Mathematics Paper 2
Grade 11
Mid – Year Examination
2017

DURATION:	**3 hours**	**EXAMINER:**	**R. Obermeyer**
MARKS:	**146 marks**	**MODERATOR:**	**A. Janisch**
Date:	**30 June 2017**	**External Moderator:**	**I. Atteridge**

INSTRUCTIONS:

- **See overleaf for Instructions.**
- **This paper consists of 22 pages (including cover) and an information sheet.**

NAME: _____

ASSESSMENT					
Question	**Level Tested**	**Topic**	**Time Allocation**	**Possible mark**	**Mark obtained**
SECTION A					
1	1 – 4	Statistics	12 mins	**11**	
2	1 – 4	Analytical Geometry	19 mins	**16**	
3	1 – 4	Euclidean Geometry	19 mins	**16**	
4	1 – 4	Trigonometry	26 mins	**22**	
5	1 – 4	Trig Graphs	14 mins	**10**	
6	1 – 4	Trig Formulae	14 mins	**12**	
SECTION B					
7	1 – 4	Euclidean Geometry	19 mins	**16**	
8	1 – 4	Analytical Geometry	16 mins	**13**	
9	1 – 4	Trigonometry	11 mins	**7**	
10	1 – 4	Measurement	12 mins	**10**	
11	1 – 4	Trig Formulae	18 mins	**13**	
			TOTAL:	**146**	
			PERCENTAGE:		

Teacher's Signature: _____

Controller's Signature: _____

Moderator's Signature: _____

Instructions

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. This question paper consists of 22 pages (including the cover page) and an information sheet. Please check that your question paper is complete.
2. Read the questions carefully.
3. **Answer ALL the questions on the question paper and hand this in at the end of the examination.**
4. Diagrams are not necessarily drawn to scale.
5. You may use an approved non-programmable and non-graphical calculator, unless otherwise stated.
6. All necessary working details must be clearly shown.
7. Ensure that your calculator is in **DEGREE** mode.
8. It is in your own interest to write legibly and to present your work neatly.

SECTION A

Question 1

The heights of 20 children were measured (in centimetres) and the results were recorded. The data collected is given in the table below.

127	129	131	134	134
137	139	141	142	144
128	130	133	134	136
138	140	142	143	145

a. Write down the median height measured. (1)

b. Determine:

1. The mean height (2)

2. The range (1)

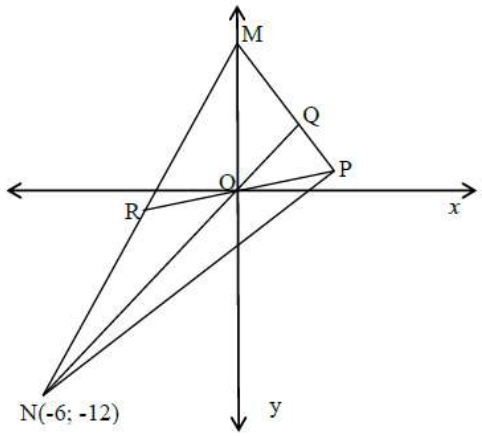
3. The interquartile range (3)

c. Draw a box and whisker diagram to represent the data. (4)

[11]

Question 2

In the diagram, M, N and P are the vertices of $\Delta\, MNP$, with $N(-6;-12)$.
M is a point on the y −axis. The equation of the line MN is $3x - y + 6 = 0$.
$MR = NR$ and $NQ \perp MP$. PR and NQ intersect at the origin O.



a. Calculate the gradient of NQ. (1)

b. Calculate the gradient of MP. (1)

c. Calculate the angle of inclination of MP. (3)

d. Determine the equation of the line MP. (4)

e. Determine the coordinates of P. (4)

f. Determine the co-ordinates of R. (3)

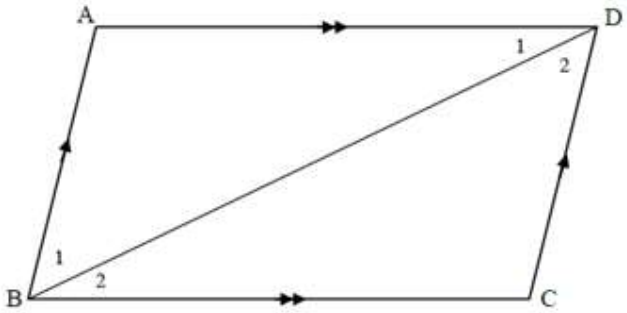
[16]

Question 3

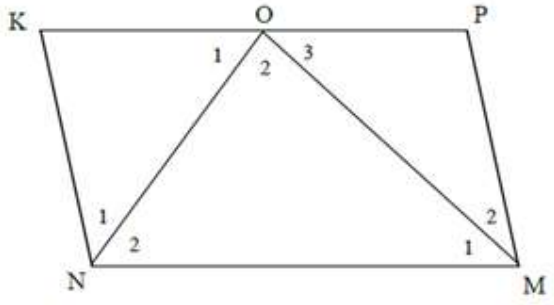
Give reasons for your statements.

a. Complete the following statement:
If the opposite angles of a quadrilateral are equal, then the quadrilateral …… (1)

b. Use the sketch below to prove that opposite sides of a parallelogram are equal. (6)



c. In the sketch below, $KPMN$ is a parallelogram. ON bisects $K\widehat{N}M$ and OM bisects $N\widehat{M}P$.



1. Show that $N\hat{O}M = 90°$. (3)

2. Prove that O is the midpoint of KP. (6)

[16]

Question 4

a. Simplify without the use of a calculator:

1. $\frac{\cos(90°-x).\sin(-x)}{\cos^2(180°+x)}$ (5)

2. $\sin 143°.\cos 127° - \sin 53°.\cos 37°$ (5)

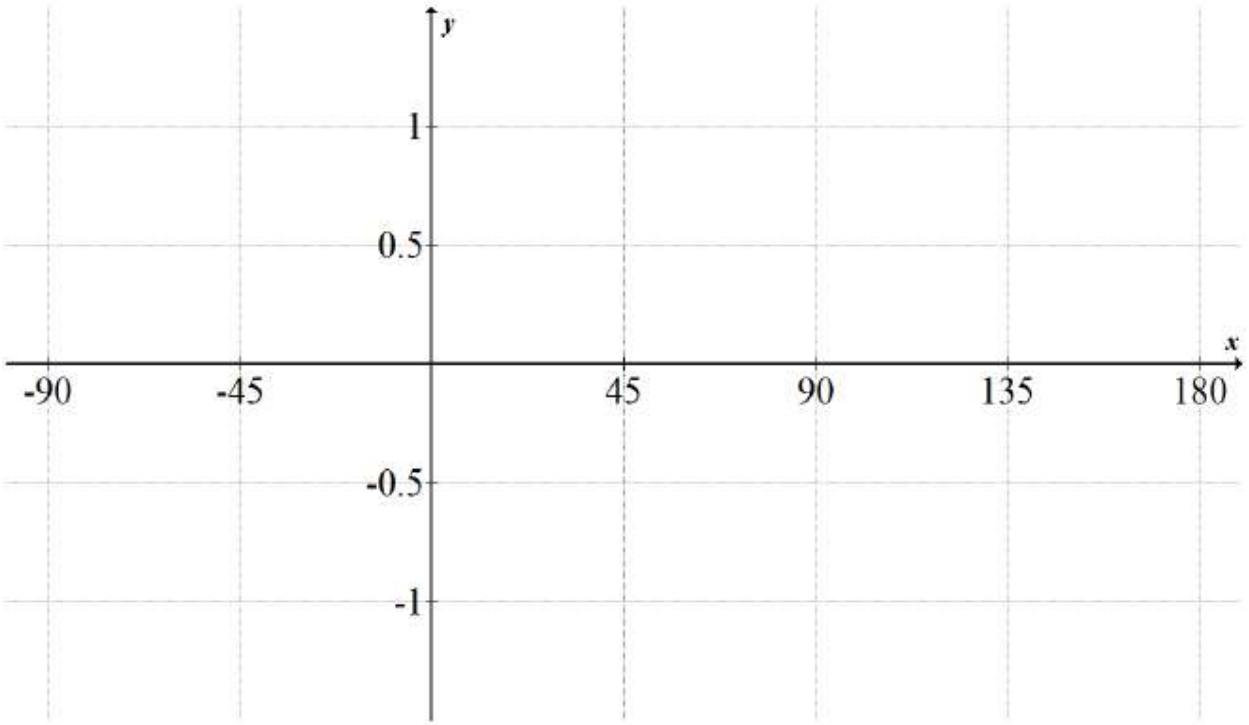
b. Prove the identity: $\left(\tan y + \frac{1}{\tan y}\right)(1 - \cos^2 y) = \tan y$. (6)

c. Determine the general solution of: $\cos\theta - \frac{1}{\cos\theta} = \frac{5}{6}$. (6)

[22]

Question 5

a. On the same system of axes sketch $f(x) = -\cos(45° - x)$ and $g(x) = \tan(-x)$ in the interval of $-90° \leq x \leq 180°$. (6)



b. For which values of x is $f(x) - g(x) \leq 0$ for $x \in [-90°; 90°]$ (2)

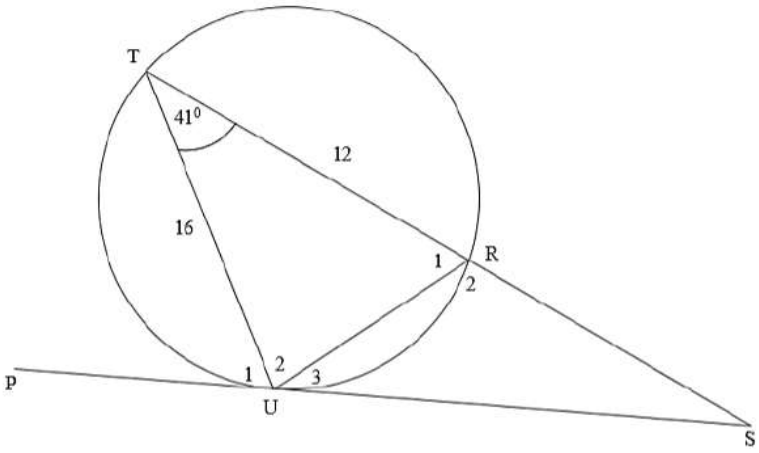
c. Write down the equation of $h(x)$ if $h(x) = -f(x - 45°)$. (2)

[10]

Question 6

a. Complete: …….= $a^2 + b^2 - 2ab\cos C$ (1)

b. TRS is a secant of the circle, and SU is a tangent at U. $TU = 16$ cm, $TR = 12$ cm and $\hat{T} = 41°$. $U\hat{T}R = \hat{U}_3$



Calculate:

1. The length of UR, correct to two decimal places. (3)

2. The size of $\hat{U}_2$. (3)

3. The length of secant TRS. (5)

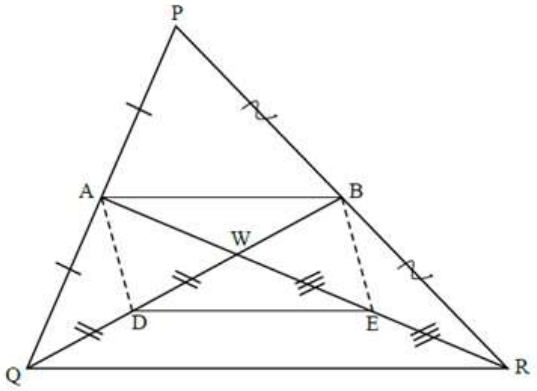
[12]

SECTION B

Question 7

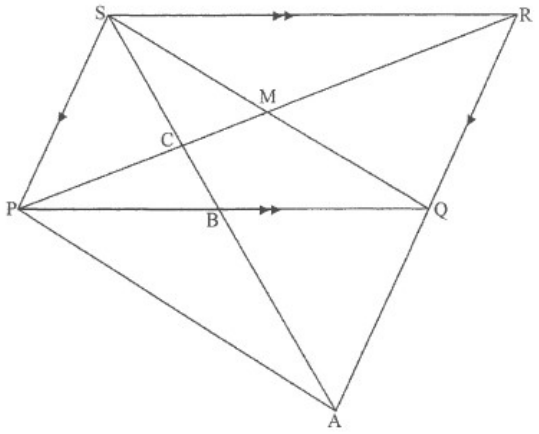
a. Complete the following statement:
The line through the midpoint of two sides in a triangle is parallel to and …….. the third side. (1)

b. In ΔPQR, A and B are the midpoints of sides PQ and PR respectively.
AR and BQ intersect at W.
D and E are the points on WQ and WR respectively such that $WD = DQ$ and $WE = ER$.



Prove that $ADEB$ is a parallelogram. (5)

c. In the diagram below, $PQRS$ is a parallelogram having diagonals PR and QS intersecting at M.
B is a point on PQ such that SBA and RQA are straight lines and $SB = BA$.
SA cuts PR in C and PA is drawn.



1. Prove that $SP = QA$. (4)

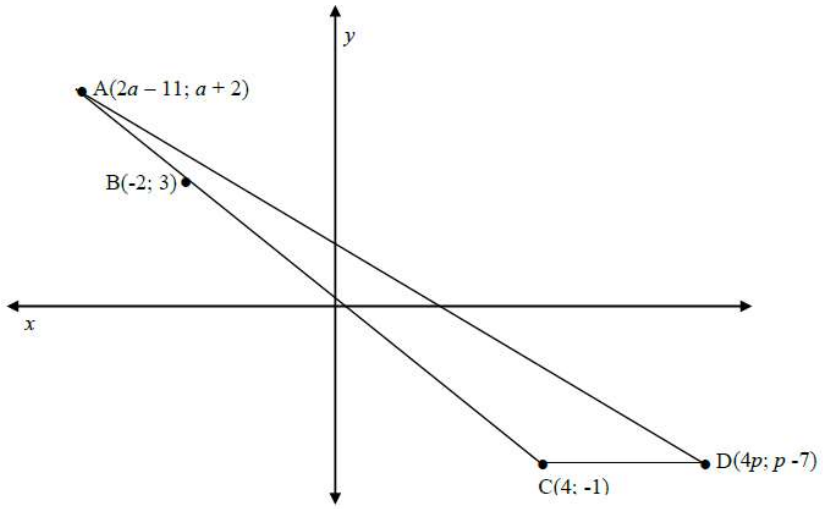
2. Prove that $SPAQ$ is a parallelogram. (2)

3. Prove that $AR = 4MB$. (4)

[16]

Question 8

The points $A(2a-11;a+2)$, $C(4;-1)$ and $D(4p;p-7)$ are the vertices of ΔACD with $B(-2;3)$ on AC.



a. If points A, B and C are collinear, find the value of a. (4)

b. Determine the equation of the line AC. (3)

c. Hence, or otherwise, determine the co-ordinates of M, the midpoint of BC. (3)

d. Determine the value of p if CD is parallel to the x −axis. (3)

[13]

Question 9

Given: $p.\sin\beta - 4 = 0$ and $p.\cos\beta + 3 = 0$ where $p > 0$

a. Explain why $\beta \in [90°; 180°]$. (3)

b. Show that $\tan\beta = -\frac{4}{3}$. (2)

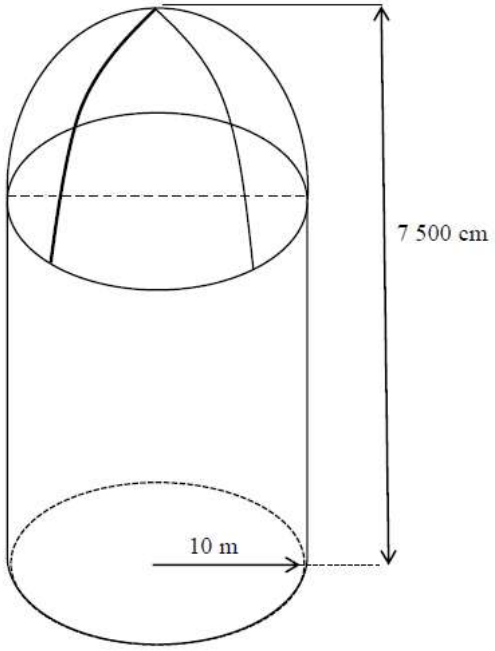
c. Determine the numerical value of p. (2)

[7]

Question 10

Surface Area = $2\pi rh$	**Surface Area =** $4\pi r^2$
Volume = $\frac{1}{3}lbh$	**Volume =** lbh

The picture below shows a storage tank in which a farmer stores his grain. The tank is made up of a right cylinder with a hemisphere on top. The perpendicular height of the tank to the top is 7 500 cm and the radius of the tank is 10 m.



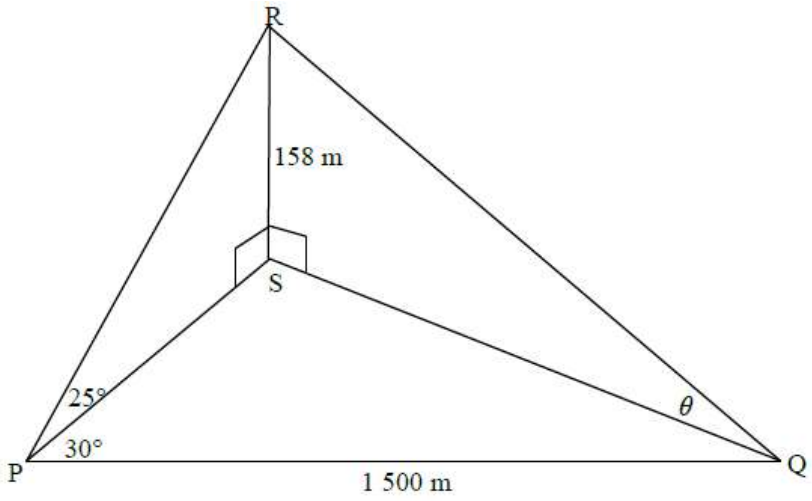
a. Calculate the total surface area of the tank (including the base). (5)

b. Calculate the volume of the tank. (5)

[10]

Question 11

In the diagram below, PQ is a straight line 1 500 m long. RS is a vertical tower 158 m high with P, Q and S points in the same horizontal plane.
The angles of elevation of R from P and Q are $25°$ and θ.
$S\hat{P}Q = 30°$.



a. Determine the value of θ. (9)

b. Calculate the area of ΔSPQ. (4)

[13]

Additional working pages