EXAMINATION	NATIONAL SENIOR CERTIFICATE
GRADE	12
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SUBJECT	MATHEMATICS
PAPER	1
MARK TOTAL	150
DURATION (HOURS)	3
NUMBER OF PAGES	11

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INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

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

QUESTION 1

1.1 Solve for x:

1.1.1 $x^2 - 9x + 14 = 0$ (2)

1.1.2 $-x(x + 8) = 4$ (correct to two decimal places.) (4)

1.1.3 $-x^2 - 3x + 40 > 0$ (3)

1.2 Solve the following equations simultaneously for x and y:

$$y + 2 = 2x$$
$$xy = 4$$
(5)

1.3 Determine the value(s) of x if

$$3\sqrt{x + 2} = 2 - x$$
(5)

1.4 Solve for x:

$$0{,}5^x < 8$$
(3)

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QUESTION 2

2.1 The 4^{th} term of a geometric sequence is 6, and the 9^{th} term is 0,1875. Determine the sequence. (5)

2.2 Calculate the sum of all the integers from 100 to 300 that are multiples of 4. (5)

2.3 The first two terms of a converging geometric series are 8 and m. The sum to infinity of the series is 12. Determine the constant ratio of the series. (6)

[16]

QUESTION 3

Given the quadratic sequence: $-12;\ -11;\ -8;\ -3$ ...

3.1 Determine the next two terms in the sequence. (3)

3.2 Determine the general term of the quadratic sequence. (4)

3.3 Determine the general term of the first differences of the sequence. (2)

3.4 Determine the difference between T_{60} and T_{61} of the quadratic sequence. (3)

[12]

QUESTION 4

4.1 Computer equipment depreciates at a rate of 14,5% p.a. on the reducing balance method. After 5 years the equipment is worth R150 000. Calculate the original value of the equipment to the nearest rand. (3)

4.2 Abel and Kagiso invest money for 10 years in different accounts as described below. They start saving at the same time.

Abel's investments:	**Kagiso's investments:**
• He makes an initial deposit of R100 000. • 5 years later he makes a deposit of R240 000. • For the first five years the interest rate of the investment is 10% p.a. Thereafter, it changes to 10% p.a., compounded quarterly.	He saves R3000 at the end of each month. This investment earns him 10% p.a. compounded monthly.

4.2.1 Determine who's investment was more profitable after the ten year period. Show all calculations. (8)

4.2.2 After the 10 years, Abel withdraws money from his account such that the balance after the withdrawal is R600 000. He then starts to withdraw R20 000 from the account quarterly of which the interest rate is still 10% p.a., compounded quarterly. For how many years will he be able to do this? (5)

[16]

QUESTION 5

5.1 Given:

$f(x) = \frac{-2}{x-2} + 1$ and $g(x) = -(x+1)^2 + 4$.

5.1.1 Write down the coordinates of the turning point of g. (1)

5.1.2 Determine the x- and y-intercepts of f. (3)

5.1.3 Determine the x- intercepts of g. (4)

5.1.4 Sketch the graphs of f and g on the same set of axes. Indicate all asymptotes and intercepts with the axes. (5)

5.1.5 Determine the equation of $k(x)$ if k is the resulting graph if g is translated 5 units to the right and 2 units down. (2)

5.2 Draw a sketch graph of $y = ax^2 + bx + c$ if $a < 0$, $b < 0$, $c < 0$ and $ax^2 + bx + c = 0$ has only one solution. (4)

[19]

QUESTION 6

The sketch below shows the graph of the function $f(x) = log_a x$.
The graph passes through the point $(4;\ -2)$.

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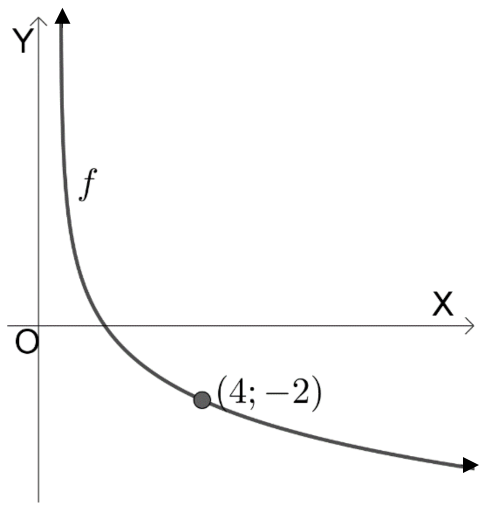


6.1 Determine the value of a. (3)

6.2 Give the equation of $g(x)$ if g is the reflection of f in the x-axis. (2)

6.3 Give the equation of $f^{-1}(x)$, the inverse function of f. (2)

6.4 Give the domain of $f(x)$. (2)

6.5 Use the graph to determine the value(s) of x for which $f(x) \geq -2$. (3)

[12]

QUESTION 7

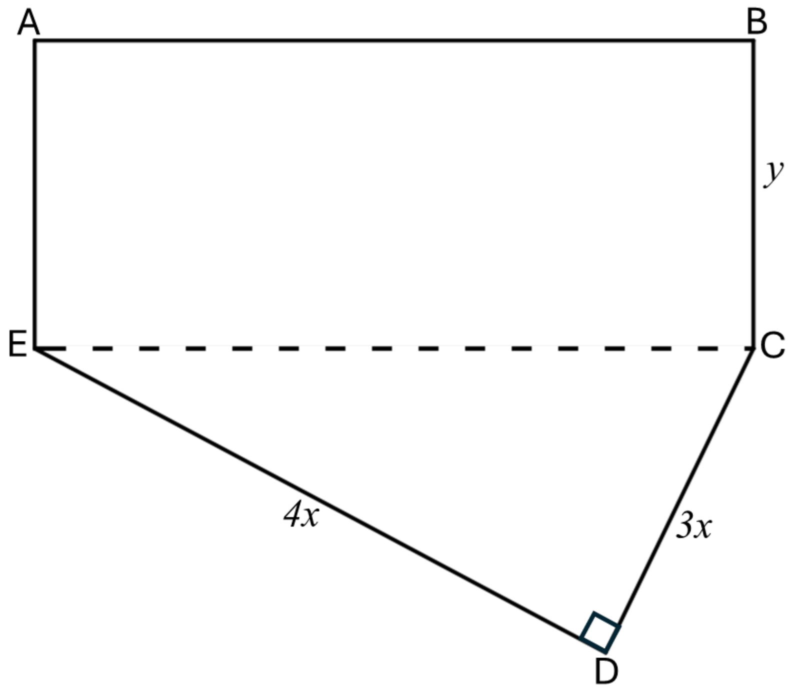
7.1 Determine the derivative of $f(x) = x^2 - 4$ from first principles. (5)

7.2 Determine $f'(x)$ if

7.2.1 $f(x) = 4x^2 - \frac{1}{2x^2}$ (3)

7.2.2 $f(x) = \left(\sqrt{x} + 2\right)^2$ (4)

7.3 A farmer wishes to fence off a piece of land ABCDE as shown in the diagram below. This piece of land is comprised of a rectangle ABCE and a triangle CDE with $\hat{D} = 90°$. The perimeter of ABCDE is 100 metres.
CD= $3x$, DE= $4x$ and BC= y. (All in metres)



7.3.1 Calculate y in terms of x. (3)

7.3.2 Show that the area of the land ABCDE can be given as:

$$A(x) = 250x - 24x^2$$ (3)

7.3.3 Hence, determine the value of x for which the area will be a maximum. (3)

[21]

QUESTION 8

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

8.1 Determine the coordinates of the x-intercepts of f. (4)

8.2 Determine the coordinates of the y-intercept of f. (2)

8.3 A tangent $y = g(x)$ is drawn to f at the y-intercept of f. Show that the equation of the tangent is $g(x) = 3x - 10$. (4)

8.4 Determine the coordinates of the point of inflection of f. (4)

8.5 Calculate the vertical distance between the point of inflection of f and the graph g. (3)

[17]

QUESTION 9

9.1 If P(A) = 0,4 and P(B') = 0,52, calculate P(A ∪ B) if:

9.1.1 A and B are mutually exclusive events. (3)

9.1.2 A and B are independent events. (5)

9.2 The digits 0; 1; 2; 3; 4; 5; 6; must be used to form a 3-digit code.

9.2.1 How many unique 3-digit codes can be formed if digits may not be repeated? (2)

9.2.2 Using the digits above, determine the probability that randomly chosen digits will form a 3-digit code if:

- Digits may be repeated.
- The code must be greater than 300.
- The code must be divisible by 5. (5)

[15]

GRAND TOTAL: [150]

INFORMATION SHEET: MATHEMATICS

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

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

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

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

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

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

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

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

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

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

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

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

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

$\sin 2\alpha = 2\sin\alpha.\cos\alpha$

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

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

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