Province of the
EASTERN CAPE
EDUCATION

NATIONAL SENIOR CERTIFICATE

GRADE 11

NOVEMBER 2018

TECHNICAL MATHEMATICS P1
MARKING GUIDELINE

MARKS: 150

This marking guideline consists of 14 pages.

NOTE:

- If a candidate answered a question TWICE, mark the FIRST attempt ONLY.
- Consistent accuracy applies in ALL aspects of the memorandum UNLESS stated otherwise.
- If a candidate crossed out an attempt of a question and did not redo the question, mark the crossed-out attempt.
- The mark for substitution is awarded for substitution into the correct formula.

QUESTION 1				
1.1	1.1.1	$\left(\frac{2}{3^{-2}}\right)^{-1} = \frac{2^{-1}}{3^2}$ $= \frac{1}{9.2}$ $= \frac{1}{18}$	✓Distributive law ✓Positive exponent ✓ $\frac{1}{18}$	
		OR $\left(\frac{2}{3^{-2}}\right)^{-1} = \left(2.3^2\right)^{-1}$ $= (18)^{-1}$ $= \frac{1}{18}$	**OR** ✓Positive exponent ✓Simplification ✓ $\frac{1}{18}$	(3)
	1.1.2	$\left(3 - \frac{1}{x}\right)\left(9 + \frac{3}{x} + \frac{1}{x^2}\right)$ $= 27 - \frac{1}{x^3}$	✓ 27 ✓ $-\frac{1}{x^3}$	(2)
	1.1.3	$\frac{\sqrt{32} + \sqrt{8}}{6\sqrt{2}}$ $= \frac{\sqrt{2^5} + \sqrt{2^3}}{6\sqrt{2}}$ $= \frac{2^{\frac{5}{2}} + 2^{\frac{3}{2}}}{6.2^{\frac{1}{2}}}$ $= \frac{2^{\frac{5}{2}-\frac{1}{2}}}{6} + \frac{2^{\frac{3}{2}-\frac{1}{2}}}{6}$ $= \frac{2^2}{6} + \frac{2}{6}$ $= 1$	✓Prime factors ✓Exponential form ✓Division rule ✓1	(4)

		OR $\frac{\sqrt{32}+\sqrt{8}}{6\sqrt{2}}$ $=\frac{\sqrt{2^5}+\sqrt{2^3}}{6\sqrt{2}}$ $=\frac{\sqrt{2^3}\left(\sqrt{2^2}+1\right)}{6\sqrt{2}}$ $=\frac{\sqrt{2^3}(3)}{2.3\sqrt{2}}$ $=\frac{\sqrt{2^3}}{2\sqrt{2}}=\frac{\sqrt{2^3}}{\sqrt{2^3}}$ $=1$	**OR** ✓Prime factors ✓Exponential form ✓Simplification ✓1	
		OR $\frac{\sqrt{32}+\sqrt{8}}{6\sqrt{2}}$ $=\frac{\sqrt{16.2}+\sqrt{4.2}}{6\sqrt{2}}$ $=\frac{4\sqrt{2}+2\sqrt{2}}{6\sqrt{2}}$ $=\frac{6\sqrt{2}}{6\sqrt{2}}$ $=1$	**OR** ✓Product of prime factors ✓Simplification ✓Sum ✓1	
	1.1.4	$\frac{3.3^x-4.3^{x+2}}{2.3^x-3^{x+1}}$ $=\frac{3.3^x-4.3^x.3^2}{2.3^x-3^x.3^1}$ $=\frac{3^x\left(3-4.3^2\right)}{3^x(2-3)}$ $=\frac{-33}{-1}$ $=33$	✓Factors in the numerator ✓Factors in the denominator ✓Simplification ✓33	(4)
1.2	1.2.1	$\log\left(\frac{9c^3}{100}\right)$ $=\log 9+\log c^3-\log 100$ $=2\log 3+3\log c-2\log 10$ $=2\log 3+3\log c-2$	✓$\log 9+\log c^3-\log 100$ ✓$2\log 3+3\log c-2$	(2)

	1.2.2	$\log\left(\frac{9c^3}{100}\right) - 3\log c$ $= 2\log 3 + 3\log c - 2 - 3\log c$ $= 2\log 3 - 2$ $= 2\left(\frac{12}{25}\right) - 2$ $= -\frac{26}{25}$	✓Substitute $2\log 3 + 3\log c - 2$ ✓Substitute $\frac{12}{25}$ ✓ $-\frac{26}{25}$	(3)
1.3		$\begin{array}{r} {}^{1111} \\ 100001_2 \\ -\ 1111_2 \\ \hline 10010_2 \end{array}$ $2^4, 2^3, 2^2, 2^1, 2^0$ 1 0 0 1 0 $2^4 \times 1 + 2^3 \times 0 + 2^2 \times 0 + 2^1 \times 1 + 2^0 \times 0 = 18$ The code DCDL code = 18	✓Lending evidence ✓Binary difference ✓Place value product ✓DCDL = 18	
		OR $2^5, 2^4, 2^3, 2^2, 2^1, 2^0$ 1 + 0+ 0 + 0+ 0 + 1 = 33 2^3 , 2^2 , 2^1 , 2^0 1 1 1 1 = 15 33 – 15 = the code DCDL code = 18	**OR** ✓Method ✓33 ✓15 ✓DCDL = 18	(4)
1.4	1.4.1	$\frac{x^2 + xy}{2x^3 - x^2y - 3xy^2} - \frac{1}{2x - 3y} = 0$ $\text{LHS} = \frac{x(x + y)}{x(2x^2 - xy - 3y^2)} - \frac{1}{2x - 3y}$ $\text{LHS} = \frac{x + y}{(2x - 3y)(x + y)} - \frac{1}{2x - 3y}$ $\text{LHS} = \frac{1}{2x - 3y} - \frac{1}{2x - 3y}$ LHS = 0 = RHS	✓ $x(x + y)$ ✓ $x(2x^2 - xy - 3y^2)$ ✓ $\frac{1}{2x - 3y} - \frac{1}{2x - 3y}$	(3)

	1.4.2	LHS = log6 + 2log20 – log3 – 3log2 = log6 + log400 – log3 – log8 $= \log\left(\frac{6\times 400}{3\times 8}\right)$ = log100 $= \log 10^2$ = 2log10 = 2 = RHS	✓ {log400 and log8} ✓ $\log\left(\frac{6\times 400}{3\times 8}\right)$ ✓ {log100 OR $\log 10^2$} ✓ 2log10	
		OR LHS = log6 + 2log20 – log3 – 3log2 = log(2.3) + 2log(2^2.5) – log3 – 3log2 = log2 + log3 + 2log2^2 + 2log5 – log3 – 3log2 = log2 + 4log2 + 2log5 – 3log2 = 2log2 + 2log5 = 2log10 = 2 = RHS	**OR** ✓ log(2.3) ✓ 2log(2^2.5) ✓Simplification ✓2log10	
		OR LHS = log6 + 2log20 – log3 – 3log2 = log(2.3) + 2log(2.10) – log3 – 3log2 = log2 + log3 + 2log2 + 2log10 – log3 – 3log2 = 2log10 = 2 = RHS	**OR** ✓ log(2.3) ✓ 2log(2.10) ✓Simplification ✓2log10	(4)
				[29]

QUESTION 2

2.1	2.1.1	$\left(\sqrt{x}+\sqrt{2}\right)\left(\sqrt{x}-\sqrt{2}\right)=0$ $x-x\sqrt{2}+x\sqrt{2}-2=0$ $x-2=0$ $x=2$	✓Expansion ✓x =2	(2)
	2.1.2	$4x^{\frac{5}{2}}=128$ $x^{\frac{5}{2}}=32$ $\left(x^{\frac{5}{2}}\right)^{\frac{2}{5}}=\left(2^5\right)^{\frac{2}{5}}$ $x=4$	✓Simplification ✓$\left(2^5\right)^{\frac{2}{5}}$ ✓x= 4	(3)
	2.1.3	$\frac{3^x+3^{x+1}}{6^x.3}=\frac{2}{3}$ $\frac{3^x+3^x.3}{3^x.2^x.3}=\frac{2}{3}$ $\frac{3^x(1+3)}{3^x.2^x.3}=\frac{2}{3}$ $\frac{4}{2^x.3}=\frac{2}{3}$ $4=2.2^x$ $2^2=2^{x+1}$ $2=x+1$ $x=1$	✓Same base rule ✓$3^x.2^x$ ✓$3^x(1+3)$ ✓$4=2.2^x$ OR $2^2=2^{x+1}$ ✓Equating exponents ✓x =1	(6)
	2.1.4	$\log_3 x+\log_3 4=\log_7\left(\frac{1}{49}\right)$ $\log_3 4x=\log_7 1-\log_7 49$ $\log_3 4x=0-2\log_7 7$ $\log_3 4x=-2$ $3^{-2}=4x$ $x=\frac{1}{36}$	✓$\log_3 4x$ ✓$\log_7 1-\log_7 49$ ✓$\log 1=0$ ✓$2\log_7 7$ ✓Exponential form ✓$x=\frac{1}{36}$	(6)

2.2	2.2.1	$F = \frac{k.Q_1 \times Q_2}{r^2}$ $r^2 = \frac{k.Q_1 \times Q_2}{F}$ $r = \sqrt{\frac{k.Q_1 \times Q_2}{F}}$	✓Cross multiplication ✓r	(2)
	2.2.2	$r = \sqrt{\frac{(9 \times 10^9)(8 \times 10^{-7})(8 \times 10^{-7})}{8,64 \times 10^{-3}}}$ $r = 8,2 \times 10^{-1}$	✓Substitution ✓$r = 8,2 \times 10^{-1}$	(2)
				[21]

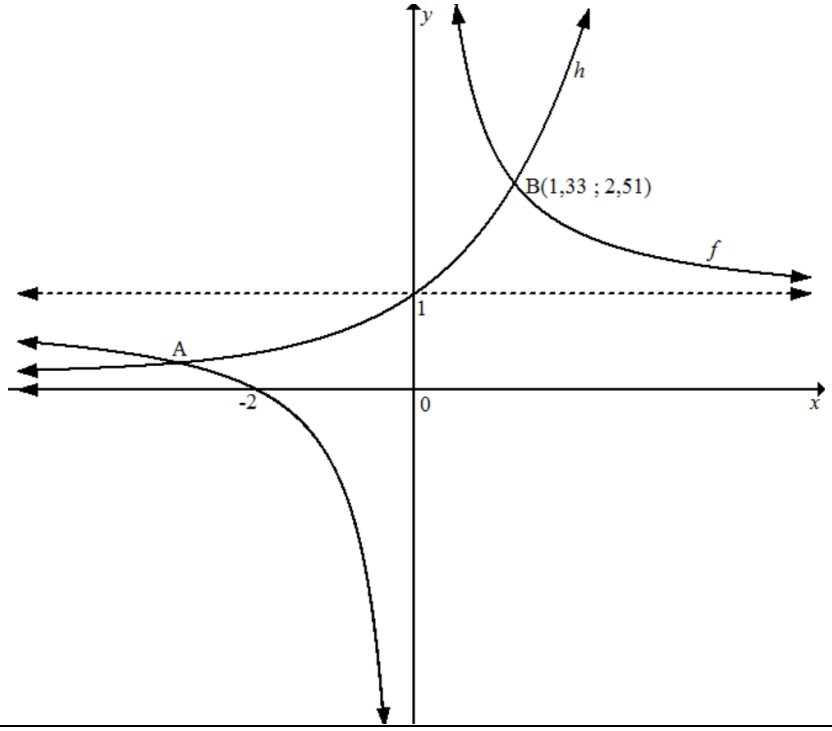
	QUESTION 3			
3.1	3.1.1	$x(x+6)=0$ $x=0$ or $x=-6$	✓Factors ✓Both values of x	(2)
	3.1.2	$3x^2-5x=2$ $3x^2-5x-2=0$ $(3x+1)(x-2)=0$ $x=-\frac{1}{3}$ or $x=2$	✓Standard quadratic form ✓Factors ✓ $x=-\frac{1}{3}$ ✓ $x=2$	
		OR $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$ $x=\frac{-(-5)\pm\sqrt{(-5)^2-4(3)(-2)}}{2\times 3}$ $x=-\frac{1}{3}$ or $x=2$	**OR** ✓Formula ✓Substitution ✓ $x=-\frac{1}{3}$ ✓ $x=2$	(4)
	3.1.3	**-1 for incorrect rounding** $2x-\frac{1}{x}=3$ $2x^2-1=3x$ $2x^2-3x-1=0$ $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$ $x=\frac{-(-3)\pm\sqrt{(-3)^2-4(2)(-1)}}{2\times 2}$ $x=1,8$ or $x=-0,3$	✓Multiplying by LCD ✓Standard form ✓Correct formula ✓Substitution ✓ $x=1,8$ ✓ $x=-0,3$	(6)
	3.1.3	$x^2-7x+10<0$ $(x-2)(x-5)<0$ Test Values: $x=2$ and $x=5$ $2<x<5$	✓Factors ✓Critical values ✓Correct notation	(3)

3.2	$y + 2x - 3 = 0$ .....(1) $y = x^2 + 2x + 3$.....(2) $y = 3 - 2x$.....(3) Substitute (3) into (2) : $x^2 + 2x + 3 = 3 - 2x$ $x^2 + 4x = 0$ $x(x + 4) = 0$ $x = 0$ or $x = -4$ $y = 3 - 2(0)$ or $y = 3 - 2(-4)$ $y = 3$ or $y = -5$	✓Equation (3) ✓Substitution ✓Standard form ✓Factors ✓Both values of x ✓Both values of y	(6)
3.3	$A = l \times b$ $= 10 \times 3 = 30$ Then $2A = (10 + x)(3 + x)$ $2 \times 30 = 30 + 13x + x^2$ $60 = 30 + 13x + x^2$ $0 = -30 + 13x + x^2$ $0 = (x + 15)(x - 2)$ $x = -15$ or $x = 2$ $\therefore$ The length must be increased by 2m	✓$(10+x)(3+x)$ ✓60 ✓Standard form ✓Factors ✓ $x = -15$ or $x = 2$ ✓$x = 2$m or $x \neq -15$m **OR** $x = 2$m	(6)
			[27]
QUESTION 4			
4.1	$\sqrt{-4}$ is imaginary $\sqrt{6}$ is irrational $-\sqrt{121}$ is rational and integer	✓$\sqrt{-4}$ imaginary ✓$\sqrt{6}$ irrational ✓$-\sqrt{121}$ rational ✓ $-\sqrt{121}$ integer	(4)
4.2	$\Delta = b^2 - 4ac$ $= (5)^2 - 4(2)(3)$ $= 1$ Roots are Real, Rational and Unequal	✓Substitution ✓$\Delta = 1$ ✓Rational ✓Real and Unequal	(4)

4.3	$h(x) = 2x^2 + px + 3$ $\Delta = b^2 - 4ac = 0$ $0 = (p)^2 - 4(2)(3)$ $24 = p^2$ $\therefore p = \pm 2\sqrt{6}$	✓Discriminant =0 ✓Substitution ✓ $p = 2\sqrt{6}$ ✓ $p = -2\sqrt{6}$	(4)
			[12]

QUESTION 5

5.1	Radius = OE = $\sqrt{9 - 0^2}$ Radius = 3 $q = -r = -3$	✓$x = 0$ ✓Radius =3 ✓$q = -3$	(3)
5.2	$a = m_{ED} = \frac{3}{3} = 1$	✓a =1	(1)
5.3	$f(x) = x - 3$	✓Substitute a =1 ✓Substitute $q = -3$	(2)
5.4	DE = $\sqrt{OD^2 + OE^2}$ DE = $\sqrt{3^2 + 3^2}$ DE = $3\sqrt{2} = 4,24$	✓Pythagoras theorem/Distance formula ✓Substitution ✓ ED = $3\sqrt{2}$ or 4,24	(3)
			[9]

QUESTION 6			
6.1	$0 = -\frac{2}{x} - 1$ $x = -2$	✓f (x) =0 ✓x = – 2	(2)
6.2	$h(0) = 2^0 = 1$	✓Accurate answer	(1)
6.3	$x = 0$ and $y = 1$	✓ $x = 0$ ✓ $y = 1$	(2)
6.4		✓ Shape of $f(x)$ ✓Asymptote ✓x-intercept ✓Shape of $h(x)$ ✓y-intercept of $h(x)$	(5)
6.5	$x \in R$ but $x \neq 0$ **OR** $x < 0$ or $x > 0$ **OR** $-\infty < x < 0$ or $0 < x < \infty$ **OR** $x \in (-\infty; 0)$ or $(0; \infty)$	✓✓Accurate answer	(2)
6.6	6.6.1 See from the graph in 6.4	✓Accurate labelling	(1)
	6.6.2 $x > 1{,}33$	✓✓Accurate value and notation	(2)
6.7	$g(x) = -\frac{2}{x} - 1$	✓Accurate answer	(1)
			[16]

QUESTION 7				
7.1	7.1.1	$x = 0$	✓Accurate answer	(1)
	7.1.2	$0 = x^2 - 2x - 3$ $(x + 1)(x - 3) = 0$ $A(-1; 0)$ or $B(3; 0)$ **-1 MARK for not writing intercepts in coordinate form**	✓$g(x)$ =0 ✓(3; 0) ✓(- 1; 0)	(3)
	7.1.3	$x = \frac{-b}{2a}$ $x = \frac{-(-2)}{2(1)}$ $x = 1$ $f(1) = (1)^2 - 2(1) - 3 = -4$ $C(1; -4)$	✓Formula ✓Substitution ✓ x =1 ✓ $C(1; -4)$	
		OR $x = \frac{3 + (-1)}{2}$ $x = 1$ $f(1) = (1)^2 - 2(1) - 3 = -4$ $C(1; -4)$	**OR** ✓Average Formula ✓Substitution ✓ x =1 ✓ $C(1; -4)$	(4)
	7.1.4	$y \geq -4$ **OR** $-4 \leq y < \infty$ **OR** $y \in [-4; \infty)$	✓Notation ✓Value(s) - 4	(2)
	7.1.5	$b^2 - 4ac < 0$ $(-2)^2 - 4 \times 1 \times c < 0$ $c > 1$	✓$b^2 - 4ac < 0$ ✓Substitution ✓Notation ✓Value	(4)
7.2	$f(1) = (1)^2 + (1) - 1 = 1$ $f(3) = (3)^2 + (3) - 1 = 11$ $\text{Average gradient} = \frac{f(3) - f(1)}{3 - 1}$ $\text{Average gradient} = \frac{11 - 1}{2}$ $= 5$		✓ $f(1)$ ✓ $f(3)$ ✓Average gradient formula. ✓Substitution ✓Average gradient = 5	(5)
				[19]

QUESTION 8				
8.1	8.1.1	P = R5 600; n = 3 years (36 months); i = 11.5% p.a. A = P(1 + $i.n$) A = 5 600 [1 + (0, 115)(3)] A = R7 532	✓SI Formula ✓Substitution ✓Value of A	(3)
	8.1.2	The monthly loan repayments: R7 532÷ 36 months = R209,22 However, R12 is paid for insurance monthly, therefore, the total monthly instalment is R209,22+ R12 = R221,22	✓$\frac{7\,532}{36}$ ✓Adding the monthly insurance ✓R221,22	(3)
8.2	$A = P(1-i)^n$ $\frac{200\,000}{4} = 200\,000(1-i)^5$ $i = 1-(0,25)^{\frac{1}{5}}$ $i = 0,2421$ Interest = 24,21%		✓$A = \frac{200\,000}{4}$ ✓Formula ✓Substitution ✓Interest rate = 24,21%	(4)
8.3	8.3.1	$i_{eff} + 1 = \left(1 + \frac{i^m}{m}\right)^m$ $i_{eff} = \left(1 + \frac{0,11}{12}\right)^{12} - 1$ $i_{eff} = 0,1157$ Interest rate = 11,57%	✓Formula ✓Substitution ✓Interest rate	(3)

	8.3.2	T_0 11% T_6 13% T_{10} P A_1 A_2 $A_1 = P(1+i)^n$ $A_1 = P\left(1+\frac{0,11}{12}\right)^{6\times 12}$ $A_1 = P\left(1+\frac{0,11}{12}\right)^{72}$ Then, $A_2 = A_1\left(1+\frac{0,13}{4}\right)^{4\times 4} = 300\,000$ $A_2 = P\left(1+\frac{0,11}{12}\right)^{72}\left(1+\frac{0,13}{4}\right)^{16} = 300\,000$ $P = \frac{300\,000}{\left(1+\frac{0,11}{12}\right)^{72}\left(1+\frac{0,13}{4}\right)^{16}}$ P = R93 229,14 was invested initially.	A_1.....First 6 years A_2.....Last 4 years ✓Substitute *i* and *n* ✓A_1 ✓ A_2 ✓ P = R93 229,14	(4)
				[17]
			TOTAL:	**150**