



education
MPUMALANGA PROVINCE
REPUBLIC OF SOUTH AFRICA

**NATIONAL
SENIOR CERTIFICATE**

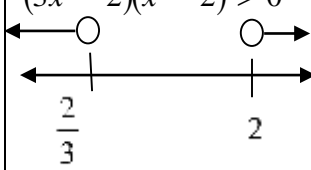
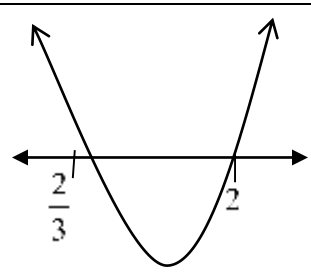
GRADE 12

**MATHEMATICS PAPER 1
SEPTEMBER 2018
MARKING GUIDELINES**

MARKS: 150

TIME: 3 hours

These marking guidelines consist of 12 pages

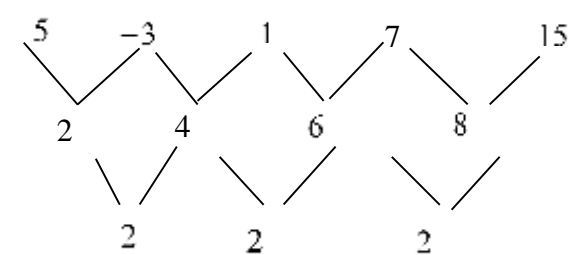
QUESTION 1		[26]
1.1.1	$x^2 + 5x + 6 = 0$ $(x+2)(x+3) = 0$ $x = -2 \text{ or } x = -3$	✓ Factors ✓ Answers (2)
1.1.2	$x(2x - 5) + 1 = 0$ $2x^2 - 5x + 1 = 0$ $x = \frac{-(-5) \pm \sqrt{(5)^2 - 4(2)(1)}}{2(2)}$ $x = \frac{5 \pm \sqrt{17}}{6}$ $x = 1,52 \text{ or } x = 0,15$	✓ Standard form ✓ Substitution into correct formula ✓ $\sqrt{17}$ ✓ ✓ Answers (5)
1.1.3	$3x^2 - 8x + 4 > 0$ $(3x - 2)(x - 2) > 0$  OR  $x < \frac{2}{3} \text{ or } x > 2$ OR $x \in \left(-\infty; \frac{2}{3}\right) \cup (2; \infty)$	✓ Critical Values ✓ Method ✓ Notation (3)
1.1.4	$3^x - 3^{x-2} = 24$ $3^x(1 - 3^{-2}) = 24$ $3^x\left(\frac{8}{9}\right) = 24$ $3^x = 27$ $3^x = 3^3$ $x = 3$	✓ Common factor ✓ Simplification ✓ Exponential Law ✓ Answer (4)
1.2	$y + \frac{1}{2}x = 2$ $x^2 + y^2 + 6x = 4y - 4$	

<p>$y = -\frac{1}{2}x + 2$</p> <p>Substitute $y = -\frac{1}{2}x + 2$ in $x^2 + y^2 + 6x = 4y - 4$</p> $x^2 + \left(-\frac{1}{2}x + 2\right)^2 + 6x = 4\left(-\frac{1}{2}x + 2\right) - 4$ $x^2 + 4 - 2x + \frac{1}{4}x^2 + 6x = 8 - 2x - 4$ $\frac{5}{4}x^2 + 6x = 0$ $x\left(\frac{5}{4}x + 6\right) = 0$ $x = 0 \quad \text{or} \quad \frac{5}{4}x = -6$ $x = -\frac{24}{5}$ <p>Substitute $x = 0$ in $y = -\frac{1}{2}x + 2$</p> $y = -\frac{1}{2}(0) + 2 = 2$ <p>Substitute $x = -\frac{24}{5}$ in $y = -\frac{1}{2}x + 2$</p> $y = -\frac{1}{2}\left(-\frac{24}{5}\right) + 2 = \frac{22}{5}$ <p>OR</p> $y + \frac{1}{2}x = 2$ $x^2 + y^2 + 6x = 4y - 4$ $2y = -x + 4$ $x = -2y + 4$ <p>Substitute $x = -2y + 4$ in $x^2 + y^2 + 6x = 4y - 4$</p> $(4 - 2y)^2 + y^2 + 6(4 - 2y) = 4y - 4$ $16 - 16y + 4y^2 + y^2 + 24 - 12y = 4y - 4$ $5y^2 - 32y + 44 = 0$ $(5y - 22)(y - 2) = 0$ $y = \frac{22}{5} \quad \text{or} \quad y = 2$ $x = -2\left(\frac{22}{5}\right) + 4 = -\frac{24}{5}$ $x = -2(2) + 4 = 0$	<p>✓ y the subject</p> <p>✓ Substitution</p> <p>✓ Standard form</p> <p>✓ Factors</p> <p>✓ x-values</p> <p>✓ Substitution</p> <p>✓ y-values (7)</p> <p>✓ x the subject</p> <p>✓ Substitution</p> <p>✓ Standard form</p> <p>✓ Factors</p> <p>✓ y - values</p> <p>✓ Substitution</p> <p>✓ y-values</p>
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<p>1.3</p>	$px^2 + x(p-2) + p = 0$ $0 = (p-2)^2 - 4(p)(p)$ $0 = p^2 - 4p + 4 - 4p^2$ $-3p^2 - 4p + 4 = 0$ $3p^2 + 4p - 4 = 0$ $(3p-2)(p+2) = 0$ $p = \frac{2}{3} \text{ or } p = -2$	<ul style="list-style-type: none"> ✓ $\Delta = 0$ ✓ substitution in Δ ✓ Simplification ✓ Factors ✓ answer <p style="text-align: right;">(5)</p>
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QUESTION 2

[26]

<p>2.1</p>	<p>....;; 1 ; 7 ; 15 ; 25;</p>	
<p>2.1.1</p>	 <p>$\therefore T_1 = -5$</p>	<ul style="list-style-type: none"> ✓ Differences ✓ Answer <p style="text-align: right;">(2)</p>
<p>2.1.2</p>	$2a = 2$ $a = 1$ $3a + b = 2$ $3(1) + b = 2$ $b = -1$ $1 - 1 + c = -5$ $c = -5$ $\therefore T_n = n^2 - n - 5$	<ul style="list-style-type: none"> ✓ Value of a ✓ Value of b ✓ Value of c ✓ General term <p style="text-align: right;">(4)</p>
<p>2.1.3</p>	$T_n = n^2 - n - 5$ $415 = n^2 - n - 5$ $n^2 - n - 420 = 0$ $(n-21)(n+20) = 0$ $\therefore n = 21$	<ul style="list-style-type: none"> ✓ Standard Form ✓ Factors ✓ Correct n value <p style="text-align: right;">(3)</p>

2.2	$x ; x + 3 ; 3x - 1$	
2.2.1	$\frac{x + 3}{x} = \frac{3x - 1}{x + 3}$ $3x^2 - x = x^2 + 6x + 9$ $2x^2 - 7x - 9 = 0$ $(2x - 9)(x + 1) = 0$ $x = \frac{9}{2} \text{ or } x = -1$	✓ Ratio ✓ Standard Form ✓ Factors ✓ Correct x values (4)
2.2.2	$-1 ; 2 ; -4$ $S_n = \frac{a(r^n - 1)}{(r - 1)}$ $S_{20} = \frac{-1((-2)^{20} - 1)}{-2 - 1}$ $S_{20} = 349525$	✓ Sequence ✓ Substitution into the correct formula ✓ Answer (3)
2.2.3	$\frac{9}{2} ; \frac{15}{2} ; \frac{25}{2}$ $r = \frac{5}{3}$ Will not converge r is not between -1 and 1	✓ value of r ✓ Reason (2)
2.3	$T_n = a + (n - 1)d$ $T_k = a + (k - 1)d = m$ $a = m - (k - 1)d$ $T_m = a + (m - 1)d = k$ $a = k - (m - 1)d$ $m - d(k - 1) = k - d(m - 1)$ $-d(k - 1) + d(m - 1) = k - m$ $d[(m - 1) - (k - 1)] = k - m$ $d = \frac{k - m}{m - k}$	✓ Substitution into correct formula ✓ Substitution into correct formula ✓ Equating ✓ Factors ✓ Answer (5)
2.4	$1 + q + 2 + q + 3 + q + 4 + q + 5 + q = 15k$ $5q + 15 = 15k$ $5q = 15k - 15$ $q = 3k - 3$	✓ Equation ✓ Simplification ✓ Answer (3)

QUESTION 3		[21]
3.1	$y = -x^2 + 2x + 3$ $y = -(x^2 - 2x + 1 - 1) + 3$ $y = -(x - 1)^2 + 4$ TP (1 ; 4) OR $x = \frac{-b}{2a}$ $x = \frac{-2}{2(-1)}$ $x = 1$ TP (1 ; 4)	✓ Completing of the square ✓ Value of x ✓ Value of y ✓ Turning point (4) ✓ Formula for x ✓ Value of x ✓ Value of y ✓ Turning point
3.2	$-x^2 + 2x + 3 = 0$ $x^2 - 2x - 3 = 0$ $(x - 3)(x + 1) = 0$ $x = 3$ or $x = -1$ AB = 4units	✓ Factors ✓ Correct x values ✓ Answer (3)
3.3	$EF = -x^2 + 2x + 3 - (-x + 3)$ $= -x^2 + 3x$ $Max: -2x + 3 = 0$ OR $x = \frac{-b}{2a}$ $x = \frac{3}{2}$ OR $x = \frac{-3}{2(-1)} = \frac{3}{2}$	✓ $f(x) - g(x)$ ✓ Derivative OR formula ✓ Value of x (3)
3.4	$p(x) = -(x - 1)^2 + 4 - 2$ $p(x) = -(x - 1)^2 + 2$ $y \leq 2; y \in R$ OR $(-\infty ; 2]$	✓✓ Answer (2)
3.5.1	Four units down One unit to the left Reflection over the x -axis	✓ Translation ✓ Translation ✓ Reflection (3)

3.5.2	$x \geq 0$ or $x \leq 0$	✓✓ Answers (2)
3.6.1	$B(3; 0)$ $0 < x < 3$	✓ Critical values ✓ Notation (2)
3.6.2	$x > 1$	✓✓ Answer (2)
QUESTION 4		[12]
4.1.1	$y = a^x$ OR $\frac{1}{3} = a^1$ $9 = a^{-2}$ $a = \frac{1}{3}$ $a = \frac{1}{3}$	✓ Substitution ✓ Answer (2)
4.1.2	$g(x) = \frac{k}{x+p} + q$ $g(x) = \frac{k}{x+2} + 1$ $\frac{1}{3} = \frac{k}{1+2} + 1$ $\frac{-2}{3} = \frac{k}{3}$ $k = -2$ $g(x) = \frac{-2}{x+2} + 1$	✓ Substitution of p and q ✓ Substitution of $\left(1; \frac{1}{3}\right)$ ✓ Value of k ✓ Equation (4)
4.2	$y = \log_{\frac{1}{3}} x$	✓ Answer (1)
4.3	$h(x) = x + c$ $9 = -2 + c$ $c = 11$	✓ Substitution of $(-2; 9)$ ✓ Answer (2)
4.4	$0 < x \leq 1$ OR $x \in (0; 1]$	✓✓ Answer (2)

QUESTION 5		[15]
5.1	$A = P(1 - i)^n$ $x = 2x(1 - 0,075)^n$ $\frac{1}{2} = (1 - 0,075)^n$ $\log \frac{1}{2} = n \log 0,925$ $n = \frac{\log \frac{1}{2}}{\log 0,925}$ $n = 8,89$ $n = 8 \text{ years } 11 \text{ months}$	<ul style="list-style-type: none"> ✓ Substitution into correct formula ✓ Substitute A & P ✓ Use of logs ✓ Answer ✓ Rounding to months (5)
5.2.1	$\frac{30}{100}(18\ 480)$ $= R5\ 544$	<ul style="list-style-type: none"> ✓ Answer (1)
5.2.2	$P = \frac{x [1 - (1 + i)^{-n}]}{i}$ $P = \frac{5544 \left[1 - \left(1 + \frac{0,08}{12} \right)^{-300} \right]}{\frac{0,08}{12}}$ $P = R718\ 305,71$	<ul style="list-style-type: none"> ✓ Substitution in correct Formula ✓ value of n ✓ value of i ✓ Answer (4)
5.3	$A = P(1 + i)^n$ $A = 1000 \left(1 + \frac{0,15}{12} \right)^{18}$ $A = R\ 1\ 250,58$ $F = \frac{x [(1 + i)^n - 1]}{i}$ $= \frac{700 \left[\left(1 + \frac{0,15}{12} \right)^{18} - 1 \right]}{\frac{0,15}{12}}$ $x = R\ 14\ 032,33$ $\text{Total: R } 15\ 282,91$	<ul style="list-style-type: none"> ✓ Substitution in correct Formula ✓ Value of A ✓ Substitution into correct formula ✓ Value of F ✓ answer (5)

QUESTION 6	Penalty of -1 for notation in Question 6	[13]
6.1	$f(x) = -2x^2 + 5$ $f(x+h) = -2(x+h)^2 + 5$ $f(x+h) = -2x^2 - 4xh - 2h^2 + 5$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{-2x^2 - 4xh - 2h^2 + 5 - (-2x^2 + 5)}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{-2x^2 - 4xh - 2h^2 + 5 + 2x^2 - 5}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{-4xh - 2h^2}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{h(-4x - 2h)}{h}$ $= -4x$	<p>✓ Finding $f(x+h)$</p> <p>✓ Simplification</p> <p>✓ Correct substitution into Formula and notation</p> <p>✓ Common factor</p> <p>✓ Answer (5)</p>
6.2	$y = 5x + \frac{6}{\sqrt{x}}$ $y = 5x + \frac{6}{x^{\frac{1}{2}}}$ $y = 5x + 6x^{-\frac{1}{2}}$ $\frac{dy}{dx} = 5 - 3x^{-\frac{3}{2}}$	<p>✓ $x^{1/2}$</p> <p>✓ Exponent Law</p> <p>✓ ✓ Derivative (4)</p>
6.3.1	$g(x) = \frac{2x^3 + x^2 - 3x}{x-1}$ $= \frac{x(2x+3)(x-1)}{x-1}$ $= x(2x+3) = 2x^2 + 3x$ $g'(x) = 4x + 3$ $g'(2) = 11$	<p>✓ Factorise</p> <p>✓ Simplify</p> <p>✓ Derivative</p> <p>✓ Answer (4)</p>

QUESTION 7		[16]
7.1	$y = a(x - x_1)(x - x_2)(x - x_3)$ $y = 2(x + 1)\left(x - \frac{1}{2}\right)(x - 3)$ $y = 2(x^2 - 2x - 3)\left(x - \frac{1}{2}\right)$ $y = 2\left(x^3 - \frac{5}{2}x^2 - 2x + \frac{3}{2}\right)$ $y = 2x^3 - 5x^2 - 4x + 3$	<ul style="list-style-type: none"> ✓ Substitution of x values into correct formula ✓ Simplification ✓ Simplification ✓ Answer (4)
7.2	$y = 2x^3 - 5x^2 - 4x + 3$ $6x^2 - 10x - 4 = 0$ $3x^2 - 5x - 2 = 0$ $(x - 2)(3x + 1) = 0$ $x = 2 \text{ or } x = -\frac{1}{3}$ $y = 2\left(-\frac{1}{3}\right)^3 - 5\left(-\frac{1}{3}\right)^2 - 4\left(-\frac{1}{3}\right) + 3$ $y = \frac{100}{27}$ $A\left(-\frac{1}{3}; \frac{100}{27}\right)$	<ul style="list-style-type: none"> ✓ Derivative ✓ = 0 ✓ Factors ✓ x - values ✓ select one value ✓ y - value (6)
7.3	$f(x) = 2x^3 - 5x^2 - 4x + 3$ $f(x) = 2(-2)^3 - 5(-2)^2 - 4(-2) + 3 = -25 \quad \therefore D(-2; -25)$ $f'(x) = 6x^2 - 10x - 4$ $f'(x) = 6(-2)^2 - 10(-2) - 4 = 40$ $y - y_1 = m(x - x_1)$ $y + 25 = 40(x + 2)$ $y = 40x + 55$	<ul style="list-style-type: none"> ✓ Value of $f(-2)$ ✓ Value of $f'(-2)$ ✓ Substitution into correct formula ✓ Answer (4)

7.4	$12x - 10 > 0$ $x > \frac{5}{6}$	✓ Inequality ✓ Answer (2)
QUESTION 8 [7]		
8.1	$\text{Area} = 2(\frac{1}{2}b \times H) + Lx B + Lx B + Lx B$ $600 = 5x \cdot 12x + 5xy + 12xy + 13xy$ $= 60x^2 + 30xy$ $\therefore y = \frac{600 - 60x^2}{30x}$ $= \frac{20 - 2x^2}{x}$	✓ area ✓ method ✓ Answer (3)
8.2	$\text{Volume} = \text{area of base} \times h$ $= \frac{1}{2} 5x \cdot 12x \cdot \frac{20 - 2x^2}{x}$ $= 600x - 60x^3$ $\text{Max : } 600 - 180x^2 = 0$ $x^2 = \frac{10}{3}$ $\therefore x = \sqrt{\frac{10}{3}}$	✓ Volume ✓ simplification ✓ $f'(x) = 0$ ✓ answer (4)

QUESTION 9		[15]
9.1.1	Event A : 1,2 B: 2,4,6 C : 6 $P(A) = \frac{2}{6} = \frac{1}{3}$ $P(B) = \frac{3}{6} = \frac{1}{2}$ $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$ $= \frac{2}{6} + \frac{1}{2} - \frac{1}{6}$ $= \frac{2}{3}$	✓ P(A) ✓ P(B) ✓ Substitution into correct formula ✓ Answer (4)
9.1.2	A and C are mutually exclusive $P(A \text{ and } C) = 0$	✓ Events ✓ Reason (2)
9.1.3	$P(B) \times P(C) = \frac{1}{2} \times \frac{1}{6} = \frac{1}{12}$ $P(B \cap C) = \frac{1}{6}$ $P(B) \times P(C) \neq P(B \cap C)$ B and C are not independent events	✓ $P(B) \times P(C)$ ✓ $P(B \cap C)$ ✓ Conclusion (3)
9.2.1	$6! = 720$	✓ $6!$ ✓ Answer (2)
9.2.2	$1!4!1! = 24$	✓ $1!4!1!$ ✓ Answer (2)
9.2.3	$2! \times 4! \times 5 = 240$ $P(\text{Visits}) = \frac{240}{720} = \frac{1}{3}$	✓ $2! \times 4! \times 5$ ✓ Answer (2)

TOTAL: 150