

KWAZULU-NATAL PROVINCE

EDUCATION
REPUBLIC OF SOUTH AFRICA



NATIONAL SENIOR CERTIFICATE

GRADE 12

MATHEMATICS P1

COMMON TEST

JUNE 2022

MARKING GUIDELINE



MARKS: 150

TIME: 3 hours

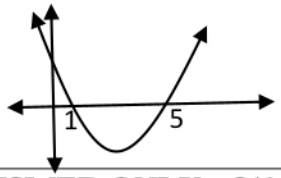
NOTE:

- If a candidate answered a QUESTION TWICE, mark only the FIRST attempt.
- If a candidate crossed out an answer and did not redo it, mark the crossed-out answer.
- Consistent accuracy applies to ALL aspects of the marking guidelines.
- Assuming values/answers to solve a problem is unacceptable.

This marking guideline consists of 11 pages.

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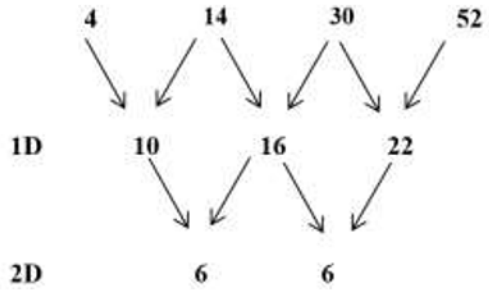
QUESTION 1

1.1.1	$x = 0 \quad or \quad x = \frac{2}{3}$	A✓ 0 A✓ $\frac{2}{3}$	(2)
1.1.2	$2x^2 + 5x - 9 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $x = \frac{-(5) \pm \sqrt{(5)^2 - 4(2)(-9)}}{2(2)}$ $x = -3{,}71 \quad or \quad 1{,}21$ **ANSWER ONLY – MAX 1/4**	A✓standard form CA✓substitution in correct formula CACA✓✓answers **(Penalize 1 mark if rounding off is incorrect-once here for entire paper)**	(4)
1.1.3	$\sqrt{16a^2 + x^2} - 5a = 0$ $\sqrt{16a^2 + x^2} = 5a$ $16a^2 + x^2 = 25a^2$ $x^2 - 9a^2 = 0$ $(x + 3a)(x - 3a) = 0$ $x = -3a \quad or \; x = 3a$	A✓Isolating surd A✓ squaring both sides CA✓standard form CA✓factors CA✓answers	(5)
1.1.4	Since the numerator: $-4 < 0$ $\therefore (x - 1)(x - 5) > 0$ $x < 1 \quad or \quad x > 5$ **OR**  **ANSWER ONLY – 3/4 MARKS**	A✓condition for numerator A✓ $(x - 1)(x - 5) > 0$ CA✓ CA ✓ answers **OR** If graphical solution is used: AA 2 marks for graph CACA 2 marks for answer	(4) (4)
1.2	$x - y = 3 \quad \rightarrow (1)$ $x^2 - 2y^2 - 7 = xy \quad \rightarrow (2)$ From (1): $x = y + 3 \quad \rightarrow (3)$ Substituting (3) into (2): $(y + 3)^2 - 2y^2 - 7 = y(y + 3)$ $y^2 + 6y + 9 - 2y^2 - 7 = y^2 + 3y$ $-2y^2 + 3y + 2 = 0$ $2y^2 - 3y - 2 = 0$ $(2y + 1)(y - 2) = 0$ $y = -\frac{1}{2} \; or \; y = 2$	A✓Making *x/y* the subject CA✓substitution CA✓standard form CA✓factors CA✓ *y/x* values	

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	$x = 2\frac{1}{2} \quad or \quad x = 5$	CA✓*x/y* – values	(6)
1.3	$\frac{\sqrt{m^{2022} - m^{2020}}}{\sqrt{25\,m^{2024} - 25\,m^{2022}}}$ $= \frac{\sqrt{m^{2020}(m^2 - 1)}}{\sqrt{25\,m^{2022}(m^2 - 1)}}$ $= \sqrt{\frac{1}{25m^2}}$ $= \frac{1}{5m}$ **OR** $\frac{\sqrt{m^{2022} - m^{2020}}}{\sqrt{25\,m^{2024} - 25\,m^{2022}}}$ $= \frac{\sqrt{m^{2022}\left(1 - \frac{1}{m^2}\right)}}{\sqrt{25\,m^{2024}\left(1 - \frac{1}{m^2}\right)}}$ $= \sqrt{\frac{1}{25m^2}}$ $= \frac{1}{5m}$	A✓Factorization of numerator A✓Factorization of denominator CA✓simplification CA✓answer **OR** A✓Factorization of numerator A✓Factorization of denominator CA✓simplification CA✓answer	(4) (4)
			[25]

QUESTION 2

2.1	$T_7 = 154$; $T_8 = 200$	AA✓✓ Answers	(2)
2.2	 $2a = 6 \quad \therefore a = 3$ $3a + b = 10 \quad \therefore b = 1$ $a + b + c = 4 \quad \therefore c = 0$	A✓ a – value CA✓b – value CA✓c – value CA✓answer	

	$T_n = 3n^2 + n$ **OR** $\boldsymbol{T_n = T_1 + (n-1)d_1 + \frac{(n-1)(n-2)}{2}d_2}$ **OR** $\boldsymbol{T_n = \frac{(n-1)}{2}[2a + (n-2)d] + T_1}$	**OR** **OR**	(4)
2.3	$T_n = 3n^2 + n = 8164$ $3n^2 + n - 8164 = 0$ $n = \frac{-1 \pm \sqrt{1 - 4(3)(-8164)}}{2(3)}$ $n = 52 \ \ or \ \ -52{,}33$ *n/a* **OR** $T_n = 3n^2 + n = 8164$ $3n^2 + n - 8164 = 0$ $(n - 52)(3n + 157) = 0$ $n = 52 \ \ or \ \ -52{,}33$ *n/a* **ANSWER ONLY – MAX 1/5**	A✓Equating n^{th} term to 8164 CA✓standard form CA✓substitution into formula CACA✓✓*n* – values and rejection **OR** A✓Equating n^{th} term to 8164 CA✓standard form CA✓factors CACA✓✓*n* – values and rejection	(5) (5)
			[11]

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QUESTION 3

3.1	$S_n = a + (a+d) + \cdots (a + (n-2)d) + (a + (n-1)d)$ (1) $S_n = (a + (n-1)d) + (a + (n-2)d) + \cdots (a+d) + a$ (2) $2S_n = (2a + (n-1)d) + (2a + (n-1)d) + \cdots$ to *n* terms $2S_n = n(2a + (n-1)d)$ $S_n = \frac{n}{2}[2a + (n-1)d]$	A✓equation (1) A✓equation (2) A✓$2S_n$ equation A✓ $n(2a + (n-1)d)$	(4)
3.2	$S_n = \frac{n}{2}[2a + (n-1)d]$ $S_{64} = \frac{64}{2}[2(24) + (64-1)(12)]$ $= 25728$	A✓Substitution of *n* value A✓Substitution of *a* and *d* values CA✓Answer	(3)

3.3.1	$x + (x + 4) + (x + 8) + \cdots$ AS $y + 4y + 16y + \cdots$ GS $(x + y) + (x + 4 + 4y) + (x + 8 + 16y) + \cdots$ NS $x + y = 8$ ….→ (1) $x + 4 + 4y = 21$ ….→ (2) From (1): $x = 8 - y$ ….→ (3) Subst. (3) into (2): $8 - y + 4 + 4y = 21$ $3y = 9$ $y = 3$ $x = 5$ $T_3 = x + 8 + 16y$ $T_3 = 5 + 8 + 16(3)$ $T_3 = 61$	A✓ AS terms A✓GS terms A✓NS terms A✓ $x + y = 8$ A✓ $x + 4 + 4y = 21$ CA✓*y*/*x* value CA✓*x*/*y* value CA✓Answer	(8)
3.3.2	AS: 5 ; 9 ; 13 ; …... GS: 3 ; 12 ; 48 ; …… $P_n = 4n + 1$ …….AS $Q_n = 3.4^{n-1}$ …….GS $T_n = 4n + 1 + 3.4^{n-1}$ ……. NS	CA✓ AS terms CA✓GS terms CA✓ AS – n^{th} term CA✓GS – n^{th} term CA✓NS – n^{th} term	(5)
			[20]

QUESTION 4

4.1.1	Tebego: $A = P(1 + i)^n$ $A = 120\,000\left(1 + \frac{9{,}8\%}{12}\right)^{60}$ $A = R195\,488{,}5357$	A✓Substitution CA✓Answer	(2)
4.1.2	Shante: $A = P(1 + i)^n$ $A = 120\,000\left(1 + \frac{12{,}3\%}{4}\right)^{20}$ $A = R219\,911{,}5884$	A✓Substitution CA✓Answer	(2)
4.1.3	Interest (Tebego): $= R75\,488{,}5357$ Interest (Shante): $= R99\,911{,}5884$ Interest (Difference): $= R24\,423{,}05$	CA✓Tebogo – Interest CA✓Shante – Interest CA✓Answer	(3)
4.2	$A = P(1 - i)^n$ $85\,000 = P(1 - 10{,}25\%)^8$ $\frac{85\,000}{(1 - 10{,}25\%)^8} = P$ Original Value of Bakkie was R 201 903	A✓Substitution *i* and *n* A✓Making P the subject CA✓Answer	(3)

4.3	$10000 = \left[x\left(1+\frac{10\,\%}{1}\right)^{2}\left(1+\frac{12\,\%}{4}\right)^{16}+5000\right]\left(1+\frac{12\,\%}{4}\right)^{8}$ $10000 = [x(1{,}1)^{2}(1{,}03)^{16}+5000](1{,}03)^{8}$ $10000 = x(1{,}1)^{2}(1{,}03)^{24}+5000(1{,}03)^{8}$ $\frac{10000-5000(1{,}03)^{8}}{(1{,}1)^{2}(1{,}03)^{24}} = x$ $x = R1490{,}50$ **OR** $x\left(1+\frac{10\,\%}{1}\right)^{2}\left(1+\frac{12\,\%}{4}\right)^{24}+5000\left(1+\frac{12\,\%}{4}\right)^{8} = 10\,000$ $x\left(1+\frac{10\,\%}{1}\right)^{2}\left(1+\frac{12\,\%}{4}\right)^{24}+6333{,}85 = 10\,000$ $x\left(1+\frac{10\,\%}{1}\right)^{2}\left(1+\frac{12\,\%}{4}\right)^{24} = 3666{,}15$ $x = \frac{3666{,}15}{\left(1+\frac{10\,\%}{1}\right)^{2}\left(1+\frac{12\,\%}{4}\right)^{24}}$ $x = R1490{,}50$	A✓ $x\left(1+\frac{10\,\%}{1}\right)^{2}$ A✓$\left(1+\frac{12\,\%}{4}\right)^{16}$ A✓$\left(1+\frac{12\,\%}{4}\right)^{8}$ CA✓Simplifying CA✓Making *x* the subject CA✓Answer **OR** A✓ $x\left(1+\frac{10\,\%}{1}\right)^{2}$ A✓$\left(1+\frac{12\,\%}{4}\right)^{24}$ A✓$\left(1+\frac{12\,\%}{4}\right)^{8}$ CA✓6333,85 CA✓ Making *x* the subject CA✓Answer	(6) (6)
			[16]

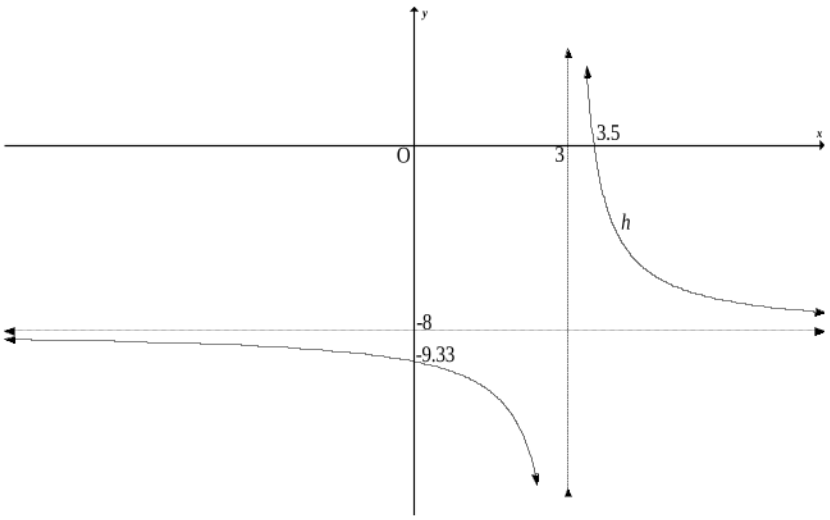
QUESTION 5

5.1	$y = \log_a x$ $4 = \log_a 625$ $a^4 = 625 = 5^4$ $a = 5$	A✓Substitution A✓Writing in exponential form CA✓Answer	(3)
5.2	$B(1\ ;\ 0)$	AA✓✓answer	(2)
5.3	$y = 5^x$	CA✓ on 5 CA✓Exponential equation	(2)
5.4	$P'(4\ ;625)$	A✓A✓answer	(2)
			[9]

QUESTION 6

6.1	$(2\ ;\ -12)$	A✓A✓Answer	(2)
6.2	$g(3) = 3(3-2)^2 - 12$ $t = -9$ **ANSWER ONLY – FULL MARKS**	A✓ CA✓Answer	(2)
6.3	$p(x) = -3x$	CA✓ CA✓Answer	(2)
6.4	$NQ = -3x - [3(x-2)^2 - 12]$ $NQ = -3x - [3(x^2 - 4x + 4) - 12]$ $NQ = -3x^2 + 9x$ $NQ' = -6x + 9 = 0$ or $x = -\frac{b}{2a} = -\frac{9}{2(-6)}$ $x = \frac{3}{2}$ The maximum length of NQ: $= -3\left(\frac{3}{2}\right)^2 + 9\left(\frac{3}{2}\right)$ $= -\frac{27}{4} + \frac{27}{2}$ $= \frac{27}{4}$ units	A✓Subtraction A✓$-3x^2 + 9x$ CA✓Derivative and equal to 0 CA✓x – value CA✓Answer	(5)
6.5	$-27 < k < 0$	A✓end points CA✓interval	(2)
6.6	Maximum value of $2^{-\frac{1}{2}g(x)}$ $= 2^{-\frac{1}{2}(-12)} = 2^6$ $= 64$	A✓maximum value = – 12 CA✓Answer	(2)
			[15]

QUESTION 7

7.1	$x = 3$ $y = -8$	A✓Vertical asymptote A✓Horizontal asymptote	(2)
7.2	y – intercept : $\left(0\ ;-9\frac{1}{3}\right)$ x – intercept: $\frac{4}{x-3} = 8$ $8x - 24 = 4$ $8x = 28$ $x = \frac{28}{8} = \frac{7}{2}$	A✓ y – intercept A✓$\frac{4}{x-3} = 8$ CA✓ x - intercept	(3)
7.3		CA✓both asymptotes CA✓both x and y intercepts A✓shape	(3)
7.4	$x = 7$	CA✓CA✓Answer	(2)
7.5	$y = k - x$ $-8 = k - 3$ $k = -5$ **OR** $y = -(x-3) - 8$ $y = -x - 5$ $k = -5$	A✓subst. of (3 ; – 8) CA✓answer **OR** A✓$y = -(x-3) - 8$ CA✓answer	(2) (2)
			[12]

QUESTION 8 (penalize 1 mark once for incorrect notation in this question only)

8.1	$f'(x) = \lim_{n\to 0} \frac{f(x+h)-f(x)}{h}$ $f'(x) = \lim_{h\to 0} \frac{(x+h)^2-5(x+h)-(x^2-5x)}{h}$ $f'(x) = \lim_{h\to 0} \frac{x^2+2xh+h^2-5x-5h-x^2+5x}{h}$ $f'(x) = \lim_{h\to 0} \frac{2xh+h^2-5h}{h}$ $f'(x) = \lim_{h\to 0} \frac{h(2x+h-5)}{h}$ $f'(x) = 2x-5$ **OR** $f(x+h) = (x+h)^2-5(x+h)$ $= x^2+2xh+h^2-5x-5h$ $f(x+h)-f(x) = 2xh+h^2-5h$ $\frac{f(x+h)-f(x)}{h} = \frac{h(2x+h-5)}{h} = (2x+h-5)$ $f'(x) = \lim_{h\to 0}(2x+h-5)$ $f'(x) = 2x-5$	A✓formula A✓substitution CA✓ simplification of numerator CA✓factorization CA✓answer **OR** A✓ $f(x+h)$ value CA✓ $f(x+h)-f(x)$ value CA✓ $\frac{f(x+h)}{h}$ value A✓formula CA✓answer	(5) (5)
8.2.1	$g(x) = \left(\frac{4}{x}-\frac{x}{4}\right)^2$ $g(x) = 16x^{-2}-2+\frac{1}{16}x^2$ $g'(x) = -32x^{-3}+\frac{1}{8}x$	A✓1st and 3rd terms A✓2nd term CACA✓✓ derivatives	(4)
8.2.2	$D_x\left[\frac{7}{\sqrt{x}}-\frac{2}{x^3}\right]$ $= D_x\left[7x^{-\frac{1}{2}}-2x^{-3}\right]$ $= -\frac{7}{2}x^{-\frac{3}{2}}+6x^{-4}$	A✓A✓writing in exponential form – each term CACA✓✓answers	(4)

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8.3	$t(x) = \sqrt{x^3}$ $t(x) = x^{\frac{3}{2}}$ $t'(x) = \frac{3}{2}x^{\frac{1}{2}}$ $m = t'(4) = \frac{3}{2}(4)^{\frac{1}{2}} = 3$ $y = \sqrt{4^3} = \sqrt{64} = 8$ $y = mx + c$ $8 = 3(4) + c \qquad \therefore c = -4$ $y = 3x - 4$	A✓derivative A✓m of tangent CA✓c – value CA✓answer	(4)
			[17]

QUESTION 9

9.1	D (0 ; 12)	AA✓✓Answer	(2)
9.2	$f(x) = x^3 - x^2 - 8x + 12$ $f'(x) = 3x^2 - 2x - 8 = 0$ $(3x + 4)(x - 2) = 0$ $x = -\frac{4}{3} \quad or \quad 2$ $y = \frac{500}{27} \quad or \quad 0$ Max: $\left(-\frac{4}{3}; 18.52\right)$ Min: $(2; 0)$	A✓derivative A✓derivative equal to 0 CA✓factors CA✓ x – values CA✓ y - values	(5)
9.3	$f''(x) = 6x - 2 = 0$ $x = \frac{1}{3}$ Choose values of x on either side of $x = \frac{1}{3}$ $f''(-2) = 6(-2) - 2 = -14$ Since $f''(x) < 0 \ \therefore f$ is concave down for $x < \frac{1}{3}$ $f''(2) = 6(2) - 2 = 10$ Since $f''(x) > 0 \ \therefore f$ is concave up for $x > \frac{1}{3}$ $\therefore f$ has a point of inflection at $x = \frac{1}{3}$, since there is a change in concavity.	A✓2nd derivative = 0 A✓$x = \frac{1}{3}$ A✓2nd derivative value and conclusion A✓2nd derivative value and conclusion	(4)
9.4	$(-2\ ;\ 1)$	CACA✓✓answer	(2)
9.5.1	$k = 0 \ or \ k = 18.52$	A✓ $k = 0$ CA✓ $k = 18.52$	(2)
9.5.2	$k = 12$	A✓ A✓Answer	(2)
			[17]

QUESTION 10

10.1	Volume(V) = Area of Base x Height $V(x) = x^3 - 8x^2 + 5x + 50 = l \times b \times h$ $V(x) = (5 - x)(10 + 3x - x^2) = l \times b \times h$ $l \times b = 10 + 3x - x^2$…. Area of base of the box.	A✓Formula A✓Product A✓Answer	(3)
10.2	$V(x) = x^3 - 8x^2 + 5x + 50$ $V'(x) = 3x^2 - 16x + 5 = 0$ $(3x - 1)(x - 5) = 0$ $x = \frac{1}{3}$ *or* 5 Since the coefficient of x^3 = 1, the shape of the cubic function is  $x = \frac{1}{3}$ The volume will be at a maximum. **OR** <u>For the last mark:</u> $x = \frac{1}{3}$ The volume will be at a maximum. **OR** <u>For the last mark:</u> $V''(x) = 6x - 16$ $V''\left(\frac{1}{3}\right) = 6\left(\frac{1}{3}\right) - 16 = -14 < 0$ $V''(5) = 6(5) - 16 = 14 > 0$ $x = \frac{1}{3}$ The volume will be at a maximum.	A✓derivative A✓derivative equal to 0 CA✓factors CA✓ x – values CA✓ Conclusion	(5)
			[8]
		TOTAL	**150**