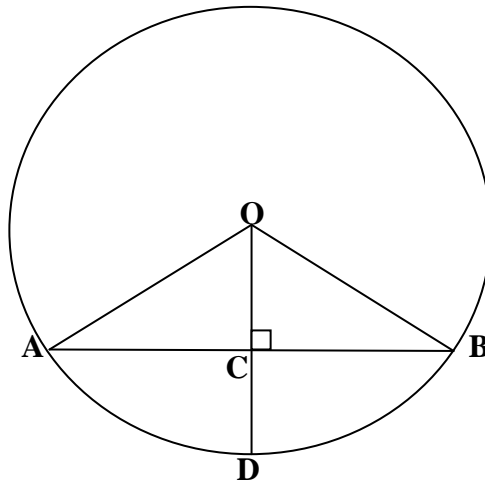 $R\hat{S}T = \hat{S}_1 = 23°$ and QR = RS.
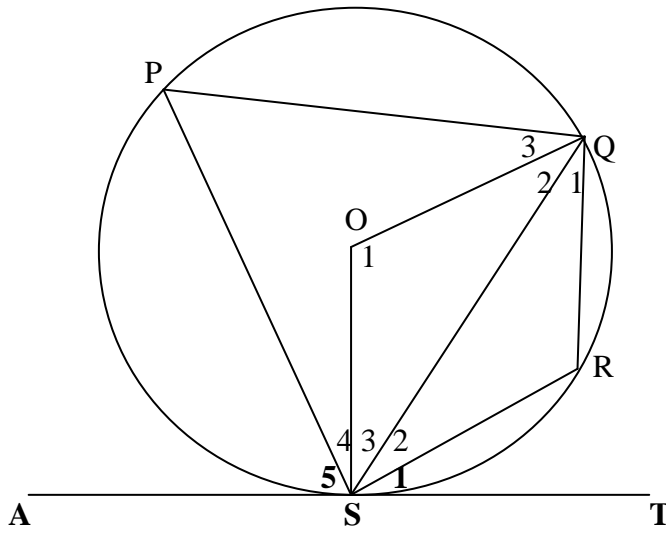
Calculate, with reasons, the sizes of:

10.3.1 $Q\hat{S}R$ (4)

10.3.2 $\hat{R}$ (2)

10.3.3 $\hat{P}$ (2)

10.3.4 $\hat{O}_1$ (2)

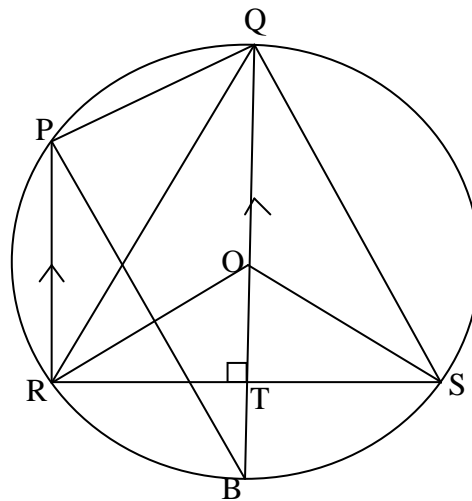   **[17]**

QUESTION 11

11.1   In the diagram below, AB is a chord of a circle with centre O.
       D is a point on the circle. OD is perpendicular to AB.   OA = 25 cm and CD = 18 cm.

       Calculate, with reasons, the length of AB.   (5)

11.2   In the diagram below, QOB is the diameter of the circle with centre O.   PR∥QB,
       QB⊥RS and $P\hat{B}Q = 25°$. P, R and S are points on the circle.

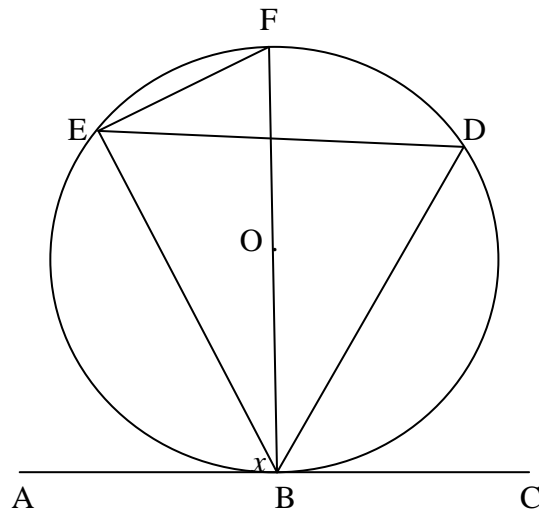   11.2.1   Determine, with reasons, three other angles each equal to 25°.   (6)

     11.2.2   Determine, with reasons:

           (a) $R\hat{O}B$ (2)

           (b) $O\hat{R}T$ (2)

           (c) $R\hat{O}S$ (2)

           (d) $R\hat{P}Q$ (2)

                                                                   [19]

QUESTION 12

12.1　In the diagram below, ABC is a tangent at B to the circle with centre O.
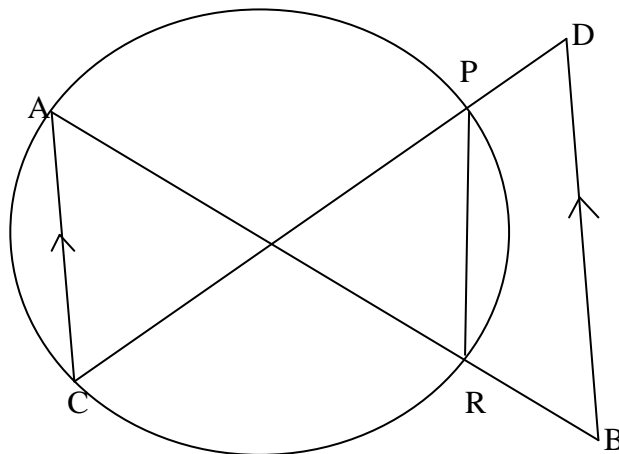　　　D and E are points on this circle. $A\hat{B}E = x$.

　　　12.1.1　Express in terms of *x*:

　　　　　　(a)　$F\hat{B}E$　　　　　　　　　　　　　　　　　　　　　　　(1)

　　　　　　(b)　$\hat{F}$　　　　　　　　　　　　　　　　　　　　　　　(1)

　　　12.1.2　Prove that AB is NOT a tangent to circle OEB.　　　　　　　(3)

12.2　In the diagram, chords AR and CP intersect inside the circle.
　　　AR and CP are respectively produced to B and D such that AC ‖ DB.

　　　Prove that PDBR is a cyclic quadrilateral.　　　　　　　　　　　(7)

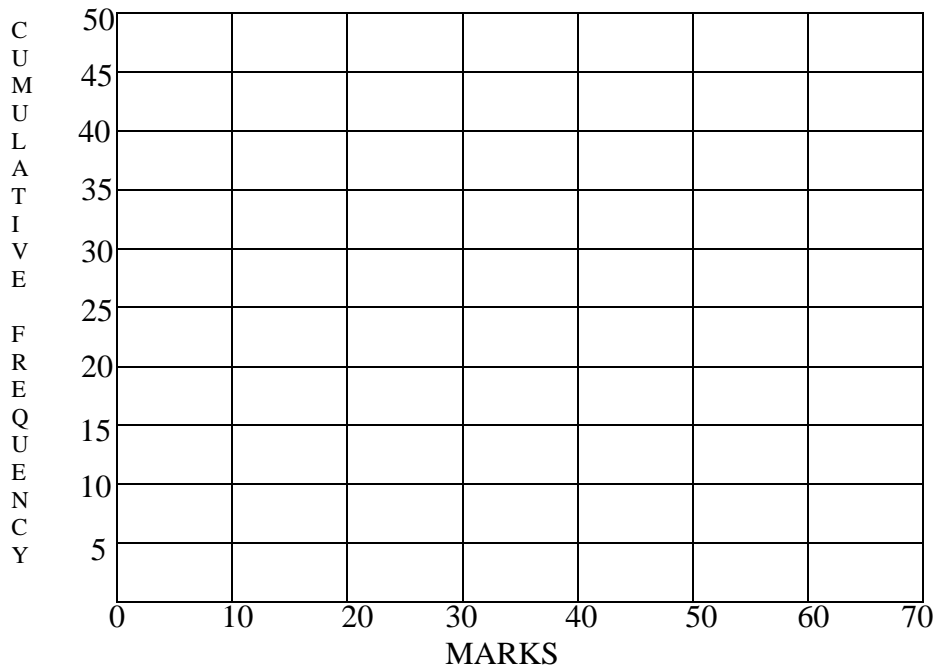　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　**[12]**

　　　　　　　　　　　　　　　　　　　　　　　　　　TOTAL:　150

NAME:

DIAGRAM SHEET 1

QUESTION 3.1

Interval	Frequency	Cumulative frequency
$0 \leq x < 10$	2	
$10 \leq x < 20$	7	
$20 \leq x < 30$	14	
$30 \leq x < 40$	12	
$40 \leq x < 50$	5	

QUESTION 3.2:

NAME:

DIAGRAM SHEET 2

QUESTION 10.2

QUESTION 12.1