DEPARTMENT OF EDUCATION
REPUBLIC OF SOUTH AFRICA

SENIOR CERTIFICATE EXAMINATION - 2005

MATHEMATICS P2

STANDARD GRADE

FEBRUARY/MARCH 2005

Marks: 150

3 Hours

This question paper consists of 12 pages, 1 formula sheet and 4 diagram sheets.

INSTRUCTIONS

1. This question paper consists of **NINE** questions, a formula sheet and diagram sheets.

2. Use the formula sheet to answer this question paper.

3. Detach the diagram sheets from the question paper and place them inside your **ANSWER BOOK**.

4. The diagrams are not drawn to scale.

5. Answer **ALL** the questions.

6. Number **ALL** the answers correctly and clearly.

7. **ALL** the necessary calculations must be shown.

8. Non-programmable calculators may be used, unless otherwise stated.

9. The number of decimal digits to which answers must be rounded off will be

   stated in the question where necessary.

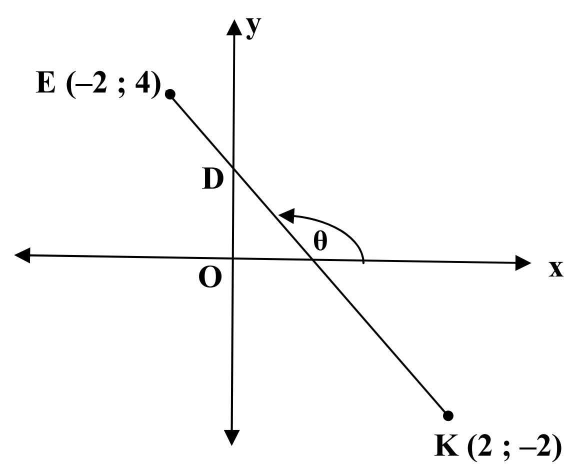
ANALYTICAL GEOMETRY

NOTE:	**– USE ANALYTICAL METHODS IN THIS SECTION.**
	– CONSTRUCTION AND MEASUREMENT METHODS MAY NOT BE USED.

QUESTION 1

In the diagram below E (–2 ; 4), K (2 ; –2) and N (p ; 7)

are three points in a Cartesian plane.

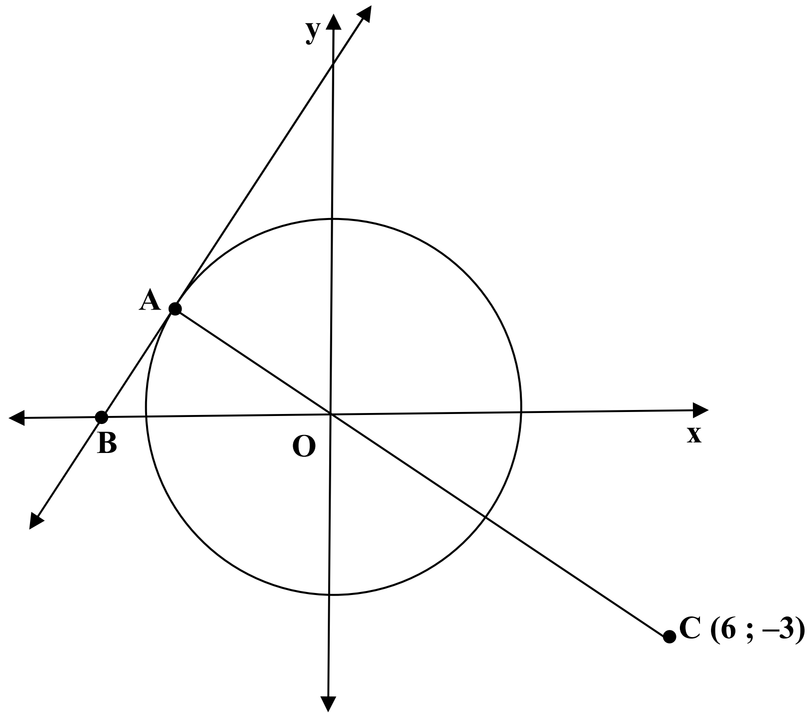


Determine:

1.1	The equation of straight line KE	(5)
1.2	The length of ED, if D is the *y*-intercept of KE (leave the answer in surd form)	(4)
1.3	The size of θ, the angle of inclination of KE (rounded off to ONE decimal digit)	(3)
1.4	The value of p if KE $\perp$ KN	(5)
		[17]

QUESTION 2

2.1 In the diagram alongside, straight line AB with equation $y - 2x - 5 = 0$ touches the circle $x^2 + y^2 = 5$ at point A. AO is produced to point C (6 ; –3).



Determine:

2.1.1 The coordinates of A (7)

2.1.2 The coordinates of midpoint M of OC (2)

2.1.3 Hence, the equation of the straight line parallel to AB and passing through M (4)

2.2 In each of the following determine the equation of the locus of point P(x ; y) **and** in each case also sketch the locus:

2.2.1 P is 3 units from the circle $x^2 + y^2 = 4$ (4)

2.2.2 P is two units to the left of the y-axis (4)

[21]

TRIGONOMETRY

QUESTION 3

Answer this question without the use of a calculator.

3.1 If $7\sin\theta - 5 = 0$ and $\cos\theta < 0$, calculate, **with the aid of a diagram,** the value of $\cot\theta \cdot \cos\theta$ (6)

3.2 Simplify: $$\frac{\sin(180° - x) \cdot \sec(360° - x) \cdot \cos(180° + x) \cdot \tan 300°}{\cos(90° - x)}$$ (8)

[14]

QUESTION 4

4.1 Given: $f(x) = \cos 2x$ and $g(x) = \tan x$

4.1.1 Use the system of axes provided on the diagram sheet to sketch the curves of f and g for $x \in [0°\,;180°]$. Clearly show ALL intercepts with the axes and ALL turning points. Clearly indicate any asymptotes using a dotted line(s). (8)

4.1.2 Use your graphs in QUESTION 4.1.1 to answer the following if $x \in [0°\ ;\ 180°]$:

(a) For which value of x is $\tan x$ undefined? (1)

(b) What is the period of f? (1)

(c) Determine the value(s) of x for which $f(x) - g(x) = 1$ (3)

(d) For which value(s) of x is $f(x) \geq g(x)$ for $x \in [45°\,;180°]$? (3)

4.2 Given the three points $(0°\ ;\ 0)$, $(90°\ ;\ -2)$ and $(180°\ ;\ 0)$.

On which **ONE** of the following curves would ALL of the above three points lie:

$f:\ y = -2\cos x$
$h:\ y = -\cos 2x$
$g:\ y = -2\sin x$
$k:\ y = -\sin 2x$

(2)
[18]

QUESTION 5

5.1 Use fundamental trigonometric identities and not a diagram to prove the following identity:

$$(\cot x + \tan x) \cos x = \operatorname{cosec} x$$ (6)

5.2 Given: $3 \cos x = 2{,}151$ for $x \in [0° ; 360°]$

5.2.1 Solve for x, rounded off to TWO decimal digits. (3)

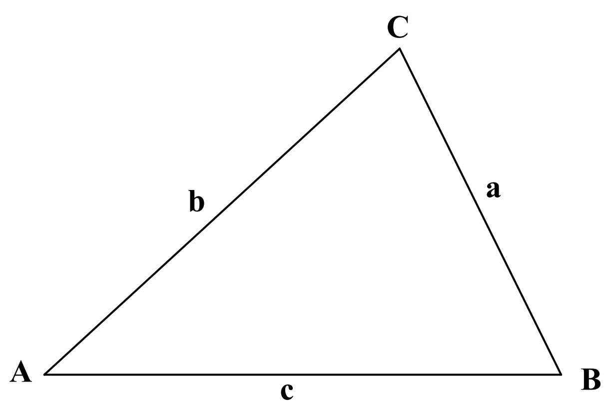
5.2.2 Hence determine the value of $\cot \frac{1}{2}x$ if $x > 90°$ (rounded off to TWO decimal digits). (2)

[11]

QUESTION 6

6.1 Use the diagram on the diagram sheet or redraw the diagram in your answer book to prove that

$$\frac{\sin A}{a} = \frac{\sin B}{b}$$



(4)

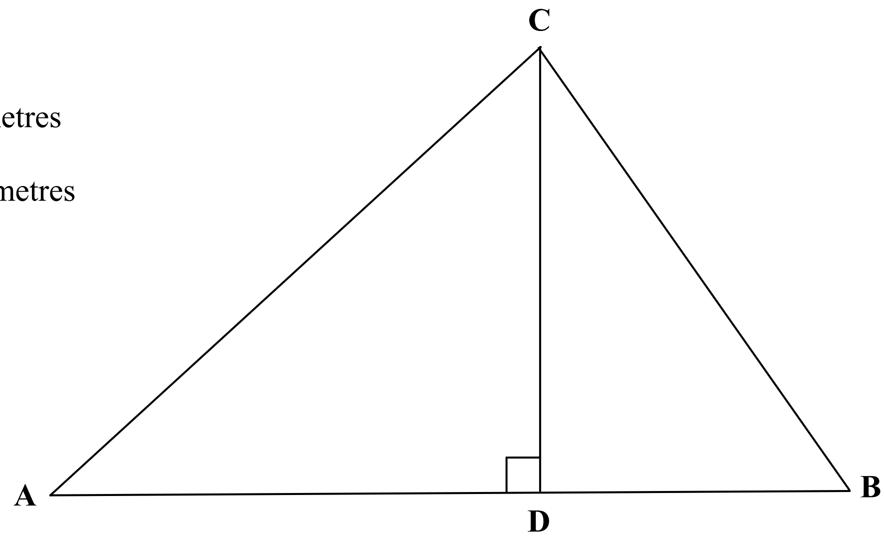
6.2 The diagram below represents a triangular piece of land ABC on Robben Island which the Heritage Foundation wants to use for a memorial site.

$\hat{B} = 63°$

AB = 500 metres

BC = 300 metres

CD $\perp$ AB



Determine the following (rounded off to TWO decimal digits):

6.2.1 The distance AC (4)

6.2.2 The size of $A\hat{C}B$ (3)

6.2.3 The area of ΔABC (3)

6.2.4 Hence, the distance DC (3)

[17]

EUCLIDEAN GEOMETRY

NOTE :

- **DIAGRAMS FOR PROVING THEORY MAY BE USED ON THE DIAGRAM SHEETS, OR REDRAWN IN YOUR ANSWER BOOK.**
- **DETACH THE DIAGRAM SHEETS FROM THE QUESTION PAPER AND PLACE THEM IN YOUR ANSWER BOOK.**
- **GIVE A REASON FOR EACH STATEMENT.**

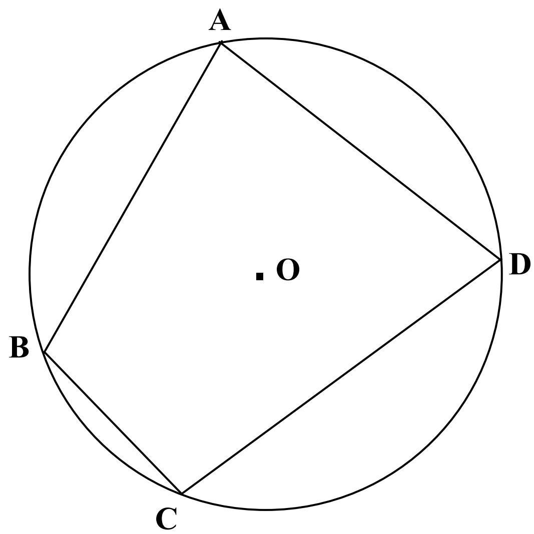
QUESTION 7

7.1 In the diagram below, ABCD is a cyclic quadrilateral of the circle with centre O.

Use the diagram on the diagram sheet or redraw the diagram in your answer book

to prove the theorem which states that

$\hat{B} + \hat{D} = 180°$

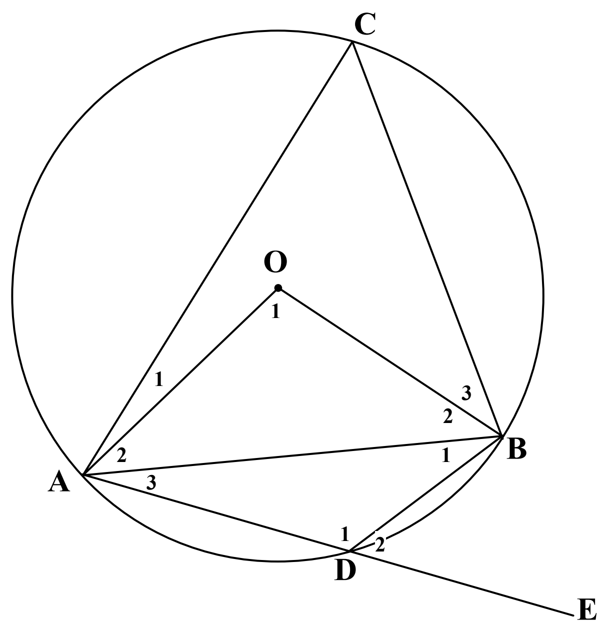


(5)

7.2 In the diagram alongside,

O is the centre of circle ADBC

$\hat{B}_2 = 40°$



7.2.1 Determine, stating reasons, the size of $\hat{D}_2$ (6)

7.2.2 If $AO \parallel DB$, determine, stating reasons, the size of $O\hat{A}D$. (1)

7.3 Complete the following statements, by only writing the appropriate missing word, to make the statement TRUE:

7.3.1 If a chord of a circle subtends a right angle on the circumference, then the chord is a … (1)

7.3.2 If a line is drawn through the end point of a chord making with the chord an angle equal to an angle in the alternate segment, then the line is a …to the circle. (1)

7.4 In the diagram alongside,

O is the centre of the circle.

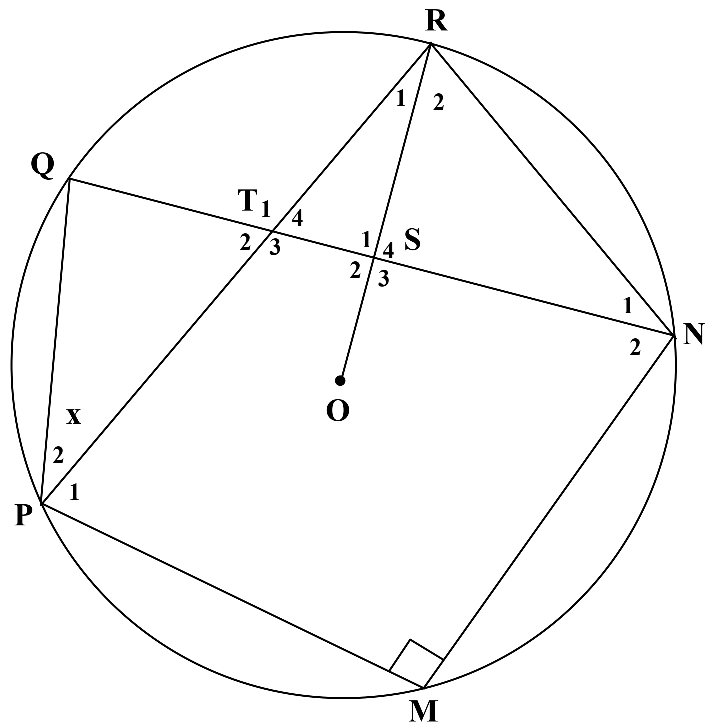
M, P, Q, R and N

are points on the circle.

PM $\perp$ MN

QN intersects PR at T

and intersects RO at S.



Let $\hat{P}_2 = x$

7.4.1 Name, stating a reason, ONE other angle equal to x. (2)

7.4.2 Prove that PT is a diameter of circle PQT. (3)

7.4.3 If it is further given that S is the midpoint of chord QN, prove that RN is a diameter of circle RSN. (3)

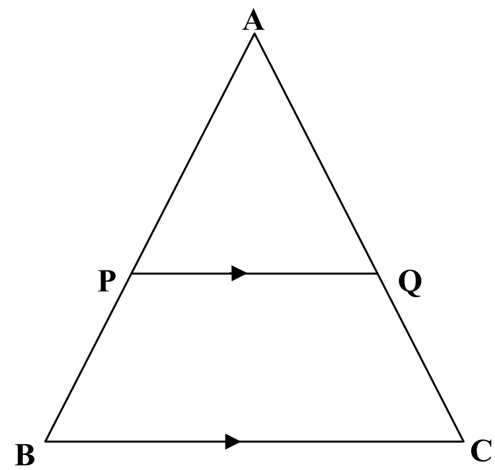
7.4.4 Hence, prove that TR is a tangent to circle RSN. (2)

[24]

QUESTION 8

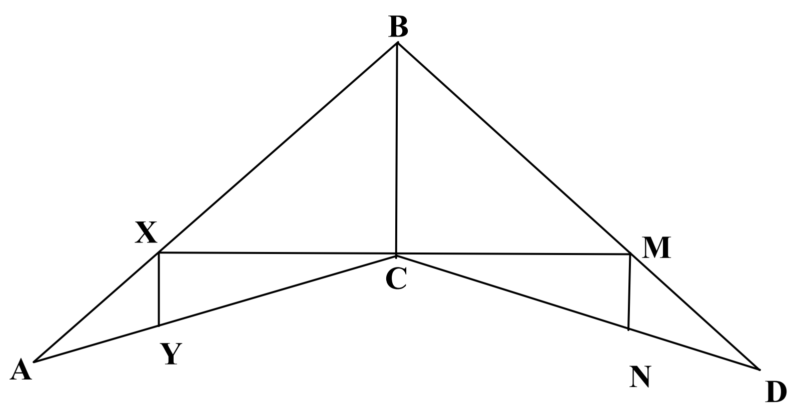
8.1 In the diagram alongside , PQ || BC with P on AB and Q on AC.
Use the diagram on the diagram sheet or redraw the diagram in your answer book to prove the theorem which states that

$$\frac{AP}{PB} = \frac{AQ}{QC}$$



(6)

8.2 In the construction of roofs, architects design trusses to support roofs.
A symmetrical truss known as the 'scissors truss' is shown in the diagram alongside.



AB = 7,5 metres

XB = 5 metres

AC = 6 metres

YC = 4 metres

8.2.1 Determine the numerical value of the following:

(a) $\dfrac{AX}{XB}$ (1)

(b) $\dfrac{AY}{YC}$ (1)

(c) $\dfrac{AX}{AB}$ (1)

8.2.2 Prove that XY || MN. (3)
[12]

QUESTION 9

In the diagram alongside, AB is a diameter of the circle with centre O.

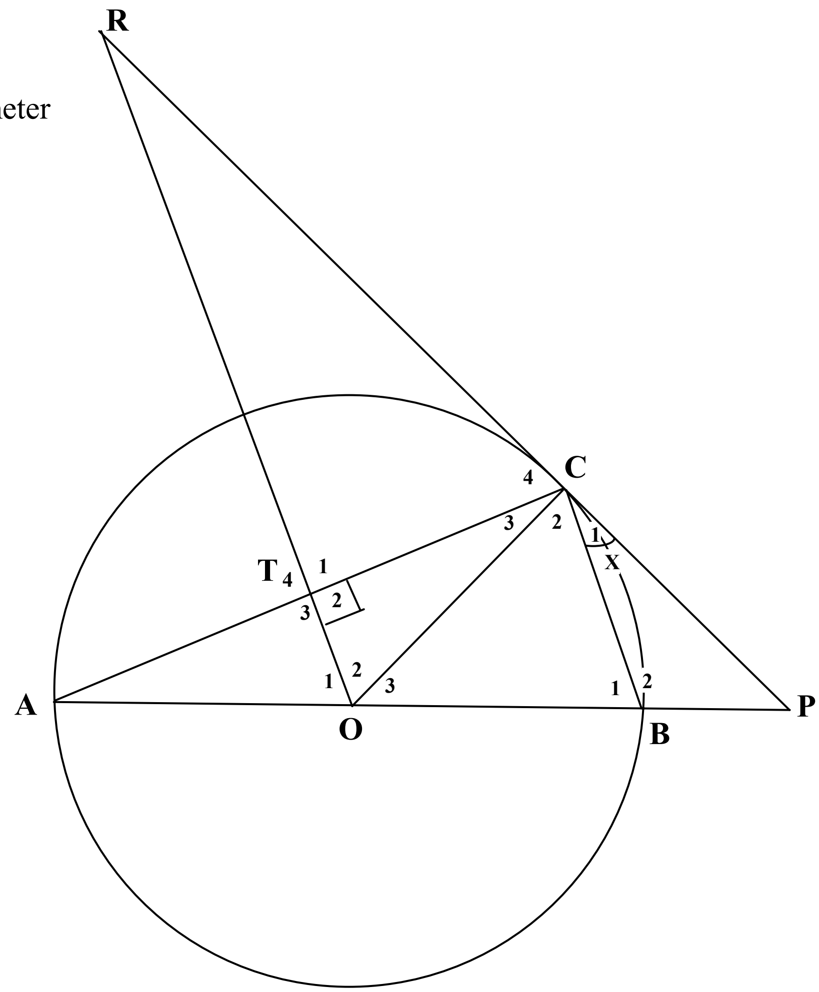
AB is produced to P.

PR is a tangent to the circle at C.

RO intersects AC at T.

$RO \perp AC$

Let $\hat{C}_1 = x$



9.1 Give, stating reasons, TWO other angles each equal to *x*. (3)

9.2 Determine the following in terms of *x*:

9.2.1 $P\hat{C}A$ (3)

9.2.2 $C\hat{B}P$ (3)

9.3 Prove that:

9.3.1 T is the midpoint of AC (2)

9.3.2 $\Delta\ PCB\ |||\ \Delta\ PAC$ (2)

9.4 Hence, prove that $2\ AT.PC = CB.AP$ (3)

[16]

TOTAL: 150

Mathematics Formula Sheet (HG and SG)
Wiskunde Formuleblad (HG en SG)

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$T_n = a + (n - 1)d$ $\qquad S_n = \frac{n}{2}(a + l)$ $\qquad S_n = \frac{n}{2}\left[2a + (n-1)d\right]$

$T_n = a.r^{n-1}$ $\qquad S_n = \frac{a(1 - r^n)}{1 - r}, r \neq 1$ $\qquad S_n = \frac{a(r^n - 1)}{r - 1}, r \neq 1$ $\qquad S_\infty = \frac{a}{1 - r}, r \neq 1$

$A = P\left(1 + \frac{r}{100}\right)^n$ $\qquad A = P\left(1 - \frac{r}{100}\right)^n$

$$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$y = mx + c$$

$$y - y_1 = m(x - x_1)$$

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$m = \tan\theta$$

$$\left(\frac{x_1 + x_2}{2}; \frac{y_1 + y_2}{2}\right)$$

$x^2 + y^2 = r^2$ $\qquad (x - p)^2 + (y - q)^2 = r^2$

In ΔABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc.\cos A$$

$$area\,\Delta ABC = \frac{1}{2}ab.\sin C$$