RONDEBOSCH BOYS' HIGH SCHOOL

Mathematics Paper 2

30 November 2015

Grade 11

MARKS: 150

TIME: 3 hours

Examiner: P Ghignone

Moderator: S Carletti

This question paper consists of 13 pages

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 in the SPECIAL ANSWER BOOK.

3. Clearly show ALL calculations, diagram, 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. Number the answers correctly according to the numbering system used in this question paper.

8. Write neatly and legibly.

QUESTION 1

The data below represent the masses (in kilograms) of 14 of the boys who walked the White Rhino Trail this year.

72 82 55 65 88 72 68 54 68 70 63 70 78 68

1.1 Determine the mean and standard deviation of the masses. (4)

1.2 How many learners fall within one standard deviation of the mean? (3)

1.3 A second group of White Rhino boys (with 18 boys in it) had a mean mass of 72 kg. If 4 boys of equal mass are added to the first group so that the mean masses of the two groups become the same, what must the weight of each boy be?

(3)

[10]

QUESTION 2

The data in the table below represent the Maths exam results obtained by a group of Grade 11 learners and the number of days each learner was absent during the year.

No. of Days Absent	1	12	3	20	30	23	7	2	9
Maths Exam result (%)	85	60	70	55	40	60	65	35	70

2.1 Draw the scatter plot of the data above by making use of the grid provided. (3)

2.2 Calculate the equation of the least squares regression line of the data. (3)

2.3 Calculate the correlation coefficient. (2)

2.4 Describe the correlation between a learner's absenteeism and his Maths exam result. (1)

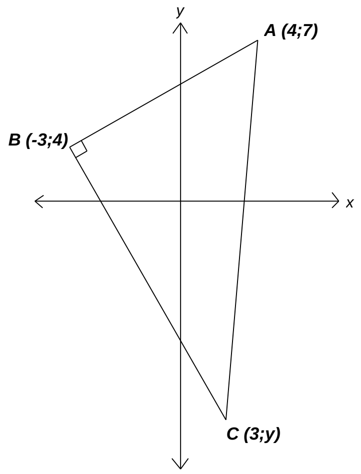
2.5 Label the outlier on your scatter plot with the letter L. (1)

2.6 The equation for the line of best fit is $y = A + Bx$. If the outlier were excluded from the data set, what would happen to the value of B? (2)

[12]

QUESTION 3

3.1 In the diagram below, ΔABC is a right-angled triangle with $AB \perp BC$. ΔABC has vertices $A\,(4;7), B\,(-3;4)$ and $C(3;y)$ in the Cartesian plane.



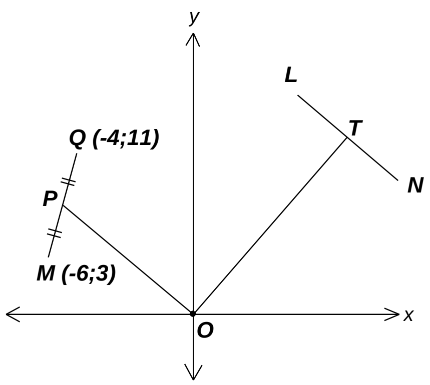
3.1.1 Determine the gradient of AB. (2)

3.1.2 Hence write down the gradient of BC. (1)

3.1.3 Determine the value of y. (3)

3.1.4 If $BC = 2\sqrt{58}$ units, calculate the area of ΔABC. (4)

3.2 In the diagram below, P is the midpoint of line MQ with $M(-6;3)$ and $Q(-4;11)$. Line OT has the equation $y = \frac{3}{2}x$ and line LN has the equation $x + y = 15$.



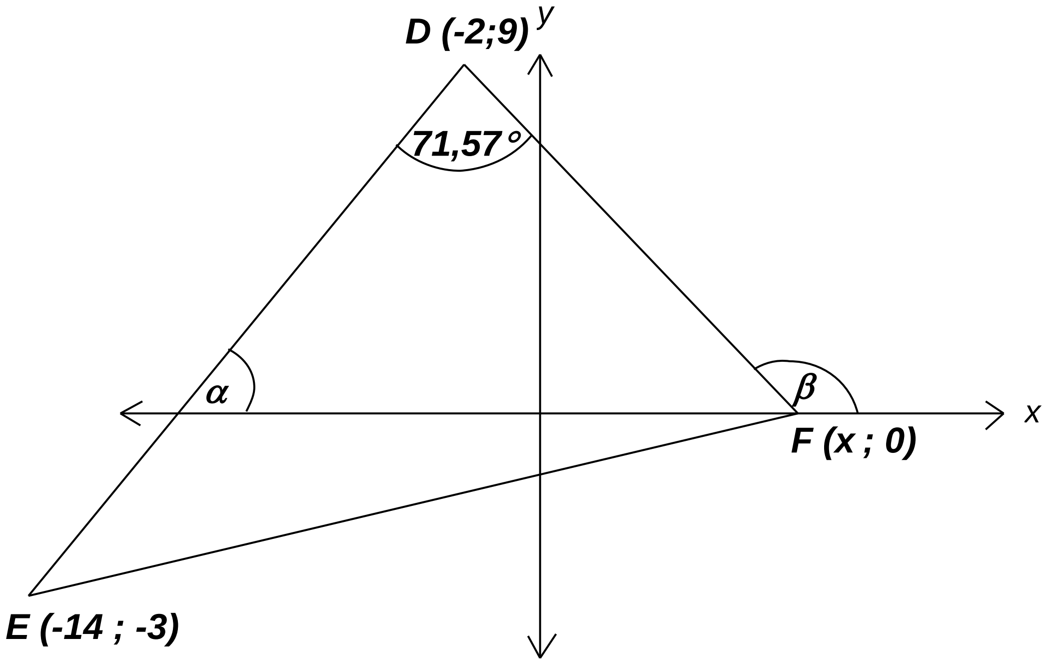
3.2.1 Calculate the coordinates of T. Show your working. (3)

3.2.2 If T is the point $(6;9)$, determine the length of PT, leaving your answer in surd form. (4)

[17]

QUESTION 4

In the sketch, ΔDEF lies in the Cartesian plane with $D(-2;9)$, $E(-14;-3)$ and F on the x-axis.



4.1 Determine the angle of inclination, α. (2)

4.2 Given that $\widehat{D} = 71{,}57°$, determine the gradient of DF. (4)

4.3 Given that the gradient of DF is -2, determine the x-coordinate of f. (2)

4.4 Give the co-ordinates of P if $DEPF$ is a parallelogram. (2)

4.5 Will point P lie inside or outside a circle, centred on the origin $(0;0)$ with a radius of 15 units? Show all your working and give a reason for your answer. (3)

[13]

QUESITON 5

5.1 Given $\sqrt{13}\sin A + 3 = 0$ where $A \in [0°; 270°]$.

5.1.1 Represent the information in a sketch in the correct quadrant. (2)

5.1.2 Determine, without the use of a calculator, the value of:

a) $\tan^2 A + 1$ (3)

b) $(\sin A + \cos A)^2$ (3)

5.2 Simplify, without the use of a calculator:

5.2.1 $\frac{\cos(90°+x)}{\tan(180°-x).\cos(360°-x)}$ (5)

5.2.2 $\frac{3-3\cos^2 50°}{\sin^2 230°}$ (4)

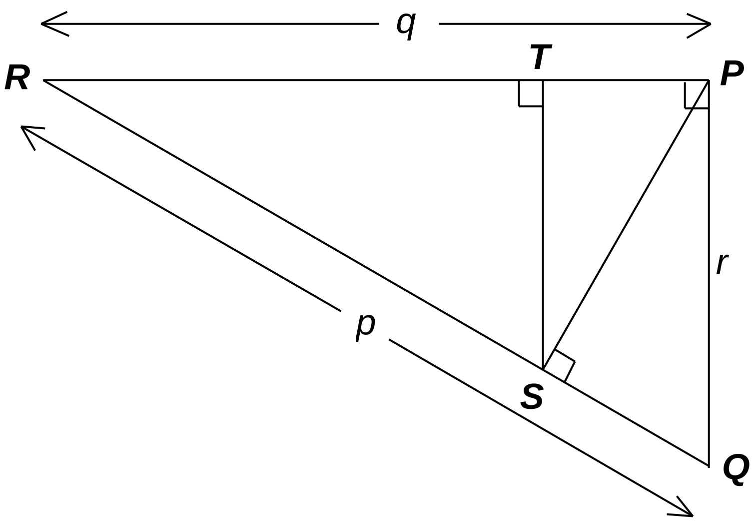
5.3 Prove that $\frac{\cos x}{1+\sin x} + \tan x = \frac{1}{\cos x}$ (5)

5.4 Determine, without the use of a calculator, the general solution of:

$$2\sin x.\tan x - \tan x = 0$$

(6)

5.5 Given ΔQRP with $\hat{P} = 90°, QR = p, RP = q$ and $PQ = r$. $PS \perp RQ$ and $ST \perp RP$. Determine the length of ST in terms of p, q and r **only**.

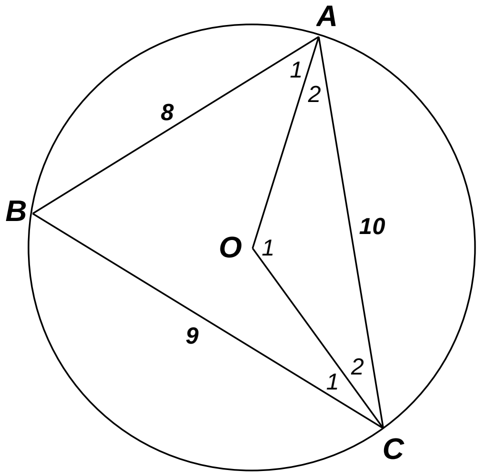


(5)

[33]

QUESTION 6

6.1 O is the centre of the circle. $AB = 8$ units, $BC = 9$ units and $AC = 10$ units.



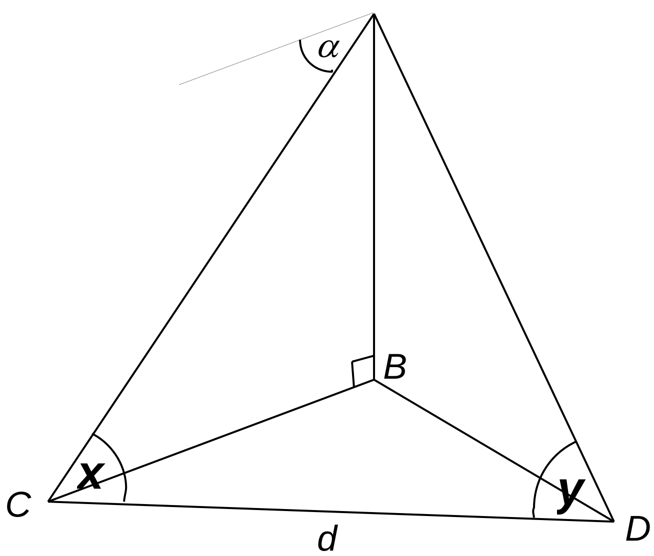
6.1.1 Determine the size of $A\hat{B}C$. (3)

6.1.2 Given that $A\hat{B}C = 71{,}79°$ determine the area of ΔABC. (3)

6.1.3 Determine the length of the diameter of the circle. (5)

6.2 In the diagram, the points B, C and D are in the same horizontal plane. From A the angle of depression of C is α, $CD = d$ metres, $A\hat{C}D = x$ and $A\hat{D}C = y$.

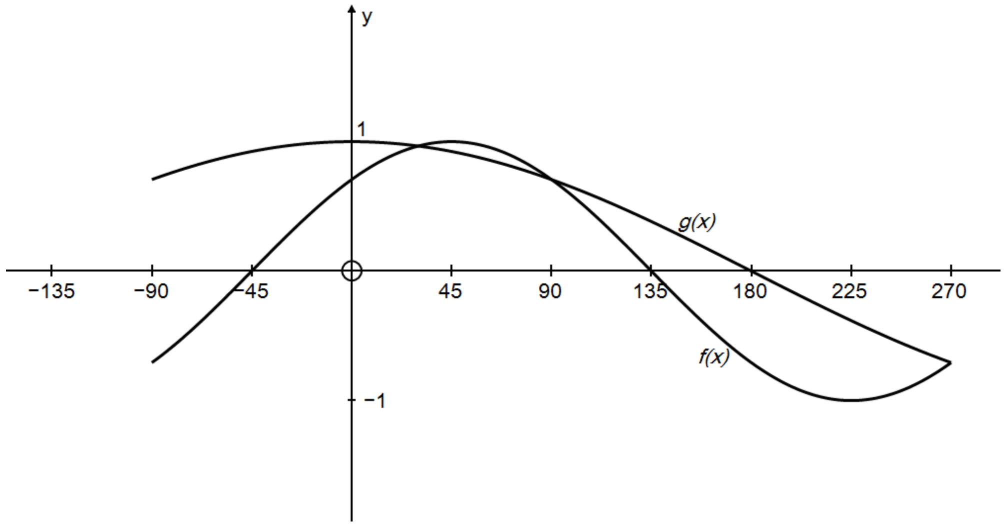
Prove that: $AB = \frac{d \sin y . \sin \alpha}{\sin(x+y)}$



(5)
[16]

QUESTION 7

7.1 The diagram shows the graphs of $f(x) = \sin(x + p)$ and $g(x) = \cos ax$; $x \in [-90°; 270°]$.



7.1.1 Determine the values of p and a. (2)

7.1.2 Give the period of $g(x)$. (1)

7.1.3 Determine the range of k, if $k(x) = f(x) - 3$ (2)

7.2 Given $h(x) = 2\tan x + 1$; $x \in [0°; 180°]$.

7.2.1 Sketch the graph of h on the grid provided. (3)

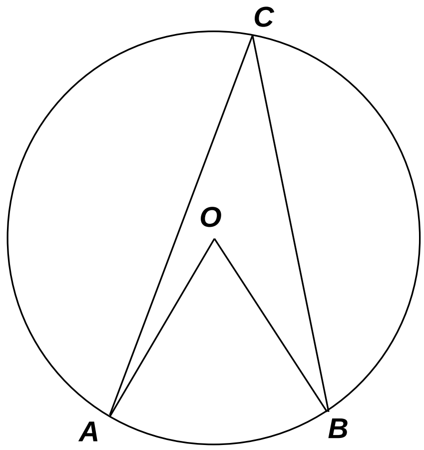
7.2.2 Write down the equation of the graph obtained if h is reflected in the x-axis and then translated 2 units down. Write your answer in the form $y = \cdots$ (2)

[10]

QUESTION 8

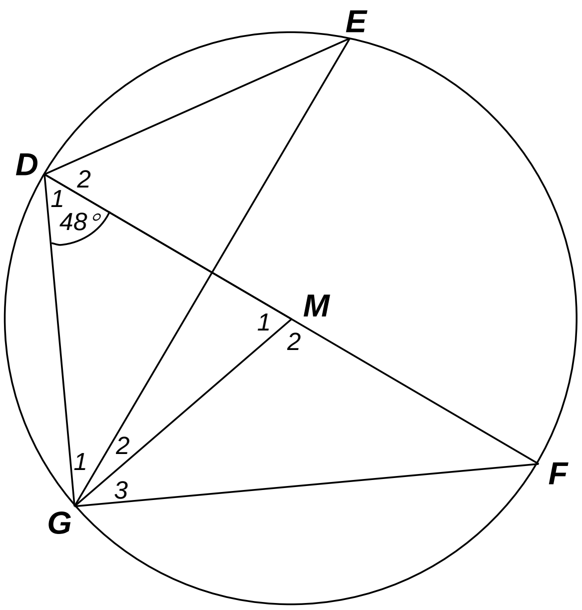
8.1 You are given a circle with $\angle AOB$ at the centre, O, and $A\hat{C}B$ on the circumference. Prove the theorem that states:

$A\hat{O}B = 2\hat{C}$



(5)

8.2 In the figure, DMF is a diameter of the circle with centre, M and $\hat{D}_1 = 48°$. Determine, with reasons, the sizes of the following angles.



8.2.1 $\hat{M}_2$ (2)

8.2.2 $D\hat{G}F$ (2)

8.2.3 $\hat{G}_3$ (3)

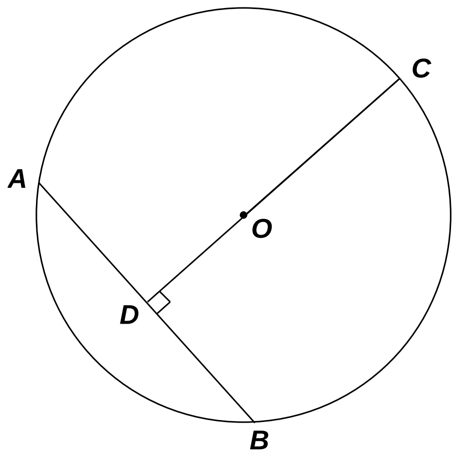
8.2.4 $\hat{E}$ (2)

[14]

QUESTION 9

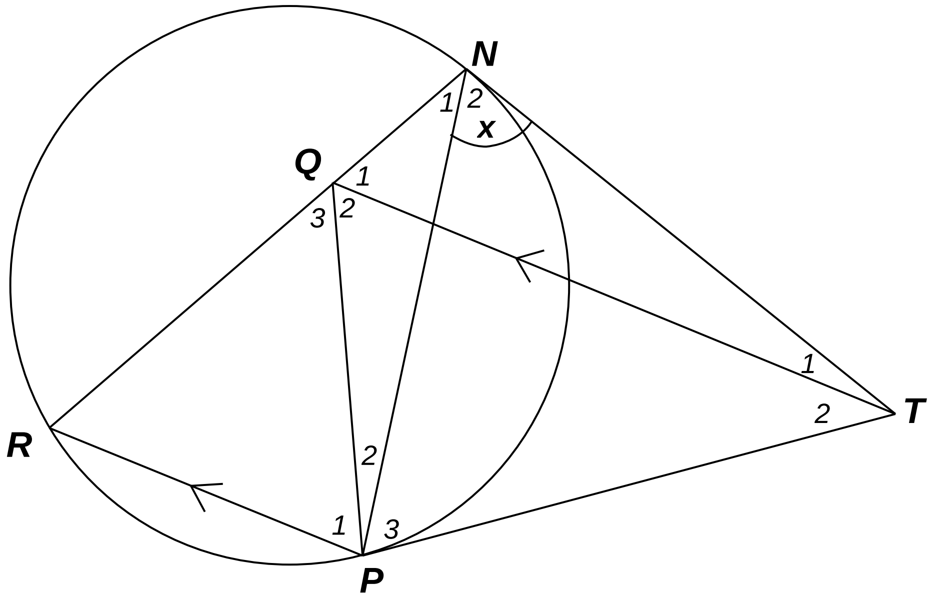
9.1 In the figure, O is the centre of the circle and COD is perpendicular to the chord AB. You are given that $OC = r$ and $AB = \frac{3r}{2}$.

Show that $CD = \frac{(4+\sqrt{7})\,r}{4}$



(5)

9.2 In the figure TN and TP are tangents at N and P respectively to the circle through N, P and R. $QT \parallel RP$ with Q on NR. $\hat{N}_2 = x$.



9.2.1 Find, with reasons, three other angles each equal to x. (6)

9.2.2 Prove that $TNQP$ is a cyclic quadrilateral. (2)

9.2.3 Prove that TQ bisects $N\hat{Q}P$. (2)

9.2.4 Prove that ΔPRQ is isosceles. (3)

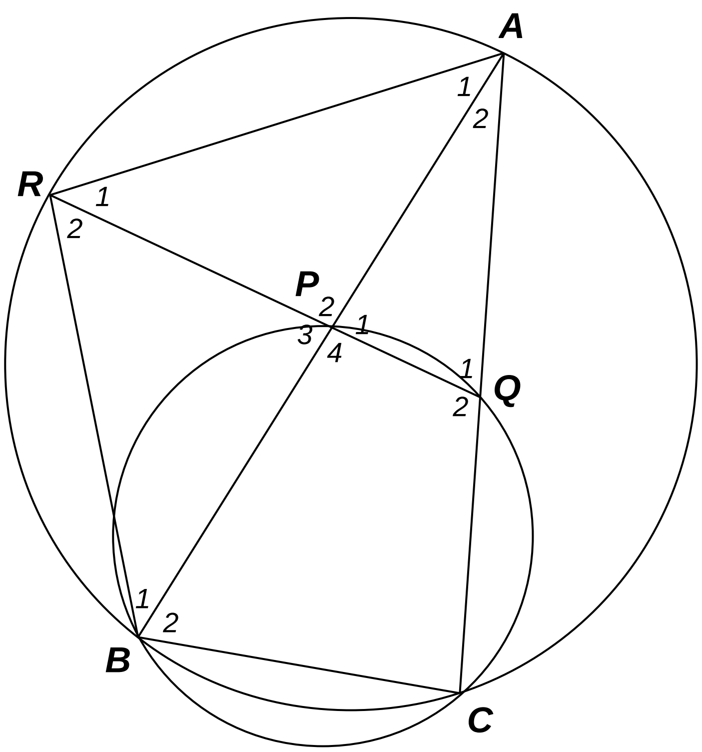
[18]

QUESTION 10

10.1 Complete the theorem: The exterior angle of a cyclic quadrilateral is … (2)

10.2 P is a point on side AB of ΔABC. The circle through P, B and C cuts AC at Q. QP produced cuts the larger circle at R.

Prove that $\hat{P}_1 = \hat{A}_1 + \hat{B}_1$ (5)



[7]

[[TOTAL 150]]