KWAZULU-NATAL PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA



NATIONAL SENIOR CERTIFICATE

GRADE 12

MATHEMATICS P1

COMMON TEST

JUNE 2022



MARKS: 150

TIME: 3 hours

This question paper consists of 9 pages and 1 information sheet.

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INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of **10** questions.
2. Read the questions carefully.
3. Answer ALL the questions.
4. Number your answers exactly as the questions are numbered.
5. Clearly show ALL calculations, diagrams, graphs, etc. which you have used in determining your answers.
6. Answers only will NOT necessarily be awarded full marks.
7. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.
8. If necessary, round off answers correct to TWO decimal places, unless stated otherwise.
9. Diagrams are NOT necessarily drawn to scale.
10. Write neatly and legibly.

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QUESTION 1

1.1 Solve for x:

1.1.1 $5x(3x-2)=0$ (2)

1.1.2 $2x^2+5x=9$ (correct to TWO decimal places) (4)

1.1.3 $\sqrt{16a^2+x^2}-5a=0$ (5)

1.1.4 $\dfrac{-4}{(x-1)(x-5)}<0$ (4)

1.2 Solve for x and y simultaneously if:

$$x-y=3 \quad \text{and} \quad x^2-2y^2-7=xy$$ (6)

1.3 Simplify fully, without the use of a calculator:

$$\frac{\sqrt{m^{2022}-m^{2020}}}{\sqrt{25m^{2024}-25m^{2022}}}$$ (4)

[25]

QUESTION 2

Given the quadratic number pattern whose terms are : 4 ; 14 ; 30 ; 52 ; ... respectively.

2.1 Write down the 7^{th} and 8^{th} terms if the pattern continues. (2)

2.2 Determine the n^{th} term of the quadratic pattern. (4)

2.3 Determine the term in the sequence that has a value of 8164. (5)

[11]

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QUESTION 3

3.1 In an arithmetic series, the first term is 'a' and the common difference is 'd'. Prove that the sum to n terms of the series is given by:

$$S_n = \frac{n}{2}[2a + (n-1)d]$$ (4)

3.2 Calculate the sum of the arithmetic series given: $24 + 36 + 48 + 60 + \ldots$ to 64 terms. (3)

3.3 The common difference of an arithmetic sequence is 4 and the common ratio of a geometric sequence is 4. A new sequence is formed by adding the corresponding terms of the arithmetic and the geometric sequences.

The first and second terms of the new sequence are 8 and 21 respectively.

3.3.1 Calculate the third term of the new sequence. (8)

3.3.2 Write down an expression for the n^{th} term of the new sequence. (5)

[20]

QUESTION 4

4.1 Tebego invests R120 000 for 5 years at 9,8 % p.a. compounded monthly.

Shante invests R120 000 for 5 years at 12,3 % p.a. compounded quarterly.

4.1.1 Determine the amount earned by Tebego at the end of 5 years. (2)

4.1.2 Determine the amount earned by Shante at the end of 5 years. (2)

4.1.3 Determine the difference in the interest earned by Tebego and Shante. (3)

4.2 The value of a bakkie presently is R85 000. Calculate the original value of the bakkie if it was bought 8 years ago and the bakkie had depreciated on the reducing balance method of 10,25 % p.a. (to the nearest rand). (3)

4.3 Mpume needs R10 000 at the end of 10 years to buy a new computer. She deposits Rx at the end of 2 years. She then deposits R5000 at the end of 8 years (6 years after the initial deposit).

Interest is calculated at 10 % p.a. for the first 4 years and then 12 % p.a. compounded quarterly for the next 6 years.

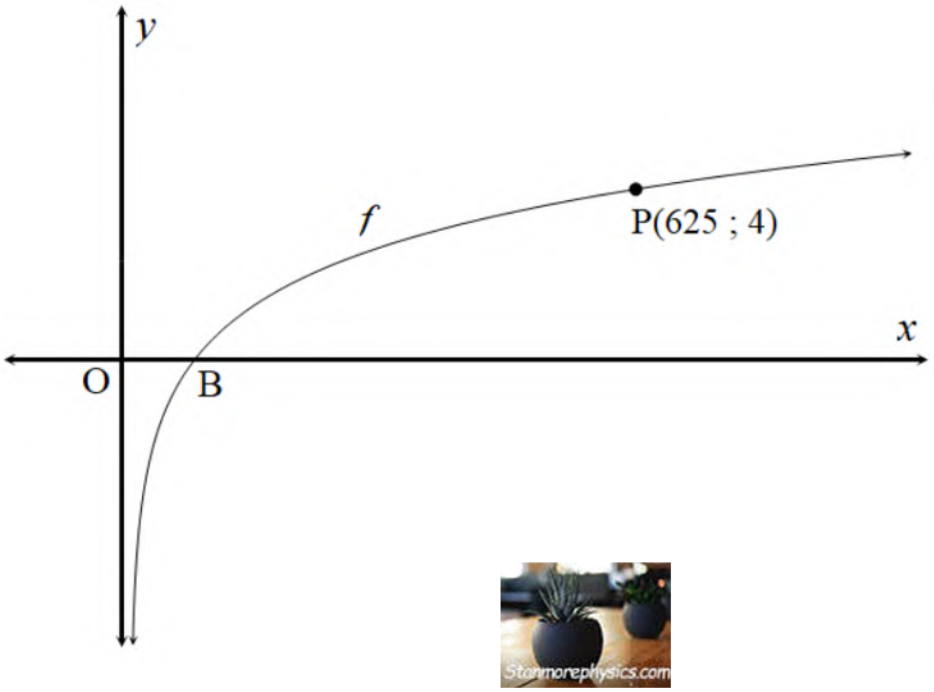
Calculate the value of x. (6)

[16]

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QUESTION 5

Given: $f(x) = \log_a x$. $P(625\ ;\ 4)$ is a point on the graph of f.
The asymptote to the graph is the y – axis. The graph intersects the x – axis at B.



5.1 Calculate the value of a. (3)

5.2 Write down the coordinates of B. (2)

5.3 Determine the equation of f^{-1}, the inverse of f, in the form $y = \ldots$ (2)

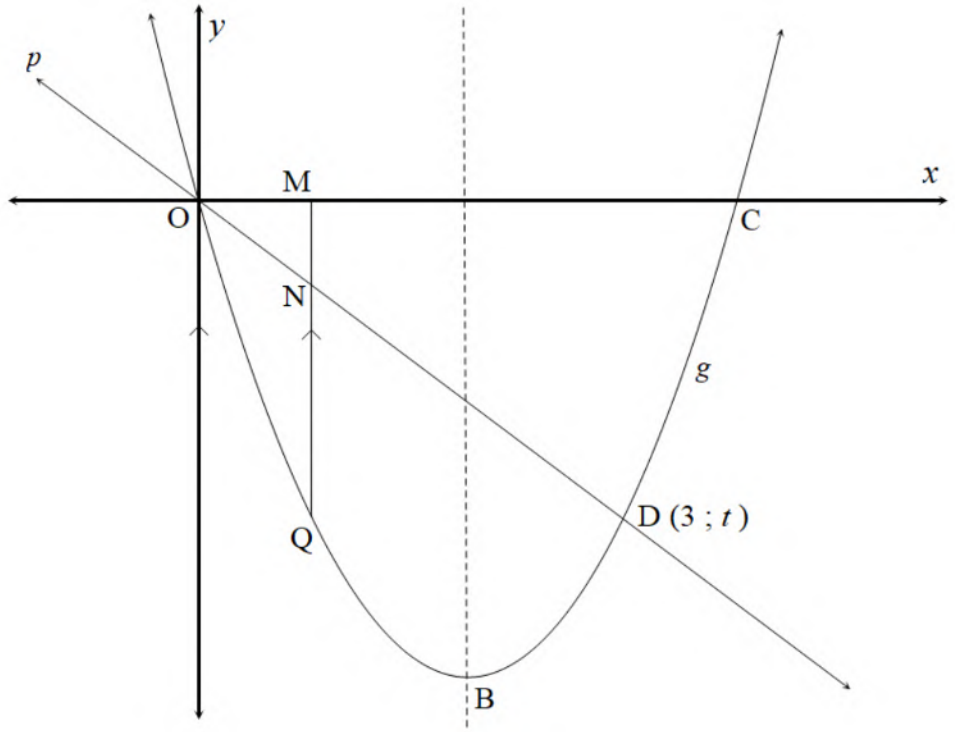
5.4 If the point P is reflected about the line $y = x$. Write down the coordinates of the image point, P′ (2)

[9]

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QUESTION 6

The graph of $g(x) = 3(x-2)^2 - 12$ is sketched below. O and C are the x-intercepts of g and B is the turning point of g. $p(x) = mx + q$ passes through O and D(3 ; t).
MNQ is parallel to the y–axis with N and Q on the graphs of p and g respectively.



6.1 Write down the coordinates of B , the turning point of g. (2)

6.2 Calculate the value of t. (2)

6.3 Write down the equation of the graph of p. (2)

6.4 Determine the maximum length of NQ between O and D. (5)

6.5 Determine the values of k for which $g(x-1) - 15 = k$ has 2 unequal positive real roots. (2)

6.6 Determine the maximum value of $2^{-\frac{1}{2}g(x)}$ (2)

[15]

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QUESTION 7

Given the graph of $h(x)=\frac{4}{x-3}-8$

7.1 Write down the equations of the asymptotes of h. (2)

7.2 Determine the intercepts of the graph of h with the axes. (3)

7.3 Sketch the graph of h. Clearly show ALL intercepts with the axes and the asymptotes. (3)

7.4 Write down the equation of the vertical asymptote of $q(x)=h(x-4)$. (2)

7.5 If $y=k-x$ is the equation for one of the axes of symmetry to the graph of h, determine the value of k. (2)

[12]

QUESTION 8

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

8.2 Determine:

8.2.1 $g'(x)$ if $g(x)=\left(\frac{4}{x}-\frac{x}{4}\right)^2$ (4)

8.2.2 $D_x\left[\frac{7}{\sqrt{x}}-\frac{2}{x^3}\right]$ (4)

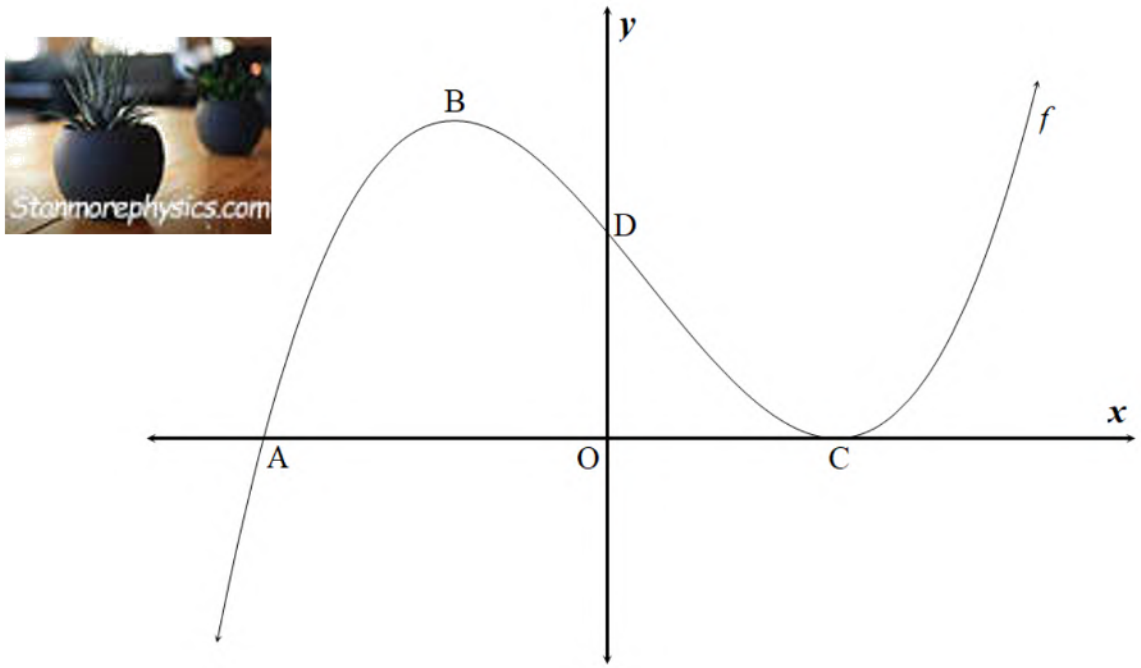
8.3 Determine the equation of the tangent to the curve $t(x)=\sqrt{x^3}$ at $x=4$. (4)

[17]

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QUESTION 9

The graph of $f(x) = x^3 - x^2 - 8x + 12$ is sketched below. B and C are the turning points, A and C are the x-intercepts, and D is the y-intercept.



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9.1 Write down the coordinates of D. (2)

9.2 Determine the coordinates of the turning points of f. (5)

9.3 Show that $f(x)$ has a point of inflection at $x = \frac{1}{3}$. (4)

9.4 If $g(x) = f(-x) + 1$, write down the coordinates of C', the image of C. (2)

9.5 Write down the value(s) of k for which $f(x) = k$ will have

9.5.1 two unequal real roots. (2)

9.5.2 one of the roots equal to 0. (2)

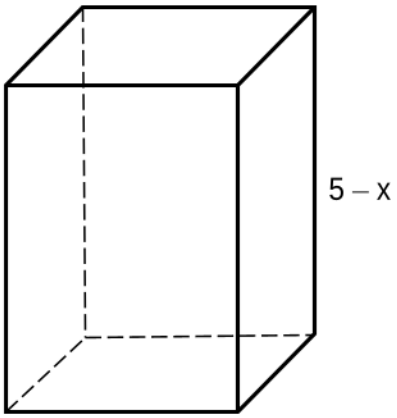
[17]

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QUESTION 10

A rectangular box of cereal has a height of $(5-x)$ units.

The expression for the volume (V) of the box is given by $V(x) = x^3 - 8x^2 + 5x + 50$.



10.1 If the height of the cereal box is (5 – x) units, determine the area of the base of the box in terms of x. (3)

10.2 Calculate the value of x for which the volume of the box will be at a maximum. (5)

[8]

TOTAL: 150

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INFORMATION SHEET: MATHEMATICS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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