

Basic Education

KwaZulu-Natal Department of Education
REPUBLIC OF SOUTH AFRICA



MATHEMATICS PI
COMMON TEST
JUNE 2016
MEMORANDUM

**NATIONAL
SENIOR CERTIFICATE**

GRADE 11

MARKS: 100
TIME: 2 hours

This memorandum consists of 8 pages.

QUESTION 1

1.1.1	$2x - \frac{3}{x} = 1$ $2x^2 - 3 = x \quad \checkmark$ $2x^2 - x - 3 = 0 \quad \checkmark$ $(2x-3)(x+1) = 0 \quad \checkmark$ $x = \frac{3}{2} \text{ or } x = -1 \quad \checkmark$	A for simplification CA for standard form CA for factorisation CA for both answers (4)
1.1.2	$3x^2 - 6x + 1 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \quad \checkmark$ $= \frac{-(-6) \pm \sqrt{(-6)^2 - 4(3)(1)}}{2(3)} \quad \checkmark$ $= \frac{6 \pm \sqrt{24}}{6}$ $= 1,82; 0,18 \quad \checkmark \quad \checkmark$	A for formula A for substitution CA; CA for answers (4)
1.1.3	$5x - 2(x^2 - 6) \leq 0$ $5x - 2x^2 + 12 \leq 0$ $2x^2 - 5x - 12 \geq 0 \quad \checkmark$ $(2x+3)(x-4) \geq 0 \quad \checkmark$ $CVs: -\frac{3}{2}; 4$ <p style="text-align: center;"> \checkmark $x \leq -\frac{3}{2}$ or $x \geq 4$ </p> <div style="text-align: center;"> </div>	A for simplification and change of sign CA for factorisation CA for $x \leq -\frac{3}{2}$ CA for $x \geq 4$ (4)
1.1.4	$2 + \sqrt{x+2} = 6 - x$ $(\sqrt{x+2})^2 = (4-x)^2 \quad \checkmark$ $x+2 = 16 - 8x + x^2 \quad \checkmark$ $x^2 - 9x + 14 = 0$ $(x-7)(x-2) = 0 \quad \checkmark$ $x = 7 \text{ or } x = 2 \quad \checkmark$ $x = 2 \text{ only} \quad \checkmark$	A for squaring both sides CA for simplification CA for factorisation CA for both answers CA for rejecting $x = 7$ (5)

1.1.5	$3^{1-2x} = 1$ $3^{1-2x} = 3^0$ ✓ $1-2x=0$ ✓ $x = \frac{1}{2}$ ✓	A for same bases A for equating exponents A for answer	(3)
1.2.	$4x^2 + 5x - p = 0$ $x = \frac{-5 \pm \sqrt{5^2 - 4(4)(-p)}}{2(4)}$ $= \frac{-5 \pm \sqrt{25+16p}}{8}$ Values of x will be real when $25+16p \geq 0$ $16p \geq -25$ $p \geq -\frac{25}{16}$ OR $4x^2 + 5x - p = 0$ $b^2 - 4ac \geq 0$ ✓ $5^2 - 4(4)(-p) \geq 0$ ✓ $16p \geq -25$ $p \geq -\frac{25}{16}$ ✓	A for solving for x CA for $25+16p \geq 0$ CA for answer OR A for $b^2 - 4ac \geq 0$ A for substitution CA for answer	(3)
1.3	$x = 2y+3$ ✓ $(2y+3)^2 - y^2 = 45$ ✓ $4y^2 + 12y + 9 - y^2 = 45$ $y^2 + 4y - 12 = 0$ ✓ $(y+6)(y-2) = 0$ ✓ $y = -6$ or $y = 2$ ✓ Also: $x = 2(-6)+3 = -9$ ✓ or $x = 2(2)+3 = 7$ ✓	A for making x subject of formula CA for substitution CA for standard form CA for factorisation CA for both y -values CA for both x -values	(6)

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QUESTION 2

2.1.1	$81^{\frac{3}{4}} = (3^4)^{\frac{3}{4}}$ ✓ $= 3^{-3}$ ✓ $= \frac{1}{27}$ ✓ OR $81^{\frac{3}{4}}$ ✓ $= \frac{1}{27}$ ✓ $81^{\frac{3}{4}}$ ✓ $= \frac{1}{27}$ ✓ $81^{\frac{3}{4}}$ ✓ $= \frac{1}{27}$ ✓	A for writing 81 as 3^4 CA for simplification CA for answer OR A for positive exponent A for surd form A for answer	(3)
2.1.2	$3 \cdot 5^{x+1} - 5^{x+3}$ $5^{x+1} - 3 \cdot 5^x$ $= 5^x(3 \cdot 5 - 5^3)$ ✓ $= 5^x(5-3)$ ✓ $= \frac{15-125}{2}$ $= \frac{-110}{2}$ ✓ $= -55$ ✓	A for factorisation of numerator A for factorisation of denominator CA for answer	(3)
2.2	$\frac{2}{(1+\sqrt{2})(1-\sqrt{2})} - \frac{8\sqrt{8}}{\sqrt{8} \cdot \sqrt{8}}$ ✓ ✓ $= \frac{2(1-\sqrt{2})}{1-2} - \frac{8\sqrt{8}}{8}$ $= -2(1-\sqrt{2}) - \sqrt{8}$ ✓ $= -2+2\sqrt{2} - 2\sqrt{2}$ ✓ $= -2$	AA for rationalising denominators A for simplification A for $\sqrt{8} = 2\sqrt{2}$	(4)

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QUESTION 2

QUESTION 3

3.1.1	22; ✓ 27 ✓	AA for correct answers	(2)
3.1.2	112 ✓	A for correct answer	(1)
3.1.3	$T_n = 5n - 3$ ✓ ✓	AA for correct expression	(2)
3.1.4	$T_n = 5n - 3$ $5n - 3 = 182$ ✓ $5n = 185$ ✓ $n = 37$ ✓ $T_{37} = 182$	CA for equating to 182 CA for answer	(2)
3.1.5	1; 3; 10 ✓ ✓ ✓	AAA for answers	(2)
3.2.1	163 ✓	AA for correct answer	(2)
3.2.2	second difference = 6 ✓ $2a = 6$ $a = 3$ ✓ $3a + b = 19$ $3(3) + b = 19$ $b = 10$ ✓ $a + b + c = 51$ $3 + 10 + c = 51$ $c = 38$ ✓ $\therefore T_n = 3n^2 + 10n + 38$ ✓	A for value of second difference A for value of a CA for value of b CA for value of c CA for expression for T_n	(5)
3.2.4	$3n^2 + 10n + 38 = 4063$ ✓ $3n^2 + 10n - 4025 = 0$ ✓ $n = \frac{-10 \pm \sqrt{(10)^2 - 4(3)(-4025)}}{2(3)}$ $= \frac{-10 \pm \sqrt{48400}}{6}$ $= \frac{-10 \pm 220}{6}$ $= 35$ or $38,33$ $\therefore T_{35} = 4063$ ✓	CA for equating to 4063 CA for standard form CA for substitution in correct formula CA for answer OR CA for equating to 4063 CA for standard form CA for factorisation CA for answer	(4) (4) (4) (4) (4) (4) (4)

QUESTION 4

4.1.1	$f(x) = y = -(x^2 + 2x - 3)$ ✓ $= -(x^2 + 2x + 1 - 1 - 3)$ ✓ $= -(x+1)^2 - 4$ ✓ $= -(x+1)^2 + 4$ ✓	A for $-(x^2 + 2x - 3)$ CA for add 1, subtract 1 CA for answer	(3)
4.1.2 and 4.1.5		4.1.2: graph of f A for shape AA for y-intercept AA for x-intercepts A for turning point 4.1.5: graph of g A for x-intercept A for y-intercept	(5)
4.1.3	$y \leq 4$ ✓ ✓	CA; CA for answer	(2)
4.1.4	reflection of f in the x-axis ✓ ✓	AA for answer	(2)
4.1.6 (a)	$x = 1; -1$ ✓ ✓	CA; CA for correct answers	(2)
4.1.6 (b)	$-3 < x < 1$ ✓ ✓	CA; CA for correct answer	(2)
4.2		A for parabola that is concave up A for no x-intercepts A for turning point with negative x-coordinate and positive y-coordinate (i.e. in second quadrant)	(3) (3) (3)

QUESTION 5

5.1	$p = -2$ ✓ $q = -1$ ✓	A for value of p A for value of q	(2)
5.2	$y = \frac{a}{x-2} - 1$ ✓ $0 = \frac{a}{-2-2} - 1$ ✓ $\frac{a}{-4} = 1$ $a = -4$ ✓	CA for substitution of values of p and q CA for substitution of $(-2;0)$ CA for answer	(3)
5.3	$\frac{1}{4} = t^2$ ✓ $t = \pm \sqrt{\frac{1}{4}}$ ✓ $t = \frac{1}{2}$ ✓	A for substitution of $(\frac{1}{2}; \frac{1}{4})$ CA for $\pm \sqrt{\frac{1}{4}}$ CA for answer	(3)
5.4	Average gradient $= \frac{g(2) - g(-2)}{2 - (-2)}$ ✓ $= \frac{(\frac{1}{2})^2 - (\frac{1}{-2})^2}{4}$ ✓ $= \frac{\frac{1}{4} - \frac{1}{4}}{4}$ $= \frac{-\frac{15}{16}}{4}$ $= -\frac{15}{64}$ ✓	A for formula A for substitution CA for answer	(3)
5.5	$y = 0$ ✓✓	AA for answer	(2)
5.6	D(0;1) ✓	A for answer	(1)

5.7	$y = -x + c$ ✓ $-1 = -(2) + c$ ✓ $c = 1$ $y = -x + 1$ ✓ OR $y = -(x+p) + q$ ✓ $= -(x-2) - 1$ ✓ $= -x + 1$ ✓	A for substitution of gradient of -1 A for substitution of $(2; -1)$ A for answer OR A for formula A for substitution in formula A for answer	(3)
5.8	E(4; -3) ✓✓	A for x-coordinate; A for y-coordinate	(2)
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TOTAL = 100