



KWAZULU-NATAL PROVINCE

EDUCATION
REPUBLIC OF SOUTH AFRICA

**NATIONAL
SENIOR CERTIFICATE**

GRADE 11

MATHEMATICS P1

COMMON TEST

Stanmorephysics.com
JUNE 2023

MARKS: 100

TIME: 2 hours

This question paper consists of 6 pages.



INSTRUCTIONS AND INFORMATION

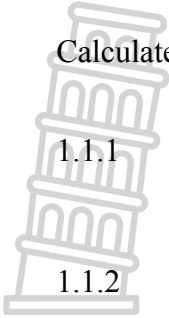
Read the following instructions carefully before answering the questions.

1. This question paper consists of 6 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. which 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 correct to TWO decimal places, unless stated otherwise.
8. Diagrams are NOT necessarily drawn to scale.
9. Write neatly and legibly.



QUESTION 1

1.1 Calculate the value of the following WITHOUT using a calculator:



$$1.1.1 \quad \frac{12^{x-2} \cdot 2^{x+2}}{8^x \cdot 3^{x-4}} \quad (4)$$

$$1.1.2 \quad \frac{\sqrt{3}(\sqrt{3} + \sqrt{6}) - \sqrt{50} - 3(3^0)}{\sqrt{8}} \quad (5)$$

1.2 Given: $2^x + 2^{x+2} = -5y + 10$

1.2.1 Express 2^x in terms of y . Write your answer in simplified form. (3)

1.2.2 Hence, solve for x if $y = \frac{15}{8}$. (3)

[15]

QUESTION 2

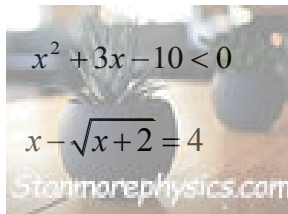
2.1 Solve for x :

$$2.1.1 \quad 2x^2 = 7x \quad (3)$$

$$2.1.2 \quad 2x^2 - 5x - 8 = 0 \quad (\text{correct to TWO decimal places}) \quad (3)$$

$$2.1.3 \quad x^2 + 3x - 10 < 0 \quad (3)$$

$$2.1.4 \quad x - \sqrt{x+2} = 4 \quad (5)$$



2.2 Solve for x and y simultaneously:

$$2y - x = 1$$

$$x^2 - 6y = 37 \quad (6)$$

[20]



QUESTION 3

3.1 The roots of a quadratic equation are given by: $x = \frac{-3 \pm \sqrt{-7m+3}}{4}$.

Determine the value(s) of m for which this equation will have:

3.1.1 two equal roots. (2)

3.1.2 non-real roots. (2)

3.2 Consider the equation: $\frac{1}{x+3} - 1 = \frac{2x}{3-x}$

3.2.1 Why is $x \neq 3$ or $x \neq -3$? (1)

3.2.2 Solve the equation. (6)

3.3 Two numbers, m and n (with $m > n$), are chosen so that their sum is three times their positive difference.

3.3.1 Show that $m = 2n$ (3)

3.3.2 Hence, determine the value of $\frac{5mn}{m^2 + n^2}$ (2)

[16]

QUESTION 4

4.1 Consider the functions: $f(x) = \frac{1}{2}x + 2$ and $g(x) = 2^{x+1} - 1$

4.1.1 Write down the equation of the asymptote of g . (1)

4.1.2 Sketch the graphs of f and g on the same system of axes in your ANSWER BOOK. Show clearly the asymptote and the intercepts with the axes. Label all relevant points. (5)

4.1.3 Use your graphs to determine the value(s) of x for which $f(x) \cdot g(x) < 0$. (2)

4.2 Draw a sketch graph of $y = ax^2 + bx + c$ where $a > 0$, $b > 0$, $c < 0$ and $ax^2 + bx + c = 0$ has TWO solutions. (4)

[12]

QUESTION 5

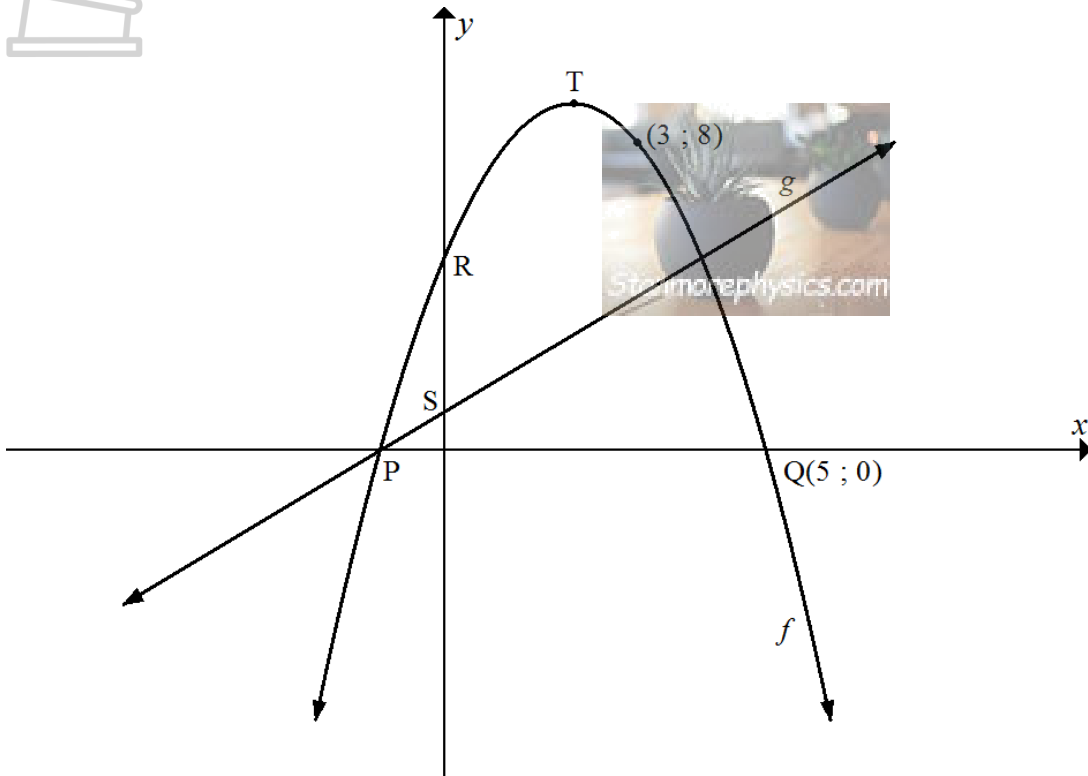
Consider the function: $f(x) = \frac{-2}{x-3} + 1$

- 5.1 Calculate the coordinates of the y -intercept of f . (2)
- 5.2 Calculate the coordinates of the x -intercept of f . (3)
- 5.3 Sketch the graph of f in your ANSWER BOOK, showing clearly the asymptotes and the intercepts with the axes. (4)
- 5.4 For which values of x is $f(x) \leq 0$? (2)
- 5.5 Calculate the average gradient of f between $x = -2$ and $x = 1$. (4)
- 5.6 Graph h is obtained by translating f by 2 units to the left and 3 units down. Determine the equation of the axis of symmetry of h that has a positive gradient. (4)

[19]

QUESTION 6

The sketch below shows the graphs of $f(x) = ax^2 + bx + c$ and $g(x) = x + 1$. Graph f intersects the x -axis at P and Q(5 ; 0) and the y -axis at R. The point (3 ; 8) lies on f and T is the turning point of f . Graph g intersects the x -axis at P and the y -axis at S.



- 6.1 Calculate the coordinates of P. (2)
- 6.2 Show that $a = -1$, $b = 4$ and $c = 5$. (3)
- 6.3 Calculate the length of RS. (2)
- 6.4 Calculate the coordinates of T, the turning point of f . (3)
- 6.5 Determine the value of k for which the line $y = x + k$ will be a tangent to f . (4)
- 6.6 Determine the values of n for which the equation $-x^2 + 4x + 5 = x + n$ will always have two positive different roots. (2)
- 6.7 Determine the value of d so that the distance between the roots of the equation $-x^2 + 4x + 5 = d$ is 4. (2)

[18]

TOTAL MARKS: [100]



KWAZULU-NATAL PROVINCE

**EDUCATION
REPUBLIC OF SOUTH AFRICA**

**NATIONAL
SENIOR CERTIFICATE**

GRADE 11

MATHEMATICS P1

COMMON TEST

JUNE 2023

MARKING GUIDELINE

MARKS: 100

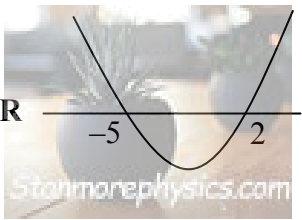
These marking guidelines consist of 8 pages.



QUESTION 1

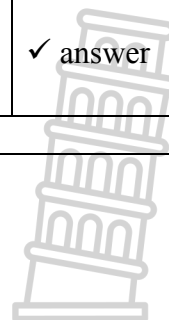
| | | |
|--------------|--|--|
| <p>1.1.1</p> | $\frac{12^{x-2} \cdot 2^{x+2}}{8^x \cdot 3^{x-4}}$ $= \frac{(2^2 \times 3)^{x-2} \cdot 2^{x+2}}{(2^3)^x \cdot 3^{x-4}}$ $= \frac{2^{2x-4} \cdot 3^{x-2} \cdot 2^{x+2}}{2^{3x} \cdot 3^{x-4}}$ $= 2^{-2} \cdot 3^2$ $= \frac{9}{4} \text{ or } = 2\frac{1}{4}$ | <ul style="list-style-type: none"> ✓ prime bases ✓ application of law: \times exponents ✓ application of laws: adding & subtracting exponents ✓ answer <p style="text-align: right;">(4)</p> |
| <p>1.1.2</p> | $\frac{\sqrt{3}(\sqrt{3} + \sqrt{6}) - \sqrt{50} - 3(3^0)}{\sqrt{8}}$ $= \frac{3 + \sqrt{18} - \sqrt{50} - 3(1)}{\sqrt{8}}$ $= \frac{3 + \sqrt{9 \times 2} - \sqrt{25 \times 2} - 3}{\sqrt{4 \times 2}}$ $= \frac{3\sqrt{2} - 5\sqrt{2}}{2\sqrt{2}}$ $= \frac{-2\sqrt{2}}{2\sqrt{2}}$ $= -1$ | <ul style="list-style-type: none"> ✓ $\sqrt{3}(\sqrt{3} + \sqrt{6}) = 3 + \sqrt{18}$ ✓ $3^0 = 1$ ✓ simplifying surds ✓ subtracting surds ✓ answer <p style="text-align: right;">(5)</p> |
| <p>1.2.1</p> | $2^x + 2^{x+2} = -5y + 10$ $2^x(1 + 2^2) = -5y + 10$ $5(2^x) = -5y + 10$ $2^x = -y + 2$ | <ul style="list-style-type: none"> ✓ common factor ✓ 5 ✓ answer <p style="text-align: right;">(3)</p> |
| <p>1.2.2</p> | $2^x = \frac{-15}{8} + 2$ $2^x = \frac{1}{8}$ $2^x = 2^{-3}$ $\therefore x = -3$ | <ul style="list-style-type: none"> ✓ simplifying RHS ✓ bases the same ✓ answer <p style="text-align: right;">(3)</p> |
| [15] | | |

QUESTION 2

| | | |
|--------------------|---|---|
| <p>2.1.1</p> | $2x^2 = 7x$ $2x^2 - 7x = 0$ $x(2x - 7) = 0$ $x = 0 \text{ or } x = \frac{7}{2} = 3,5$ | <ul style="list-style-type: none"> ✓ standard form ✓ factors ✓ both x values <p style="text-align: right;">(3)</p> |
| <p>2.1.2</p> | $2x^2 - 5x - 8 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $x = \frac{-(-5) \pm \sqrt{(-5)^2 - 4(2)(-8)}}{2(2)}$ $x = 3,61 \text{ or } x = -1,11$ <div style="border: 1px solid black; padding: 5px; width: fit-content; margin-left: 20px;"> <p>NOTE: Wrong formula: 0/3</p> </div> | <ul style="list-style-type: none"> ✓ correct substitution into quadratic formula ✓ 3,61 ✓ -1,11 <p style="text-align: right;">(3)</p> |
| <p>2.1.3</p> | $x^2 + 3x - 10 < 0$ $(x + 5)(x - 2) < 0$ <div style="display: flex; align-items: center; justify-content: center;"> <div style="text-align: center; margin-right: 20px;"> $\begin{array}{c} + \quad - \quad + \\ \leftarrow \quad \circ \quad \circ \quad \rightarrow \\ -5 \quad \quad 2 \end{array} x$ </div> <div style="text-align: center; margin-right: 20px;"> <p>OR</p> </div> <div style="text-align: center;">  </div> </div> $-5 < x < 2$ <p>OR</p> $x \in (-5; 2)$ | <ul style="list-style-type: none"> ✓ factors ✓✓ answer OR ✓✓ answer <p style="text-align: right;">(3)</p> |
| <p>2.1.4</p> | $x - \sqrt{x + 2} = 4$ $x - 4 = \sqrt{x + 2}$ $x^2 - 8x + 16 = x + 2$ $x^2 - 9x + 14 = 0$ $(x - 7)(x - 2) = 0$ $x = 7 \text{ or } x \neq 2$ | <ul style="list-style-type: none"> ✓ isolate the surd ✓ square both sides ✓ standard form ✓ factors ✓ answers with selection <p style="text-align: right;">(5)</p> |
| <p>2.2</p> | $2y - x = 1 \text{ and } x^2 - 6y = 37$ $x = 2y - 1$ $(2y - 1)^2 - 6y = 37$ $4y^2 - 4y + 1 - 6y = 37$ $4y^2 - 10y - 36 = 0$ $2y^2 - 5y - 18 = 0$ $(2y - 9)(y + 2) = 0$ $y = 4,5 \text{ or } y = -2$ $x = 8 \text{ or } x = -5$ <div style="border: 1px solid black; padding: 5px; width: fit-content; margin-left: 20px;"> <p>Note: If learner makes a mistake which leads to both equations being LINEAR award maximum 3/6 marks</p> <ul style="list-style-type: none"> ✓ $x = 2y - 1$ ✓ substitution ✓ first unknown </div> | <ul style="list-style-type: none"> ✓ $x = 2y - 1$ ✓ substitution ✓ standard form ✓ factors ✓ y-values ✓ x-values <p style="text-align: right;">(6)</p> |
| <p>[20]</p> | | |

QUESTION 3

| | | |
|-------|---|---|
| 3.1.1 | $x = \frac{-3 \pm \sqrt{-7m+3}}{4}$ $-7m+3=0$ $m = \frac{3}{7}$ | ✓ $-7m+3=0$ ✓ answer (2) |
| 3.1.2 | $-7m+3 < 0$ $m > \frac{3}{7}$ <div style="border: 1px solid black; padding: 5px; display: inline-block; margin-left: 100px;">Answer only: full marks</div> | ✓ $-7m+3 < 0$ ✓ answer (2) |
| 3.2.1 | The equation is undefined at $x = 3$ or $x = -3$ | ✓ undefined (1) |
| 3.2.2 | $\frac{1}{x+3} - 1 = \frac{2x}{3-x}$ $\frac{1}{x+3} - 1 = -\frac{2x}{x-3}$ $x-3 - (x+3)(x-3) = -2x(x+3)$ $x-3 - x^2 + 9 = -2x^2 - 6x$ $x^2 + 7x + 6 = 0$ $(x+1)(x+6) = 0$ $x = -1 \text{ or } x = -6$ | ✓ change of sign ✓ multiplying by LCD ✓ removing brackets ✓ standard form ✓ factors ✓ answers (6) |
| 3.3.1 | $m+n = 3(m-n)$ $m+n = 3m-3n$ $4n = 2m$ $m = 2n$ | ✓ LHS of equation ✓ RHS of equation ✓ simplification (3) |
| 3.3.2 | $\frac{5mn}{m^2+n^2} = \frac{5(2n)(n)}{(2n)^2+n^2}$ $= \frac{10n^2}{5n^2}$ $= 2$ | ✓ substitution of $m = 2n$ ✓ answer (2) |
| | | [16] |

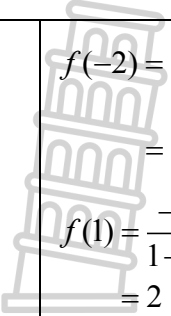


QUESTION 4

| | | |
|-------|--|--|
| 4.1.1 | $y = -1$ | ✓ answer (1) |
| 4.1.2 | | Graph of f ✓ x -intercept of -4 ✓ y -intercept of 2 Graph of g ✓ x -intercept of -1 ✓ y -intercept of 1 ✓ horizontal asymptote and shape (5) |
| 4.1.3 | $-4 < x < -1$ OR $x \in (-4; -1)$ | ✓ ✓ answer (2) ✓ ✓ answer (2) |
| 4.2 | | ✓ shape: $a > 0$ ✓ turning point on LHS of y -axis $b < 0$ ✓ y -int below x -axis: $c < 0$ ✓ 2 x -intercepts: one positive and one negative (4) [12] |

QUESTION 5

| | | |
|------------|--|--|
| <p>5.1</p> | $y = \frac{-2}{0-3} + 1$ $= \frac{5}{3}$ $\left(0; \frac{5}{3}\right)$ <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> Answer only: 2 marks </div> | <p>✓ let $x = 0$</p> <p>✓ answer</p> <p style="text-align: right;">(2)</p> |
| <p>5.2</p> | $0 = \frac{-2}{x-3} + 1$ $\frac{-2}{x-3} = -1$ $-2 = -1(x-3)$ $-2 = -x + 3$ $x = 5$ $(5; 0)$ | <p>✓ let $y = 0$</p> <p>✓ simplification</p> <p>✓ answer</p> <p style="text-align: right;">(3)</p> |
| <p>5.3</p> | | <p>✓ asymptotes</p> <p>✓ x-intercept</p> <p>✓ y-intercept</p> <p>✓ shape</p> <p style="text-align: right;">(4)</p> |
| <p>5.4</p> | $3 < x \leq 5$ <p>OR</p> $x \in (3; 5]$ | <p>✓✓ answer</p> <p>OR</p> <p>✓✓ answer</p> <p style="text-align: right;">(2)</p> |

| | | |
|------------|--|--|
| <p>5.5</p> |  $f(-2) = \frac{-2}{-2-3} + 1$ $= \frac{7}{5}$ $f(1) = \frac{-2}{1-3} + 1$ $= 2$ $\text{Av grad} = \frac{2 - \frac{7}{5}}{1 - (-2)}$ $= \frac{1}{5}$ | <p>✓ value of $f(-2)$</p> <p>✓ value of $f(1)$</p> <p>✓ substitution</p> <p>✓ answer</p> <p style="text-align: right;">(4)</p> |
| <p>5.6</p> | <p>The new point of intersection of the asymptotes will be at $(1 ; -2)$.</p> $-2 = 1(1) + c$ $c = -3$ $y = x - 3$ <p>OR</p> $y - (-2) = 1(x - 1)$ $y + 2 = x - 1$ $y = x - 3$ | <p>✓ 1 ✓ -2</p> <p>✓ subst $m = 1$ and $(1 ; -2)$.</p> <p>✓ answer</p> <p>OR</p> <p>✓ subst $m = 1$ and $(1 ; -2)$.</p> <p>✓ answer</p> <p style="text-align: right;">(4)</p> |
| | | <p>[19]</p> |



QUESTION 6

| | | | |
|-----|---|--|-------------|
| 6.1 | $x + 1 = 0$ $x = -1$ $P(-1 ; 0)$ | $\checkmark y = 0$ $\checkmark x = -1$ | (2) |
| 6.2 | $y = a(x + 1)(x - 5)$ $8 = a(3 + 1)(3 - 5)$ $8 = -8a$ $a = -1$ $y = -1(x + 1)(x - 5)$ $= -x^2 + 4x + 5$ | \checkmark subst x -intercepts \checkmark subst (3 ; 8) $\checkmark a = -1$ | (3) |
| 6.3 | $RS = 5 - 1$ $= 4$ units | $\checkmark y$ at $S = 1$ \checkmark answer | (2) |
| 6.4 | Axis of symmetry: $x = \frac{-4}{2(-1)} = 2$ Maximum value: $y = -(2)^2 + 4(2) + 5 = 9$ $T(2 ; 9)$ | $\checkmark x = 2$ \checkmark substitution of x $\checkmark y = 9$ | (3) |
| 6.5 | $-x^2 + 4x + 5 = x + k$ $-x^2 + 3x + 5 - k = 0$ $\Delta = (3)^2 - 4(-1)(5 - k)$ $= 29 - 4k$ For a tangent: $29 - 4k = 0$ $k = \frac{29}{4}$ | \checkmark equating \checkmark calculating Δ $\checkmark \Delta = 0$ \checkmark answer | (4) |
| 6.6 | $5 < n < \frac{29}{4}$ OR $n \in \left(5 ; \frac{29}{4} \right)$ | $\checkmark \checkmark$ answer $\checkmark \checkmark$ answer | (2) |
| 6.7 | $d = 5$ | $\checkmark \checkmark d = 5$ | (2) |
| | | | [18] |

TOTAL: 100