

KEARSNEY COLLEGE

Founded in 1921

TRIALS EXAMINATION

TUESDAY 9th SEPTEMBER 2014

TIME: 3 HOURS

MARKS: 150

**MATHEMATICS
PAPER II**

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY:

1. This question paper consists of **22 pages** with **5 sections**. Please check that your paper is complete. An information sheet has been printed on the inside of the cover sheet.
2. Write down your Examination number and Maths teacher's name on each section in the space provided.
3. Read the questions carefully.
4. Answer all the questions.
5. You may use an approved non-programmable and non-graphical calculator, unless otherwise stated. Ensure that your calculator is in **DEGREE** mode.
6. Round off your answers to **one decimal digit** where necessary.
7. All the necessary working details must be clearly shown.
8. It is in your own interest to write legibly and to present your work neatly.

ANSWER ONLY – NO MARKS

SECTION A (29 Marks)

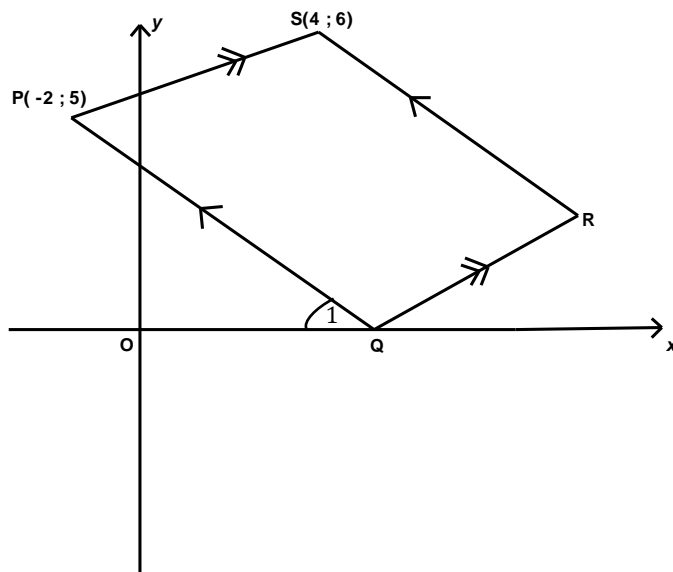
Examination Number: _____ Maths Teacher: _____
 (Govender, Owen, Botha, Willows, Ungerer)

QUESTION 1

In the diagram, PQRS is a parallelogram.

P is the point $(-2 ; 5)$, S is the point $(4 ; 6)$ and Q is on the x -axis.

The equation of the line RS is given by $2y = -x + 6$



- (a) Determine the size of \hat{Q}_1 correct to one decimal digit. (3)

- (b) Determine the equation of PQ in the form $y = mx + c$ (3)

- (c) Determine the co-ordinates of Q. (2)

[8]

PLEASE TURN OVER

QUESTION 2

- (a) Determine the centre and radius of the circle with equation

$$(x + 2)^2 - 12 = 4y - y^2 \quad (4)$$

- (b) Determine the equation of the tangent to the circle at the point (2 ; 2) (2)

[6]

QUESTION 3

A large company employs 9 people.

The commission that each person earned (in rands) in August is reflected below.

3 900	5 700	7 300	10 600	13 000	13 600	15 100	15 800	17 100
-------	-------	-------	--------	--------	--------	--------	--------	--------

(a) Calculate the mean of the above data. (2)

(b) Calculate the standard deviation for the data. (2)

(c) The company rates the staff according to the amount of commission earned. A person whose commission is more than one standard deviation above the mean receives rating of "good." How many people will receive a rating of "good" for August? (2)

[6]

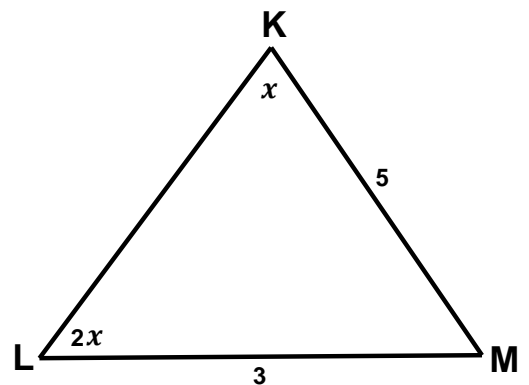
PLEASE TURN OVER

QUESTION 4

- (a) If $\sin^2 25^\circ = m$, calculate, **without using a calculator**, the value of $\cos 20^\circ \cdot \cos 70^\circ + \sin 20^\circ \cdot \sin 70^\circ$ in terms of m

(4)

- (b) In $\triangle KLM$, $KM = 5$ units ; $LM = 3$ units ; $\hat{K} = x$ and $\hat{L} = 2x$ and $0^\circ < x < 45^\circ$. Calculate the value of x , giving your answer correct to one decimal digit.



(5)

[9]

TOTAL : 29 MARKS

SECTION B (31 Marks)

Examination Number: _____ Maths Teacher: _____
 (Govender, Owen, Botha, Willows, Ungerer)

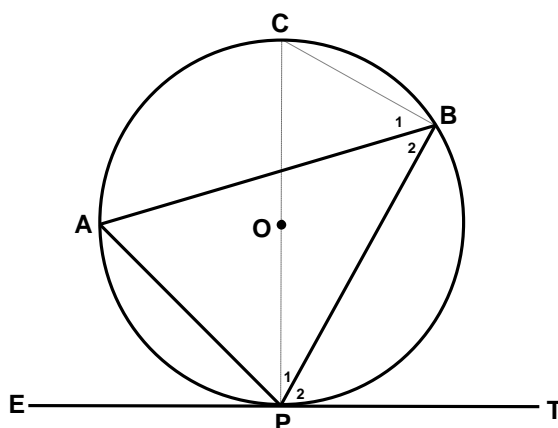
QUESTION 5

Using the given diagram, prove, by filling in the spaces, the theorem that states:

“ The angle between a tangent to a circle and a chord drawn from the point of contact is equal to the angle in the alternate segment.”

Given: Circle with centre O ; EPT is a tangent at P
 PB is a chord and point A is on the major segment.

Required to prove: $\hat{P}_2 = \hat{A}$



Construction: Draw diameter PC and draw CB.

Proof: $\hat{P}_1 + \hat{P}_2 =$ _____

_____ angle in a semi-circle

\therefore _____ angles of a Δ

$$\therefore \hat{P}_2 = \hat{C}$$

But _____

$$\therefore \hat{P}_2 = \hat{A}$$

QUESTION 6

(a) Complete the following statement:

The exterior angle of a triangle _____

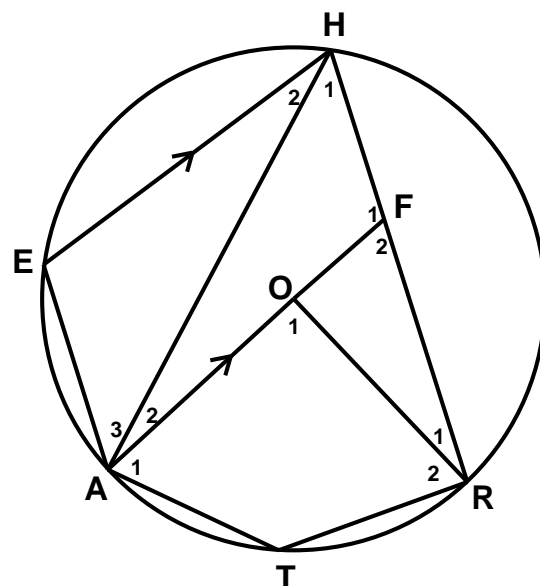
_____ (1)

(b) In the diagram O is the centre of the circle HEATR.

AOF is parallel to EH

HATR is a cyclic quadrilateral.

$\hat{F}_2 = 78^\circ$ and $\hat{R}_1 = 22^\circ$



Calculate, with reasons, the size of:

(1) \hat{O}_1 (2)

(2) \hat{H}_1 (2)

(3) \hat{T} (2)

(4) \hat{H}_2 (3)

[10]

PLEASE TURN OVER

QUESTION 7

Determine, correct to one decimal place, the general solution of : $\sin \theta + 2 \cos \theta = 0$

[3]**QUESTION 8**

If $\sin 80^\circ = m$, express the following in terms of m

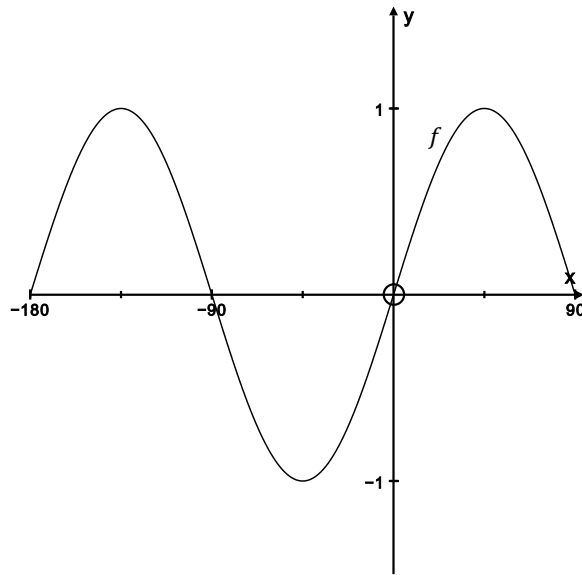
(a) $\cos(-10^\circ)$ (2)

(b) $\cos 160^\circ$ (2)

[4]

QUESTION 9

The graph of $f(x) = \sin 2x$ for $x \in [-180^\circ; 90^\circ]$ is shown below.



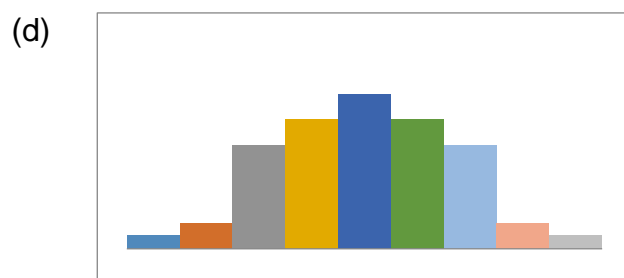
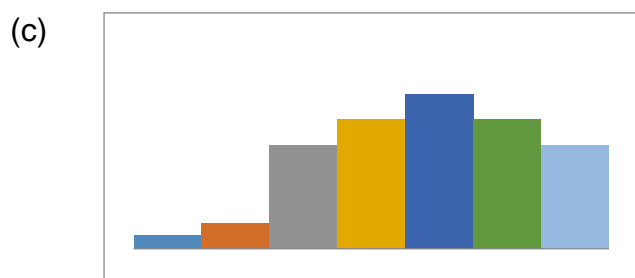
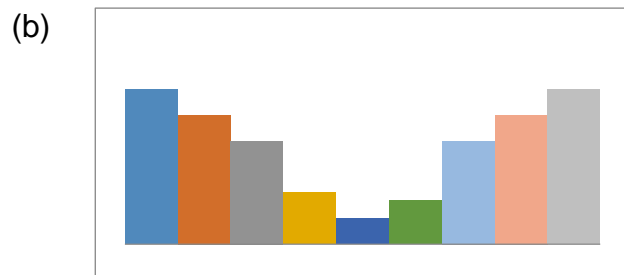
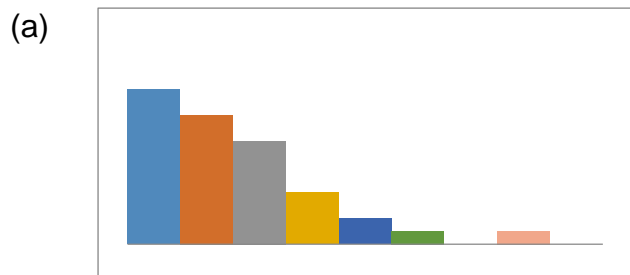
- (a) Write down the range of f . (1)
- (b) Determine the period of $f\left(\frac{3}{2}x\right)$. (1)
- (c) Describe the transformation that graph f has to undergo in order to produce the function $y = \sin 2(x + 30^\circ)$. (2)

[4]

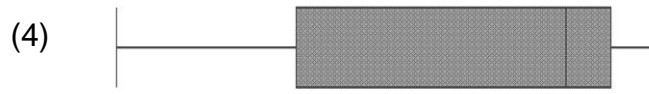
PLEASE TURN OVER

QUESTION 10

Four histograms are given below:



Match the correct box-and-whisker plot to each of the histograms above.



(a) _____

(b) _____

(c) _____

(d) _____

[4]

SECTION C (26 Marks)

Examination Number: _____ Maths Teacher: _____
(Govender, Owen, Botha, Willows, Ungerer)

QUESTION 11

Consider the expression: $\cos \theta + 2 \cos(\theta + 240^\circ)$

- (a) Simplify the expression and leave the answer in terms of $\sin \theta$ (5)

[Show all your working details]

- (b) Determine the minimum value of the expression (1)

[6]

PLEASE TURN OVER

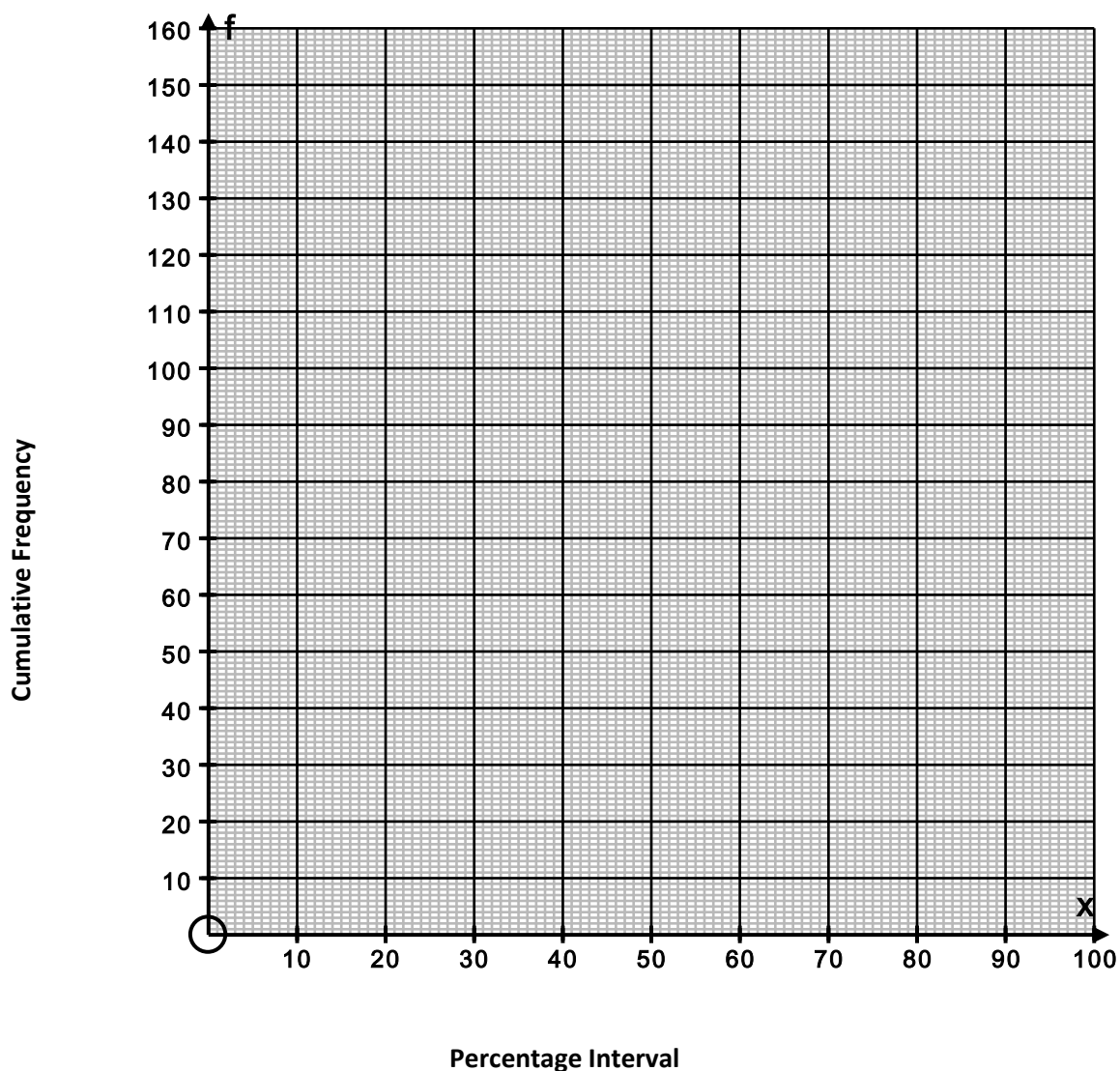
QUESTION 12

The average percentage of 150 learners for all their subjects is summarised in the cumulative frequency table below.

PERCENTAGE INTERVAL	CUMULATIVE FREQUENCY
$0 < x \leq 10$	5
$10 < x \leq 20$	21
$20 < x \leq 30$	50
$30 < x \leq 40$	70
$40 < x \leq 50$	88
$50 < x \leq 60$	110
$60 < x \leq 70$	135
$70 < x \leq 80$	142
$80 < x \leq 90$	147
$90 < x \leq 100$	150

(a) Draw the ogive (cumulative frequency graph) representing the above data

(4)



(b) Use the ogive to approximate the following: (Show on the graph where you will find the values used)

(1) the number of learners who scored less than 85%. (2)

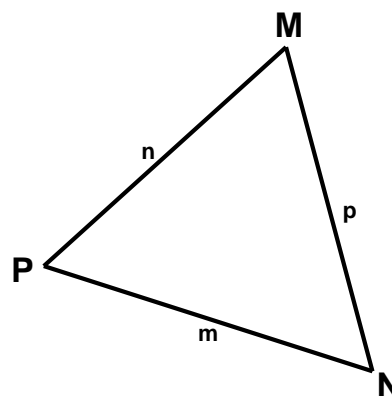
(2) the interquartile range (Show ALL calculations) (3)

[9]

QUESTION 13

In the figure, MNP is any triangle.
Use the figure to show the following:

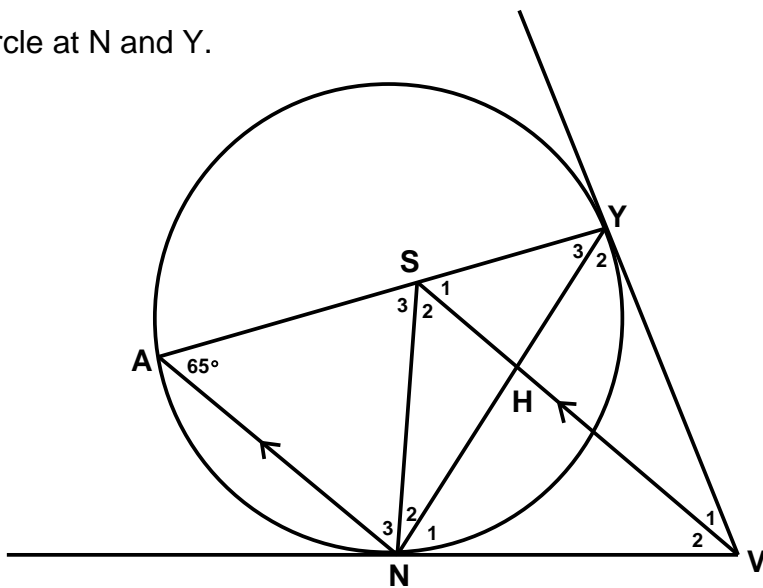
$$m = \frac{p \cdot \sin M}{\sin(M + N)}$$



[3]

QUESTION 14

In the diagram, VN and VY are tangents to the circle at N and Y.
 NA // VS and $\hat{A} = 65^\circ$



(a) Write down, with reasons, three other angles also equal to 65°

(6)

(b) Prove that VYSN is a cyclic quadrilateral

(2)

[8]

TOTAL : 26 MARKS

SECTION D (34 Marks)

Examination Number: _____ Maths Teacher: _____
 (Govender, Owen, Botha, Willows, Ungerer)

QUESTION 15

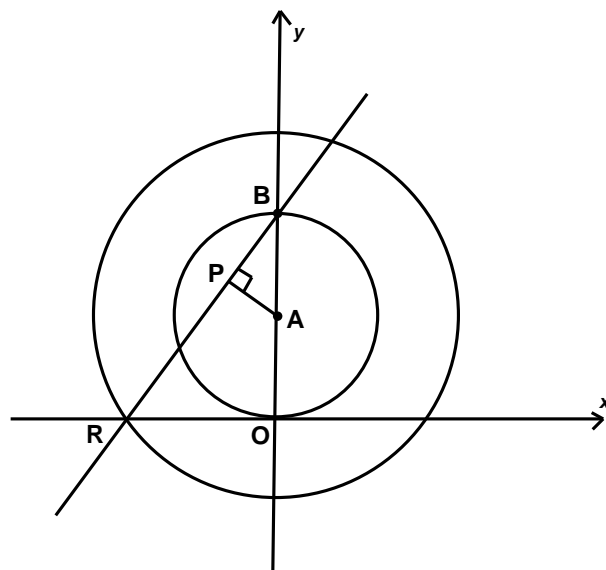
In the diagram, two concentric circles are drawn. Both circles have A as their centre and A lies on the y – axis.

The smaller circle cuts the y – axis at the origin O and the point B.

The line through B having equation $y = \frac{3}{2}x + 6$ cuts the x – axis at R.

The larger circle passes through R.

- (a) Determine the equations of both circles. (6)



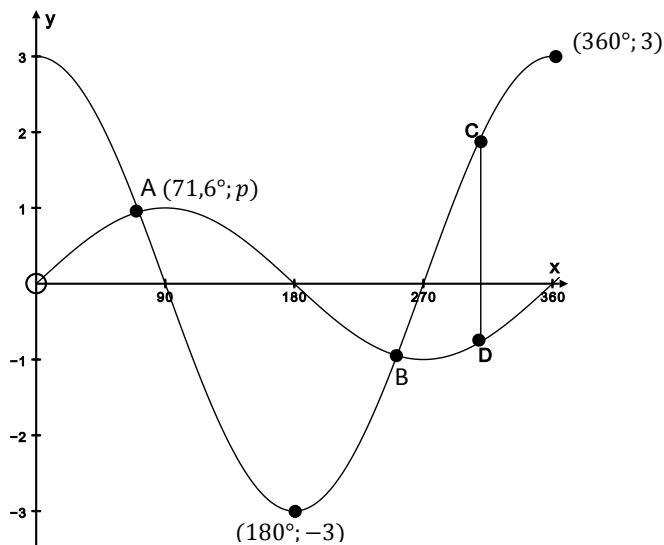
- (b) Determine the co-ordinates of P, the point on the line passing through B and R, which is closest to A. (5)

[11]

PLEASE TURN OVER

QUESTION 16

In the diagram, the graphs of $f(x) = 3\cos x$ and $g(x) = \sin x$ for $x \in [0^\circ; 360^\circ]$ intersect at $A(71,6^\circ; p)$ and B .



Use the graphs to answer the following questions

- (a) Determine the value of p , rounded off to two decimal places. (1)
- (b) Give the co-ordinates of B . (2)
- (c) For what values of x is $f(x) \leq g(x)$. (2)
- (d) Calculate the length of CD , correct to one decimal digit, given that CD is parallel to the y -axis and the y -co-ordinate of C is $2p$. (3)

[8]

PLEASE TURN OVER

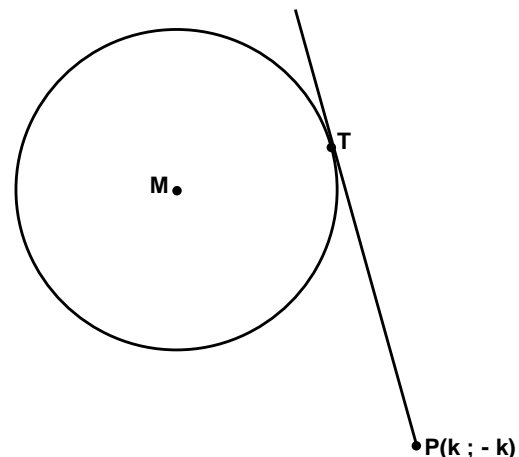
QUESTION 17

M is the centre of a circle with equation $(x - 1)^2 + (y - 2)^2 = 2$.

P is any point outside the circle with co-ordinates $(k ; -k)$.

A tangent PT is drawn from P touching the circle at T.

- (a) Show that $PT^2 = 2k^2 + 2k + 3$ (5)



- (b) Determine the length, rounded off to one decimal digit, of the shortest possible tangent that can be drawn from P to the circle.

(5)

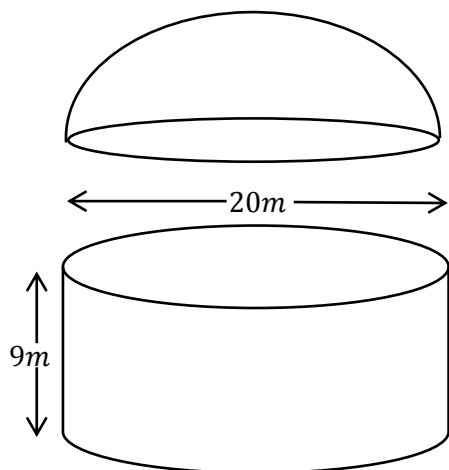
[10]

QUESTION 18

The building known as **The Dome of The Rock** in Jerusalem has a cylindrical portion above the main building and a gold hemispherical dome on top of the cylindrical section.

The diameter of the inside of the dome is 20 m and the inside height of the cylindrical section is 9 m .

Formulae you may need: πr^2 ; $2\pi r h$; $4\pi r^2$



Calculate the internal surface area of the cylindrical section and hemisphere. Assume they have the same radii.

[Leave your answer in terms of π]

[5]

TOTAL : 34 MARKS

SECTION E (30 Marks)

Examination Number: _____ Maths Teacher: _____
 (Govender, Owen, Botha, Willows, Ungerer)

QUESTION 19

In the diagram, PQRS is a parallelogram. Side RS is extended to W.

WQ intersects PS at X.

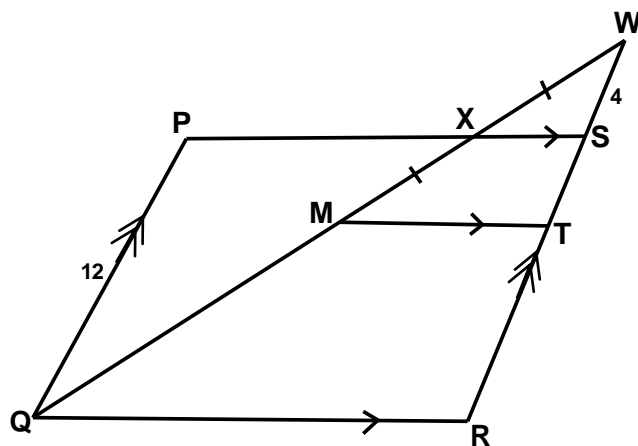
M is a point on XQ such that $MX = XW$.

$MT \parallel XS$.

$PQ = 12$ cm. $WS = 4$ cm.

- (a) Calculate the length of TR, giving reasons.

(4)



- (b) Determine the value of $\frac{XM}{XQ}$, giving reasons

(3)

[7]

PLEASE TURN OVER

QUESTION 20

(a) Ring the correct answer

DEFG is a cyclic quadrilateral.

$GK \perp DF$ and $FS \perp DG$

$\hat{K}_1 =$ _____

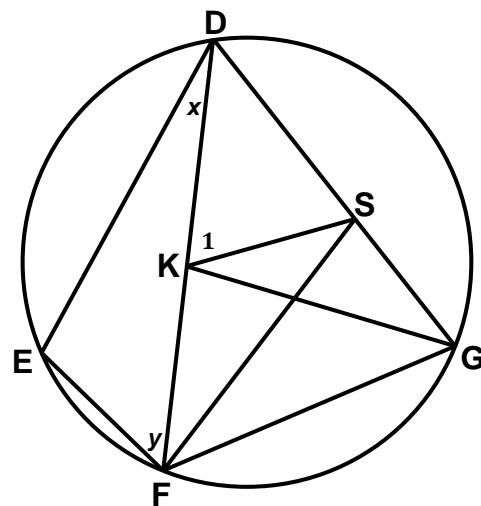
A: $180^\circ - x + y$

B: $180^\circ - x - y$

C: $x + y$

D: $x - y$

(3)

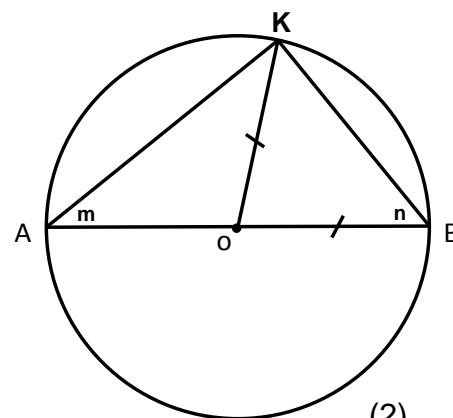


(b) For each of the following, **state the relationship that exists between m and n**. Show all your working. Reasons are **not** required.

(1) If $a + m = 90^\circ$ and $2a + 2n = 180^\circ$, then

(2)

(2) Diameter AB passes through the centre of the circle O. K is a point on the circumference.



(2)

[7]

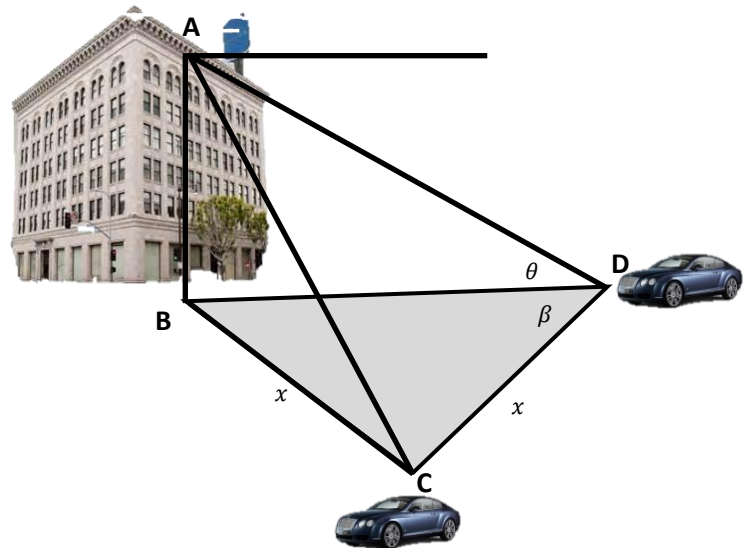
QUESTION 21

A surveillance camera, A, at the top of a security building shows 2 cars parked outside the Building (B).

The angle of elevation of A from D is θ . Car C is equidistant from Car D and the building B.

Let x denote the distance DC and $\hat{CDB} = \beta$

- (a) Find BD in terms of x and $\cos 2\beta$ (4)



- (b) Prove that: $AB = 2x \cdot \cos \beta \cdot \tan \theta$ (3)

QUESTION 22

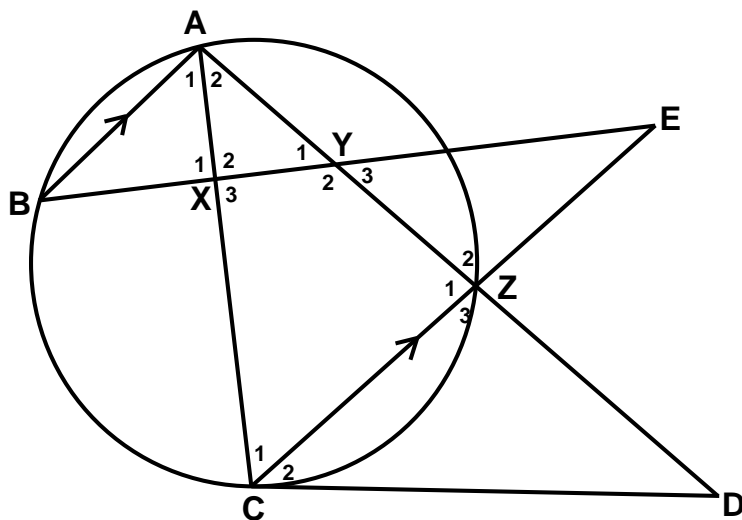
In the figure, CD is a tangent to the circle through A, B, C and Z.

Line segment BA is parallel to CE and AX = YX.

AC, AD, CE and BE are straight lines

Prove:

(a) $\hat{A}_{1+2} = \hat{C}_{1+2}$ (4)



(b) $\triangle BAY \parallel \triangle DCA$ (3)

(c) $AC = \frac{AY \cdot CD}{AB}$ (2)

[9]

TOTAL : 30 MARKS