education

Department:
Education
REPUBLIC OF SOUTH AFRICA

SENIOR CERTIFICATE EXAMINATION - 2005

MATHEMATICS P2

STANDARD GRADE

OCTOBER/NOVEMBER 2005

Marks: 150

Time: 3 Hours

This question paper consists of 11 pages, 1 information sheet and 5 diagram sheets.

INSTRUCTIONS

1. This question paper consists of **9** 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

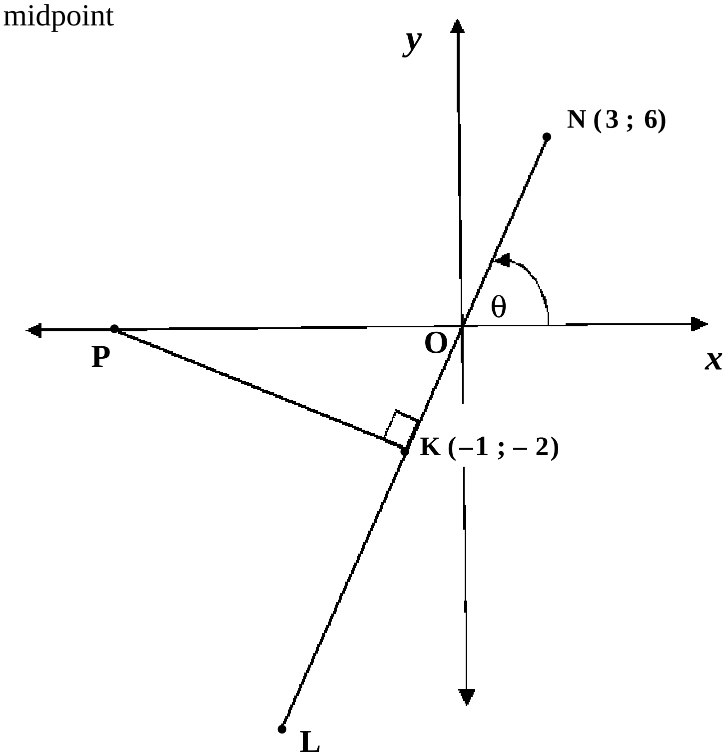
NOTE:	**- USE ANALYTICAL METHODS IN THIS SECTION.**
	- CONSTRUCTION AND MEASUREMENT METHODS MAY NOT BY USED.

QUESTION 1

In the diagram alongside, K (–1 ; – 2) is the midpoint of LN with N (3 ; 6).

PK ⊥ LN with P on the *x*-axis.

The angle of inclination of NL is θ.



1.1 Determine:

1.1.1 the gradient of NK . (3)

1.1.2 the size of θ, rounded off to ONE decimal digit. (2)

1.1.3 the coordinates of L. (4)

1.1.4 the length of NK, rounded off to ONE decimal digit. (3)

1.2 Determine the equation of the straight line parallel to PK and which passes through N. (5)

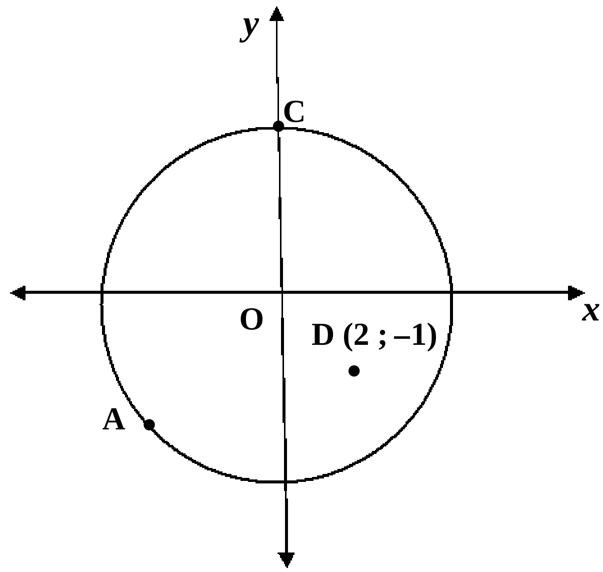
[17]

QUESTION 2

2.1 In the diagram alongside, the circle $x^2 + y^2 = 25$ with centre O (0 ; 0) cuts the y-axis at C.

The straight line with equation $y = 5 + 2x$ cuts the circle at A.

D (2 ; –1) is a point inside the circle.



2.1.1 Determine the coordinates of C. (2)

2.1.2 Calculate the coordinates of A. All calculations must be shown. (6)

2.1.3 If B (3 ; – 4) is a point on the circle, determine:

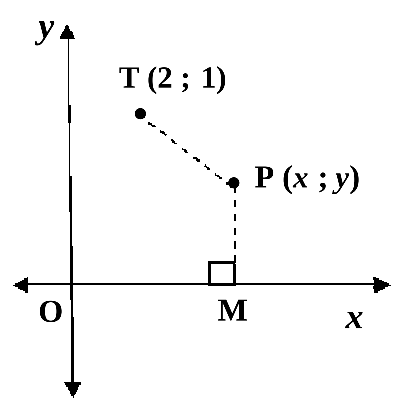
(a) the gradient of OB. (2)

(b) the equation of the tangent to the circle at point B. (4)

(c) whether points C, D and B are collinear. (5)

2.2 In the diagram alongside, point P (x ; y) is equidistant to both T (2 ; 1) and the x-axis.

Point M lies on the x-axis.



2.2.1 Determine the coordinates of M. (1)

2.2.2 Show that the equation of the locus of P is given by

$$2y = x^2 - 4x + 5$$ (5)

[25]

TRIGONOMETRY

QUESTION 3

Answer this question without the use of a calculator.

3.1 Determine the numerical value of $\dfrac{\cos 315^\circ \,.\, \operatorname{cosec} 60^\circ}{\tan 150^\circ}$

All the necessary steps to obtain the value must be shown. (6)

3.2 If $\cot\theta = -\dfrac{3}{2}$ and $\sin\theta > 0$, calculate by using a sketch, the value of

$$\cos\theta \,.\, \sin\theta$$ (5)

3.3 Simplify to a single trigonometric ratio of A:

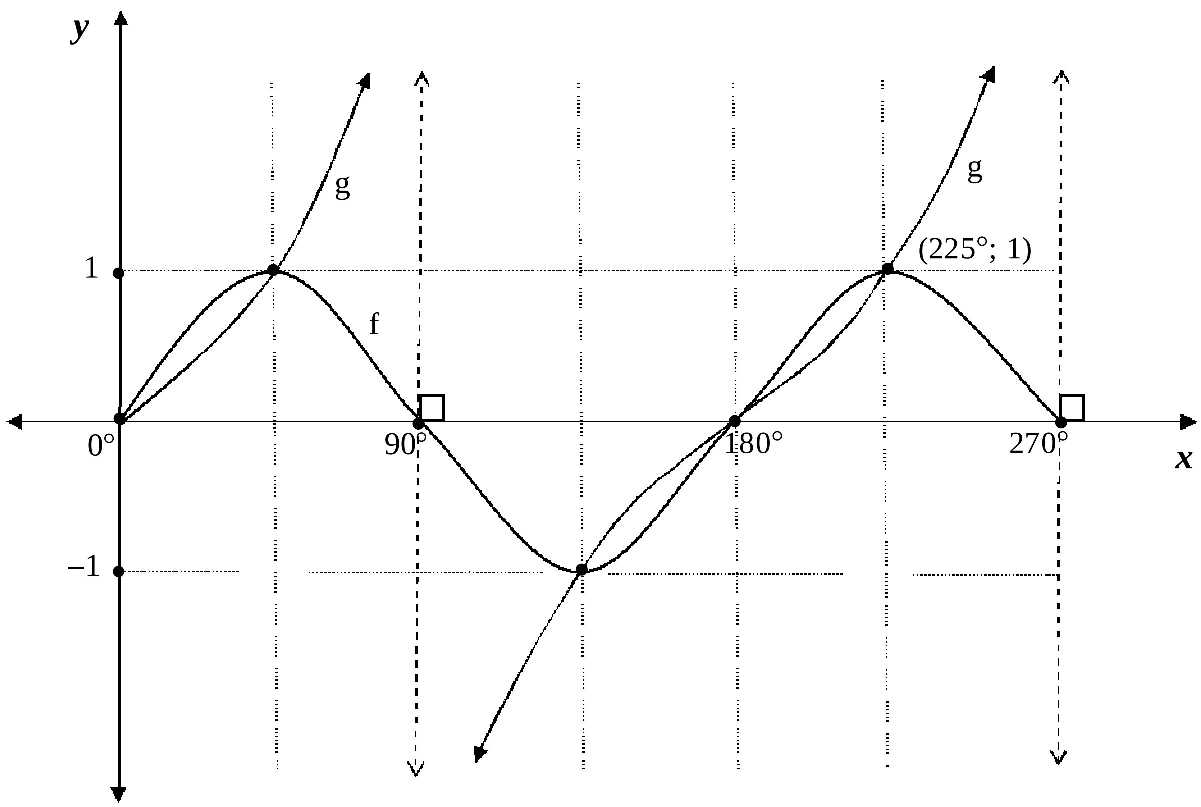
$$\frac{\tan(180^\circ + A)\,.\,\cos(180^\circ - A)\,.\,\sin(360^\circ - A)}{\cos(90^\circ - A)}$$ (6)

[17]

QUESTION 4

Sketch graphs of the curves of f and g are drawn below with

f (x) = sin px and g (x) = tan x, for $x \in [0° ; 270°]$.



4.1 Write down:

4.1.1 the value of p. (1)

4.1.2 the minimum value of f. (1)

4.2 Use the graphs to determine for which value(s) of x is:

4.2.1 $f(x) - g(x) = 0$, where $x \in (0° ; 180°)$. (2)

4.2.2 $f(x) \geq g(x)$, where $x \in [90° ; 180°]$. (3)

4.3 A sketch graph of the curve of f is drawn on the diagram sheet.

4.3.1 Sketch the curve of h on the same system of axes if

$$h(x) = -2\cos x \quad \text{for} \quad x \in [0^\circ ; 270^\circ]$$

Show clearly the coordinates of all turning points and intercepts with the axes. (4)

4.3.2 Use the graphs of f and h to determine the value(s) of x for which

$$h(x) - f(x) = 2, \quad \text{for } x \in [0^\circ ; 270^\circ]$$ (1)

[12]

QUESTION 5

5.1 Solve for ?, where 2? ∈ [90° ; 270°] and round off to ONE decimal digit if

$$\sin 2? = -0{,}839$$ (3)

5.2 5.2.1 Complete the following identity: $\sin^2\beta + \cos^2\beta = \ldots\ldots\ldots$ (1)

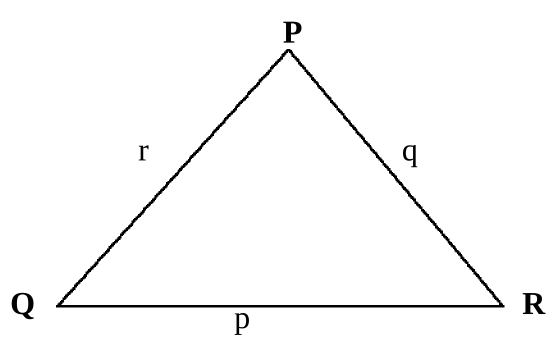
5.2.2 Use fundamental trigonometric identities and **not a diagram**, to prove the following identity:

$$(1+\cos\beta)(1-\cos\beta)\,.\,\mathrm{cosec}\,\beta = \sin\beta$$ (4)

[8]

QUESTION 6

6.1 In the diagram alongside, ? PQR is an acute-angled triangle.



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

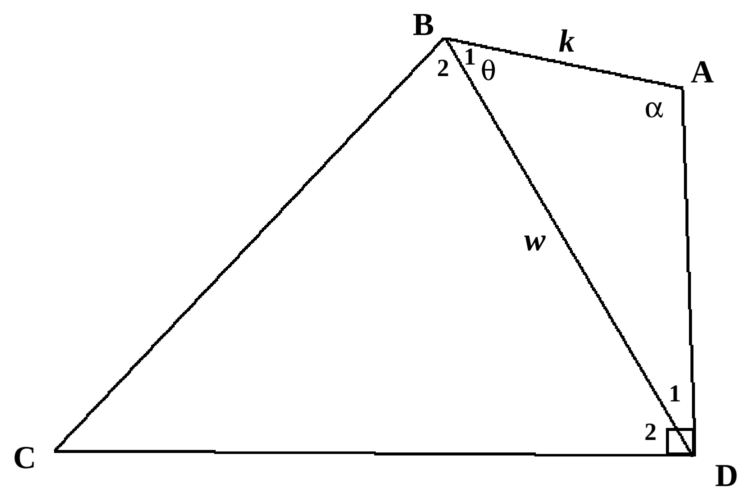
$$\text{Area of ? PQR} = \tfrac{1}{2}(p)(r)\sin Q$$ (4)

6.2 Farmer Thlabane wants to provide tarred paths for all her farm workers. She draws a plan of the five paths (as shown below) which connect the workers' homes that are positioned at A, B, C and D.

$\hat{B}_1 = \theta$ and $\hat{A} = \alpha$

AB = k and BD = w

AD $\perp$ CD



6.2.1 Prove that the length of the path connecting A and B is given by

$$k = w \sin(\theta + \alpha) \cdot \operatorname{cosec} \alpha \quad (4)$$

6.2.2 Hence, if $\alpha = 104°$, $\hat{D}_2 = 59°$, w = 52 metres and DC = 65 metres, calculate:

(a) the value of k (round off to the nearest metre). (4)

(b) the area of Δ BCD (round off to the nearest square metre). (3)

(c) the total length of the tarred paths if AD = 38 metres (round off to the nearest metre). (6)

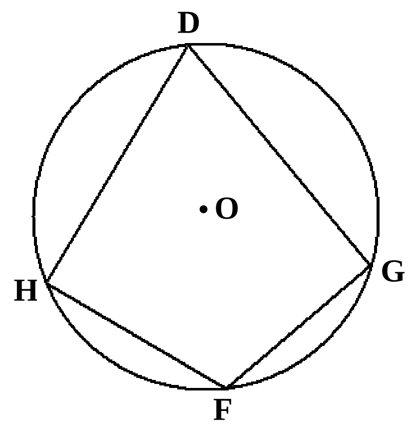
[21]

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, UNLESS OTHERWISE STATED.**

QUESTION 7

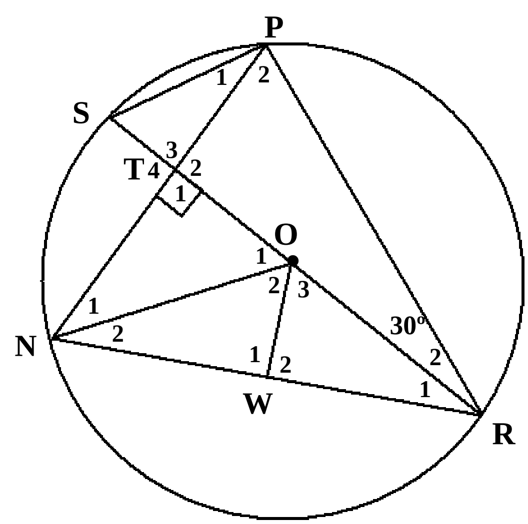
7.1 In the diagram alongside, O is the centre of a circle.



Use the diagram on the diagram sheet, or redraw the diagram in your answer book to prove the theorem which states that:

If DHFG is a cyclic quadrilateral, then $\hat{D} + \hat{F} = 180^\circ$ (5)

7.2 In the diagram alongside, the vertices of ? PNR lie on the circle with centre O.



Diameter SR and chord NP intersect at T.

Point W lies on NR.

OT ⊥ NP

$\hat{R}_2 = 30^\circ$

7.2.1 Determine, stating reasons, the size of:

(a) $\hat{S}$ (3)

(b) $\hat{R}_1$ (3)

(c) $\hat{N}_1$ (3)

7.2.2 If it is further given that NW = WR, prove that TNWO is a cyclic quadrilateral. (4)

[18]

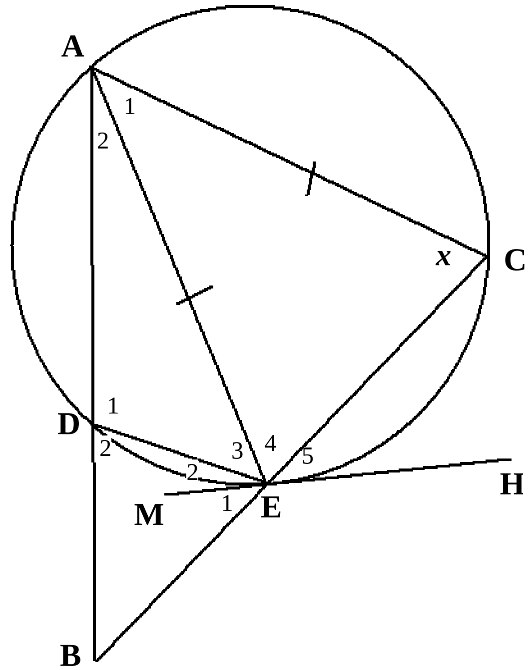
QUESTION 8

In the diagram alongside, ADEC is a cyclic quadrilateral with AE = AC.

AD and CE produced, meet at B.

Tangent MH touches the circle at E.

Let $\hat{C} = x$



8.1 Name, stating reasons, THREE other angles each equal to *x*. (5)

8.2 Determine $\hat{E}_1$ in terms of *x*. (1)

8.3 Prove that AE is a tangent to the circle passing through points E, D and B. (4)

[10]

QUESTION 9

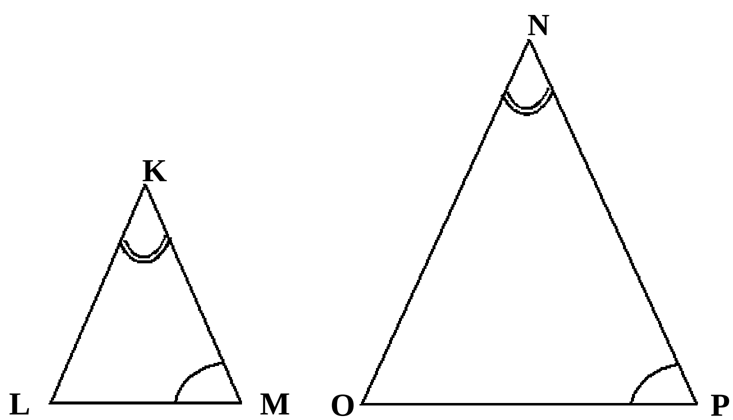
9.1 In the diagram alongside,

? KLM and ? NOP are given.

Use the diagram on the diagram sheet, or redraw the diagram in your answer book to prove the theorem which states that:

If $\overset{?}{\mathbf{K}} = \overset{?}{\mathbf{N}}$, $\overset{?}{\mathbf{L}} = \overset{?}{\mathbf{O}}$ **and** $\overset{?}{\mathbf{M}} = \overset{?}{\mathbf{P}}$

then $\frac{\mathbf{KL}}{\mathbf{NO}} = \frac{\mathbf{KM}}{\mathbf{NP}}$



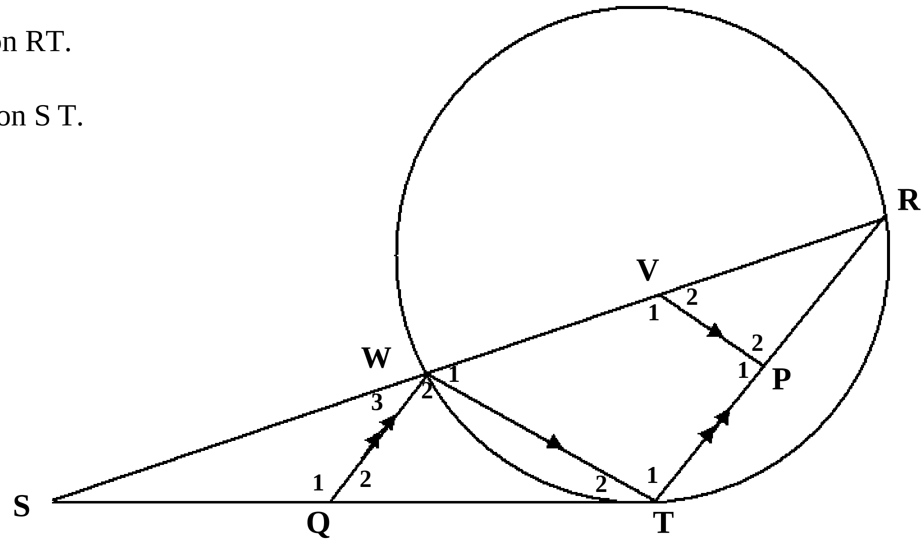
(7)

9.2 In the diagram below, ST is a tangent to circle RWT at T.

SWVR is a straight line.

VP || WT with P on RT.

WQ || RT with Q on ST.



9.2.1 Prove that $\Delta STW ||| \Delta SRT$ (4)

9.2.2 Hence, write ST^2 in terms of the sides of ΔSTW and ΔSRT. (2)

9.2.3 Hence, calculate the length of WR if ST = 6 cm and SW = 4 cm. (3)

9.2.4 Name, without stating reasons, ONE other pair of similar triangles in the diagram. (2)

9.2.5 Hence or otherwise, determine the numerical value of $\frac{RP}{PT}$ if VR = 2 cm. State reason(s). (4)

[22]

TOTAL: 150

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

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

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

$T_n = a.r^{n-1}$ $\quad$ $S_n = \frac{a(1 - r^n)}{1 - r}$ $(r \neq 1)$ $\quad$ $S_n = \frac{a(r^n - 1)}{r - 1}$ $(r \neq 1)$

$S_\infty = \frac{a}{1 - r}$ $\quad (|r| < 1)$

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

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

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

$y = mx + c$

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

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

$m = \tan\theta$

$(x_3 ; y_3) = \left(\frac{x_1 + x_2}{2} ; \frac{y_1 + y_2}{2}\right)$

$x^2 + y^2 = r^2$

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

In Δ ABC: $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

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

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

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MATHEMATICS SG / WISKUNDE SG
PAPER II / VRAESTEL II
NOVEMBER 2005

DIAGRAM SHEET / DIAGRAMVEL

INSTRUCTION

This diagram sheet must be handed in with your answer book. Please ensure that your details are complete.

INSTRUKSIE

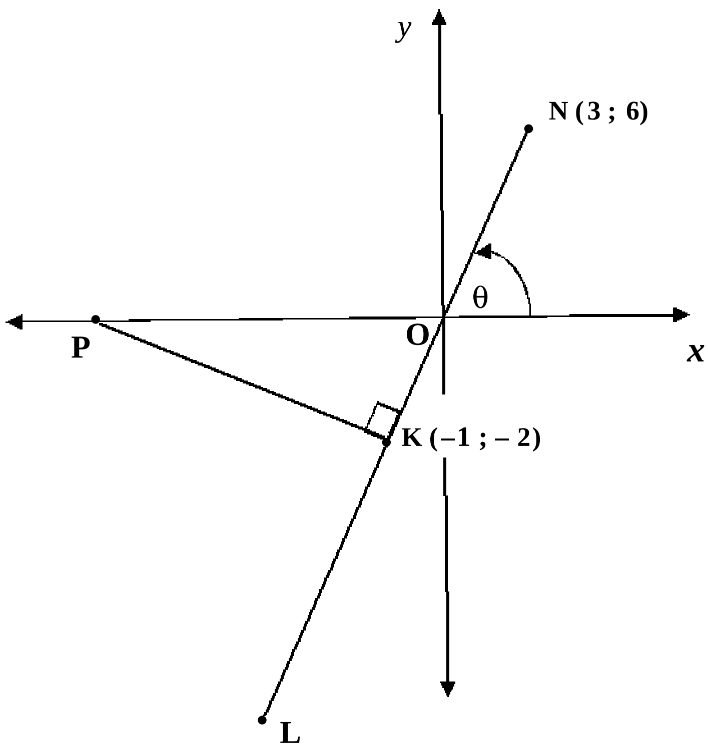
Hierdie diagramvel moet saam met jou antwoordeboek ingelewer word. Maak asseblief seker dat jou besonderhede volledig ingevul is.

EXAMINATION NUMBER
EKSAMENNOMMER

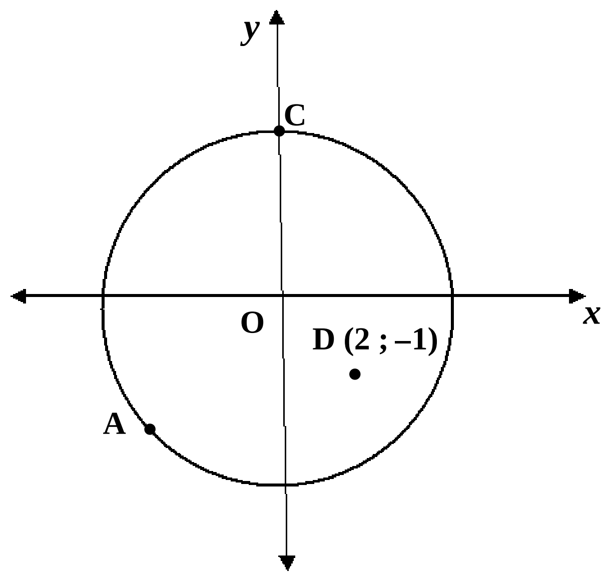
CENTRE NUMBER
SENTRUMNOMMER

EXAMINATION NUMBER
EKSAMENNOMMER

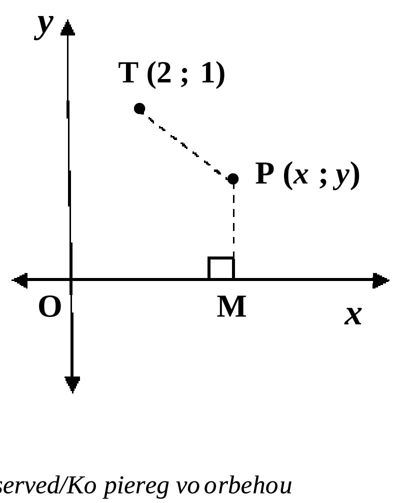
QUESTION 1 / VRAAG 1



QUESTION 2.1 / VRAAG 2.1



QUESTION 2.2 / VRAAG 2.2



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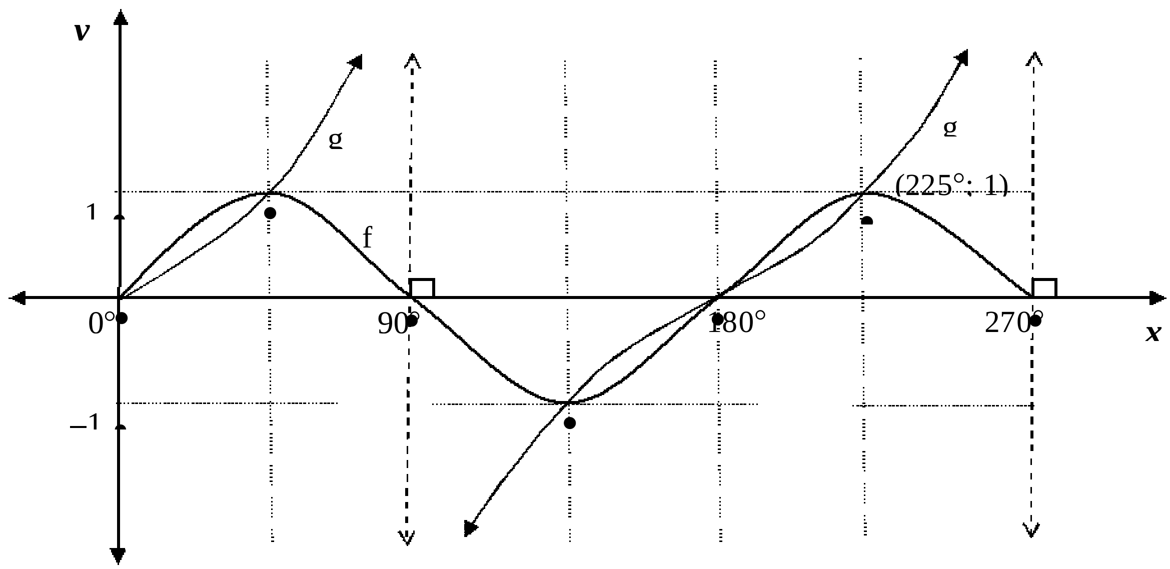
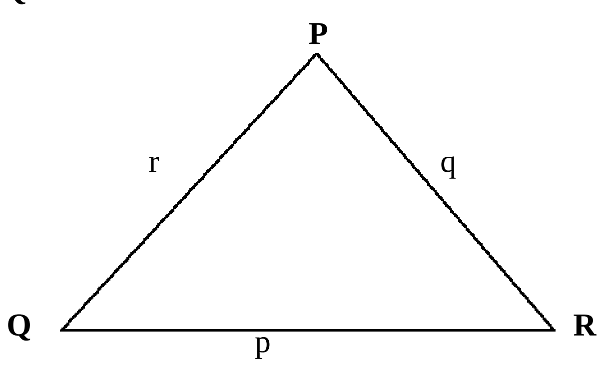
QUESTION 4 / VRAAG 4



QUESTION 6.1 / VRAAG 6.1



QUESTION 6.2 / VRAA G 6.2

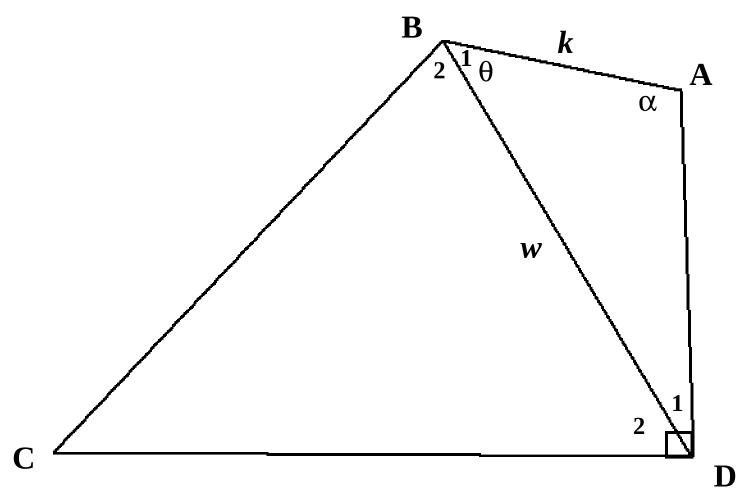


DIAGRAM SHEET/DIAGRAMVEL

EXAMINATION NUMBER
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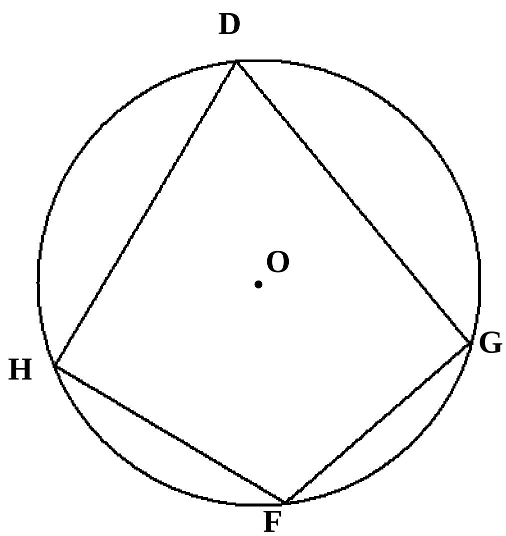
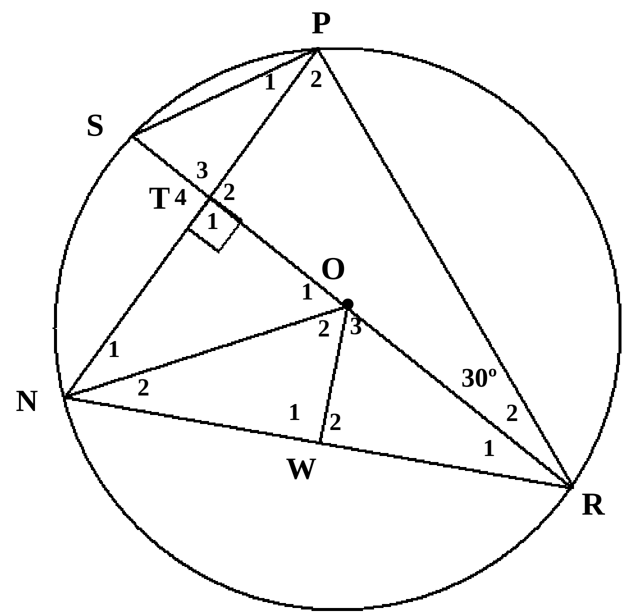
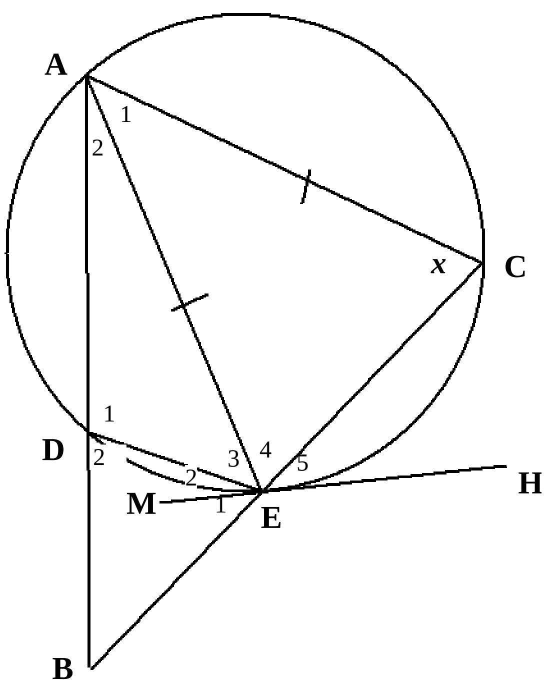
QUESTION 7.1 / VRAAG 7.1



QUESTION 7.2 / VRAAG 7.2



QUESTION 8 / VRAAG 8



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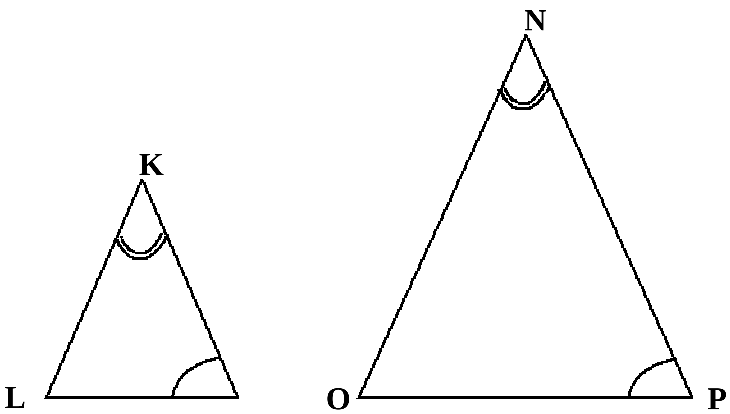
QUESTION 9.1 / VRAAG 9.1



QUESTION 9.2 / VRAAG 9.2