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TOTAL MARKS

NATIONAL SENIOR CERTIFICATE EXAMINATION
MAY 2025

MATHEMATICS: PAPER I

EXAMINATION NUMBER

Time: 3 hours 150 marks

READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. This question paper consists of 20 pages and an Information Sheet of 2 pages (i–ii). Please check that your paper is complete.
2. Read the questions carefully.
3. **Answer ALL the questions on the question paper and hand it in at the end of the examination. Remember to write your examination number in the space provided on the question paper.**
4. Diagrams are not necessarily drawn to scale.
5. You may use an approved non-programmable and non-graphical calculator, unless otherwise stated.
6. Ensure that your calculator is in **DEGREE** mode.
7. Clearly show **ALL** calculations, diagrams, graphs etc. that you have used in determining your answers. **Answers only will NOT necessarily be awarded full marks.**
8. Round off to **TWO decimal places** unless otherwise stated.
9. It is in your own interest to write legibly and set your work out neatly.
10. One blank page (page 20) is included at the end of the question paper. Use this page if you run out of space for a question. Clearly indicate the number of the question you are answering should you use this additional space.

FOR OFFICE USE ONLY: MARKER TO ENTER MARKS

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	TOTAL
16	16	14	6	7	15	16	10	14	8	9	10	9	/150

N12MATH-1-E

SECTION A

QUESTION 1

(a) In an arithmetic sequence the first term is 34 and the second term is 25.

Determine:

(1) the value of the 16^{th} term.

(3)

(2) the sum of the first 128 terms.

(2)

(b) Consider $\sum_{n=0}^{1} p^{3n} = 1001$.

Determine the value of p.

(3)

(c) Given the quadratic sequence: –13 ; 0 ; 11 ; …

(1) Determine the next two terms of the sequence.

(2)

(2) Determine the n^{th} term of the sequence.

(4)

(3) Which term has the maximum value?

(2)
[16]

QUESTION 2

(a) Given $p(x) = 5x^2$.

Using first principles, determine $p'(x)$.

(5)

(b) Determine each of the following:

(1) $\frac{dy}{dx}$, if $y = \sqrt{x} + \frac{1}{x^3} + 1$

(4)

(2) $D_x\left(\frac{x^2 - 25}{x - 5}\right)$

(3)

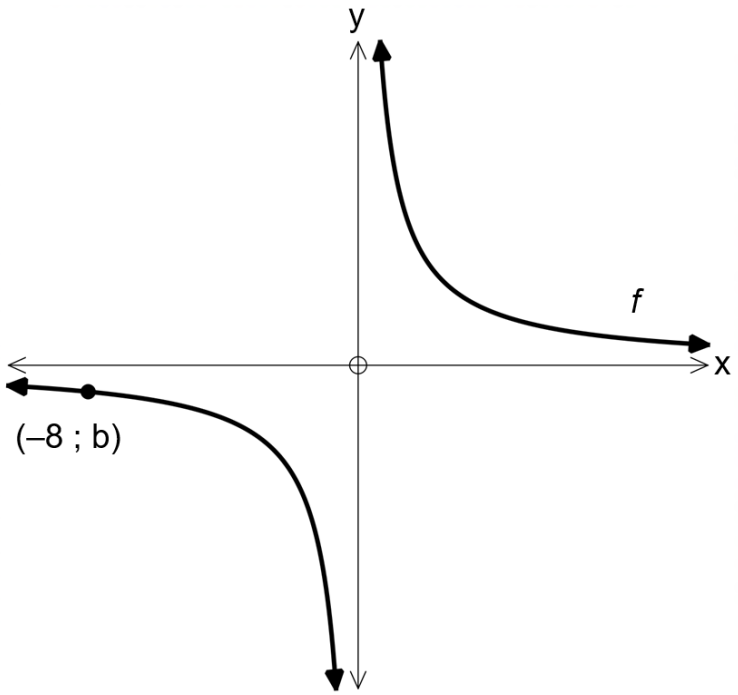
(c) Consider $k(x) = x^3 + 6x^2 - 7$.

For which values of x will the graph of k be concave up?

(4)
[16]

QUESTION 3

In the diagram $f(x) = \frac{8}{x}$ has been drawn and the coordinates (–8 ; b) has been shown.



(a) Determine the value of b.

(1)

(b) Determine the domain of f.

(1)

(c) Give the equations of the axes of symmetry of f.

(2)

(d) For which values of x will $f(x) \geq 0$?

(1)

(e) Write down the equation of the new graph in the form y = …. when:

(1) f is reflected in the *y*-axis.

(1)

(2) f is shifted 10 units down.

(1)

(3) f is reflected in the y = x line.

(2)

(f) Now consider $g(x) = 4$.

(1) Sketch the graph of g alongside f on the given diagram before Question 3 (a), indicating all intercepts with axes.

(2)

(2) Determine the coordinates where f and g intersect.

(3)
[14]

QUESTION 4

Mr Kunene is granted a loan under the following conditions:

- The interest rate is 9,57% per annum compounded monthly.
- The value of the loan is R120 000.
- The period of the loan is 5 years.

(a) How much will Mr Kunene pay each month if the monthly payments start in one month's time?

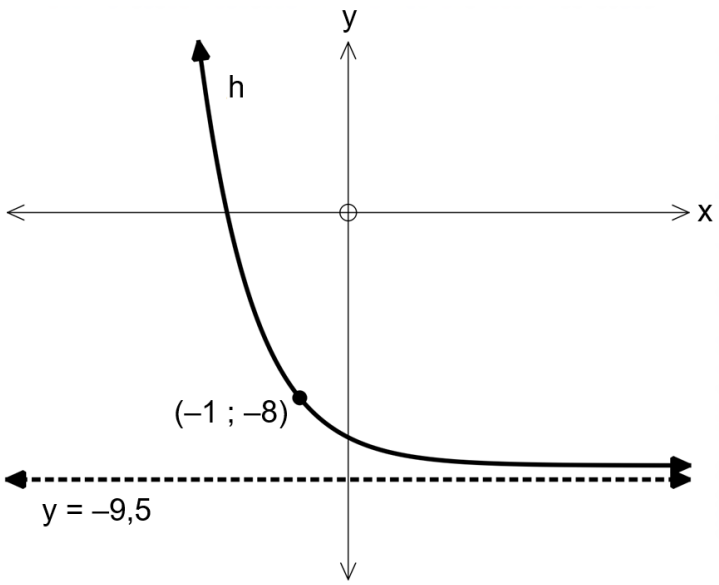
(3)

(b) Determine the effective annual interest rate.

(3)
[6]

QUESTION 5

In the diagram below, the graph of $h(x) = a^x + b$ is given.
The point (–1 ; –8) lies on h and y = –9,5 is an asymptote of h.



(a) Determine the range of h.

(1)

(b) Find the value of a.

(3)

(c) Determine the coordinates of the x intercept of h.

(3)
[7]

QUESTION 6

(a) For a certain sample set, the following results were measured regarding events S and T:

- P(S) = 0,7
- P(T) = 0,2

Determine P(S∪T) if:

(1) S and T are mutually exclusive events.

(2)

(2) S and T are independent events.

(4)

(b) The letters of the word MEERKAT are randomly arranged.

(1) In how many ways can the letters be arranged?

(3)

(2) What is the probability that the first letter is E and the last letter is E?

(3)

(3) What is the probability that the two Es will be next to each other?

(3)
[15]

74 marks

SECTION B

QUESTION 7

(a) Solve for x.

(1) $11-2x+\sqrt{2x^2-29x+114}=0$

(4)

(2) $0=5^{2x}-9(5^x)-10$

(4)

(3) $x^{\frac{8}{3}} - 9x^{\frac{10}{3}} = 0$

(3)

(b) Consider $k = \frac{x}{2}(x-4)$ for $k \in \mathbb{R}$.

For which value(s) of k will x be real?

(5)
[16]

QUESTION 8

Sunette would like to invest in her grandson's future:

(a) Sunette has the goal of generating R200 000 at the end of 16 years. She would like to start by depositing a certain amount of money at the start of the investment and then depositing half that amount 8 years later. The bank offers 11% interest per annum compounded quarterly. How much would Sunette need to deposit at the start of the investment?

(5)

(b) Sunette also starts an annuity. When she opens the account, she immediately pays R800 and then continues to make payments of R800 at the end of each month. The investment contract is for 16 years, and the bank offers 9% interest per annum compounded monthly.

After making the last payment at the end of the 10^{th} year, she stops making any payments due to financial difficulties. She leaves the money in the account until the end of the investment period.

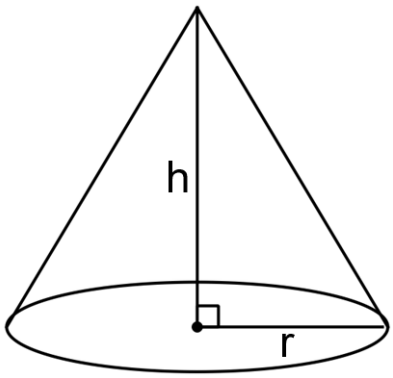
Calculate the value of the investment at the end of the 16-year period.

(5)
[10]

QUESTION 9

The diagram shows a cone. The sum of the radius and the height of the cone is 30 centimetres.

$V_{cone} = \frac{1}{3}\pi r^2 h$



(a) Show that the volume of this cone is given by $V = 10\pi r^2 - \frac{\pi}{3}r^3$.

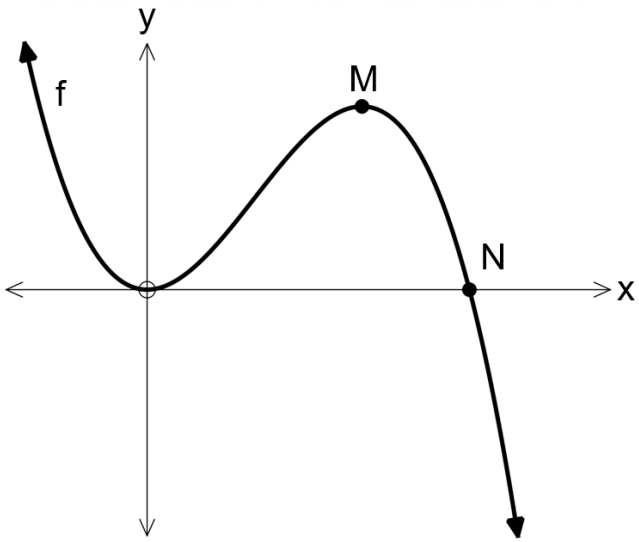
(2)

(b) Determine the maximum volume of the cone.

(4)

(c) The graph represents the function $f(x) = 10\pi x^2 - \frac{\pi}{3}x^3$.

M is a turning point, and N is an x intercept.



(1) Give the coordinates of M.

(2)

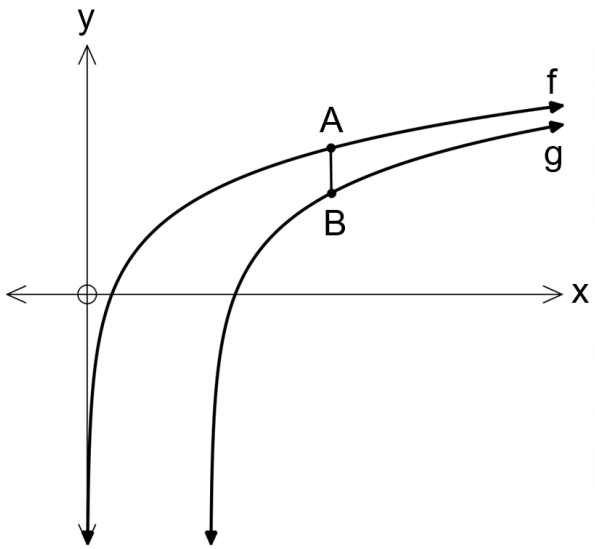
(2) Calculate the values of a and b if the equation of the tangent to f at N is given as: $y = a\pi x + b\pi$.

(6)

[14]

QUESTION 10

The sketch below shows the graphs of $f(x) = \log_2 x$ and $g(x) = \log_2(x-5)$.



(a) Give the equations of the asymptotes of f and g.

(2)

(b) For which values of x will $f'(x) \times g(x) \leq 0$?

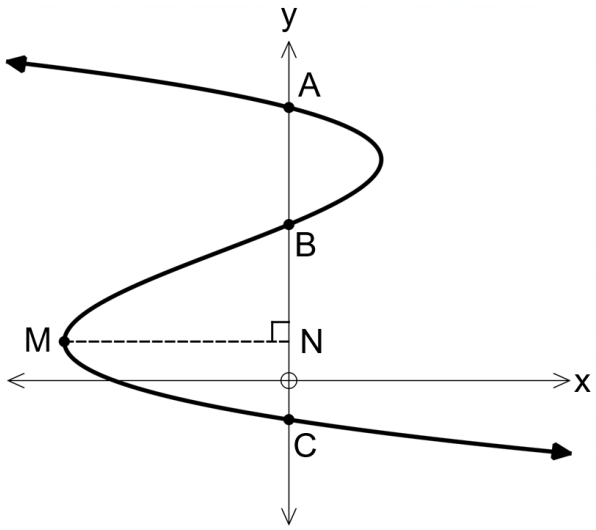
(2)

(c) AB is a vertical line segment with endpoints on f and g.
For which value(s) of x will AB = 1 unit?

(4)
[8]

QUESTION 11

Consider the graph represented by the relation: $x = -(y+1)(y-4)(y-7)$.
The graph cuts the *y*-axis at A, B and C.



(a) Determine the length of AC.

(3)

(b) Write the inverse of the relation above in the form: y = …

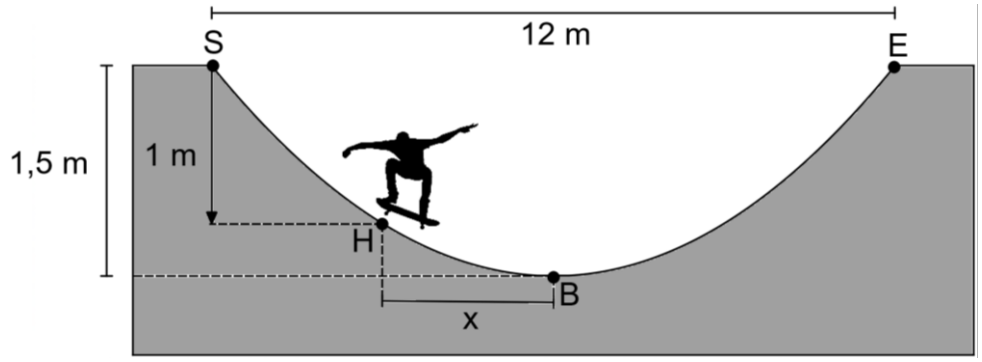
(1)

(c) Hence determine the length of MN if M is the turning point of the relation and N lies on the *y*-axis such that MN ⊥ AC.

(5)
[9]

QUESTION 12

A skateboarding ramp is created using the curve of a parabola.
The vertical distance from the top to the bottom of the ramp is 1,5 metres.
The horizontal distance from the start (S) to the end (E) of the ramp is 12 metres.
The bottom of the ramp is at (B).



(a) If Haleema starts at the top of the ramp at S and travels 1 metre vertically down to H, what is the **horizontal distance** (x) from Haleema at H to the bottom of the ramp at B?

Leave your answer in simplified surd form.

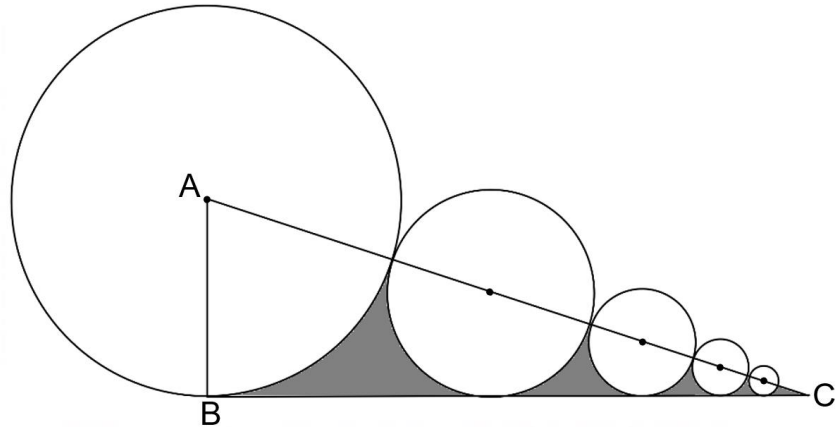
(7)

(b) Calculate the steepest gradient of the ramp.

(3)
[10]

QUESTION 13

Circles are placed next to each other indefinitely along a straight line BC so that the circles are touching each other. The radius of each circle is half the radius of the previous circle, and the radius of the largest circle is 1 metre. A is the centre of the largest circle. AC is a straight line drawn through the centres of all the circles.



(a) Show that AC is 3 metres.

(2)

(b) Calculate the area of the shaded regions.

(7)
[9]

76 marks

Total: 150 marks

ADDITIONAL SPACE (ALL QUESTIONS)

REMEMBER TO CLEARLY INDICATE AT THE QUESTION THAT YOU HAVE USED THE ADDITIONAL SPACE TO ENSURE THAT ALL ANSWERS ARE MARKED.