FINAL

KWAZULU-NATAL PROVINCE

EDUCATION
REPUBLIC OF SOUTH AFRICA

NATIONAL
SENIOR CERTIFICATE

GRADE 12

MATHEMATICS P1

MARKING GUIDELINE

COMMON TEST

JUNE 2023

MARKS: 150

This memorandum consists of 20 pages.

QUESTION 1

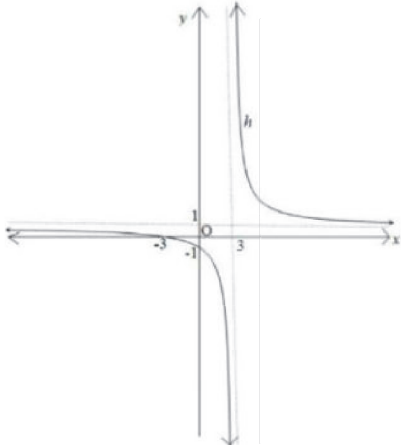| 1.1.1	$x(x-2)=0$ $x=0$ or $x=2$	A✓ factors A✓ $x=0$ A✓ $x=2$	(3)
1.1.2	$5x^2+11x-3 \quad 0$ $x=\dfrac{-b\pm\sqrt{b^2-4ac}}{2a}$ $x=\dfrac{-11\pm\sqrt{(11)^2-4(5)(-3)}}{2(5)}$ $x=0,25$ or $-2,45$	A✓ standard form CA✓ substitution CA✓ answers	(3)
1.1.3	$x^2-2x-8\le\bullet$ $(x-4)(x+2)\le 0$ $x\in[-2;4]$ OR $-2\le x\le 4$ **OR** $x^2-2x-8\le 0$ $(x-4)(x+2)\le 0$ $x\in[-2;4]$ OR $-2\le x\le 4$	A✓ standard form CA✓ factors CA✓ critical values A✓ correct notation **OR** A✓ standard form CA✓ factors CA✓ end values A✓ correct notation	(4)
1.1.4	$\sqrt{\dfrac{2^{2022}(2+1)}{2^{2022}}+x^2-x}=x$ $\sqrt{3+x^2-x}=x$ $\left(\sqrt{3+x^2-x}\right)^2=x^2$ $3+x^2-x=x^2$	A✓ factors on the numerator CA✓ simplifying CA✓ squaring	

	$3 - x = 0$ $x = 3$	CA✓answer	(4)
1.2	$-m - 8 < 0$ $-8 < m$ **OR** $-m - 8 < 0$ $-m < 8$ $m > -8$	A✓ A✓ answer **OR** A✓ A✓answer	 (2)
1.3.1	Perimeter $= 2l + 2b$ $24 = (2x + y) + y + (2x + y) + y$ $24 = 4x + 4y$	A✓	(1)
1.3.2	Area $= lb$ $32 = y(2x + y)$ $32 = y^2 + 2xy$	A✓	(1)
1.3.3	$24 = 4x + 4y$ ……………. (1) $6 = x + y$ $x = 6 - y$ (3) $32 = y^2 + 2xy$ …………...(2) $32 = 2y(6 - y) + y^2$ $32 = 12y - 2y^2 + y^2$ $32 = 12y - y^2$ $y^2 - 12y + 32 = 0$ $(y - 4)(y - 8) = 0$ $y = 4$ or 8 $y = 4$ only $x = 6 - 4 = 2$ ∴ length $= 8$m and width $= 4$m	 A✓ equation 3 CA✓substitution CA✓factors CA✓ y values CA✓ x value CA✓ answer	 (6)
			[24]

QUESTION 2			
2.1	$T_1 = -2(1)^2 + 40(1) + 103$ $T_1 = 141$	A✓substitution A✓answer	(2)

2.2	141 ; 175 ; 205 ; 231 ; ....
	
	     34 ; 30 ; 26 ; ....
	
	       −4 ; −4 ; ....
	
	 The second difference is −4
	
	 OR
	
	 $2a =$ second difference
	
	 $2(-2) = -4$
	
	 The second difference is −4
		A✓ first difference
		
		 A✓ answer
		
		 OR
		
		 A✓
		
		 A✓ answer
			(2)

2.3	$301 = -2n^2 + 40n + 103$ $2n^2 - 40n + 198 = 0$ $n^2 - 20n + 99 = 0$ $(n-9)(n-11) = 0$ $n = 9$ or 11	A✓ equating A✓ standard form CA✓ answers **(conditional if answers are natural numbers)**	(3)
2.4	The maximum value is at the turning point At turning point $n = -\dfrac{b}{2a}$ $n = \dfrac{-40}{2(-2)} = 10$ $\therefore T_{10}$ has the maximum value. **OR** $\dfrac{dT_n}{dn} = -4n + 40$ $0 = -4n + 40$ $4n = 40$	 A✓substitution CA✓answer **OR** A✓ derivative	

	$\therefore T_{10}$ has the maximum value.	CA✓answer	
	$T_n = -2n^2 + 40n + 103$ has a maximum value	A✓ $T_9 = 301$ and	
	$T_9 = 301$		
	$T_{11} = 301$	$T_{11} = 301$	
	$\therefore T_{10}$ has the maximum value.	CA✓answer	
		CA✓ answer	
	Answer only, full marks		
			(2)
			[9]

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QUESTION 3 (DO NOT MARK 3.3.1)

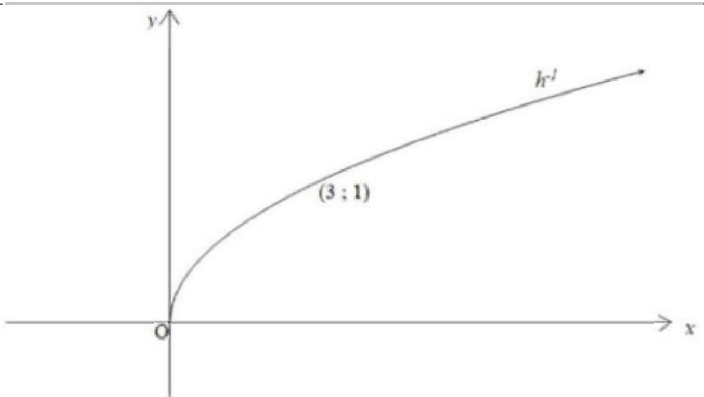|			
3.1.1	21 ; 24	A✓ A✓	(2)
3.1.2	T_{20} of original sequence is T_{10} of GP In the GP: $3 ; 6 ; 12$ $T_n = ar^{n-1}$ $T_{10} = 3.2^9 = 512$ T_{21} of original sequence is T_{11} of AP $3 ; 9 ; 15$ $T_n = a + (n-1)d$ $T_{11} = 3 + (11-1)6$ $T_{11} = 63$ $T_{20} - T_{21} = 512 - 63 = 449$	A✓ Sub in formula for GP CA✓ 512 A✓ Sub in formula for AP CA✓ 63 CA✓ answer	(5)
3.2	$a = 8°$ $l = 52°$ $S_n = 360°$ $S_n = \dfrac{n}{2}(a+l)$ $360 = \dfrac{n}{2}(8+52)$ $360 = 30n$ $12 = n$	A✓ $S_n = 360°$ A✓ values of a and l CA✓ substitution CA✓ answer(**on condition, answer is natural**)	(4)

3.3.1	$a = 5 \quad r = \dfrac{3}{4} \quad n = 8$ $T_n = ar^{n-1}$ $T_8 = 5\left(\dfrac{3}{4}\right) \quad 0,0067 \text{ kg}$	A✓ $a = 5$ CA✓ answer	(2)
3.3.2	$\displaystyle\sum_{n=1}^{\infty} 5\left(\dfrac{3}{4}\right)^{n-1}$	A✓ $\displaystyle\sum_{n=1}$ A✓ $5\left(\dfrac{3}{4}\right)^{n-1}$	(2)
3.3.3	$115 - \displaystyle\sum_{n=1}^{\infty} 5\left(\dfrac{3}{4}\right)^{n-1} = 115 - \dfrac{5}{1 - \dfrac{3}{4}}$ His weight will eventually reach $= 95\text{kg}$	A✓ $\dfrac{5}{1 - \dfrac{3}{4}}$ CA✓ subtracting CA✓ answer	(3)
			[18]

QUESTION 4 (DO NOT MARK QUESTION 4.3 AND 4.4)		
4.1 $x = 3$	A✓	(1)
4.2 $x \in R$; $x \neq 3$	A✓ A✓	(2)
4.3 $-5 = \dfrac{a}{3-2} + p$ $-5 = a + p$ ....(1) $-1 = \dfrac{a}{3-0} + p$ $-3 = a + 3p$ ....(2) $2 = 2p$ .... $(2) - (1)$ $p = 1$ $-5 = a + 1$ $a = -6$	A✓ sub $(2; -5)$ CA✓ equation 1 A✓ sub $(0; -1)$ CA✓ equation 2 CA✓ value of p CA✓ value of a	 (6)
4.4 x-intercept $0 = \dfrac{-6}{3-x} + 1$ $\dfrac{6}{3-x} = 1$ $6 = 3 - x$ $x = -3$ y-intercept $= \dfrac{-6}{3-0} + 1 = -1$ 	 CA✓ x-intercept CA✓ y-intercept CA✓ shape	 (3)
		[12]

QUESTION 5			
5.1	$y = -2(0-3)(0+1)$ $y = -2(-3)(1)$ $y = 6$ $E(0;6)$	A✓substitute $x = 0$	(1)
5.2	$y = -2(x^2 - 2x - 3)$ $y = -2x^2 + 4x + 6$ Turning point $x = -\dfrac{b}{2a}$ $x = \dfrac{-4}{2(-2)} = 1$ $y = -2(1)^2 + 4(1) + 6 = 8$ $D(1;8)$ **OR** $y = -2[(x^2 - 2x + 1) - 3 - 1]$ $y = -2(x-1)^2 + 8$ $D(1; 8)$ **OR** $y = -2(x-3)(x+1)$ x-intercepts $= 3$ or -1 midpoint is $x = 1$ $y = -2(1-3)(1+1)$ $y = 8$ $D(1 ; 8)$	A✓ equation CA✓substitution CA✓ x value CA✓ y value **OR** A✓completing the square CA✓simplifying CA✓ x value CA✓ y value **OR** A✓ x intercepts CA✓ midpoint value CA✓ x value CA✓ y value	(4)

r

5.3	$F(-2;-8)$	A✓ x coordinate	
		A✓ y coordinate	(2)
5.4	$0 = -2(x-3)(x+1)$ $x = 3$ or -1 At Q $x = 3$ $Q(3;0)$	A✓	(1)
5.5	$y = mx + c$ $y = mx + 6$ $0 = m(3) + 6$ $-6 = 3m$ $-2 = m$ $y = -2x + 6$ **OR** $m = \dfrac{y_2 - y_1}{x_2 - x_1}$ $m = \dfrac{0-6}{3-0} = \dfrac{-6}{3} = -2$ $c = 6$ $y = -2x + 6$	A✓ y = mx + 6 CA✓substitute $(3;0)$ CA✓answer **OR** CA✓substitute in gradient formula CA✓ m = -2 CA✓answer	(3)
5.6	SP $= -2x^2 + 4x - 6 - (-2x + 6)$ SP $= -2x^2 + 6x$ Maximum SP is at turning point $x = -\dfrac{b}{2a}$ $x = -\dfrac{6}{2(-2)}$ $x = \dfrac{3}{2}$ **OR**	CA✓expression for SP CA✓ substitutio CA✓ answer **OR**	

	$SP = -2x^2 + 4x - 6 - (-2x + 6)$ $SP = -2x^2 + 6x$ $\dfrac{dSP}{dx} = -4x + 6$ $0 = -4x + 6$ $4x = 6$ $x = \dfrac{3}{2}$ **OR** $SP = -2x^2 + 4x - 6 - (-2x + 6)$ $SP = -2x^2 + 6x$ $SP = -2(x^2 - 3x)$ $SP = -2\left[\left(x^2 - 3x + \left(\dfrac{-3}{2}\right)^2\right) - \left(\dfrac{-3}{2}\right)^2\right]$ $SP = -2\left[\left(x - \dfrac{3}{2}\right)^2 - \dfrac{9}{4}\right]$ $SP = -2\left(x - \dfrac{3}{2}\right)^2 + \dfrac{9}{2}$ Maximum SP is at $x = \dfrac{3}{2}$	CA✓ expression for SP CA✓ derivative CA✓ answer **OR** CA✓ expression for SP CA✓ completing the square CA✓ answer	 (3)
5.7	$k < 6$	A✓	(1)
			[15]

QUESTION 6

6.1	$3 = a(1)^2$ $a = 3$	A✓ substitution CA✓ answer	(2)
6.2	$x = 3y^2$ $\dfrac{x}{3} = y^2$ $y = \pm\sqrt{\dfrac{x}{3}}$ $y = \sqrt{\dfrac{x}{3}}$	CA✓ swapping x and y CA✓ answer(+ve)	(2)
6.3		A✓ shape A✓ point	(2)
6.4	Yes, any vertical line cuts the graph at only one place. **OR** Yes, it passes the vertical line test **OR** Yes, it is a one to one function	A✓ answer CA✓ explanation	(2)
			[8]

QUESTION 7

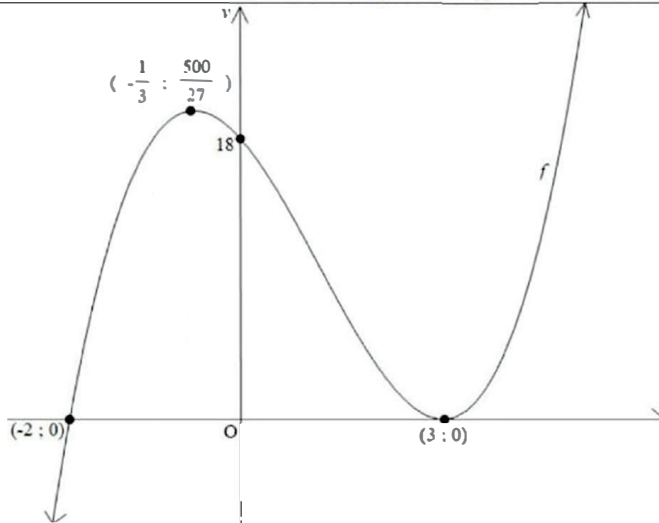|			
7.1	$(1+i) = \left(1 + \dfrac{i}{m}\right)^m$ $1 + \dfrac{r}{100} =$ $r = 100\left[\left(1 + \dfrac{7,12}{400}\right)^4 - 1\right]$ $r = 7,31\%$	A✓ formula A✓ substitution CA✓ answer	(3)
7.2.1	$A = P(1-i)^n$ $A = 1\,2500\,000\left(1 - \dfrac{11}{100}\right)^3$ $A = R881\,211,25$	A✓ substitution into correct formula CA✓ answer	(2)
7.2.2	$A = P(1+i)^n$ $A = 1\,250\,000\left(1 + \dfrac{7,5}{100}\right)^3$ $A = R1\,552\,871,10$	A✓ substitution into correct formula CA✓ answer	(2)
7.2.3	$R1\,552\,871,10 - R881\,211,25$ $= R671\,659,85$	CA✓ subtraction CA✓ answer	(2)
7.2.4 a).	4 deposits	A✓ answer	(1)

7.2.4 b).			

$T_0 \quad\quad T_1 \quad\quad\quad T_2 \quad\quad\quad T_3$

$x \quad\quad\quad x \quad\quad\quad x \quad\quad\quad x$

$671\ 659,85 = \left(1 + \dfrac{9,6}{1200}\right)^{36} + x\left(1 + \dfrac{9,6}{1200}\right)^{24} +$

$\left(1 + \dfrac{9,6}{1200}\right)^{12} + x$

$671659,85 = x\left[\left(1 + \dfrac{9,6}{1200}\right)^{36} + \left(1 + \dfrac{9,6}{1200}\right)^{24} + \left(1 + \dfrac{9,6}{1200}\right)^{12} + 1\right]$

$x = R144\ 650,97$

A✓ $x\left(1 + \dfrac{9,6}{1200}\right)^{36}$

A✓ $x\left(1 + \dfrac{9,6}{1200}\right)^{24}$

A✓ $x\left(1 + \dfrac{9,6}{1200}\right)^{12} +$ x

CA✓ setting up the equation

CA✓ answer

(5)

[15]

QUESTION 8

8.1.1	$f(x) = 3x^2 + 2x$		
	$f(x+h) = 3(x+h)^2\, 2(x+h) = 3x^2 + 6xh + 3h^2 + 2x + 2h$	A✓calculating $f(x+h)$	
	$f'(x) = \lim_{h \to 0} \dfrac{f(x+h) - f(x)}{h}$		
	$f'(x) = \lim_{h \to 0} \dfrac{3x^2 + 6xh + 3h^2 + 2x + 2h - 3x^2 - 2x}{h}$	CA✓substitution into the formula	
	$f'(x) = \lim_{h \to 0} \dfrac{6xh + 3h^2 + 2h}{h}$	CA✓simplification	
	$f'(x) = \lim_{h \to 0} \dfrac{h(6x + 3h + 2)}{h}$	CA✓factorising	
	$f'(x) = \lim_{h \to 0}(6x + 3h + 2)$		(5)
	$f'(x) = 6x + 2$	CA✓answer	
8.1.2	Average gradient $= 6x + 3h + 2$	CA✓formula for average gradient	
	$x = -1$	A✓ value for h	
	$h = 2 - (-1) = 3$	CA✓ answer	
	Ave grad $= 6(-1) + 3(3) + 2 = 5$		
	OR	**OR**	
	At $x = -1$ $\quad y = 3(-1)^2 + 2(-1) = 1$	A✓y values	
	At $x = 2$ $\quad y = 3(2)^2 + 2(2) = 16$		
	Ave grad $= \dfrac{y_2 - y_1}{x_2 - x_1}$		
	Ave grad $= \dfrac{16-1}{2-(-1)} = \dfrac{15}{3} = 5$	CA✓substituting in gradient formula	
		CA✓answer	(3)
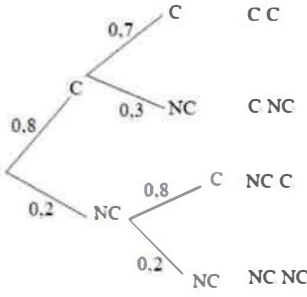
8.2.1	$g(x) = -7x^2 + 22x - 3$ $g'(x) = -14x + 22$	A✓ CA✓answer	(2)
8.2.2	$y = 5x + \dfrac{1}{2} - \dfrac{6}{\sqrt{x}}$ $y = 5x + \dfrac{1}{2} - 6x^{\frac{1}{2}}$ $\dfrac{dy}{dx} = 5 + 3x^{-\frac{3}{2}}$	A✓ CA✓ $2x^{-\frac{1}{2}}$ CA✓ CA✓(two terms)	(4)
			[14]

QUESTION 9

9.1	$y = 18$	A✓	(1)
9.2	$0 = (x-3)(x-3)(x+2)$	A✓ equating to zero	
	$x = 3$ or -2	A✓ A✓	(3)

9.3	Turning points: $f'(x) = 3x^2 - 8x - 3$	A✓ derivative	
	$0 = 3x^2 - 8x - 3$	CA✓ equating to zero	
	$0 = (3x+1)(x-3)$		
	$x = 3$ or $-\dfrac{1}{3}$	CA✓ x values	
	$y = (3-3)(3-3)(3+2) = 0 \quad (3;0)$		
	$y = \left(-\dfrac{1}{3}-3\right)\left(-\dfrac{1}{3}-3\right)\left(-\dfrac{1}{3}+2\right) = \dfrac{500}{27} = 18,52 \quad \left(-\dfrac{1}{3};\dfrac{500}{27}\right)$	CA✓ y values	
	OR	**OR**	
	Turning points: $f'(x) = 3x^2 - 8x - 3$	A✓ derivative	
	$0 = 3x^2 - 8x - 3$	CA✓ equating to zero	
	$0 = (3x+1)(x-3)$		
	$x = 3$ or $-\dfrac{1}{3}$	CA✓ x values	
	$y = (3)^3 - 4(3)^2 - 3(3) + 18 = 0 \quad (3;0)$		
	$y = \left(-\dfrac{1}{3}\right)^3 - 4\left(-\dfrac{1}{3}\right)^2 - 3\left(-\dfrac{1}{3}\right) + 18 = \dfrac{500}{27} \quad \left(-\dfrac{1}{3};\dfrac{500}{27}\right)$	CA✓ y values	(4)

9.4		A✓shape CA✓turning points labelled CA✓intercepts labelled	(3)

The graph shows points $(-\frac{1}{3} : \frac{500}{27})$, 18, $(-2 : 0)$, O, $(3 : 0)$, and f.

9.5	$f'(x) = 3x^2 - 8x - 3$		
	$-3 = 3x^2 - 8x - 3$	CA✓equating $f'(x)$ to -3	
	$0 = 3x^2 - 8x$		
	$0 = x(3x - 8)$		
		CA✓factors	
	$x = 0$ or $\dfrac{8}{3}$		
	$\therefore \ x = 0$		
	At $x = 0$ $y = 18$ and $m = -3$	CA✓ $x = 0$	
			(4)
	$y = -3x + 18$	CA✓answer	

			[15]

QUESTION 10

10.1	No people were infected	A✓	(1)
10.2	$N'(t) = -\dfrac{3}{2}t^2 + 6$ $N'(2) = -\dfrac{3}{2}(2)^2 + 6(2)$ $= 6000$ people/month	A✓ substitution into the derivative CA✓ answer	(2)
10.3	$N'(t) = -\dfrac{3}{2}t^2 + 6t$ $0 = -\dfrac{3}{2}t^2 + 6t$ $0 = t^2 - 12t$ $0 = t(t - 4)$ $t = 0$ or 4 $\therefore$ 4 months	CA✓ equating to zero CA✓ factors CA✓ both values of t CA✓ answer	(4)
10.4	Virus reached the peak after 4 months $N(4) = -\dfrac{1}{2}(4)^3 + 3(4)^2$ $\therefore$ 16 000 people	CA✓ substitution CA✓ answer	(2)
			[9]

QUESTION 11 (DO NOT MARK 11.1.1)

11.1.1	For mutually exclusive events P(A and B) = 0	A✓No A✓explanation	(2)
11.1.2	$P(\text{Grade 11 and Samsung}) = \dfrac{d}{150}$ $P(\text{Grade 11}) \times P(\text{Samsung}) = \dfrac{50}{150} \times \dfrac{90}{150}$ $P(\text{Grade 11 and Samsung}) = P(\text{Grade 11}) \times P(\text{Samsung})$ $\therefore \dfrac{d}{150} = \dfrac{50}{150} \times \dfrac{90}{150}$ $d = \dfrac{50}{150} \times \dfrac{90}{150} \times 150 = 30$	A✓ A✓ A✓ CA✓answer	(4)
11.2.1	8	A✓	(1)
11.2.2	 $P(CC \text{ or } NCC) = 0,8 \times 0,7 + 0,2 \times 0,8$ $= 0,72$	A✓ $0,8 \times 0,7$ A✓ $0,2 \times 0,8$ A✓addition CA✓answer	(4)
			[11]
		TOTAL MARKS: 150	

MARK THE PAPER OUT OF 137 THEN CONVERT TO 150