

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	$5x^2 + 11x - 3 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $x = \frac{-11 \pm \sqrt{(11)^2 - 4(5)(-3)}}{2(5)}$ $x = 0,25$ or $-2,45$	A✓ standard form CA✓ substitution CA✓ answers	(3)
1.1.3	$x^2 - 2x - 8 \leq 0$ $(x-4)(x+2) \leq 0$  $x \in [-2; 4]$ OR $-2 \leq x \leq 4$ OR $x^2 - 2x - 8 \leq 0$ $(x-4)(x+2) \leq 0$  $x \in [-2; 4]$ OR $-2 \leq x \leq 4$	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	$\sqrt{\frac{2^{2022}(2+1)}{2^{2022}}} + x^2 - x = x$ $\sqrt{3+x^2} - x = x$ $(\sqrt{3+x^2} - x)^2 = x^2$ $3+x^2 - x = x^2$	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	$24 = 4x + 4y \dots\dots\dots(1)$ $6 = x + y$ $x = 6 - y \dots\dots\dots(3)$ $32 = y^2 + 2xy \dots\dots\dots(2)$ $32 = 2y(6 - y) + y^2$ $32 = 12y - 2y^2 + y^2$ $32 = 12y - y^2$ $y^2 - 12y + 32 = 0$ $(y - 4)(y - 8) = 0$ $y = 4 \text{ or } 8$ $y = 4 \text{ only}$ $x = 6 - 4 = 2$ $\therefore \text{length} = 8\text{m and width} = 4\text{m}$	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 $2a = \text{second difference}$ $2(-2) = -4$ The second difference is -4	A✓ first difference A✓ answer OR A✓ A✓ answer	(2)
2.3	$301 = -2n^2 + 40n + 103$ $2n^2 - 40n + 198 = 0$ $n^2 - 20n + 99 = 0$ $(n-9)(n-11) = 0$ $n = 9 \text{ or } 11$	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 $n = -\frac{b}{2a}$ $n = \frac{-40}{2(-2)} = 10$ $\therefore T_{10}$ has the maximum value. OR $\frac{dT_n}{dn} = -4n + 40$ $0 = -4n + 40$ $4n = 40$	A✓ substitution CA✓ answer OR A✓ derivative 	


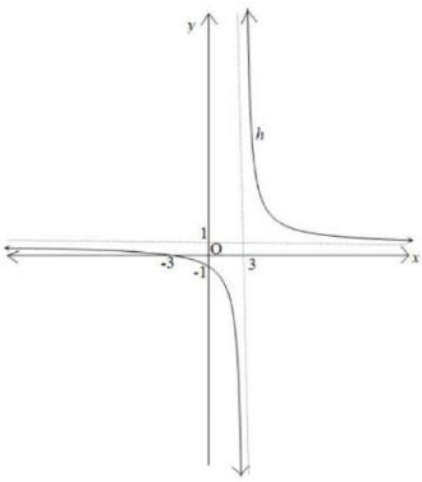
	<p>$\therefore T_{10}$ has the maximum value.</p> <p>$T_n = -2n^2 + 40n + 103$ has a maximum value</p> <p>$T_9 = 301$</p> <p>$T_{11} = 301$</p> <p>$\therefore T_{10}$ has the maximum value.</p>  <p>Answer only, full marks</p>	<p>CA✓ answer</p> <p>A✓ $T_9 = 301$ and</p> <p>$T_{11} = 301$</p> <p>CA✓ answer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





QUESTION 3 (DO NOT MARK 3.3.1)			
3.1.1	21 ; 24	A✓ A✓	(2)
3.1.2	<p>T_{20} of original sequence is T_{10} of GP</p> <p>In the GP: 3 ; 6 ; 12</p> <p>$T_n = ar^{n-1}$</p> <p>$T_{10} = 3 \cdot 2^9 = 512$</p> <p>$T_{21}$ of original sequence is T_{11} of AP</p> <p>3 ; 9 ; 15</p> <p>$T_n = a + (n-1)d$</p> <p>$T_{11} = 3 + (11-1)6$</p> <p>$T_{11} = 63$</p> <p>$T_{20} - T_{21} = 512 - 63 = 449$</p>	<p>A✓ Sub in formula for GP</p> <p>CA✓ 512</p> <p>A✓ Sub in formula for AP</p> <p>CA✓ 63</p> <p>CA✓ answer</p>	(5)
3.2	<p>$a = 8^\circ$</p> <p>$l = 52^\circ$</p> <p>$S_n = 360^\circ$</p> <p>$S_n = \frac{n}{2}(a+l)$</p> <p>$360 = \frac{n}{2}(8+52)$</p> <p>$360 = 30n$</p> <p>$12 = n$</p>	<p>A✓ $S_n = 360^\circ$</p> <p>A✓ values of a and l</p> <p>CA✓ substitution</p> <p>CA✓ answer (on condition, answer is natural)</p>	(4)



3.3.1	$a = 5 \quad r = \frac{3}{4} \quad n = 8$ $T_n = ar^{n-1}$ $T_8 = 5\left(\frac{3}{4}\right)^7 = 0.667 \text{ kg}$ 	A✓ $a = 5$ CA✓ answer	(2)
3.3.2	$\sum_{n=1}^{\infty} 5\left(\frac{3}{4}\right)^{n-1}$	A✓ $\sum_{n=1}^{\infty}$ A✓ $5\left(\frac{3}{4}\right)^{n-1}$	(2)
3.3.3	$115 - \sum_{n=1}^{\infty} 5\left(\frac{3}{4}\right)^{n-1} = 115 - \frac{5}{1 - \frac{3}{4}}$ His weight will eventually reach = 95kg	A✓ $\frac{5}{1 - \frac{3}{4}}$ 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	$-5 = \frac{a}{3-2} + p$  $-5 = a + p \dots\dots\dots(1)$ $-1 = \frac{a}{3-0} + p$ $-3 = a + 3p \dots\dots\dots(2)$ $2 = 2p \dots\dots\dots(2) - (1)$ $p = 1$ $-5 = a + 1$ $a = -6$	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 $0 = \frac{-6}{3-x} + 1$ $\frac{6}{3-x} = 1$ $6 = 3 - x$ $x = -3$ y-intercept $= \frac{-6}{3-0} + 1 = -1$ 	CA✓ x-intercept CA✓ y-intercept CA✓ shape	(3)
			[12]


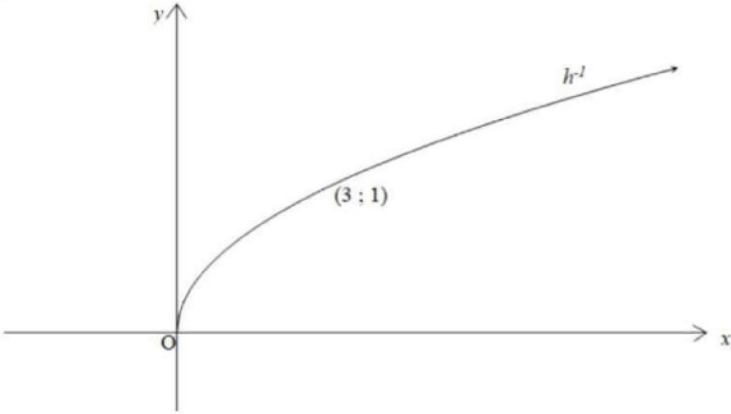
QUESTION 5

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 $x = -\frac{b}{2a}$ $x = \frac{-4}{2(-2)} = 1$ $y = -2(1)^2 + 4(1) + 6 = 8$ $D(1;8)$ <p style="text-align: center;">OR</p> $y = -2[(x^2 - 2x + 1) - 3 - 1]$ $y = -2(x-1)^2 + 8$ $D(1; 8)$ <p style="text-align: center;">OR</p> $y = -2(x-3)(x+1)$ 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)

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	$y = mx + c$ $y = mx + 6$ $0 = m(3) + 6$ $-6 = 3m$ $-2 = m$ $y = -2x + 6$ <p style="text-align: center;">OR</p> $m = \frac{y_2 - y_1}{x_2 - x_1}$ $m = \frac{0 - 6}{3 - 0} = \frac{-6}{3} = -2$ $c = 6$ $y = -2x + 6$	A✓ $y = mx + 6$ CA✓ substitute $(3; 0)$ CA✓ answer <p style="text-align: center;">OR</p> 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 $x = -\frac{b}{2a}$ $x = -\frac{6}{2(-2)}$ $x = \frac{3}{2}$ <p style="text-align: center;">OR</p>	CA✓ expression for SP CA✓ substitution CA✓ answer  <p style="text-align: center;">OR</p>	


	$SP = -2x^2 + 4x - 6 - (-2x + 6)$ $SP = -2x^2 + 6x$ $\frac{dSP}{dx} = -4x + 6$ $0 = -4x + 6$ $4x = 6$ $x = \frac{3}{2}$  <p style="text-align: center;">OR</p> $SP = -2x^2 + 4x - 6 - (-2x + 6)$ $SP = -2x^2 + 6x$ $SP = -2(x^2 - 3x)$ $SP = -2\left[x^2 - 3x + \left(\frac{-3}{2}\right)^2 - \left(\frac{-3}{2}\right)^2\right]$ $SP = -2\left[\left(x - \frac{3}{2}\right)^2 - \frac{9}{4}\right]$ $SP = -2\left(x - \frac{3}{2}\right)^2 + \frac{9}{2}$ <p>Maximum SP is at $x = \frac{3}{2}$</p>	CA✓ expression for SP CA✓ derivative CA✓ answer <p style="text-align: center;">OR</p> 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	$x = 3y^2$ $\frac{x}{3} = y^2$ $y = \pm\sqrt{\frac{x}{3}}$ $y = \sqrt{\frac{x}{3}}$	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	$(1+i) = \left(1 + \frac{i}{m}\right)^m$  $1 + \frac{r}{100} = \left(1 + \frac{7,12}{400}\right)^4$ $r = 100 \left[\left(1 + \frac{7,12}{400}\right)^4 - 1 \right]$ $r = 7,31\%$	A✓ formula A✓ substitution CA✓ answer	(3)
7.2.1	$A = P(1-i)^n$ $A = 1\,250\,000 \left(1 - \frac{11}{100}\right)^3$ $A = R881\,211,25$	A✓ substitution into correct formula CA✓ answer	(2)
7.2.2	$A = P(1+i)^n$ $A = 1\,250\,000 \left(1 + \frac{7,5}{100}\right)^3$ $A = R1\,552\,871,10$	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)




<p>7.2.4 b).</p>	<div style="text-align: center;">  </div> $671\,659,85 = x \left(1 + \frac{9,6}{1200}\right)^{36} + x \left(1 + \frac{9,6}{1200}\right)^{24} + x \left(1 + \frac{9,6}{1200}\right)^{12} + x$ $671\,659,85 = x \left[\left(1 + \frac{9,6}{1200}\right)^{36} + \left(1 + \frac{9,6}{1200}\right)^{24} + \left(1 + \frac{9,6}{1200}\right)^{12} + 1 \right]$ <p>$x = R144\,650,97$</p>	$A \checkmark x \left(1 + \frac{9,6}{1200}\right)^{36}$ $A \checkmark x \left(1 + \frac{9,6}{1200}\right)^{24}$ $A \checkmark x \left(1 + \frac{9,6}{1200}\right)^{12} + x$ <p>CA \checkmark setting up the equation</p> <p>CA \checkmark answer</p>	<p>(5)</p>
[15]			



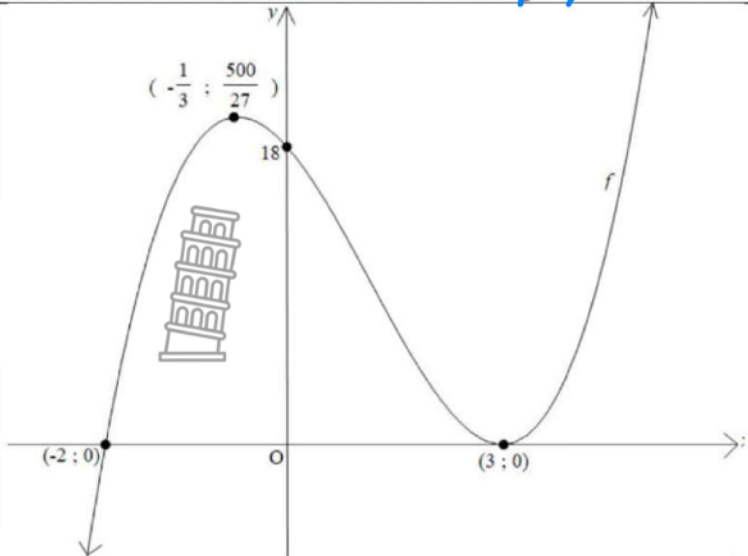
QUESTION 8			
8.1.1	$f(x) = 3x^2 + 2x$ $f(x+h) = 3(x+h)^2 + 2(x+h) = 3x^2 + 6xh + 3h^2 + 2x + 2h$  $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{3x^2 + 6xh + 3h^2 + 2x + 2h - 3x^2 - 2x}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{6xh + 3h^2 + 2h}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{h(6x + 3h + 2)}{h}$ $f'(x) = \lim_{h \rightarrow 0} (6x + 3h + 2)$ $f'(x) = 6x + 2$	A✓ calculating $f(x+h)$ CA✓ substitution into the formula CA✓ simplification CA✓ factorising CA✓ answer	(5)
8.1.2	Average gradient = $6x + 3h + 2$ $x = -1$ $h = 2 - (-1) = 3$ Ave grad = $6(-1) + 3(3) + 2 = 5$ OR At $x = -1$ $y = 3(-1)^2 + 2(-1) = 1$ At $x = 2$ $y = 3(2)^2 + 2(2) = 16$ Ave grad = $\frac{y_2 - y_1}{x_2 - x_1}$ Ave grad = $\frac{16 - 1}{2 - (-1)} = \frac{15}{3} = 5$	CA✓ formula for average gradient A✓ value for h CA✓ answer OR A✓ y values 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	$y = 5x + \frac{1}{2} - \frac{6}{\sqrt{x}}$ $y = 5x + \frac{1}{2} - 6x^{-\frac{1}{2}}$ $\frac{dy}{dx} = 5 + 3x^{-\frac{3}{2}}$	A✓ CA✓ $2x^{-\frac{1}{2}}$ CA✓ CA✓ (two terms)	(4)
			[14]




QUESTION 9			
9.1	$y = 18$	A✓	(1)
9.2	$0 = (x-3)(x-3)(x+2)$ $x = 3 \text{ or } -2$ 	A✓ equating to zero A✓ A✓	(3)
9.3	Turning points: $f'(x) = 3x^2 - 8x - 3$ $0 = 3x^2 - 8x - 3$ $0 = (3x+1)(x-3)$ $x = 3 \text{ or } -\frac{1}{3}$ $y = (3-3)(3-3)(3+2) = 0 \quad (3;0)$ $y = \left(-\frac{1}{3}-3\right)\left(-\frac{1}{3}-3\right)\left(-\frac{1}{3}+2\right) = \frac{500}{27} = 18,52 \quad \left(-\frac{1}{3}; \frac{500}{27}\right)$ OR Turning points: $f'(x) = 3x^2 - 8x - 3$ $0 = 3x^2 - 8x - 3$ $0 = (3x+1)(x-3)$ $x = 3 \text{ or } -\frac{1}{3}$ $y = (3)^3 - 4(3)^2 - 3(3) + 18 = 0 \quad (3;0)$ $y = \left(-\frac{1}{3}\right)^3 - 4\left(-\frac{1}{3}\right)^2 - 3\left(-\frac{1}{3}\right) + 18 = \frac{500}{27} \quad \left(-\frac{1}{3}; \frac{500}{27}\right)$	A✓ derivative CA✓ equating to zero CA✓ x values CA✓ y values OR A✓ derivative CA✓ equating to zero CA✓ x values CA✓ y values	(4)


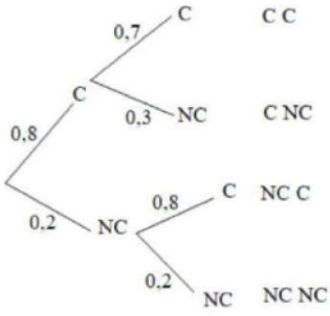



9.4		A✓ shape CA✓ turning points labelled CA✓ intercepts labelled	(3)
9.5	$f'(x) = 3x^2 - 8x - 3$ $-3 = 3x^2 - 8x - 3$ $0 = 3x^2 - 8x$ $0 = x(3x - 8)$ $x = 0 \text{ or } \frac{8}{3}$ $\therefore x = 0$ <p>At $x = 0$ $y = 18$ and $m = -3$</p> $y = -3x + 18$	CA✓ equating $f'(x)$ to -3 CA✓ factors CA✓ $x = 0$ CA✓ answer	(4)
			[15]



QUESTION 10			
10.1	No people were infected	A✓	(1)
10.2	$N'(t) = -\frac{3}{2}t^2 + 6t$  $N'(2) = -\frac{3}{2}(2)^2 + 6(2)$ $= 6000 \text{ people/month}$	A✓ substitution into the derivative CA✓ answer	(2)
10.3	$N'(t) = -\frac{3}{2}t^2 + 6t$ $0 = -\frac{3}{2}t^2 + 6t$ $0 = t^2 - 12t$ $0 = t(t - 4)$ $t = 0 \text{ or } 4$ $\therefore 4 \text{ months}$	CA✓ equating to zero CA✓ factors CA✓ both values of t CA✓ answer	(4)
10.4	Virus reached the peak after 4 months $N(4) = -\frac{1}{2}(4)^3 + 3(4)^2$ $\therefore 16\,000 \text{ people}$	CA✓ substitution CA✓ answer	(2)
			[9]



QUESTION 11 (DO NOT MARK 11.1.1)			
11.1.1	 <p>For mutually exclusive events $P(A \text{ and } B) = 0$</p>	<p>A✓No</p> <p>A✓explanation</p>	(2)
11.1.2	$P(\text{Grade 11 and Samsung}) = \frac{d}{150}$ $P(\text{Grade 11}) \times P(\text{Samsung}) = \frac{50}{150} \times \frac{90}{150}$ $P(\text{Grade 11 and Samsung}) = P(\text{Grade 11}) \times P(\text{Samsung})$ $\therefore \frac{d}{150} = \frac{50}{150} \times \frac{90}{150}$ $d = \frac{50}{150} \times \frac{90}{150} \times 150 = 30$	<p>A✓</p> <p>A✓</p> <p>A✓</p> <p>CA✓answer</p>	(4)
11.2.1	8	A✓	(1)
11.2.2	 $P(\text{CC or NCC}) = 0,8 \times 0,7 + 0,2 \times 0,8$ $= 0,72$	<p>A✓ $0,8 \times 0,7$</p> <p>A✓ $0,2 \times 0,8$</p> <p>A✓addition</p> <p>CA✓answer</p>	(4)
			[11]
TOTAL MARKS: 150			

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