DEPARTMENT OF EDUCATION

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PROVINSIALE EKSAMEN

PROVINCIAL EXAMINATION

GRAAD 12/GRADE 12

WISKUNDE/MATHEMATICS

VRAESTEL 1/PAPER 1

JUNIE/JUNE 2025

PUNTE/MARKS: 150

TYD/TIME: 3 uur/hours

Hierdie vraestel bestaan uit 11 bladsye, 1 inligtingsblad en 'n antwoordeboek van 19 bladsye./
This question paper consists of 11 pages, 1 information sheet and an answer book of 19 pages.

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of 11 questions.
2. Answer ALL the questions.
3. Number the answers correctly according to the numbering system used in this question paper.
4. Clearly show ALL calculations, diagrams, graphs, etc. that you have used in determining your answers.
5. Answers only will NOT necessarily be awarded full marks.
6. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.
7. If necessary, round off answers to TWO decimal places, unless stated otherwise.
8. Diagrams are NOT necessarily drawn to scale.
9. An information sheet with formulae is included at the end of this question paper.
10. Write neatly and legibly.

QUESTION 1

1.1 Solve for x:

1.1.1 $3x(2x+1)=0$ (2)

1.1.2 $5x^2+3x-1=0$ (correct to TWO decimal places) (3)

1.1.3 $2x^2+6x-8\geq 0$ (3)

1.1.4 $\sqrt{3x+13}=x+1$ (4)

1.1.5 $3^{2x+2}+8.3^x-1=0$ (4)

1.2 Solve for x and y simultaneously:

$x-2y-3=0$ and $x^2-3xy+y^2=11$ (6)

1.3 Given: $f(x)=x^2-5x+c$

Determine the value of $\boldsymbol{c}$ if the solution for $f(x)=0$ is $\dfrac{(5 \pm \sqrt{41})}{2}$. (3)

[25]

QUESTION 2

2.1 Consider the following quadratic pattern: x ; 17 ; y ; 57 ; 86.

Determine the values of x and y. (5)

2.2 An athlete trains by running 600 m on the first day. Thereafter, she increases the distance by 300 m every day. (This is a theoretic scenario.)

2.2.1 Calculate the distance she runs on the 15^{th} day. (3)

2.2.2 What is the total distance, in km, that she has run at the end of the 15^{th} day? (3)

2.2.3 In order to participate in the Comrades Marathon in 6 months (180 days), she must complete a qualifying race of 42 km. If she continues her pattern of training, will she have sufficient time to train for the 42 km qualifier and thus be able to participate in the Comrades? Show ALL calculations. (3)

2.3 Use an appropriate formula to calculate:

$$\sum_{n=1}^{21}(101-5n)$$ (3)

2.4 Given: A convergent geometric series with first term $T_1 = a$ and $S_\infty = p$ where $p > 0$.

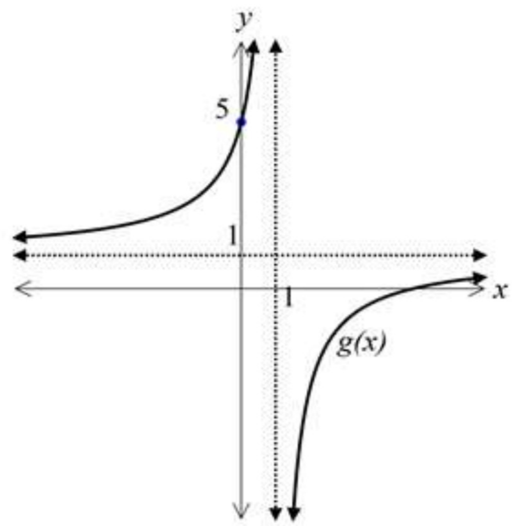
2.4.1 Show that $a \in (0\ ;\ 2p)$. (5)

2.4.2 Determine the value of the constant ratio if $a = \frac{p}{4}$. (3)

[25]

QUESTION 3

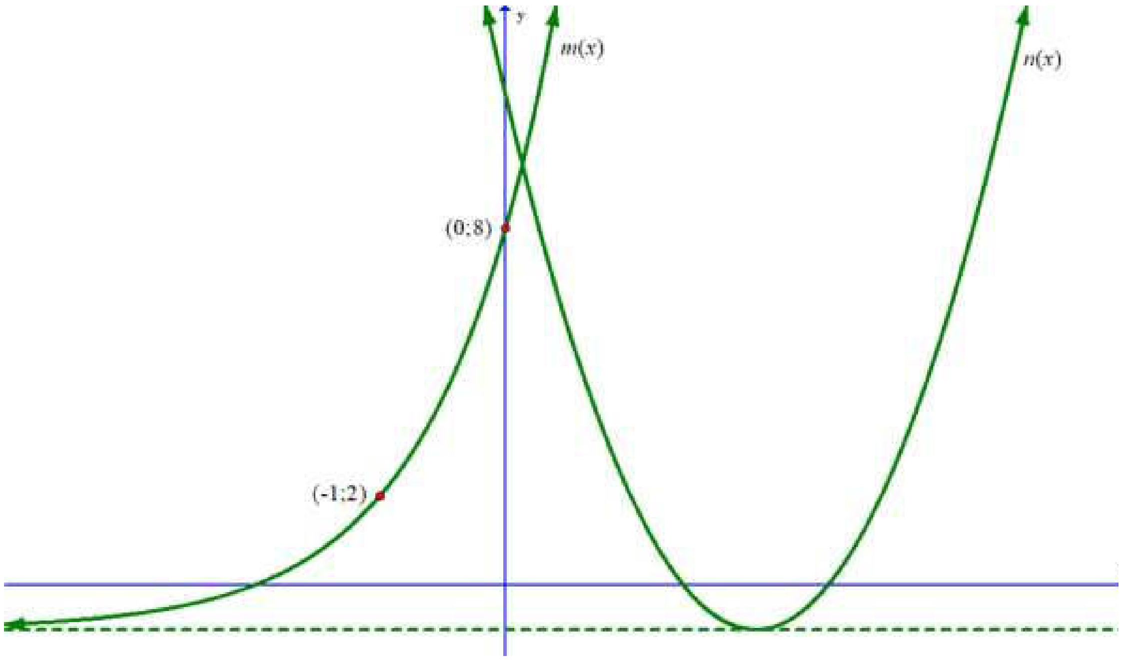
In the diagram, the hyperbola of $g(x)=\dfrac{-4}{x+r}+t$ is drawn.
The asymptotes of g cut both the x- and y-axes at 1. The y-intercept of g is 5.



3.1	Is $g(x)$ an increasing or decreasing function?	(1)
3.2	Write down the values of r and t.	(2)
3.3	Write down the range of $g(x)$.	(2)
3.4	Write down the equation of the axis of symmetry with a negative gradient.	(2)
3.5	Determine the value(s) of x for which:	
	3.5.1 $g(x)\geq 5$	(2)
	3.5.2 $g(x)<0$	(3)
3.6	Write down the equation of the vertical asymptote of $g(x+4)$.	(1)
		[13]

QUESTION 4

Drawn below are the functions $m(x) = a.b^{x+2} + q$ and $n(x) = 3x^2 - 12x + 11$.
$(0\ ;\ 8)$ and $(-1\ ;\ 2)$ are on $m(x)$.



4.1 Calculate the x-coordinate of the turning point of $n(x)$. Show ALL calculations. (2)

4.2 If the graph of $p(x)$ is obtained by reflecting graph $n(x)$ over the y-axis, determine the equation of $p(x)$. (2)

4.3 The turning point of $n(x)$ is given as $(2\ ;\ -1)$. Determine the equation of $m(x)$. (7)

4.4 For which value(s) of x will $x.n(x) < 0$? (4)

[15]

QUESTION 5

Consider the graph of $g(x) = 4^{-x}$.

5.1 Give the equation of $g^{-1}(x)$ in the form $y = ...$ (2)

5.2 Sketch the graphs of g and g^{-1} on the same set of axes, showing the intercepts with the axes, another coordinate and asymptotes. Clearly label the graphs g and g^{-1}. (4)

5.3 Write down the domain of $g^{-1}(x)$. (1)

5.4 Use the graphs to solve for x: $\dfrac{g^{-1}(x)}{g(x)} \leq 0$. (2)

[9]

QUESTION 6

6.1 Determine $f'(x)$ from first principles if $f(x)=1-3x^2$. (5)

6.2 Determine the derivative of the following, using the differentiation rules:

6.2.1 $f(x)=3x^3-\frac{7}{2x^2}+4$ (2)

6.2.2 $f(x)=\left(2\sqrt{x}-\frac{1}{x}\right)^2$ (4)

6.3 The line $g(x)=3x+2$ is a tangent to the curve of a function f at the point where $x=3$. Calculate the value of $f(3)+f'(3)$. (3)

[14]

QUESTION 7

Given: $f(x)=x^3-x^2-8x+12$.

7.1 Determine the x-intercept(s) of the function f. (4)

7.2 Calculate the coordinates of the stationary (turning) points of f. (5)

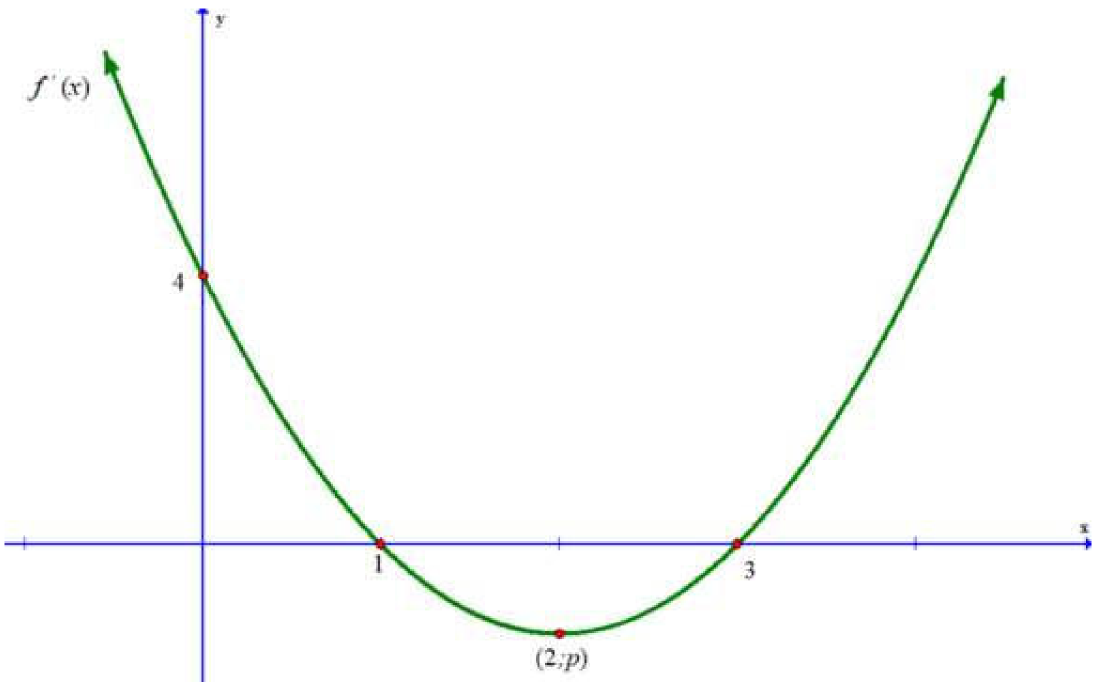
7.3 Draw a neat sketch of the given function, showing all intercepts and stationary points. (3)

7.4 For which value(s) of x will the given function be concave down? (2)

[14]

QUESTION 8

The parabola in the figure below represents the curve of $f'(x)$. The parabola is the derivative of the cubic function $f(x) = ax^3 + bx^2 + cx + d$.
The y-intercept of $f'(x)$ is 4. The x-intercepts of $f'(x)$ are 1 and 3. The turning point of $f'(x)$ is at $(2\ ;p)$.



8.1	Write down the gradient of the tangent to $f(x)$ at the point where $x = 0$.	(1)
8.2	Write down the x-coordinates of the turning points of the curve of $f(x)$.	(2)
8.3	For which value(s) of x is $f(x)$ decreasing?	(2)
		[5]

QUESTION 9

9.1 A credit card company charges 12% interest rate per year, compounded every 6 months. What annual effective interest rate does the company charge? (3)

9.2 A motor car costing R250 000 depreciated at a rate of 9,5% per annum on the reducing-balance method. Calculate the book value of the vehicle after 7 years. (3)

9.3 Jason invested R28 000 in a savings account which pays interest at a rate of 7,5% p.a., compounded monthly. After 15 months, Jason needed money to pay for his textbooks at university and he withdrew R5 500. Two years after the first deposit had been made, he deposited a further R12 000 into the same account. Calculate the amount of money in the account after 4 years. (5)

9.4 Determine the interest rate per annum, compounded quarterly, for R240 000 to grow to R374 522,21 over 5 years. (4)

[15]

QUESTION 10

10.1 The probability that all the players of the Springbok team will be fit to play, is 70%. The probability that they will win a game if all the players are fit, is 90%. When they are not fit, the probability of them winning, becomes 45%.
Draw a tree diagram to illustrate the above-mentioned. Hence, calculate the probability of them not winning their next game. (6)

10.2 The data below shows information obtained from a talent search program.

	Qualified	Did not qualify	TOTAL
Male	42	4 983	5 025
Female	37	5 163	5 200
TOTAL	79	10 146	10 225

10.2.1 Determine the probability that a person selected at random is a male who did not qualify. (1)

10.2.2 Is being female and qualifying independent of one another? Use calculations to support your answer. Round off to THREE decimal places. (3)

[10]

QUESTION 11

11.1 *R* and *Q* are two events in a sample space where $P(R) = 0{,}4$, $P(R \text{ or } Q) = 0{,}9$ and $P(Q) = y$. Determine the value of y if *R* and *Q* are mutually exclusive. (2)

11.2 *E* and *F* are two independent events. $P(E) = x$ and $P(F) = y$. $P(E \text{ and } F) = \frac{1}{3}$ and $P(E \text{ or } F) = \frac{9}{10}$. Show that $30y^2 + 10 = 37y$. (3)

[5]

TOTAL: 150

INFORMATION SHEET

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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