SACRED HEART COLLEGE

MATHEMATICS PAPER 2

GRADE 11

JULY EXAMINATION 2016

EXAMINER: M. Phungula **TIME:** 2h30 mins

MODERATOR: M. Chipindu, I. Marais **MARKS:** 125

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. This paper consists of 17 pages and Information paper. Please check that your paper is complete.
2. Read the questions carefully.
3. Answer all the questions on the space provided.
4. You may use an approved non-programmable and non-graphic calculator, unless otherwise stated.
5. **Round off your answers to two-decimal places**, where necessary, unless otherwise stated.
6. All necessary working details must be clearly shown.
7. It is in your own interest to write legibly and present your work neatly

Do not write here:

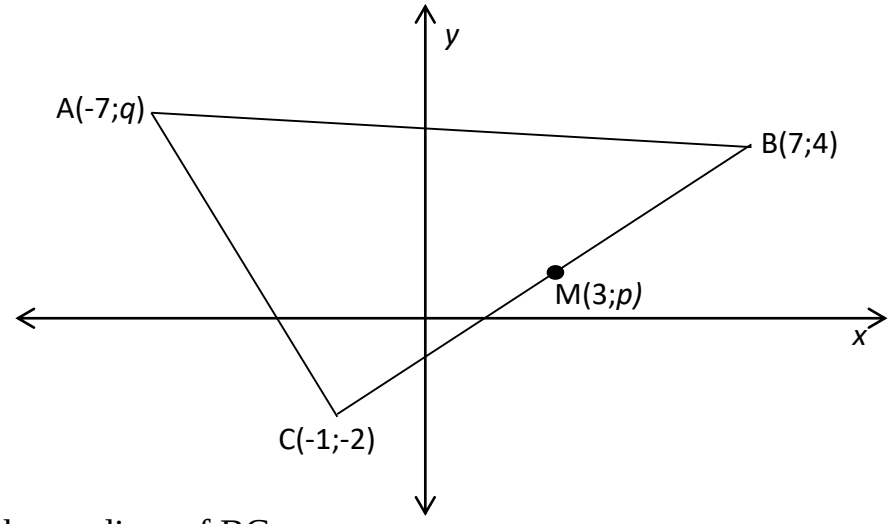
Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Total
7	20	16	11	8	17	13	10	23	125

QUESTION 1 Section A

NAME: _____

MATHS TEACHER:_____

ΔABC has vertices A(-7 ; q) , B(7 ; 4) and C(-1 ; -2) . M (3 ; p) lies on BC.



(a) Find the gradient of BC . (2)

(b) If $AC \perp BC$, show that $q = 6$ (show all working). (3)

(c) If M is the mid-point of BC , find p (show all working). (2)

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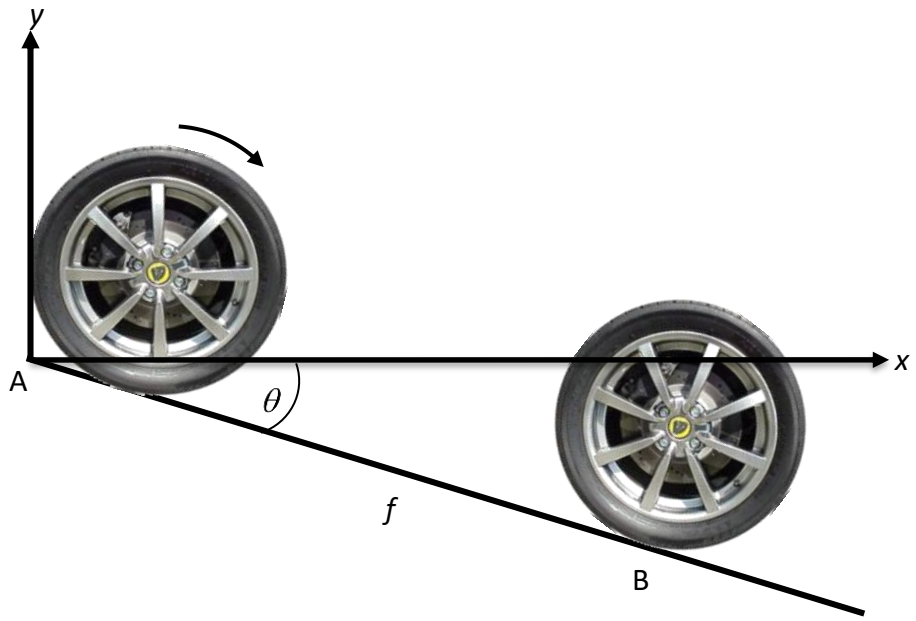
QUESTION 2

(a) A wheel rolls down a hill represented by the straight line *f*.



The wheel starts in position A and has equation:
$(x-0,5)^2+(y-0,3)^2=0,25$

The wheel rolls to a position B where its equation is then:
$x^2+y^2-4x+2y+4,75=0$

(1) State the co-ordinates of the centre of the wheel when it is in position A. (1)

_____

(2) Find the co-ordinates of the centre of the wheel when it is in position B. (4)

_____

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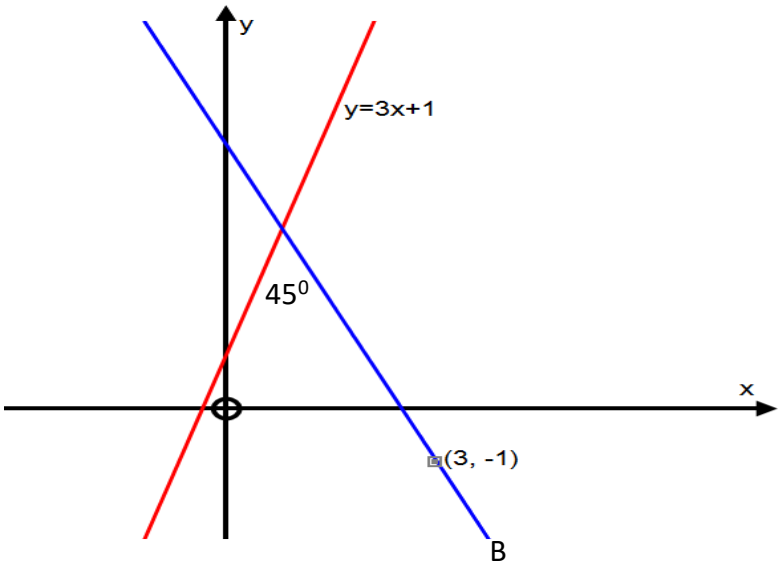
(3) Find θ the angle of inclination of the hill. (3)

(4) If the units are in metres, how far has the wheel travelled from A to B down the hill? (4)

(5) Through what angle has the wheel turned about its own axis? (3)

(b) Determine the equation of the line AB in the sketch below: (5)

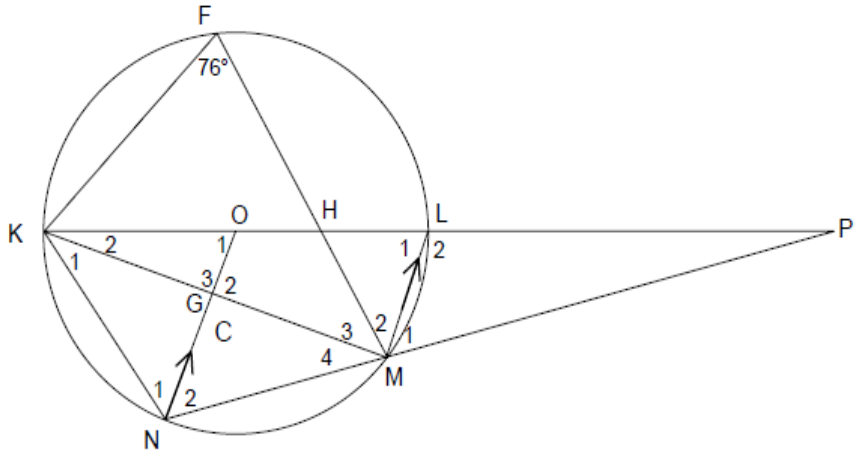
A



[20]

QUESTION 3

In the diagram below, O is the centre of the circle and diameter KL is produced to meet NM at P.
ON // LM and $\hat{F} = 76^o$



Calculate, with reasons, the size of:

(a) $\hat{L}_1$ (2)

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

(c) $\hat{M}_4$ (2)

(d) $\hat{N}_1 + \hat{N}_2$ (2)

(e) $\hat{M}_1$ (4)

(f) Prove that KG = GM (4)

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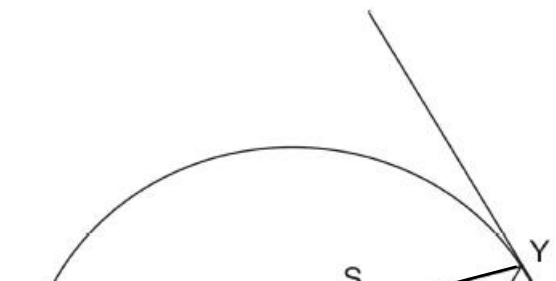
QUESTION 4 **Section B**



In the diagram alongside, VN and VY are tangents to the circle at N and Y.

NA // VS and $\hat{A} = x$

(a) Write down, with reasons, three other angles also equal to x. (6)

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(b) Prove that VYSN is a cyclic quadrilateral. (2)

_____

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(c) Prove that Δ ASN is isosceles. (3)

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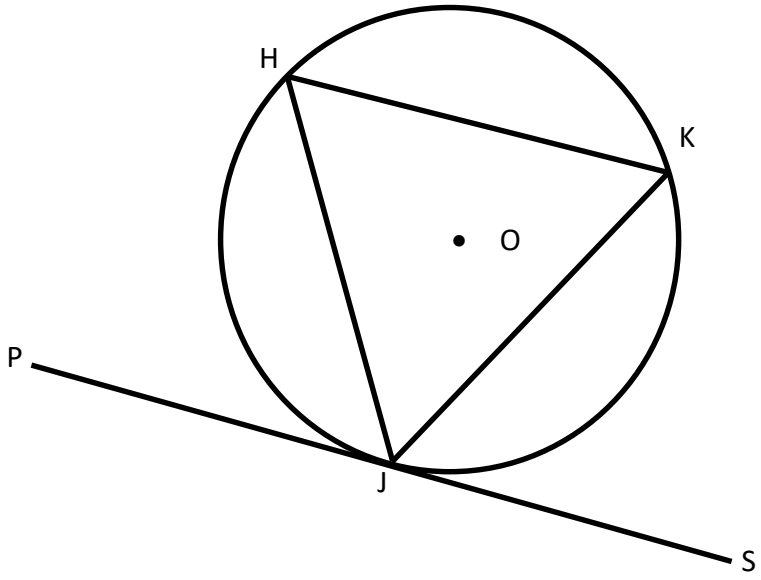
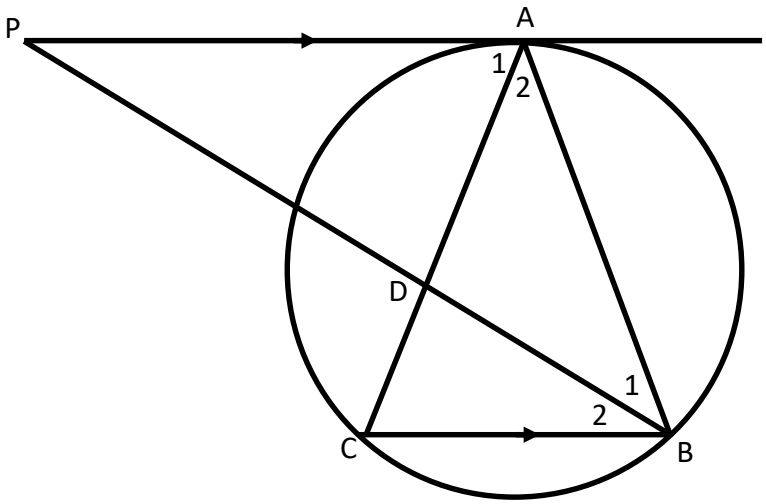
QUESTION 5

(a) Prove the theorem that states that the angle between a tangent and a chord is equal to the angle in the alternate segment. (5)



(b) In the diagram below, AB = AC and AP // BC.



Prove, with reasons that PA is a tangent to the circle ABC. (3)

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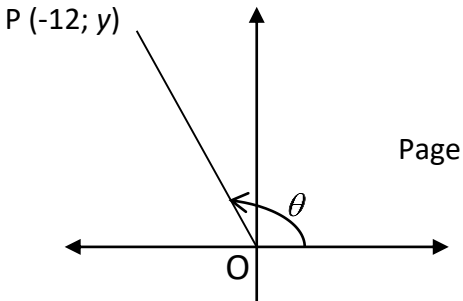
QUESTION 6



(a) In the sketch alongside,
P (-12 ; y) is a point
such that OP = 13 units.

Use the sketch to determine the following:

(1) The value of y (2)

(2) $(1-\sin^2\theta)\times\tan\theta$ (2)

(b) Simplify without the use of a calculator, showing all working :

$$\frac{\sin(180^\circ + x).\cos(90^\circ + x)}{\tan 135^\circ.\cos(-x)}$$ (4)

(c) Show, without using a calculator, that

$$\frac{tan\theta.\sqrt{1-sin^2\theta}}{sin\theta} = sin30° + cos60°$$ (4)

(d) Prove that $\frac{\cos\theta - \cos^2\theta}{\sin\theta.\tan\theta.\cos\theta} = \frac{\cos\theta}{1+\cos\theta}$ (5)

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QUESTION 7

Solve for θ in each of the following:

(a) $\cos(\theta + 30^0) = -0.5 \quad for\ \theta[0^0; 360^0]$ (4)

(b) Give the general solution: $2\sin(2\theta) = 0,5$ (4)

(c) Determine the general solution to: $\frac{1}{\cos\theta} = \frac{3}{\sin\theta}$ (5)

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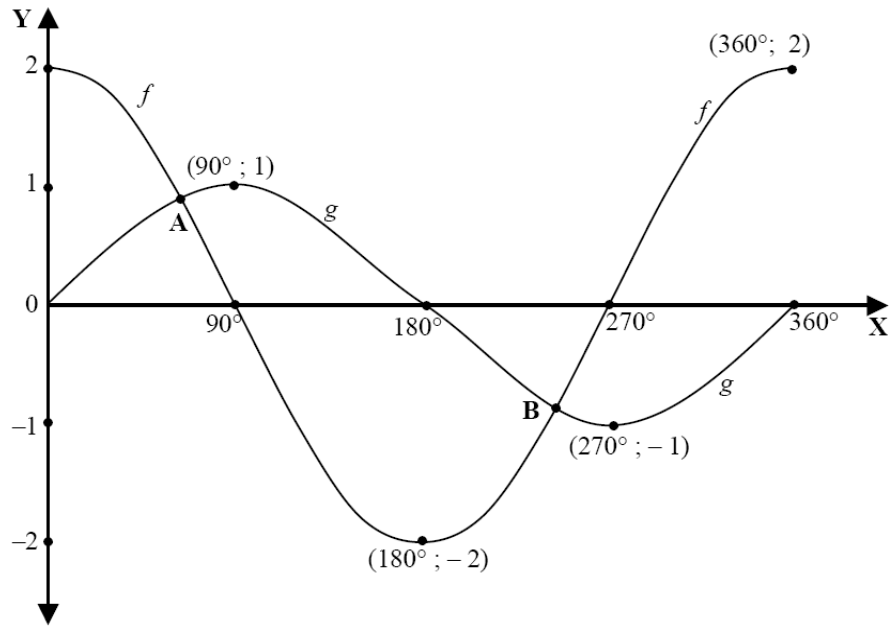
QUESTION 8

In the diagram below, the graphs of two trigonometric functions f and g are shown for $x \in [0°;360°]$, f and g intersect at $A(63,4°;p)$.



(a) Complete:

1) the equation of $f(x) =$ _____ (2)

2) the equation of $g(x) =$ _____ (1)

(b) Write down the range of *f*. _____ (2)

(c) Determine the value of p (rounded off to 1d.p) (1)

_____

_____

(d) Determine the x-co-ordinate of A, the point of intersection. (2)

_____

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(e) For which values of $x \in [0°;360°]$ is $g(x) \geq f(x)$ (2)

[10]

QUESTION 9

(a) The following are all trigonometric identities:

$$\frac{sin\theta - cos\theta}{1 - tan\theta} = -cos\theta \qquad \frac{sin^2\theta - cos^2\theta}{1 - tan^2\theta} = -cos^2\theta$$

$$\frac{sin^3\theta - cos^3\theta}{1 - tan^3\theta} = -cos^3\theta \qquad \frac{sin^4\theta - cos^4\theta}{1 - tan^4\theta} = -cos^4\theta$$

(1) Use the pattern illustrated above to simplify:

$$\frac{sin^{2012}\,\theta - cos^{2012}\theta}{1 - tan^{2012}\theta}$$ (2)

(2) Write down a general statement which can be conjectured from the listed identities. (2)

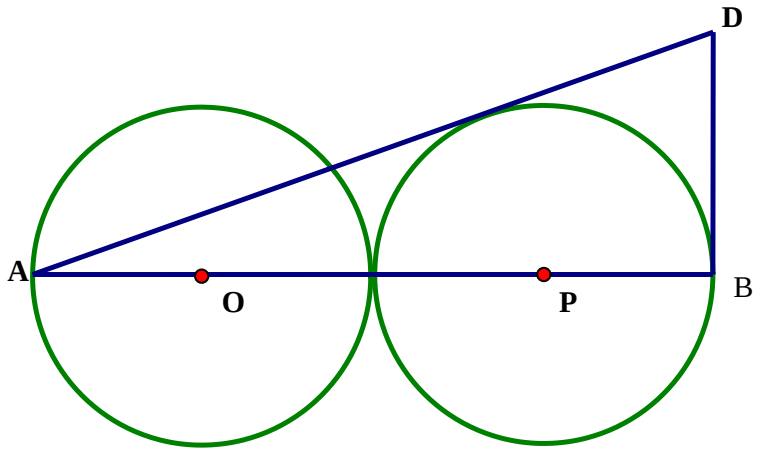
(3) Prove your statement in (2). (5)

(b) Prove that the straight line $2y - 3x = -25$ is a tangent to the circle $x^2 + y^2 - 4x + 6y = 0$ at B $(5;-5)$. (4)

(c) Show algebraically whether the point P(2;1) lies inside , on or outside the circle in (a) above. (4)

(d) Two circles of radius 2 and centres O and P touch each other as shown in the diagram below. If AD and BD are tangents, find the length of BD.

(Hint let BD = x) (6)



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