



GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

PROVINCIAL EXAMINATION

NOVEMBER 2021

GRADE 11

MARKING GUIDELINES

MATHEMATICS
(PAPER 1)

17 pages

INSTRUCTIONS AND INFORMATION**A – ACCURACY****C.A. – CONSISTENT ACCURACY****NOTE:**

- If a candidate answered a question TWICE, mark only the first attempt.
- If a candidate CROSSED OUT an answer and did not redo it, mark the crossed-out answer.
- Consistent accuracy applies to ALL aspects of the marking guidelines.
- Assuming values/answers in order to solve a question is UNACCEPTABLE.

MEMORANDUM

MATHEMATICS
(Paper 1)

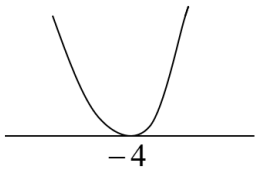
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QUESTION 1				
1.1	1.1.1	$(x+2)(2x-1) = 0$ $x = -2$ or $x = \frac{1}{2}$	✓ simplification ✓ both values for x	(2)
	1.1.2	$3-x=0$ $\therefore x=3$	✓ answer	(1)
1.2	1.2.1	$2x^2 - 3x - 4 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $x = \frac{-(-3) \pm \sqrt{(-3)^2 - 4(2)(-4)}}{2(2)}$ $x = 2,35$ or $x = -0,85$	✓ correct substitution ✓✓ answers	(3)
	1.2.2	$(2x+3)(3-x) > 4$ $-2x^2 + 3x + 9 > 4$ $-2x^2 + 3x + 5 > 0$ $2x^2 - 3x - 5 < 0$ $(2x-5)(x+1) < 0$ $\therefore -1 < x < \frac{5}{2}$ NOTE: Candidates can write the answer as separate inequalities but must state AND between the inequalities, not OR.	✓ simplify ✓ standard form ✓ factors ✓ critical values ✓ answer	(5)
	1.2.3	$\sqrt{x+2} + x = 4$ $\sqrt{x+2} = 4-x$ $x+2 = 16-8x+x^2$ $a^2 + b^2 = c^2$ $0 = x^2 - 9x + 14$ $0 = (x-7)(x-2)$ $x \neq 7$ or $x = 2$	✓ squaring both sides ✓ standard form ✓ factors ✓ critical values ✓ exclusion of $x = 7$	(5)

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	1.2.4	$2^{2x+1} - 3(2^{2x-1}) + 4^x = 12$ $2^{2x} \left(2 - \frac{3}{2} + 1 \right) = 12$ $2^{2x} \left(\frac{3}{2} \right) = 12$ $2^{2x} = 8$ $2^{2x} = 2^3$ $x = \frac{3}{2}$	<div>✓ correct factorisation</div> <div>✓ simplification $2^{2x} = 8$</div> <div>✓ equating to like bases</div> <div>✓ answer</div>	(4)
1.3	1.3.1	$f(x) = x^2 + 8x + 16$ $f(2) = 2^2 + 8(2) + 16$ $f(2) = 36$	<div>✓ answer</div>	(1)
	1.3.2	$f(x) > 0$ $x^2 + 8x + 16 > 0$ $(x + 4)(x + 4) > 0$ $(x + 4)^2 > 0$ CV: -4 <div><div><div>+</div><div>0</div><div>+</div></div><div>-4</div></div> OR 	<div>✓ factors</div> <div>✓ critical value</div> <div>✓ answer</div>	(3)

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1.4	$y - 2x + 1 = 0$ and $xy = 2y + x^2 + 3x - 10 \dots (2)$ $y = 2x - 1 \dots (1)$ sub (2) into (1) $x(2x - 1) = 2(2x - 1) + x^2 + 3x - 10$ $2x^2 - x = 4x - 2 + x^2 + 3x - 10$ $x^2 - 8x + 12 = 0$ $(x - 6)(x - 2) = 0$ $x = 6$ or $x = 2$ if $x = 6$ if $x = 2$ $y = 2(6) - 1$ $y = 2(2) - 1$ $y = 11$ $y = 3$ NOTE: Any other valid method.	✓ y as subject in (1) ✓ substitution ✓ standard form ✓ factors ✓ values for x ✓ values for y	(6)
1.5	$(xp)^2 + 3 = 2x(p - x)$ $x^2 p^2 + 3 = 2px - 2x^2$ $x^2 p^2 + 3 - 2px + 2x^2 = 0$ $(p^2 + 2)x^2 - 2xp + 3 = 0$ $\Delta = b^2 - 4ac$ $= (-2p)^2 - 4(p^2 + 2)(3)$ $= 4p^2 - 12p^2 - 24$ $= -8p^2 - 24$ $p^2 > 0$ for $p \in \mathbb{R}$ $\therefore -8p^2 < 0$ for $p \in \mathbb{R}$ $\therefore -8p^2 - 24 < 0$ for $p \in \mathbb{R}$ \therefore roots are non-real.	✓ standard form ✓ substitution ✓ value for Δ ✓ complete explanation	(4)
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QUESTION 2			
2.1	2.1.1	$\left\{ \frac{16x^2}{81x^{-2}} \right\}^{-\frac{1}{2}}$ $= \left\{ \frac{81x^{-2}}{16x^2} \right\}^{\frac{1}{2}}$ $= \frac{9}{4x^2}$ <p>NOTE: Any correct alternative method.</p>	<ul style="list-style-type: none"> ✓ interchange base AND additive inverse of index ✓ answer <p>(2)</p>
	2.1.2	$\frac{9^x + 3^{2x+1}}{18^x \cdot 2^{-x}}$ $= \frac{3^{2x} + 3^{2x+1}}{3^{2x} \cdot 2^x \cdot 2^{-x}}$ $= \frac{3^{2x}(1+3)}{3^{2x} \cdot 2^0}$ $= 4$ <p>NOTE: Any correct alternative method.</p>	<ul style="list-style-type: none"> ✓ simplification of 9^x and 18^x ✓ factorise ✓ answer <p>(3)</p>
	2.1.3	$\sqrt{10 - 3^{2x}} = 3^x - 2$ $10 - 3^{2x} = (3^x - 2)^2$ $10 - 3^{2x} = 3^{2x} - 4 \cdot 3^x + 4$ $2 \cdot 3^{2x} - 4 \cdot 3^x - 6 = 0$ $3^{2x} - 2 \cdot 3^x - 3 = 0$ $(3^x - 3)(3^x + 1) = 0$ $3^x = 3 \quad \text{or} \quad 3^x = -1$ $x = 1 \quad \text{no solution} (3^x > 0)$	<ul style="list-style-type: none"> ✓ squaring both sides ✓ simplification ✓ standard form ✓ factors ✓ value of x and rejection <p>(5)</p>
2.2		$3\sqrt{2a} - 2\sqrt{3a}$ $= \sqrt{(3\sqrt{2a} - 2\sqrt{3a})^2}$ $= \sqrt{9 \cdot 4a^2 - 12\sqrt{6a^2} + 4 \cdot 9a^2}$ $= \sqrt{9 \cdot 2a - 12\sqrt{6a^2} + 4 \cdot 3a}$ $\sqrt{18a - 12a\sqrt{6} + 12a}$ $= \sqrt{30a - 12a\sqrt{6}}$	<ul style="list-style-type: none"> ✓ surd and squaring ✓ multiplication ✓ simplification ✓ simplification <p>(4)</p>
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QUESTION 3				
3.1	3.1.1	A = 9 B = 11	✓ answer ✓ answer	(2)
	3.1.2	$T_n = 2n + 1$	✓✓ answer	(2)
	3.1.3	$T_n = 2n + 1$ $T_n = 2(100) + 1$ $T_n = 201$ NOTE : Answer only, award FULL marks.	✓ substitution ✓ answer	(2)
	3.1.4	$T_n = 2n + 1$ $305 = 2n + 1$ $304 = 2n$ $n = 152$	✓ substitution ✓ answer	(2)
3.2	$T_3 - T_2 = T_2 - T_1$ $3x^2 + 4x - 3 - (2x^2 + 5x + 2)$ $\qquad\qquad\qquad = 2x^2 + 5x + 2 - (2x^2 + 5x + 5)$ $3x^2 + 4x - 3 - 2x^2 - 5x - 2$ $\qquad\qquad\qquad = 2x^2 + 5x + 2 - 2x^2 - 5x - 5$ $x^2 - x - 5 = -3$ $x^2 - x - 2 = 0$ $(x - 2)(x + 1)$ $\therefore x = 2 \text{ or } x = -1$		✓ substitution ✓ simplification ✓ standard form ✓ answers	(4)
[12]				

QUESTION 4			
4.1	$ \begin{array}{ccccc} -1 & ; & x & ; & 3 & ; & x+8 \\ & \swarrow & & \swarrow & & \swarrow & \\ & x-(-1) & & 3-x & & x+8-3 & \\ & & \swarrow & & \swarrow & & \\ & & 3-x-(x+1) & & x+5-(3-x) & & \end{array} $ $ \begin{aligned} 3-x-(x+1) &= x+5-(3-x) \\ 3-x-x-1 &= x+5-3+x \\ 2-2x &= 2x+2 \\ 4x &= 0 \\ \therefore x &= 0 \end{aligned} $	<ul style="list-style-type: none"> ✓ first differences ✓ second differences ✓ equating ✓ answer 	(4)
4.2	$ \begin{array}{ccccc} -1 & ; & 0 & ; & 3 & ; & 8 \\ & \swarrow & & \swarrow & & \swarrow & \\ & 1 & & 3 & & 5 & \\ & & \swarrow & & \swarrow & & \\ & & 2 & & 2 & & \end{array} $ $ \begin{aligned} 2a &= 2 \\ a &= 1 \\ 3a+b &= 1 \\ 3(1)+b &= 1 \\ b &= -2 \\ a+b+c &= -1 \\ 1-2+c &= -1 \\ c &= 0 \\ T_n &= n^2 - 2n \\ T_n &= n^2 - 2n + 1 - 1 \\ T_n &= (n-1)^2 - 1 \end{aligned} $ <p>NOTE: If a candidate uses $T_n = (n-1)^2 - 1$ to validate the quadratic pattern, award ZERO marks.</p>	<ul style="list-style-type: none"> ✓ 2nd difference ✓ value for a ✓ value for b ✓ value for c ✓ equation of T_n ✓ complete the square of T_n 	(6)

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4.3	$T_n = (n-1)^2 - 1$ $T_{65} = (65-1)^2 - 1$ $T_{65} = 4095$	✓ substitution ✓ answer	(2)
4.4	$(n-1)^2 - 1 > 9800$ $n^2 - 2n - 9800 > 0$ $(n+98)(n-100)$ CVs -98 or 100 $n > 100$ $\therefore n = 101$	✓ setting up inequality ✓ factors ✓ choice of $n = 100$ ✓ answer	(4)
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QUESTION 5			
5.1	5.1.1	$A = P(1-i)^n$ $A = 250000(1-0.1)^5$ $A = R147622,50$	✓ correct substitution into correct formula ✓ answer (2)
	5.1.2	$A = P(1+i)^n$ $A = 250\,000(1+0.08)^5$ $A = R367\,332,02$	✓ correct substitution into correct formula ✓ answer (2)
	5.1.3	$\frac{95}{100} \times 147\,622,50$ $= R140\,241,375$ New Machine - Sale of Old Machine $R367\,332,02 - R140\,241,375$ $R227\,090,65$	✓ R140 241, 375 ✓ answer (2)
5.2	5.2.1	$1+i_{eff} = \left(1 + \frac{i_{nom}}{m}\right)^m$ $1+i_{eff} = \left(1 + \frac{0.115}{12}\right)^{12}$ $i_{eff} = 12,13\%$ Bank B offers a better interest rate. NOTE: Award no marks if candidate concludes only.	✓ correct substitution into correct formula ✓ 12,13% ✓ conclusion (3)

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5.2.2	<p>$A = P(1 + i)^n$</p> <p>$R280\,000 = \left[P \left(1 + \frac{0.115}{12} \right)^{24} - 50\,000 \right] \left(1 + \frac{0.115}{12} \right)^{36}$</p> <p>$P = R197\,759,51.$</p> <p style="text-align: center;">OR</p> <p>$A = P(1 + i)^n$</p> <p>$R280\,000 = P \left(1 + \frac{0.115}{12} \right)^{60} - 50\,000 \left(1 + \frac{0.115}{12} \right)^{36}$</p> <p>$P = R197\,759,51$</p> <p style="text-align: center;">OR</p> <p>$A = P(1 + i)^n$</p> <p>$R280\,000 = [P(1 + 0,1213)^2 - 50\,000](1 + 0,1213)^3$</p> <p>$P = R197\,729,98$</p> <p style="text-align: center;">OR</p> <p>$A = P(1 + i)^n$</p> <p>$R280\,000 = P(1 + 0,1213)^5 - 50\,000(1 + 0,1213)^3$</p> <p>$P = R197\,727,98$</p>	<p>✓ value of i</p> <p>✓ $n = 24$</p> <p>✓ $n = 36$</p> <p>✓ setting up equation</p> <p>✓ answer</p> <p style="text-align: center;">OR</p> <p>✓ value of i</p> <p>✓ $n = 60$</p> <p>✓ $n = 36$</p> <p>✓ setting up equation</p> <p>✓ answer</p> <p style="text-align: center;">OR</p> <p>✓ value of i</p> <p>✓ $n = 2$</p> <p>✓ $n = 3$</p> <p>✓ setting up equation</p> <p>✓ answer</p> <p style="text-align: center;">OR</p> <p>✓ value of i</p> <p>✓ $n = 5$</p> <p>✓ $n = 3$</p> <p>✓ setting up equation</p> <p>✓ answer</p>	(5)
[14]			

QUESTION 6			
6.1	$f(x) = \frac{3}{x+2} - 1$ $2 = \frac{3}{k+2} - 1$ $3 = \frac{3}{k+2}$ $3k + 6 = 3$ $k = -1$	✓ substitution ✓ answer	(2)
6.2	$x = -2$ $y = -1$	✓ answer ✓ answer	(2)
6.3	$f(x) = \frac{3}{x+2} - 1$ $f(0) = \frac{3}{0+2} - 1$ $= \frac{1}{2}$ $\therefore \left(0; \frac{1}{2}\right)$ <p>NOTE: Answer MUST be presented in coordinate form.</p>	✓ answer	(1)
6.4	$f(x) = \frac{3}{x+2} - 1$ $0 = \frac{3}{x+2} - 1$ $1 = \frac{3}{x+2}$ $x + 2 = 3$ $x = 1$ $(1; 0)$ <p>NOTE: Answer does NOT need to be in coordinate form.</p>	✓ simplification ✓ answer	(2)

6.5		<ul style="list-style-type: none"> ✓ shape ✓ asymptotes ✓ x- and y- intercepts 	(3)
6.6	$m = -1$ and $(-2; -1)$ is on the axis of symmetry $\therefore y = mx + c$ $-1 = -1(-2) + c$ $\therefore c = -3$ $\therefore y = -x - 3$ NOTE: Any other valid method.	<ul style="list-style-type: none"> ✓ substitution for m AND the point ✓ answer 	(2)
6.7	$x > -2$	✓ answer	(1)
6.8	$f(x) = \frac{3}{x+2} - 1$ $-y = \frac{3}{x+2} - 1$ $y = -\left(\frac{3}{x+2} - 1\right)$ $y = \frac{-3}{x+2-4} + 1$ $y = \frac{-3}{x-2} + 1$	<ul style="list-style-type: none"> ✓ make y negative ✓ subtract 4 ✓ answer 	(3)
[16]			

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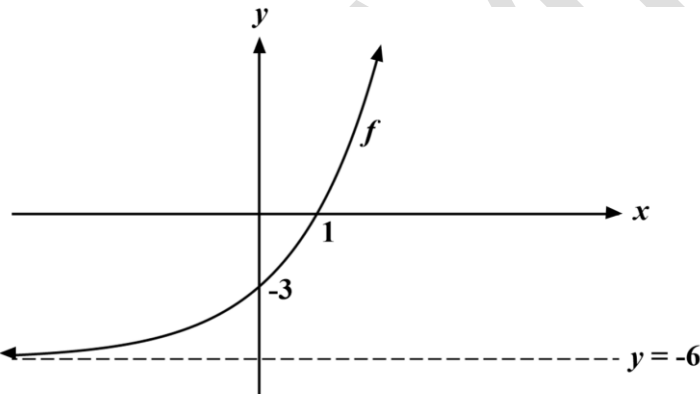
QUESTION 7			
7.1	$q = 5$	✓ answer	(1)
7.2	$f(x) = -x^2 - 4x + 5$ $x^2 + 4x - 5 = 0$ $(x+5)(x-1) = 0$ $x = -5$ or $x = 1$ $\therefore EP = 6$ units	✓ factors ✓ critical values ✓ answer	(3)
7.3	$x = \frac{-b}{2a}$ $x = \frac{-(-4)}{2(-1)}$ $x = -2$ $f(-2) = 9$ $\therefore N(-2; 9)$ <p style="text-align: center;">OR</p> $f(x) = -(x^2 + 4x) + 5$ $f(x) = -(x^2 + 4x + 2^2) + 5 + 4$ $f(x) = -(x + 2)^2 + 9$ $\therefore N(-2; 9)$ NOTE: Answer does NOT have to be in coordinate form.	✓ x-value ✓ y-value <p style="text-align: center;">OR</p> ✓ x-value ✓ y-value	(2)
7.4	m of $g = 1$ $\therefore m$ of $h = -1$ $y = mx + c$ $9 = -1(-2) + c$ $c = 7$ $h(x) = -x + 7$ NOTE: Any other valid method.	✓ gradient of $h = -1$ ✓ $c = 7$ ✓ answer	(3)
7.5	$M(0; 5)$ and $N(-2; 9)$ $m_{MN} = \frac{y_2 - y_1}{x_2 - x_1}$ $m_{MN} = \frac{9 - 5}{-2 - 0}$ $m_{MN} = -2$ NOTE: NO marks for applying incorrect gradient formula.	✓ correct substitution ✓ answer	(2)

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7.6	<p>At point N: $f(-2) = 9$ At point T: $g(-2) = 3$ \therefore distance of NT = $9 - 3$ $= 6$ units</p> <p>OR</p> $NT = f(x) - g(x)$ $= -x^2 - 4x + 5 - (x + 5)$ $= -x^2 - 5x$ $x = -2$ $\therefore NT = -(-2)^2 - 5(-2)$ $NT = 6 \text{ units}$ <p>NOTE: Any other valid method.</p>		<p>✓ $g(-2) = 3$ ✓ method ✓ answer</p> <p>OR</p> <p>✓ method</p> <p>✓ substitution ✓ answer</p>	(3)
7.7	<p>By symmetry: $S(-4; 5)$</p> <p>OR</p> <p>At point S: $y = 5$ $\therefore 5 = -x^2 - 4x + 5$ $x^2 + 4x = 0$ $x(x + 4) = 0$ $x = 0$ or $x = -4$ $\therefore S(-4; 5)$</p>		<p>✓✓✓ answer</p> <p>OR</p> <p>✓ $y = 5$ ✓ equating</p> <p>✓ selection of -4</p>	(3)
7.8	7.8.1	$x = -5$ <p>OR</p> $x = 0$	<p>✓ answer</p> <p>✓ answer</p>	(2)
	7.8.2	$x > 1$	✓ answer	(1)
[20]				

QUESTION 8			
8.1	let $x = 0$ $f(x) = 3 \cdot 2^x - 6$ $f(0) = 3 \cdot 2^0 - 6$ $y = -3$ $\therefore (0; -3)$ NOTE: Answer MUST be in coordinate form.	✓ answer	(1)
8.2	let $y = 0$ $0 = 3 \cdot 2^x - 6$ $6 = 3 \cdot 2^x$ $2 = 2^x$ $x = 1$ $\therefore (1; 0)$ NOTE: Answer does NOT have to be in coordinate form.	✓ simplify both sides to base 2 ✓ answer	(2)
8.3		✓ shape ✓ asymptote ✓ x- and y- intercepts	(3)
8.4	$y > -6$ OR $y \in [-6; \infty]$	✓ answer	(1)
[7]			

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QUESTION 9

NOTE: Candidates may present answers as a fraction, decimal fraction or percentage.

9.1	9.1.1	$P(\text{male}) = \frac{120}{236}$ $P(\text{male}) = 0,51$	$\checkmark \frac{120}{236}$ \checkmark answer	(2)
	9.1.2	$P(\text{Female and plays sport}) = \frac{67}{236}$ $P(\text{Female and plays sport}) = 0,28$	$\checkmark \frac{67}{236}$ \checkmark answer	(2)
9.2	$P(\text{Male and does not play sport}) = \frac{51}{236}$ $P(\text{Male and does not play sport}) = 0,22$ $\neq 0$ NOT mutually exclusive OR There are 51 male learners who do not play sport. Therefore the two are NOT mutually exclusive. NOTE: Accept alternative answers expressed as a percentage or in fraction form.		$\checkmark 0,22$ \checkmark conclusion OR \checkmark statement \checkmark conclusion	(2)
9.3	$P(\text{male and does not play sport}) = 0,22$ $P(\text{male}) \times P(\text{does not play sport})$ $= \frac{120}{236} \times \frac{100}{236}$ $= 0,22$ $\therefore P(\text{male and does not play sport})$ $= P(\text{male}) \times P(\text{does not play sport})$ \therefore the events ARE independent (correct to two decimal places)		$\checkmark \checkmark P(\text{male}) \times P(\text{does not play sport})$ $= 0,22$ \checkmark equating \checkmark conclusion	(4)
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QUESTION 10			
10.1	$c = 84 - 75$ $c = 9$	✓ answer	(1)
10.2	$f + 18 + x = 41$ $f = 41 - x - 18$ $f = 23 - x$	✓ equating correctly ✓ answer	(2)
10.3	$f = 23 - x \quad \therefore x = 23 - f$ $e = 17 - x \quad \therefore x = 17 - e$ $\therefore 23 - f = 17 - e$ but $40 + e + f + x = 75$ $\therefore e + f + x = 35$ $\therefore 17 - x + 23 - x + x = 35$ $40 - x = 35$ $x = 5$	✓ equating expressions of x ✓ equating to 75 ✓ simplification ✓ answer	(4)
			[7]

TOTAL: 150