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DEPARTEMENT VAN ONDERWYS
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**PROVINSIALE VOORBEREIDENDE EKSAMEN/
PROVINCIAL PREPARATORY EXAMINATION**

GRAAD/GRADE 12

WISKUNDE/MATHEMATICS

VRAESTEL/PAPER 1

SEPTEMBER 2025

PUNTE/MARKS: 150

TYD/TIME: 3 uur/hours

**Hierdie vraestel bestaan uit 9 bladsye, 1 inligtingsblad
en 'n 23 bladsy- SPESIALE ANTWOORDEBOEK./
This question paper consists of 9 pages, 1 information sheet
and a 23-page SPECIAL ANSWER BOOK.**

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 in the SPECIAL ANSWER BOOK provided.
3. Clearly show ALL calculations, diagrams, graphs, etc. which you have used in determining your answers.
4. Answers only will NOT necessarily be awarded full marks.
5. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.
6. If necessary, round off answers correct to TWO decimal places, unless stated otherwise.
7. Diagrams are NOT necessarily drawn to scale.
8. An information sheet with formulae is included at the end of the question paper.
9. Write neatly and legibly.

QUESTION 1

1.1 Solve for x :

1.1.1 $x + x^2 = 0$ (2)

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

1.1.3 $2x^2 - 7 \leq 5x$ (4)

1.1.4 $3^{2x} - 9 = 24.3^x + 72$ (4)

1.1.5 $\sqrt{x^2 + 14} = 3\sqrt{x}$ (4)

1.2 Solve for x and y simultaneously:

$5x - y = 4$ and $x^2 - x + y^2 = 4 - 3y$ (5)

1.3 Determine, without using a calculator, the value of k in:

$4^{24} + 8^{16} + 16^{12} + 64^8 = 2^k$ (3)
[25]

QUESTION 2

2.1 Consider the arithmetic sequence: $15 ; 13 ; 11 ; 9 ; \dots ; -121$

2.1.1 Calculate the number of terms in the sequence. (3)

2.1.2 Hence, calculate the value of the following series:

$$7 + 15 + 7 + 13 + 7 + 11 + 7 + 9 + 7 \dots + 7 - 121 \quad (4)$$

2.2 Consider the following sequence of numbers illustrated by the columns and rows below.

2							Row 1
4	6						Row 2
8	10	12					Row 3
14	16	18	20				Row 4
22	24	26	28	30			Row 5
32	34	36	38	40	42		Row 6

2.2.1 The first term of Row n is given by $T_n = an^2 + bn + c$.

Determine the values of a , b and c . (3)

2.2.2 Hence, calculate the first term of Row 21. (2)

2.2.3 Calculate the 10th term of Row 21. (2)

[14]

QUESTION 3

3.1 Consider the geometric series: $729 + 243 + 81 + \dots$

3.1.1 Calculate T_9 . (3)

3.1.2 It is given that:

$$729 + 243 + 81 + \dots + T_m = 1093\frac{1}{3}$$

Calculate m . (3)

3.2 Consider the following infinite geometric series: $1 + r + r^2 + r^3 + \dots$

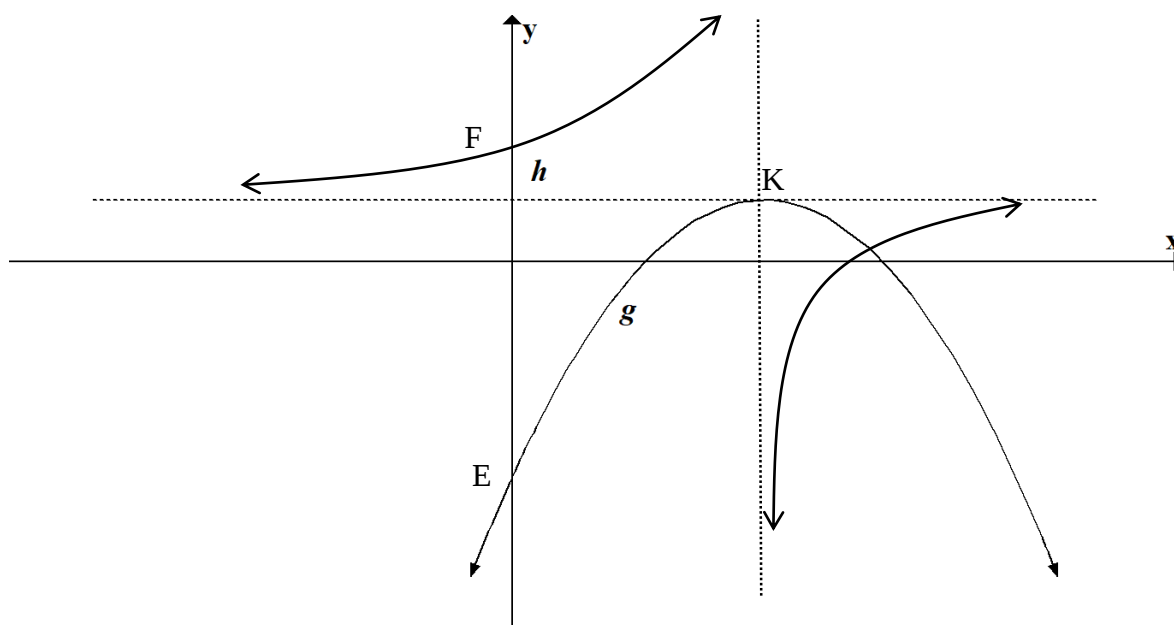
The second and each consecutive term that follows, is twice the sum of all the terms in the series following that term. Determine the value of the 2nd and 3rd terms of the series.

(5)
[11]

QUESTION 4

Sketched below are the graphs of $g(x) = ax^2 + bx - 7$ and $h(x) = -\frac{2}{x-3} + 2$.

E and F are the y-intercepts of g and h respectively. The turning point K is also the point of intersection of the two asymptotes of h .



- 4.1 Write down the coordinates of K. (2)
- 4.2 Calculate the length of EF. (4)
- 4.3 Determine the values of a and b in $g(x) = ax^2 + bx - 7$. (4)
- 4.4 Write down the range of $h(x) + 3$. (2)
- 4.5 For which values of p will $g(x) = p$ have TWO unequal positive roots? (2)
- 4.6 Determine the equation of the line of symmetry of h , $m < 0$, in the form $y = mx + c$. (3)
- 4.7 Describe the transformation from graph g to the graph of t , where $t(x) = (x - 3)^2$. (2)
- 4.8 It is given that $g(x) = f'(x)$.

Determine the x -value(s) where the gradient of a tangent to f is equal to 1. (3)

[22]

QUESTION 5

Given the graph: $f(x) = \left(\frac{1}{3}\right)^x$

- 5.1 Determine the equation of g , which is the reflection of f about the line $y = x$, in the form $y = \dots$ (2)
- 5.2 Sketch the graphs of f and g on the same system of axes. Clearly show the intercepts with the axes. (4)
- 5.3 For which values of x is $g(x) > -1$? (3)
- 5.4 Describe the transformation of f to form graph h , where $h(x) = 27 \cdot \left(\frac{1}{3}\right)^x$. (2)

[11]**QUESTION 6**

- 6.1 Thabo deposits R3 550 into a savings account which pays interest at a rate of 8% p.a., compounded half-yearly.
- Calculate the:
- 6.1.1 Effective interest rate he receives on his savings (3)
- 6.1.2 Final amount in his account after a period of 5 years (2)
- 6.2 A vehicle was bought for R185 000. Over a period of n years the value of the vehicle depreciated, according to a reducing-balance method, at a rate of 19% p.a., to a value of R48 896. Calculate n . (3)
- 6.3 Thembi was granted a loan of R35 000 at an interest rate of 18% p.a., compounded monthly. He agreed to repay the loan over 4 years.
- 6.3.1 Calculate the monthly instalment to repay the loan. (3)
- 6.3.2 Thembi was unable to pay the 21st and 22nd instalments. If he resumes payment at the end of the 23rd month, what will the outstanding balance be? (5)

[16]

QUESTION 7

7.1 Given: $f(x) = -\frac{2}{x}$

Determine $f'(x)$ from first principles. (5)

7.2 Determine:

7.2.1 $D_x [3x^2 - 7x + 4]$ (2)

7.2.2 $\frac{dk}{dx}$, if $y = \frac{3}{x^3}$ and $k = y - \frac{1}{y}$ (4)

[11]

QUESTION 8

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

8.1 Determine the value(s) of x for which $f(x) = 0$ (3)

8.2 Calculate the coordinates of the turning points of f . (5)

8.3 Sketch the graph of f . Clearly show all turning points and intercepts with the axes. (3)

8.4 Determine for which values of x is:

8.4.1 $f'(x) < 0$ (2)

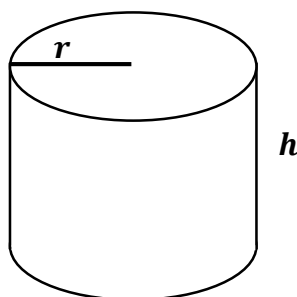
8.4.2 the graph of f concave down (4)

8.5 A tangent is drawn to the graph of g , where $g(x) = f(x-2)$. Calculate the gradient of the tangent at $x = 0$. (3)

[20]

QUESTION 9

A cylinder with radius r and height h is given. The dimensions of the cylinder are such that the sum of the diameter and the height is equal to 24 units.



Calculate the length of the radius such that the volume of the cylinder is a maximum. [6]

QUESTION 10

Sharon and Denice are retired teachers. Some days they forget to drink their medication. The probability that neither Sharon nor Denice will forget to take their medication, is 0,6.

- 10.1 Calculate the probability that at least one of them will forget to take their medication. (1)
- 10.2 The probability that Sharon forgets to take medication at any randomly selected day is 0,24. The probability that both of them will forget to take their medication, is 0,14. Calculate the probability that Denice will forget to take medication on that day. (3)
- 10.3 Determine whether the event of Sharon forgetting to take medication and the event of Denice forgetting to take medication are independent. (3)
- [7]

QUESTION 11

The digits 0, 1, 2, 3, 4, 5 and 8 are used to make 3-digit codes.

- 11.1 Determine how many unique codes are possible if the:
- 11.1.1 digits can be repeated (1)
- 11.1.2 digits cannot be repeated (2)
- 11.2 In the case where digits may be repeated, what is the probability that the codes are numbers that are greater than 400 and exactly divisible by 5? (4)
- [7]

TOTAL: 150

INFORMATION SHEET

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

$$A = P(1 + ni)$$

$$A = P(1 - ni)$$

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

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

$$T_n = a + (n - 1)d$$

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

$$T_n = ar^{n-1}$$

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

$$S_\infty = \frac{a}{1 - r} ; -1 < r < 1$$

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

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

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

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

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

$$y = mx + c$$

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

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

$$m = \tan \theta$$

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

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

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

$$\text{area } \triangle ABC = \frac{1}{2}ab \cdot \sin C$$

$$\sin(\alpha + \beta) = \sin \alpha \cdot \cos \beta + \cos \alpha \cdot \sin \beta$$

$$\sin(\alpha - \beta) = \sin \alpha \cdot \cos \beta - \cos \alpha \cdot \sin \beta$$

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

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

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

$$\sin 2\alpha = 2 \sin \alpha \cdot \cos \alpha$$

$$\bar{x} = \frac{\sum_{i=1}^n x_i}{n}$$

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

$$P(A) = \frac{n(A)}{n(S)}$$

$$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$

$$\hat{y} = a + bx$$

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