NATIONAL SENIOR CERTIFICATE EXAMINATION
NASIONALE SENIORSERTIFIKAAT-EKSAMEN

NOVEMBER 2008

MATHEMATICS / WISKUNDE
FIRST PAPER / EERSTE VRAESTEL

SUBJECT CODE / VAKKODE	:	**MATH**
TIME / TYD	:	**3 HOURS / UUR**
MARKS / PUNTE	:	**150**

education

Department:
Education
REPUBLIC OF SOUTH AFRICA

NASIONALE SENIOR SERTIFIKAAT

GRAAD 12

WISKUNDE V1

NOVEMBER 2008

PUNTE: 150

TYD: 3 uur

Hierdie vraestel bestaan uit 10 bladsye, 'n inligtingsblad en 2 diagramvelle.

INSTRUKSIES EN INLIGTING

Lees die volgende instruksies noukeurig deur voordat die vrae beantwoord word.

1. Hierdie vraestel bestaan uit 11 vrae. Beantwoord AL die vrae.

2. Dui ALLE berekeninge, diagramme, grafieke, ensovoorts wat jy in die bepaling van jou antwoorde gebruik het, duidelik aan.

3. 'n Goedgekeurde wetenskaplike sakrekenaar (nieprogrammeerbaar en niegrafies) mag gebruik word, tensy anders vermeld.

4. Indien nodig, rond antwoorde af tot TWEE desimale plekke, tensy anders vermeld.

5. Diagramme is NIE noodwendig volgens skaal geteken nie.

6. TWEE diagramvelle vir die beantwoording van VRAAG 5.1, VRAAG 5.2, VRAAG 11.2 en VRAAG 11.3 is aan die einde van hierdie vraestel aangeheg. Skryf jou eksamennommer in die ruimtes gelaat op hierdie velle en lewer dit saam met jou ANTWOORDEBOEK in.

7. Nommer die antwoorde korrek volgens die nommeringstelsel wat in hierdie vraestel gebruik is.

8. Dit is tot jou eie voordeel om leesbaar te skryf en netjiese werk in te lewer.

VRAAG 1

1.1 Los op vir x, afgerond tot TWEE desimale plekke waar nodig:

1.1.1 $x^2 = 5x - 4$ (3)

1.1.2 $x(3 - x) = -3$ (5)

1.1.3 $3 - x < 2x^2$ (5)

1.2 Bepaal die waardes van x en y indien beide vergelykings gelyktydig opgelos kan word:

$$2x + y = 3$$
$$x^2 + y + x = y^2$$ (8)

1.3 Gegee $x = 999\,999\,999\,999$, bepaal die presiese waarde van $\dfrac{x^2 - 4}{x - 2}$.
Dui AL jou berekeninge aan. (3)

1.4 Verduidelik waarom die vergelyking $\dfrac{x^4 + 1}{x^4} = \dfrac{1}{2}$ geen reële wortels het nie. (2)
[26]

VRAAG 2

2.1 Beskou die ry: $\frac{1}{2}\,;4\,;\frac{1}{4}\,;7\,;\frac{1}{8}\,;\,10\,;...$

2.1.1 Indien die patroon op dieselfde manier voortgaan, skryf die volgende TWEE terme van die ry neer. (2)

2.1.2 Bereken die som van die eerste 50 terme van die ry. (7)

2.2 Beskou die ry: 8 ; 18 ; 30 ; 44 ; …

2.2.1 Gee die volgende TWEE terme van die ry indien die patroon op dieselfde manier voortgaan. (2)

2.2.2 Bereken die n^{de} term van die ry. (6)

2.2.3 Watter term van die ry is 330? (4)
[21]

VRAAG 3

Gegee die meetkundige reeks: $8x^2 + 4x^3 + 2x^4 + ...$

3.1 Bepaal die n^{de} term van die reeks. (1)

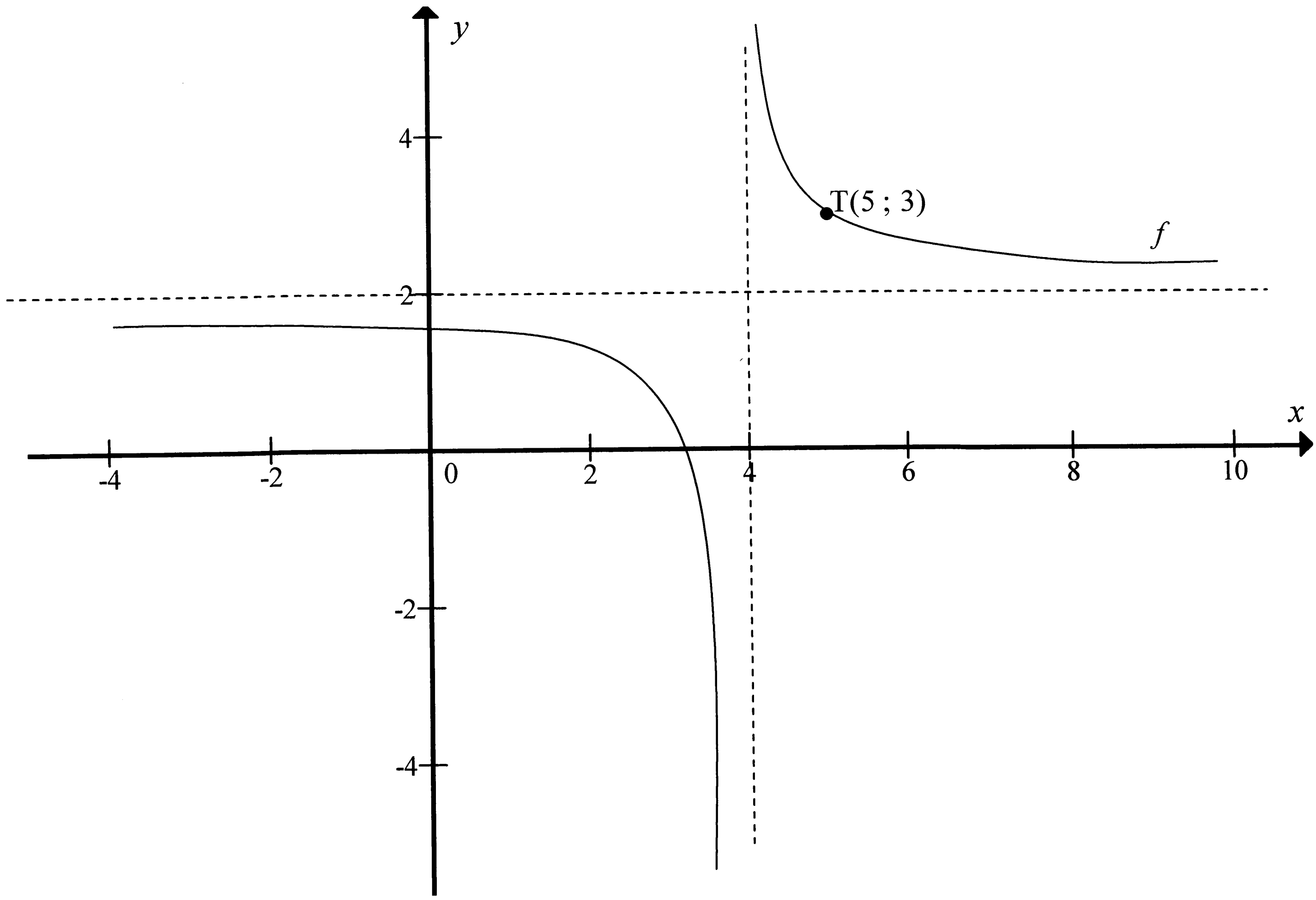
3.2 Vir watter waarde(s) van x sal die reeks konvergeer? (3)

3.3 Bereken die som tot oneindigheid van die reeks indien $x = \frac{3}{2}$. (3)
[7]

VRAAG 4

Die diagram hieronder stel die grafiek van $f(x) = \dfrac{a}{x-p} + q$ voor.

T(5 ; 3) is 'n punt op f.



4.1 Bepaal die waardes van a, p en q. (4)

4.2 Indien die grafiek van f oor die lyn met vergelyking $y = -x + c$ gereflekteer word, sal die nuwe grafiek met die grafiek van $y = f(x)$ saamval. Bepaal die waarde van c. (3)
[7]

VRAAG 5

Gegee: $h(x) = 4^x$ en $f(x) = 2(x-1)^2 - 8$.

5.1 Skets die grafieke van h en f op die diagramvel voorsien. Dui AL die snypunte met die asse, asook enige draaipunte aan. (8)

5.2 Sonder enige verdere berekeninge, skets die grafiek van $y = \log_4 x = g(x)$ op dieselfde assestelsel. (2)

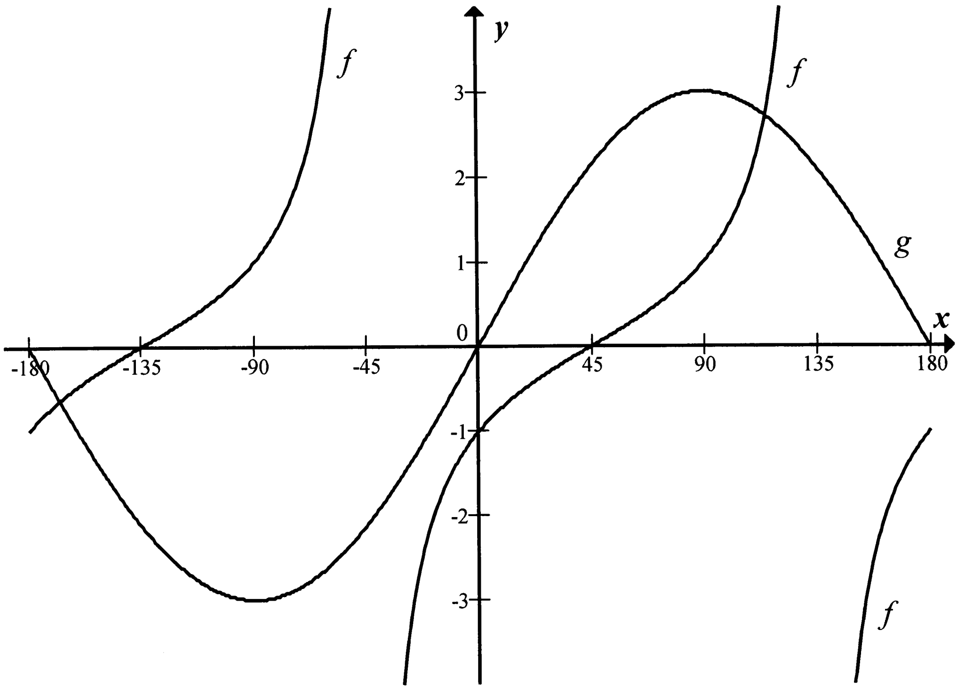
5.3 Die grafiek van f word 2 eenhede na LINKS geskuif. Skryf die vergelyking van die nuwe grafiek neer. (2)

5.4 Bewys algebraïes dat $h\left(x+\frac{1}{2}\right) = 2h(x)$. (3)

[15]

VRAAG 6

Die grafieke van die funksies $f(x) = \tan(x - 45°)$ en $g(x) = 3\sin x$ vir $x \in [-180° ; 180°]$, is hieronder geskets.



6.1 Skryf die vergelykings van die asimptote van $y = f(x)$ vir $x \in [-90° ; 180°]$ neer. (2)

6.2 Beskryf die transformasie van die grafiek van f na h indien $h(x) = \tan(45° - x)$. (2)

6.3 Die periode van g is verminder na 180° en die amplitude en y-afsnit bly dieselfde. Skryf die vergelyking van die gevolglike funksie neer. (2)

[6]

VRAAG 7

7.1 R1 570 is belê teen 12% p.j. saamgestelde rente. Na verloop van hoeveel jaar sal die waarde van die belegging R23 000 wees? (4)

7.2 'n Boer het so pas 'n nuwe trekker vir R800 000 gekoop. Hy het besluit om die trekker na 5 jaar te vervang wanneer die inruilwaarde van die trekker R200 000 sal wees. Daar word verwag dat die vervangingswaarde van die trekker teen 8% per jaar sal verhoog.

7.2.1 Die boer wil sy huidige trekker na 5 jaar met 'n nuwe trekker vervang. Die boer wil kontant betaal vir die nuwe trekker nadat hy sy huidige trekker vir R200 000 ingeruil het. Hoeveel sal hy moet betaal? (3)

7.2.2
- Een maand nadat hy sy huidige trekker gekoop het, deponeer die boer x rand in 'n rekening met 'n rentekoers van 12% p.j., maandeliks saamgestel.
- Hy gaan voort om aan die einde van elke maand dieselfde bedrag vir 'n totaal van 60 maande te deponeer.
- Aan die einde van 60 maande het hy die presiese bedrag wat nodig is om 'n nuwe trekker te koop nadat hy die ou trekker ingeruil het.

Bereken die waarde van x. (6)

7.2.3 Veronderstel dat hy 12 maande na die aankoop van die huidige trekker en elke 12 maande daarna, R5 000 uit sy rekening onttrek om vir onderhoud van die trekker te betaal. Indien hy 5 sulke onttrekkings maak, wat sal die nuwe maandelikse deposito wees? (4)
[17]

VRAAG 8

8.1 Bepaal $f'(x)$ vanuit eerste beginsels indien $f(x) = -3x^2$. (5)

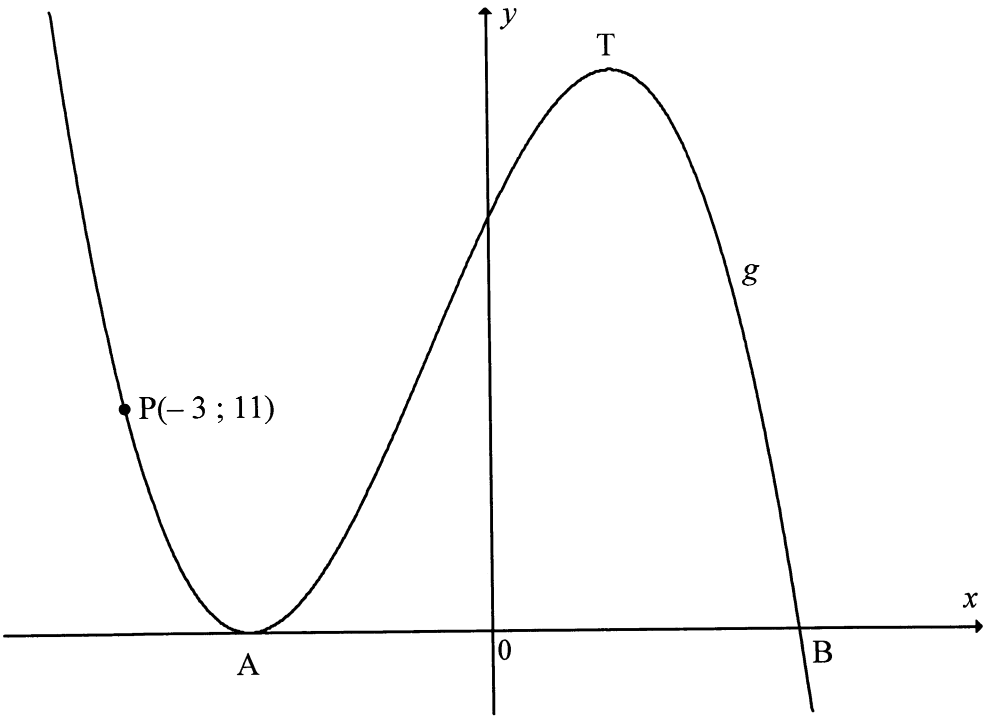
8.2 Bepaal deur van die reëls van differensiasie gebruik te maak:

$$\frac{dy}{dx} \text{ indien } y = \frac{\sqrt{x}}{2} - \frac{1}{6x^3}$$

Toon AL die berekeninge. (3)
[8]

VRAAG 9

Die grafiek van $g(x) = -2x^3 - 3x^2 + 12x + 20 = -(2x-5)(x+2)^2$ is hieronder geskets.
A en T is draaipunte van g. A en B is die x-afsnitte van g.
P(– 3 ; 11) is 'n punt op die grafiek.



9.1 Bepaal die lengte van AB. (2)

9.2 Bepaal die x-koördinaat van T. (4)

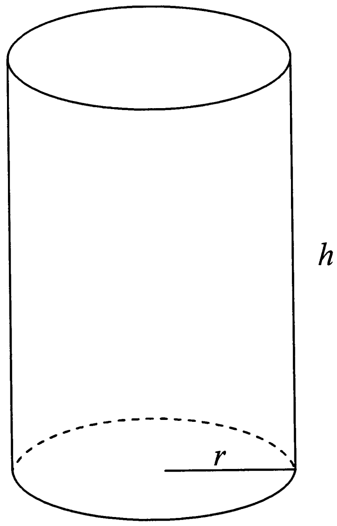
9.3 Bepaal die vergelyking van die raaklyn aan g by P(– 3 ; 11), in die formaat $y = \ldots$ (5)

9.4 Bepaal die waarde(s) van k waarvoor $-2x^3 - 3x^2 + 12x + 20 = k$ drie definitiewe wortels het. (3)

9.5 Bepaal die x-koördinaat van die buigpunt (infleksiepunt). (4)
[18]

VRAAG 10

'n Glas, in die vorm van 'n silinder, moet 200 mℓ vloeistof hou as dit vol is.



10.1 Wys dat die hoogte van die glas, h, as $h = \dfrac{200}{\pi r^2}$ uitgedruk kan word. (2)

10.2 Wys dat die totale oppervlakarea van die glas as $S(r) = \pi r^2 + \dfrac{400}{r}$ uitgedruk kan word. (2)

10.3 Bepaal gevolglik die waarde van r waarvoor die totale oppervlakarea van die glas 'n minimum is. (5)

[9]

VRAAG 11

Amina besit 'n klein fabriek wat twee tipes selfone vervaardig, naamlik Acuna en Matata selfone.

- Elke Acuna selfoon benodig 10 man-ure om te vervaardig en elke Matata selfoon benodig 8 man-ure om te vervaardig.
- Elke Acuna selfoon benodig 3 man-ure in die toetsafdeling en elke Matata selfoon benodig 4 man-ure in die toetsafdeling.
- Die vervaardigingsafdeling het 'n maksimum van 800 man-ure beskikbaar per week.
- Die toetsafdeling het 'n maksimum van 360 man-ure beskikbaar per week.
- Die fabriek moet ten minste 60 van die Matata selfone per week vervaardig.

Laat x die aantal Acuna selfone wat in een week vervaardig word, voorstel.
Laat y die aantal Matata selfone wat in een week vervaardig word, voorstel.

11.1 Skryf die beperkinge, in terme van x en y neer wat die inligting hierbo voorstel. (3)

11.2 Gebruik die aangehegte grafiekpapier (DIAGRAMVEL 2) om hierdie beperkinge grafies voor te stel. (5)

11.3 Dui die gangbare gebied duidelik aan deur dit te skakeer. (1)

11.4 Indien die wins op een Acuna selfoon R200 is en die wins op een Matata selfoon R250 is, gee die uitdrukking wat die wins, P, op die selfone sal voorstel. (1)

11.5 Maak gebruik van 'n soeklyn en jou grafiek en bepaal die aantal Acuna en Matata selfone wat 'n maksimum wins sal gee indien aanvaar word dat alles uitverkoop is. Skets 'n soeklyn op jou grafiek. (3)

11.6 Indien die winsfunksie van die fabriek $P = 180x + 240y$ is, sal daar enige verskil in die optimale oplossing wees? Gee 'n rede vir jou antwoord. (3)
[16]

TOTAAL: 150

INLIGTINGSBLAD: WISKUNDE
INFORMATION SHEET: MATHEMATICS

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

$A = P(1 + ni)$ $A = P(1 - ni)$ $A = P(1 - i)^n$ $A = P(1 + i)^n$

$\sum_{i=1}^{n} 1 = n$ $\sum_{i=1}^{n} i = \frac{n(n+1)}{2}$ $\sum_{i=1}^{n} (a + (i-1)d) = \frac{n}{2}(2a + (n-1)d)$

$\sum_{i=1}^{n} ar^{i-1} = \frac{a(r^n - 1)}{r - 1}$; $r \neq 1$ $\sum_{i=1}^{\infty} ar^{i-1} = \frac{a}{1 - r}$; $-1 < r < 1$

$F = \frac{x[(1+i)^n - 1]}{i}$ $P = \frac{x[1 - (1+i)^{-n}]}{i}$

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

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ $M\left(\frac{x_1 + x_2}{2} ; \frac{y_1 + y_2}{2}\right)$

$y = mx + c$ $y - y_1 = m(x - x_1)$ $m = \frac{y_2 - y_1}{x_2 - x_1}$ $m = \tan\theta$

$$(x - a)^2 + (y - b)^2 = r^2$$

In ΔABC:

$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$ $a^2 = b^2 + c^2 - 2bc.\cos A$ $area\ \Delta ABC = \frac{1}{2} ab.\sin C$

$\sin(\alpha + \beta) = \sin\alpha.\cos\beta + \cos\alpha.\sin\beta$ $\sin(\alpha - \beta) = \sin\alpha.\cos\beta - \cos\alpha.\sin\beta$

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$\cos 2\alpha = \begin{cases} \cos^2\alpha - \sin^2\alpha \\ 1 - 2\sin^2\alpha \\ 2\cos^2\alpha - 1 \end{cases}$ $\sin 2\alpha = 2\sin\alpha.\cos\alpha$

$\bar{x} = \frac{\sum fx}{n}$ $\sigma^2 = \frac{\sum_{i=1}^{n} (x_i - \bar{x})^2}{n}$

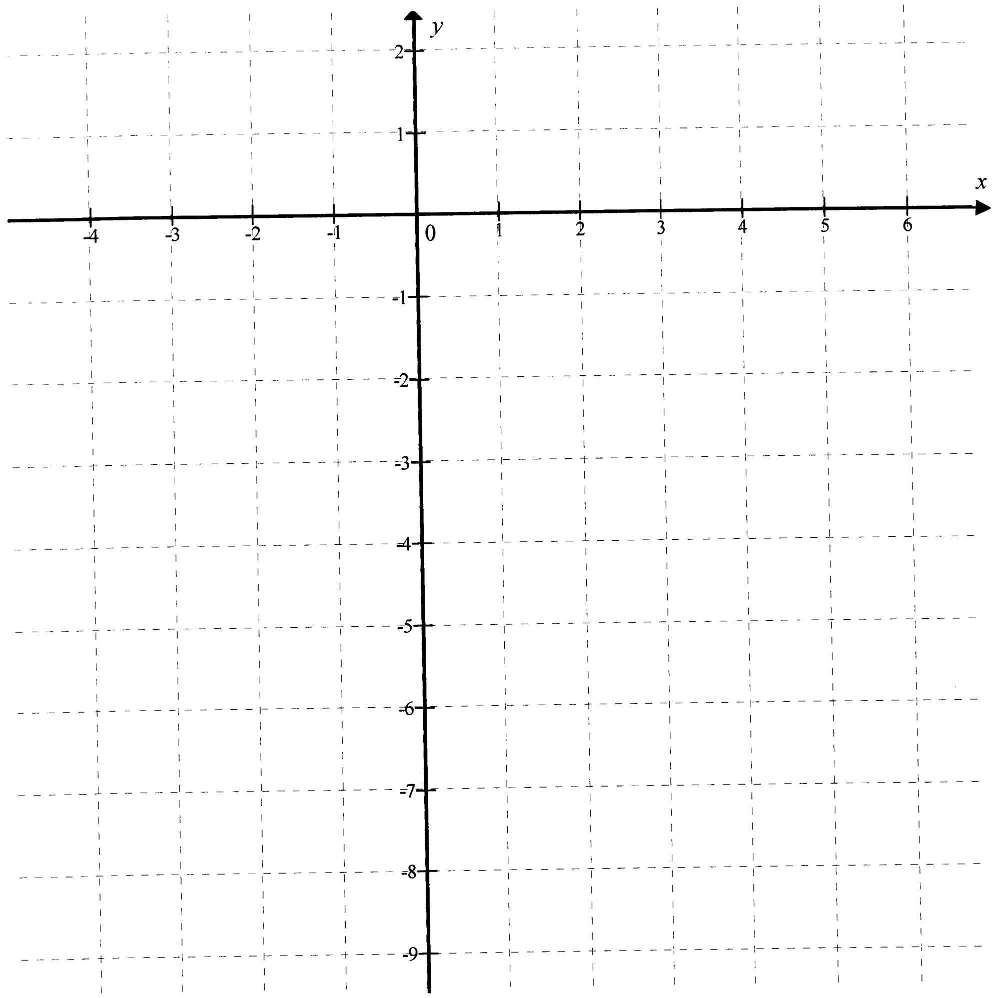
$P(A) = \frac{n(A)}{n(S)}$ $P(A\ of\ B) = P(A) + P(B) - P(A\ en\ B)$

$\hat{y} = a + bx$ $b = \frac{\sum (x - \bar{x})(y - \bar{y})}{\sum (x - \bar{x})^2}$

EKSAMENNOMMER:

DIAGRAMVEL 1

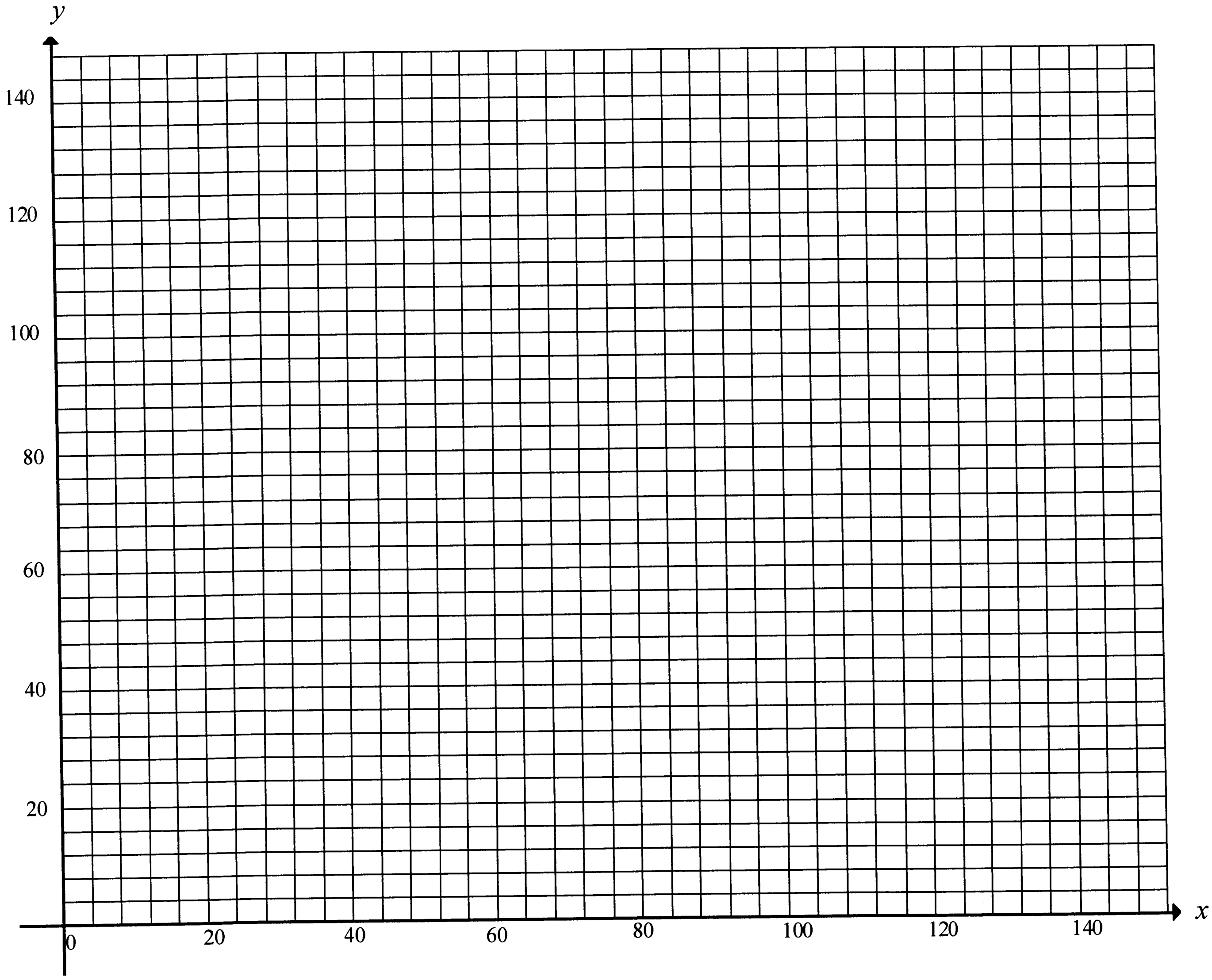
VRAAG 5.1 EN 5.2



EKSAMENNOMMER:

DIAGRAMVEL 2

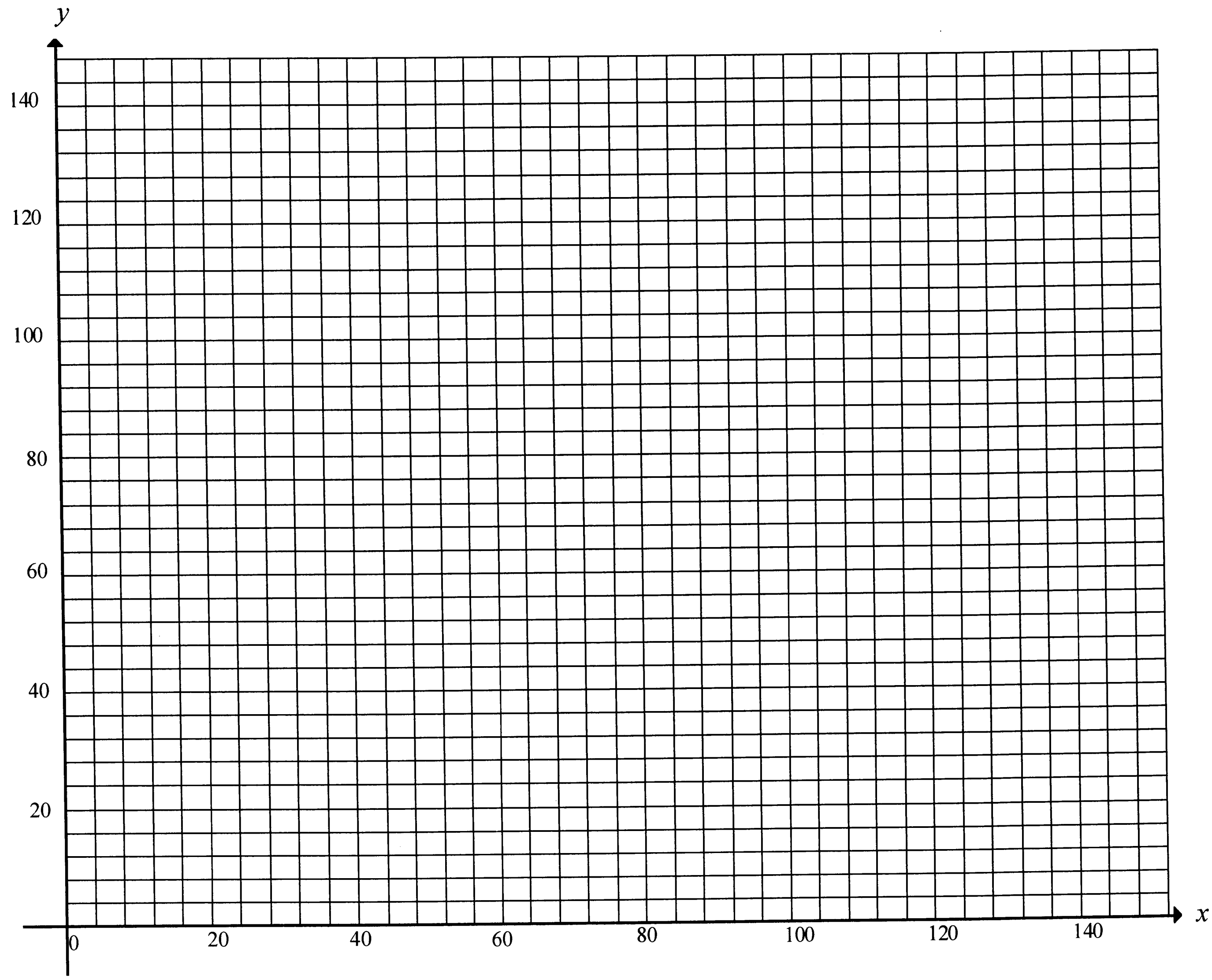
VRAAG 11.2 EN 11.3



EXAMINATION NUMBER:

DIAGRAM SHEET 2

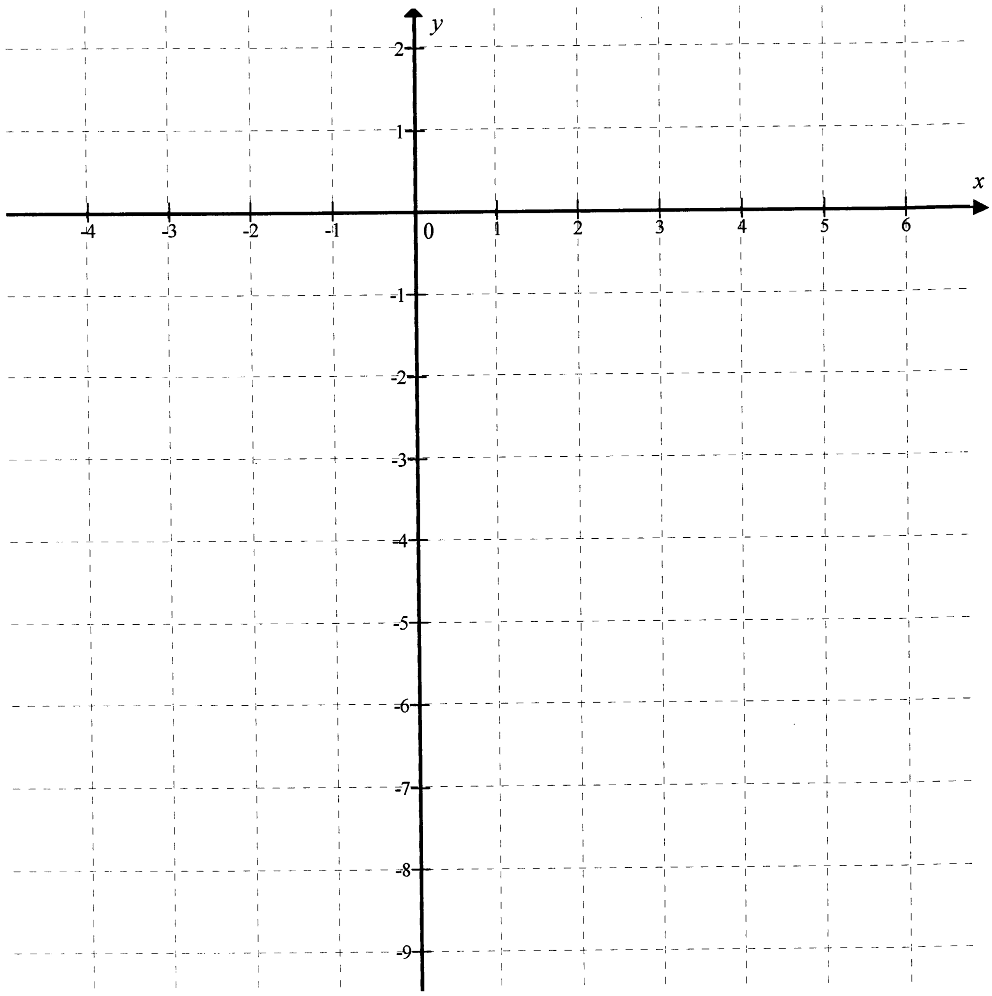
QUESTIONS 11.2 AND 11.3



EXAMINATION NUMBER:

DIAGRAM SHEET 1

QUESTIONS 5.1 AND 5.2



INFORMATION SHEET: MATHEMATICS
INLIGTINGSBLAD: WISKUNDE

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

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$\sum_{i=1}^{n} ar^{i-1} = \frac{a(r^n - 1)}{r - 1}$; $r \neq 1$ $\quad \sum_{i=1}^{\infty} ar^{i-1} = \frac{a}{1-r}$; $-1 < r < 1$

$F = \frac{x\left[(1+i)^n - 1\right]}{i}$ $\quad P = \frac{x[1 - (1+i)^{-n}]}{i}$

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

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ $\quad \mathrm{M}\left(\frac{x_1 + x_2}{2}; \frac{y_1 + y_2}{2}\right)$

$y = mx + c$ $\quad y - y_1 = m(x - x_1)$ $\quad m = \frac{y_2 - y_1}{x_2 - x_1}$ $\quad m = \tan\theta$

$$(x - a)^2 + (y - b)^2 = r^2$$

In ΔABC:

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$\bar{x} = \frac{\sum fx}{n}$ $\quad \sigma^2 = \frac{\sum_{i=1}^{n} (x_i - \bar{x})^2}{n}$

$P(A) = \frac{n(A)}{n(S)}$ $\quad P(A\ or\ B) = P(A) + P(B) - P(A\ and\ B)$

$\hat{y} = a + bx$ $\quad b = \frac{\sum (x - \bar{x})(y - \bar{y})}{\sum (x - \bar{x})^2}$

NORTH WEST

QUESTION 11

Amina owns a small factory that manufactures two types of cellular phones, namely Acuna and Matata cellular phones.

- Each Acuna cellular phone requires 10 manhours to manufacture and each Matata cellular phone requires 8 manhours to manufacture.
- Each Acuna cellular phone requires 3 manhours in the testing department and each Matata cellular phone requires 4 manhours in the testing department.
- The manufacturing department has a maximum of 800 manhours available per week.
- The testing department has a maximum of 360 manhours available per week.
- The factory needs to manufacture at least 60 of the Matata models each week.

Let x represent the number of Acuna cellular phones manufactured in one week.
Let y represent the number of Matata cellular phones manufactured in one week.

11.1 Write down the constraints, in terms of x and y, that represent the above-mentioned information. (3)

11.2 Use the attached graph paper (DIAGRAM SHEET 2) to represent the constraints graphically. (5)

11.3 Clearly indicate the feasible region by shading it. (1)

11.4 If the profit on one Acuna cellular phone is R200 and the profit on one Matata cellular phone is R250, write down an expression that will represent the profit, P, on the cellular phones. (1)

11.5 Using a search line and your graph, determine the number of Acuna and Matata cellular phones that will give a maximum profit, assuming they are all sold out. Draw a search line on your graph. (3)

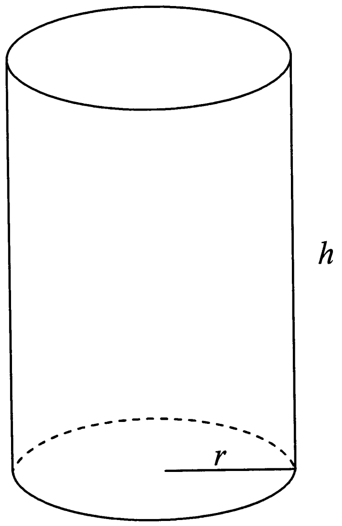
11.6 If the profit function for the factory was $P = 180x + 240y$, would there be any difference in the optimal solution? Give a reason for your answer. (3)

[16]

TOTAL: 150

QUESTION 10

A drinking glass, in the shape of a cylinder, must hold 200 mℓ of liquid when full.



10.1 Show that the height of the glass, h, can be expressed as $h = \frac{200}{\pi r^2}$. (2)

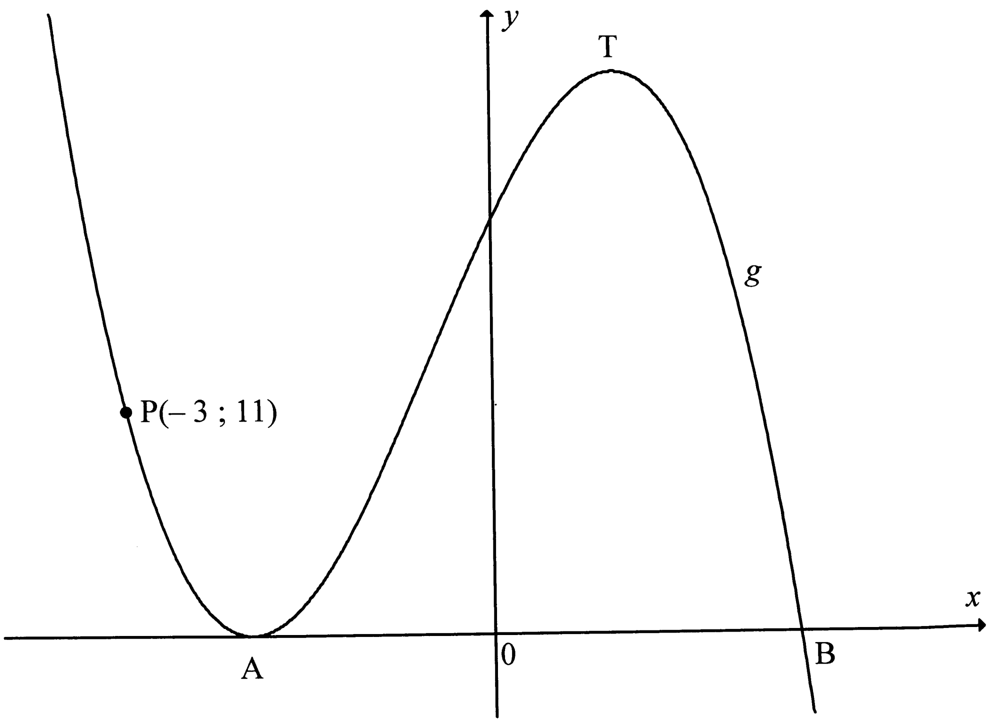
10.2 Show that the total surface area of the glass can be expressed as $S(r) = \pi r^2 + \frac{400}{r}$. (2)

10.3 Hence determine the value of r for which the total surface area of the glass is a minimum. (5)

[9]

QUESTION 9

Sketched below is the graph of $g(x) = -2x^3 - 3x^2 + 12x + 20 = -(2x-5)(x+2)^2$
A and T are turning points of g. A and B are the x-intercepts of g.
P(– 3 ; 11) is a point on the graph.



9.1 Determine the length of AB. (2)

9.2 Determine the x-coordinate of T. (4)

9.3 Determine the equation of the tangent to g at P(– 3 ; 11), in the form $y = \ldots$ (5)

9.4 Determine the value(s) of k for which $-2x^3 - 3x^2 + 12x + 20 = k$ has three distinct roots. (3)

9.5 Determine the x-coordinate of the point of inflection. (4)
[18]

QUESTION 7

7.1 R1 570 is invested at 12% p.a. compound interest. After how many years will the investment be worth R23 000? (4)

7.2 A farmer has just bought a new tractor for R800 000. He has decided to replace the tractor in 5 years' time, when its trade-in value will be R200 000. The replacement cost of the tractor is expected to increase by 8% per annum.

7.2.1 The farmer wants to replace his present tractor with a new one in 5 years' time. The farmer wants to pay cash for the new tractor, after trading in his present tractor for R200 000. How much will he need to pay? (3)

7.2.2

- One month after purchasing his present tractor, the farmer deposited x rands into an account that pays interest at a rate of 12% p.a., compounded monthly.
- He continued to deposit the same amount at the end of each month for a total of 60 months.
- At the end of 60 months he has exactly the amount that is needed to purchase a new tractor, after he trades in his present tractor.

Calculate the value of x. (6)

7.2.3 Suppose that 12 months after the purchase of the present tractor and every 12 months thereafter, he withdraws R5 000 from his account, to pay for maintenance of the tractor. If he makes 5 such withdrawals, what will the new monthly deposit be? (4)
[17]

QUESTION 8

8.1 Determine $f'(x)$ from first principles if $f(x) = -3x^2$. (5)

8.2 Determine, using the rules of differentiation:

$$\frac{dy}{dx} \text{ if } y = \frac{\sqrt{x}}{2} - \frac{1}{6x^3}$$

Show ALL calculations. (3)
[8]

QUESTION 5

Given: $h(x) = 4^x$ and $f(x) = 2(x-1)^2 - 8$.

5.1 Sketch the graphs of h and f on the diagram sheet provided. Indicate ALL intercepts with the axes and any turning points. (8)

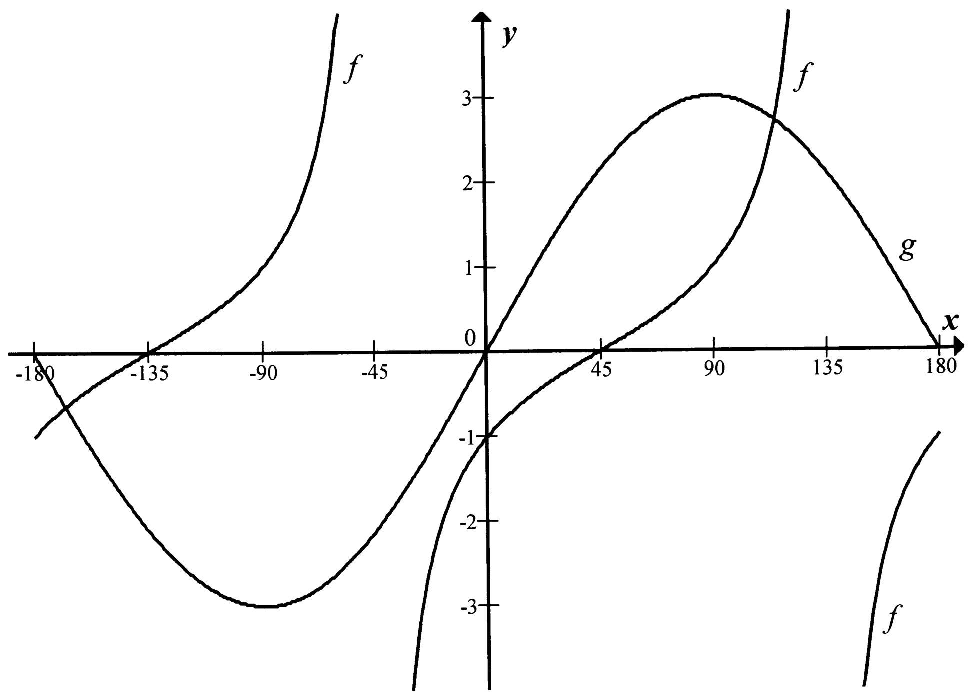
5.2 Without any further calculations, sketch the graph of $y = \log_4 x = g(x)$ on the same system of axes. (2)

5.3 The graph of f is shifted 2 units to the LEFT. Write down the equation of the new graph. (2)

5.4 Show, algebraically, that $h\left(x + \frac{1}{2}\right) = 2h(x)$. (3)
[15]

QUESTION 6

Sketched below are the graphs of the functions $f(x) = \tan(x - 45°)$ and $g(x) = 3\sin x$ for $x \in [-180° ; 180°]$.



6.1 Write down the equations of the asymptotes of $y = f(x)$ for $x \in [-90° ; 180°]$. (2)

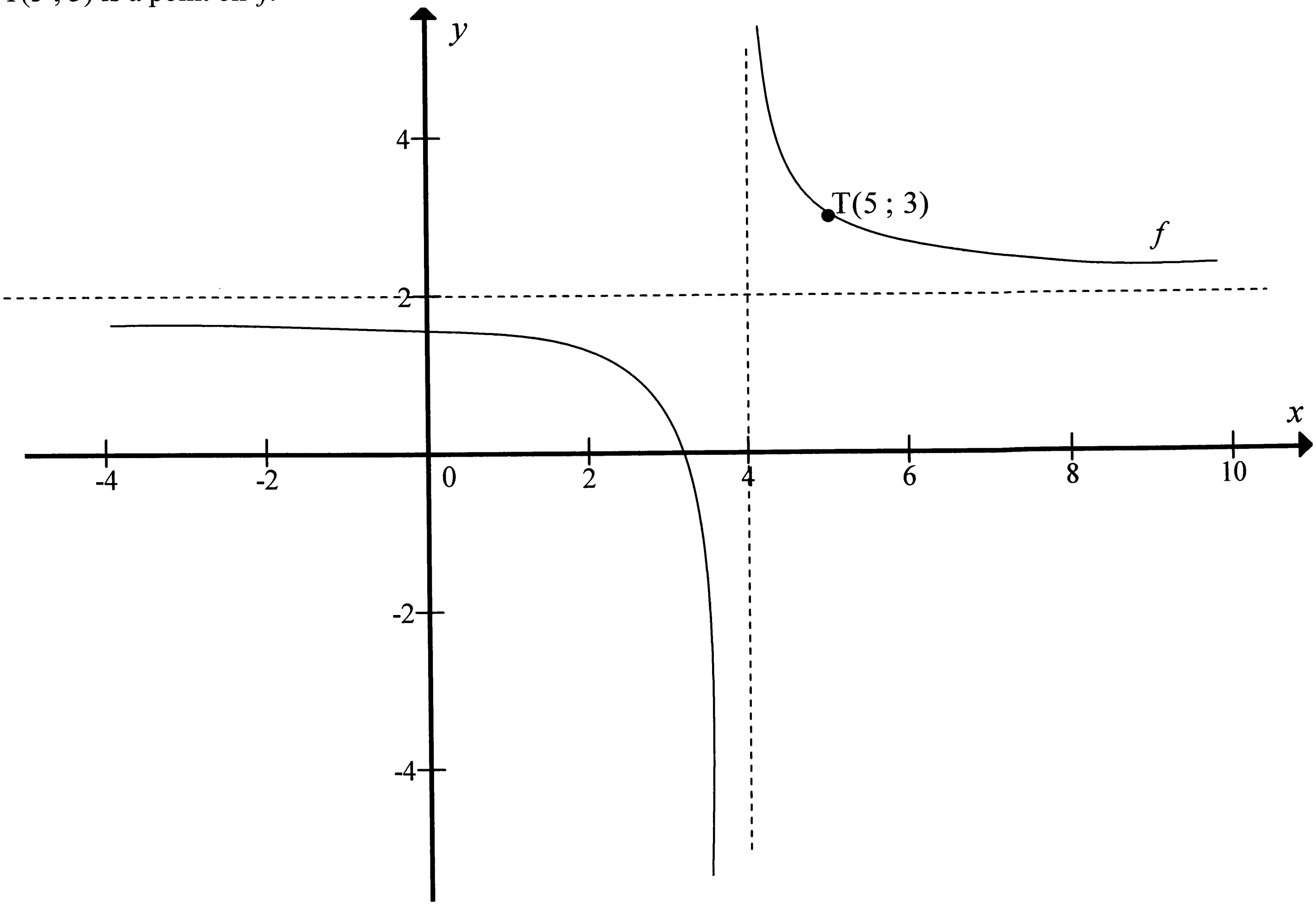
6.2 Describe the transformation of the graph of f to h if $h(x) = \tan(45° - x)$. (2)

6.3 The period of g is reduced to 180° and the amplitude and y-intercept remain the same. Write down the equation of the resulting function. (2)
[6]

QUESTION 4

The diagram below represents the graph of $f(x) = \dfrac{a}{x - p} + q$.

T(5 ; 3) is a point on f.



4.1 Determine the values of a, p and q. (4)

4.2 If the graph of f is reflected across the line having equation $y = -x + c$, the new graph coincides with the graph of $y = f(x)$. Determine the value of c. (3)

[7]

QUESTION 2

2.1 Consider the sequence: $\frac{1}{2};4;\frac{1}{4};7;\frac{1}{8};10;...$

2.1.1 If the pattern continues in the same way, write down the next TWO terms in the sequence. (2)

2.1.2 Calculate the sum of the first 50 terms of the sequence. (7)

2.2 Consider the sequence: 8 ; 18 ; 30 ; 44 ; …

2.2.1 Write down the next TWO terms of the sequence, if the pattern continues in the same way. (2)

2.2.2 Calculate the n^{th} term of the sequence. (6)

2.2.3 Which term of the sequence is 330? (4)
[21]

QUESTION 3

Given the geometric series: $8x^2+4x^3+2x^4+...$

3.1 Determine the n^{th} term of the series. (1)

3.2 For what value(s) of x will the series converge? (3)

3.3 Calculate the sum of the series to infinity if $x=\frac{3}{2}$. (3)
[7]

QUESTION 1

1.1 Solve for x, rounded off to TWO decimal places where necessary:

1.1.1 $x^2 = 5x - 4$ (3)

1.1.2 $x(3 - x) = -3$ (5)

1.1.3 $3 - x < 2x^2$ (5)

1.2 Determine the values of x and y if they satisfy both the following equations simultaneously:

$2x + y = 3$
$x^2 + y + x = y^2$ (8)

1.3 Given $x = 999\ 999\ 999\ 999$, determine the exact value of $\frac{x^2 - 4}{x - 2}$.
Show ALL your calculations. (3)

1.4 Explain why the equation $\frac{x^4 + 1}{x^4} = \frac{1}{2}$ has no real roots. (2)
[26]

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of 11 questions. Answer ALL the questions.

2. Clearly show ALL calculations, diagrams, graphs, et cetera that you have used in determining your answers.

3. An approved scientific calculator (non-programmable and non-graphical) may be used, unless stated otherwise.

4. If necessary, answers should be rounded off to TWO decimal places, unless stated otherwise.

5. Diagrams are NOT necessarily drawn to scale.

6. TWO diagram sheets for answering QUESTION 5.1, QUESTION 5.2, QUESTION 11.2 and QUESTION 11.3 are included at the end of this question paper. Write your examination number on these sheets in the spaces provided and hand them in together with your ANSWER BOOK.

7. Number the answers correctly according to the numbering system used in this question paper.

8. It is in your own interest to write legibly and to present the work neatly.

education

Department:
Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

MATHEMATICS P1

NOVEMBER 2008

MARKS: 150

TIME: 3 hours

This question paper consists of 10 pages, an information sheet and 2 diagram sheets.

NORTH WEST

NATIONAL SENIOR CERTIFICATE EXAMINATION
NASIONALE SENIORSERTIFIKAAT-EKSAMEN

NOVEMBER 2008

MATHEMATICS / WISKUNDE
FIRST PAPER / EERSTE VRAESTEL

SUBJECT CODE / VAKKODE	:	**MATH**
TIME / TYD	:	**3 HOURS / UUR**
MARKS / PUNTE	:	**150**