GRADE 11

TECHNICAL MATHEMATICS

PAST PAPER QUESTIONS & MEMORANDUM

QUESTION 1

Simplify the following expressions:

1.1.1 $\log_5 \frac{125}{5}$ (3)

1.1.2 $\left(\sqrt[3]{64a^6}\,.\frac{1}{2}\right)^2 \times \left(\sqrt[2]{144}\,.\,a^2\right)^0$ (3)

1.1.3 $\frac{4^x+2^{2x+1}}{(2^x)^2+2^{x+3}.2^x}$ (5)

1.1.4 $\log_5 \frac{1}{5} + \log_2 \frac{1}{2} - \log \frac{1}{100} + \log_3 1$ (3)

1.1.5 Show that $\frac{\log_a 27 - \log_a 125}{\log_a 3 - \log_a 5} = 3$ (3)

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QUESTION 2

2.1 Solve for x

2.1.1 $3\times 2^{x-2}=48$ (3)

2.1.2 $3^{x}=12$ (2)

2.1.3 $\log_2(x+3)+\log_2(x-4)=3$ (7)

2.1.4 $4x^2-5x+1\geq 0$ (4)

If $i\left(R+\frac{mr}{m}\right)=nE$, Make ~~$m$~~ the subject of the formula. (3)

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QUESTION 3

3.1 Solve for x

3.1.1 $x(x-2)=15$ (3)

3.1.2 $3x^2-5x+1=0$, correct to 1 decimal place. (4)

3.2 Solve for x and y simultaneously:

$y-x=-3$

$y+2x=x^2-3$

(6)

3.3 Determine the nature of the roots of the equation : $2x^2-3x-1=0$ (5)

3.4 A rectangular piece needs to be cut from a large flat piece of sheet metal.

The length of the cut piece is to be 18,3cm longer than the width, and the piece must be 5,5 m^2.

Calculate:

3.5 3.5.1 the length of the cut piece. (5)

3.5.2 the width of the cut piece. (1)

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		QUESTION 1	
1.1		Simplify the following expressions:	
	1.1.1	$\log_5 \frac{125}{5}$ $= \log_5 25$ $= \log_5 5^2$ $= 2\log_5 5$ $= 2$	(3) $\log_5 5^2$ ✓ $2\log_5 5$ ✓ Answer ✓
	1.1.2	$\left(\sqrt[3]{64a^6}\,.\frac{1}{2}\right)^2 \times \left(\sqrt[2]{144}\,.a^2\right)^0$ $= \left(4a^2.\frac{1}{2}\right)^2 \times 1$ $= 4a^4$	(3) $\left(4a^2.\frac{1}{2}\right)^2 \times 1$ ✓✓ $4a^4$ ✓
	1.1.3	$\frac{4^x + 2^{2x+1}}{(2^x)^2 + 2^{x+3}.2^x}$ $= \frac{2^{2x} + 2^{2x}.2^1}{2^{2x} + 2^{2x}.2^3}$ $= \frac{2^{2x}(1+2)}{2^{2x}(1+8)}$ $= \frac{3}{9}$ $= \frac{1}{3}$	(5) Simplifying the numerator ✓ Simplifying the denominator ✓ Common factor in the numerator✓ Common factor in the denominator✓ answer✓
	1.1.4	$\log_5 \frac{1}{5} + \log_2 \frac{1}{2} - \log \frac{1}{100} + \log_3 1$ $= \log_5 5^{-1} + \log_2 2^{-1} - \log 10^{-2} + 0$ $= -\log_5 5 - \log_2 2 + \log 10$ $= -1 - 1 + 1 = -1$	(3) $\log_5 5^{-1} + \log_2 2^{-1} - \log 10^{-2} + 0$ ✓ $-\log_5 5 - \log_2 2 + \log 10$ ✓ -1 ✓

	1.1.5	Show that $\frac{\log_a 27-\log_a 125}{\log_a 3-\log_a 5}=3$ $=\dfrac{\log_a 3^3-\log_a 5^3}{\log_a 3-\log_a 5}$ $=\dfrac{3\log_a 3-3\log_a 5}{\log_a 3-\log_a 5}$ $=\dfrac{3(\log_a 3-\log_a 5)}{\log_a 3-\log_a 5}$ $=3$	(3) $\log_a 3^3-\log_a 5^3$ ✓ $3\log_a 3-3\log_a 5$ ✓ 3(must be a product of the calculations above) ✓
			[17]

		QUESTION 2	
2.1		Solve for x	
	2.1.1	$3\times 2^{x-2}=48$ $2^{x-2}=16$ $2^{x-2}=2^4$ $x-2=4$ $x=6$	(3) $2^{x-2}=16$ ✓ $2^{x-2}=2^4$ ✓ $x=4$ ✓
	2.1.2	$3^x=12$ $x=\log_3 12$ $x=2{,}26$ OR $\log 3^x=\log 12$ $x\log 3=\log 12$ $x=\dfrac{\log 12}{\log 3}$ $x=2{,}26$	(2) $x=\log_3 12$ ✓ $x=2{,}26$✓ $x\log 3=\log 12$ $x=\frac{\log 12}{\log 3}$✓ $x=2{,}26$✓

	2.1.3	$\log_2(x+3)+\log_2(x-4)=3$ $x+3>0 \quad or \quad x-4>0$ $x>-3 \quad or \quad x>4$ $\therefore x>4$ $\log_2(x+3)(x-4)=3$ $(x+3)(x-4)=8$ $x^2-x-20=0$ $(x-5)(x+4)=0$ $x=5 \ or \ x=-4$ $\therefore x=5$	(7) $x>-3 \ or \ x>4$ ✓ $x>4$ ✓ $\log_2(x+3)(x-4)=3$ ✓ $x^2-x-20=0$✓ $(x-5)(x+4)=0$✓ $x=5 \ or \ x=-4$✓ $\therefore x=5$✓
	2.1.4	$4x^2-5x+1\geq 0$ $(4x-1)(x-1)\geq 0$ CV:$\frac{1}{4}$ & 1  $x\leq\frac{1}{4} \quad or \ x\geq 1$	(4) $(4x-1)(x-1)$ ✓ CV:$\frac{1}{4}$ & 1✓ $x\leq\frac{1}{4}$✓ $x\geq 1$✓

2.2		$i\left(R+\frac{nr}{m}\right)=nE,$ $\left(R+\frac{nr}{m}\right)=\frac{nE}{i}$ $\frac{nr}{m}=\frac{nE}{i}-R$ $nr=\left(\frac{nE}{i}-R\right)m$ $m=\frac{nr}{\left(\frac{nE}{i}-R\right)}$	(3) $\left(R+\frac{nr}{m}\right)=\frac{nE}{i}$✓ $nr=\left(\frac{nE}{i}-R\right)m$ ✓ $m=\frac{\left(\frac{nE}{i}-R\right)}{nr}$ ✓
			[19]

QUESTION 3

3.1		$x(x-2)=15$ $x^2-2x-15=0$ $(x+3)(x-5)=0$ $x=3 \quad or \quad x=-5$	(3) $x^2-2x-15$ ✓standard form $(x-3)(x+5)$ ✓ factors $x=3 \quad or \quad x=-5$✓, both answers
3.2		$3x^2-5x+1=0$ $a=3 \quad b=-5 \quad c=1$ $x=\frac{-(-5)\pm\sqrt{(-5)^2-4.3.1}}{2.3}$ $x=\frac{5\pm\sqrt{25-12}}{6}$ $x=1{,}4 \quad or \quad x=0{,}2$	(4) $\frac{-(-5)\pm\sqrt{(-5)^2-4.3.1}}{2.3}$✓✓, correct substitution in a correct formula $x=1{,}4$✓ $\quad or \quad x=0{,}2$✓

3.3		$y-x=-3$ $y+2x=x^2-3$ $y=x-3------(1a)$ $Subs.\ y=x-3\ in\ y+2x=x^2-3$ $(x-3)+2x=x^2-3$ $x-3+2x=x^2-3$ $x^2-3x=0$ $x(x-3)=0$ $x=0 \quad or \quad x=3$ $for\ x=0$ $y=x-3$ $y=(0)-3$ $y=-3$ $(0;-3)$ $for\ x=3$ $y=(3)-3$ $y=0$ $(3;0)$	(6) ✓, making y the subject of the formula ✓, substitution ✓, standard form ✓, factorisation $x=0 \quad or \quad x=3$✓, both answers $y=-3 \quad or \quad y=0$✓, both answers

3.4		Determine the nature of the roots of the equation: $2x^2 - 3x - 1 = 0$ $\Delta = b^2 - 4ac$ $\Delta = (-3)^2 - 4.2.-1$ $\Delta = 9 + 8$ $\Delta = 17$ Roots are real, irrational and unequal	(5) $\Delta = b^2 - 4ac$✓ $\Delta = 17$✓ real✓, irrational ✓and unequal✓
3.5	3.5.1	$x(x + 18{,}3) = 55000$ $x^2 + 18{,}3x - 55000 = 0$ $a = 1 \quad b = 18{,}3 \quad c = -550$ $x = \frac{(-18{,}3) \pm \sqrt{(18{,}3)^2 - 4.1.-55000}}{2.1}$ $x = \frac{-18{,}3 \pm \sqrt{334{,}89 + 2200}}{2}$ $= \frac{-18{,}3 \pm \sqrt{2534{,}89}}{2}$ $x = 225{,}55 \quad or \quad x = -243{,}84$ $x \neq -243{,}84$ $\therefore$ *The length of the cut piece is* $18{,}3 + 225{,}84 = 244{,}14cm$	(5) $\frac{(-18{,}3) \pm \sqrt{(18{,}3)^2 - 4.1.-55000}}{2.1}$✓✓ correct substitution in a correct formula $x = 225{,}55 \quad or \quad x = -243{,}84$✓, both answers $x \neq -243{,}84$ $x = 225{,}55$ ✓, one of the two representations $244{,}14cm$✓
	3.5.2	*The width of the cut piece is* $225{,}84cm$	225,84cm✓ (1)
			[24]