RONDEBOSCH BOYS' HIGH SCHOOL

GRADE 11

MATHEMATICS PAPER 1
2 JUNE 2017
MEMORANDUM

MARKS: 100 **EXAMINER: S CARLETTI**

TIME: 2 HOURS **MODERATOR: S VERSTER**

This memorandum consists of 9 pages.

Question 1		
1.1.1	$x(x-1)=6$ $\therefore x^2-x-6=0$ $\therefore (x-3)(x+2)=0$ $\therefore x=3$ or $x=-2$	✓ standard form ✓ factors ✓ answers (3)R
1.1.2	$3x^2-5x+1=0$ $\therefore x=\frac{5\pm\sqrt{5^2-4(3)(1)}}{2(3)}$ $\therefore x=1{,}43$ or $x=0{,}23$	✓ substitution ✓✓ answers (rounding penalty) (3)R
1.1.3	$\therefore \sqrt{x+5}=2x+9$ $\therefore x+5=4x^2+36x+81$ $\therefore 4x^2+35x+76=0$ $\therefore (x+4)(4x+19)=0$ $\therefore x=-4$ or $x=-\frac{19}{4}$ $\therefore x=-4$	✓ square both sides ✓ factors ✓ values for x ✓ $x=-4$ (4)R
1.1.4	$x(5x-7)\geq 6$ $\therefore 5x^2-7x-6\geq 0$ $\therefore (5x+3)(x-2)\geq 0$ $\therefore x\leq -\frac{3}{5}$ or $x\geq 2$ + 0 - 0 + $-\frac{3}{5}$ 2	✓ standard form ✓ factors ✓✓ answers (4)R
1.2	$x^2-2y+3xy=6$ $\therefore (2y+1)^2-2y+3y(2y+1)=6$ $\therefore 4y^2+4y+1-2y+6y^2+3y=6$ $\therefore 10y^2+5y-5=0$ $\therefore 2y^2+y-1=0$ $\therefore (2y-1)(y+1)=0$ $\therefore y=\frac{1}{2}$ or $y=-1$ $\therefore x=2$ or $x=-1$	✓ substitution ✓ multiplying out ✓ standard form ✓ values for y ✓ $x=2$ ✓ $x=-1$ (6)R

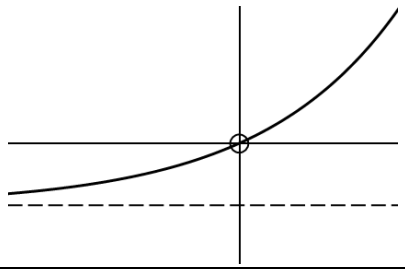
1.3	Let the sides be x and $12-x$ $\therefore Area = \frac{1}{2}x(12-x)$ $\therefore -\frac{1}{2}x^2 + 6x = 20$ $\therefore x^2 - 12x + 40 = 0$ $\therefore x = \frac{12 \pm \sqrt{12^2 - 4(40)}}{2}$ $\therefore x = 6 \pm 2i$ $\therefore$ not possible OR Let the sides be x and $12-x$ $\therefore Area = \frac{1}{2}x(12-x)$ $\therefore Area = -\frac{1}{2}x^2 + 6x$ $\therefore Area = -\frac{1}{2}(x^2 - 12x)$ $\therefore Area = -\frac{1}{2}(x-6)^2 + 18$ Has a maximum of 18, thus area of 20 is not possible.	✓ area ✓ area $= 20$ ✓ formula ✓ correct conclusion ✓ area ✓ completing the square ✓ max area $= 18$ ✓ correct conclusion (4)PS [24]

Question 2		
2.1	$kx^2 + (2k-1)x = 1-k$ $\therefore kx^2 + (2k-1)x + k - 1 = 0$ $\therefore \Delta = (2k-1)^2 - 4(k)(k-1)$ $\therefore \Delta = 4k^2 - 4k + 1 - 4k^2 + 4k$ $\therefore \Delta = 1$ $\therefore$ roots are rational (Δ is a perfect square)	✓ standard form ✓ substitution ✓ $\Delta = 1$ ✓ reason (4)C
2.2	Let the number who went on the trip be x Cost per person was $\frac{1600}{x}$ The number booked was $x+8$ The original cost per person was $\frac{1600}{x+8}$ $\therefore \frac{1600}{x} - \frac{1600}{x+8} = 10$ $\therefore 1600(x+8) - 1600x = 10x(x+8)$ $\therefore 1600x + 12800 - 1600x = 10x^2 + 80x$ $\therefore 10x^2 + 80x - 12800 = 0$ $\therefore x^2 + 8x - 1280 = 0$ $\therefore (x-32)(x+40) = 0$ $\therefore x = 32$ or $x = -40$ $\therefore x = 32$	✓ $\frac{1600}{x}$ ✓ $\frac{1600}{x+8}$ ✓ equation ✓ multiplying ✓ factors ✓ answer (6)C [10]

Question 3		
3.1.1	$\frac{3^{x+1}-3^{x-1}}{2\times 3^x}$ $=\frac{3^x(3-3^{-1})}{2\times 3^x}$ $=\frac{3-\frac{1}{3}}{2}$ $=\frac{\frac{8}{3}}{2}$ $=\frac{4}{3}$	✓ common factor ✓ simplification ✓ answer (3)R
3.1.2	$\left(\frac{\sqrt{7^{2017}}-\sqrt{7^{2015}}}{\sqrt{7^{2016}}}+\sqrt{7}\right)^2$ $=\left(\frac{\sqrt{7^{2015}}(\sqrt{7^2}-1)}{\sqrt{7^{2016}}}+\sqrt{7}\right)^2$ $=\left(\frac{6}{\sqrt{7}}+\sqrt{7}\right)^2$ $=\frac{36}{7}+12+7$ $=\frac{169}{7}$ OR $\left(\frac{\sqrt{7^{2017}}-\sqrt{7^{2015}}}{\sqrt{7^{2016}}}+\sqrt{7}\right)^2$ $=\left(\frac{7^{1008}\sqrt{7}-7^{1007}\sqrt{7}}{7^{1008}}\right)^2$ $=\left(\sqrt{7}-\frac{\sqrt{7}}{7}+\sqrt{7}\right)^2$ $=\left(2\sqrt{7}-\frac{\sqrt{7}}{7}\right)^2$ $=28-4+\frac{7}{49}$ $=24\frac{1}{7}$ OR $\left(\frac{\sqrt{7^{2017}}-\sqrt{7^{2015}}}{\sqrt{7^{2016}}}+\sqrt{7}\right)^2$ $=\left(\frac{\sqrt{7^{2016}(\sqrt{7}-\sqrt{7^{-1}})}}{\sqrt{7^{2016}}}\right)^2$ $=\left(2\sqrt{7}-\sqrt{7^{-1}}\right)^2$ $=28-4+\frac{7}{49}$ $=24\frac{1}{7}$	✓ common factor ✓ simplification ✓ squaring ✓ answer ✓ square roots ✓ simplification ✓ squaring ✓ answer ✓ common factor ✓ simplification ✓ squaring ✓ answer (4)C

3.2.1	$3x^{2/5} = 48$ $\therefore x^{2/5} = 16$ $\therefore \left(x^{2/5}\right)^{5/2} = \pm(2^4)^{5/2}$ $\therefore x = \pm 2^{10}$ $\therefore x = \pm 1024$	✓ divide by 3 ✓ raising to power $\frac{5}{2}$ ✓ $\pm$ ✓ 1024 (4)R
3.2.2	$x^{2/3} - x^{1/3} - 2 = 0$ $\therefore \left(x^{1/3} - 2\right)\left(x^{1/3} + 1\right) = 0$ $\therefore x^{1/3} = 2$ or $x^{1/3} = -1$ $\therefore x = 8$ or $x = -1$	✓ factors ✓ both solutions for $x^{1/3}$ ✓ $x = 8$ ✓ $x = -1$ (4)R
3.3	$g\left(\sqrt{4}\right) + g\left(\sqrt{8}\right)$ $= \frac{\sqrt{4}}{2} + \left(\sqrt{8}\right)^2$ $= 1 + 8$ $= 9$	✓ 1 ✓ 8 ✓ answer (3)PS
3.4	$4^a = 5$ $\therefore 4^{ab} = 5^b = 6$ $\therefore 4^{abc} = 5^{bc} = 6^c = 7$ $\therefore 4^{abcd} = 5^{bcd} = 6^{cd} = 7^d = 8$ $\therefore 2^{2abcd} = 2^3$ $\therefore 2abcd = 3$ $\therefore abcd = \frac{3}{2}$	✓ $4^{ab} = 6$ ✓ $4^{abcd} = 8$ ✓ answer (3)PS [21]

Question 4		
4.1.1	$p = 12$ $q = 13$	✓ $p = 12$ ✓ $q = 13$ (2)R
4.1.2	3 12 25 9 13 4 $2a = 4 \quad \therefore a = 2$ $3a + b = 9 \quad \therefore b = 3$ $a + b + c = 3 \quad \therefore c = -2$ $\therefore T_n = 2n^2 + 3n - 2$	✓ second difference ✓ $a = 2$ ✓ $b = 3$ ✓ $c = -2$ (4)R
4.2.1	$a = 32$ $b = 12$	✓ $a = 32$ ✓ $b = 12$ (2)R
4.2.2(a)	$T_n = n^2$	✓ answer (1)R
4.2.2(b)	$T_n = 4n$	✓ answer (1)R
4.2.3	$n^2 + 6n + 5 = 320$ $\therefore n^2 + 6n - 315 = 0$ $\therefore (n - 15)(n + 21) = 0$ $\therefore n = 15$ or $n = -21$ $\therefore n = 15$ $\therefore$ total number of squares $= 15^2 + 4(15)$ $= 285$	✓ equating ✓ both answers ✓ $n = 15$ ✓ substitution ✓ answer (5)C [15]

Question 5		
5.1.1	$x = -2$ $y = 1$	✓ $x = -2$ ✓ $y = 1$ (2)R
5.1.2	$y = -x + c$ $\therefore 1 = -(-2) + c$ $\therefore c = -1$ OR $y = -(x + 2) + 1$ $\therefore y = -x - 1$ $\therefore c = -1$	 ✓ substitution ✓ $c = -1$ ✓ equation ✓ $c = -1$ (2)R
5.1.3	$0 = \frac{3}{x+2} + 1$ $\therefore \frac{3}{x+2} = -1$ $\therefore 3 = -x - 2$ $\therefore x = -5$ $\therefore A(-5; 0)$	✓ $y = 0$ ✓ simplification ✓ answer (must be coord) (3)R
5.1.4	$y = \frac{3}{x-3} + 1$	✓ answer (1)C
5.2		 ✓ asymptote ✓ shape ✓ passing through origin (3)R [11]

Question 6		
6.1.1	$C(0;-10)$	✓ $y=-10$ (1)R
6.1.2	$x^2-3x-10=0$ $\therefore (x-5)(x+2)=0$ $\therefore x=5$ or $x=-2$ $\therefore B(5;0)$	✓ $=0$ ✓ $x=5$ (2)R
6.1.3	$D\left(\frac{3}{2};-\frac{49}{4}\right)$	✓ $x=\frac{3}{2}$ ✓ $y=-\frac{49}{4}$ (2)R
6.2	$a=2$ $b=-10$	✓ $a=2$ ✓ $b=-10$ (2)R
6.3.1	$0<x<5$	✓ answer (1)R
6.3.2	$x>-2$ and $x\neq 5$	✓ $x>-2$ ✓ $x\neq 5$ (2)C
6.4	$PQ=(2x-10)-(x^2-3x-10)$ $\therefore PQ=-x^2+5x$ $\therefore PQ=-(x^2-5x)$ $\therefore PQ=-\left(x-\frac{5}{2}\right)^2+\frac{25}{4}$ $\therefore$ maximum length $=\frac{25}{4}$ units OR $PQ=(2x-10)-(x^2-3x-10)$ $\therefore PQ=-x^2+5x$ $\therefore TP\left(\frac{5}{2};\frac{25}{4}\right)$ $\therefore$ maximum length $=\frac{25}{4}$ units	✓ subtraction ✓ simplification ✓ completing the square ✓ answer ✓ subtraction ✓ simplification ✓ turning point ✓ answer (4)C
6.5	$x^2-3x-10=x+k$ $\therefore x^2-4x-10-k=0$ $\Delta=(-4)^2-4(-10-k)=0$ $\therefore 16+40+4k=0$ $\therefore 4k=-56$ $\therefore k=-14$	✓ equating ✓ standard form ✓ substitution into Δ ✓ $\Delta=0$ ✓ answer (5)PS [19]

TOTAL MARKS: 100