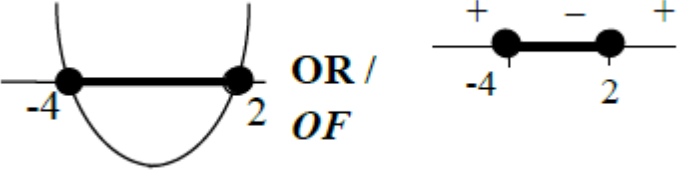


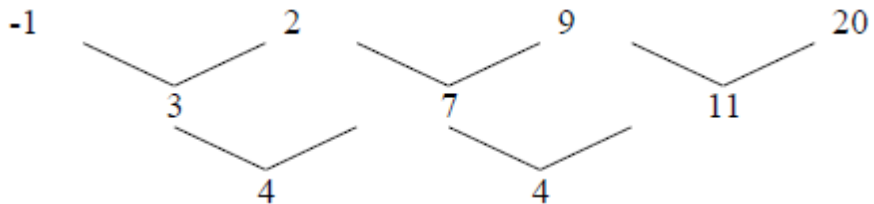
GRADE 12 MATHEMATICS PAPER 1 MEMO
31ST AUGUST 2016
150 MARKS

QUESTION 1

1.1.1	$4x^2 - 25 = 0$ $(2x + 5)(2x - 5) = 0$ ✓ $x = -\frac{5}{2}$ or $x = \frac{5}{2}$ ✓ OR $4x^2 = 25$ $x^2 = \frac{25}{4}$ $x = \pm \sqrt{\frac{25}{4}}$ ✓ $x = \pm \frac{5}{2}$ ✓	(2)
1.1.2	$(2x - 5)(x + 3) = 1$ $2x^2 + x - 15 = 1$ $2x^2 + x - 16 = 0$ ✓ $x = \frac{-1 \pm \sqrt{1^2 - 4(2)(-16)}}{2(2)}$ ✓ $x = \frac{-1 \pm \sqrt{129}}{4}$ $x = 2,59$ ✓ or $x = -3,09$ ✓	(4)
1.1.3	$2x^{\frac{-5}{3}} = 64$ $x^{\frac{-5}{3}} = 32$ ✓ $x = (2^5)^{\frac{-3}{5}}$ ✓ $x = 2^{-3} = \frac{1}{8} = 0,125$ ✓ OR $2x^{\frac{-5}{3}} = 64$ $x^{\frac{-5}{3}} = 32$ ✓ $x = (32)^{\frac{-3}{5}}$ ✓ $x = \sqrt[5]{32^{-3}}$ $x = 2^{-3} = \frac{1}{8} = 0,125$ ✓	(3)

1.1.4	$-3(x-2)(x+4) \geq 0$ $(x-2)(x+4) \leq 0 \checkmark$  $-4 \leq x \leq 2 \text{ OR } x \in [-4; 2] \checkmark \checkmark$	(3)
1.2	$y = 2x + 1 \checkmark$ $x^2 - 3x - 4 - (2x + 1) = (2x + 1)^2 \checkmark$ $x^2 - 3x - 4 - 2x - 1 = 4x^2 + 4x + 1$ $3x^2 + 9x + 6 = 0 \checkmark$ $x^2 + 3x + 2 = 0$ $(x + 2)(x + 1) = 0 \checkmark$ $x = -2 \text{ or } x = -1 \checkmark$ $y = -3 \text{ or } y = -1 \checkmark$	(6)
1.3.1	$x + 1 = \frac{-4}{x - 3}$ $(x + 1)(x - 3) = -4 \checkmark$ $x^2 - 2x - 3 = -4$ $x^2 - 2x + 1 = 0 \checkmark$ $(x - 1)^2 = 0$ $x = 1 \checkmark$	(3)
1.3.2	<p>Yes, the graph of f and the graph of g have equal roots at $x = 1 \checkmark$</p>	(1)
1.4	$\frac{3^{2015} + 3^{2013}}{9^{1006}}$ $= \frac{3^{2012}(3^3 + 3)}{3^{2012}} \checkmark \checkmark$ $= 30 \checkmark$	(3) [25]

QUESTION 2

2.1	 <p> $2a = 4 \checkmark$ $a = 2 \checkmark$ $3a + b = 3$ $b = -3 \checkmark$ $a + b + c = -1$ $c = 0 \checkmark$ $T_n = 2n^2 - 3n$ </p>	(4)
2.2	$T_n = 2n^2 - 3n$ $T_{48} = 2(48)^2 - 3(48)$ $T_{48} = 4\,464 \checkmark$	(1)
2.3	$3 + 7 + 11 + \dots$ $S_n = \frac{n}{2}[2(3) + (n-1)4] \checkmark \checkmark$ $S_n = \frac{n}{2}[6 + 4n - 4] \checkmark$ $S_n = 2n^2 + n$	(3)
2.4	$2n^2 + n = 9\,591$ $2n^2 + n - 9\,591 = 0 \checkmark$ $(n - 69)(2n + 139) = 0$ OR $n = \frac{-1 \pm \sqrt{1^2 - 4(2)(-9\,591)}}{2(2)} \checkmark$ $n = \frac{-1 \pm \sqrt{76\,729}}{4}$ $n = 69$ or $n = -\frac{139}{2}$ But $n \neq -\frac{139}{2}$ $n = 69 \checkmark$	(3) [11]

QUESTION 3

3.1.1	$w - 6 = 20 - w$ $2w = 26$ $w = 13 \checkmark$	(1)
3.1.2	$S_{20} = \frac{20}{2} [2(6) + (20-1)7] \checkmark$ $S_{20} = 1450 \checkmark$	(2)
3.1.3	$\sum_{n=1}^{20} (6 + 7(n-1)) = \sum_{n=1}^{20} (7n-1) \checkmark \checkmark$	(2)
3.2.1	$5 - (6 - x) = \sqrt{4x+12} - 5$ $x - 1 = \sqrt{4x+12} - 5$ $x + 4 = \sqrt{4x+12} \checkmark$ $x^2 + 8x + 16 = 4x + 12 \checkmark$ $x^2 + 4x + 4 = 0 \checkmark$ $(x+2)^2 = 0 \checkmark$ $x = -2 \checkmark$	(5)
3.2.2	$T_1 = 6 - (-2) = 8$ $T_2 = 5$ $d = -3 \checkmark$ $T_{10} = 8 + (10-1)(-3)$ $T_{10} = -19 \checkmark$	(2)
3.3	$81 - 243 + 729 - \dots \checkmark$ $S_{18} = \frac{81((-3)^{18} - 1)}{-3 - 1} \checkmark$ $S_{18} = -7\,845\,264\,882 \checkmark$	(3)
3.4.1	$r = \frac{(x+2)(x-2)}{x-2}$ $r = x+2 \checkmark$ $-1 < r < 1 \checkmark$ $-1 < x+2 < 1$ $-3 < x < -1 \checkmark$	(3)
3.4.2	$\left(-\frac{7}{2}\right) + \left(-\frac{7}{4}\right) + \dots$ $S_{\infty} = \frac{-\frac{7}{2}}{1 - \frac{1}{2}} \checkmark$ $S_{\infty} = -7 \checkmark$	(2)

[20]

QUESTION 4

4.1	(0;3) ✓	(1)
4.2	$x = -\frac{(-2)}{2(-1)}$ OR $-2x - 2 = 0$ ✓ $x = -1$ ✓ $y = -(-1)^2 - 2(-1) + 3$ $y = 4$ ✓ C(-1;4)	(3)
4.3	A(-3;0) ✓	(1)
4.4	$g(x) = mx + q$ $m_{AC} = \frac{4-0}{-1-(-3)}$ $m_{AC} = 2$ ✓ $y = 2x + q$ Subs A(-3;0) OR C(-1;4) $0 = 2(-3) + q$ OR $4 = 2(-1) + q$ $q = 6$ ✓ E(0;6) and C(-1;4) $CE = \sqrt{(0-(-1))^2 + (6-4)^2}$ ✓ $CE = \sqrt{5} = 2,24$ units ✓	(4)
4.5	$f'(x) = -2x - 2$ ✓ $-2x - 2 = 2$ ($m_{\text{tangent}} = 2$) ✓ $x = -2$ ✓ $f(-2) = -(-2)^2 - 2(-2) + 3$ $y = 3$ ✓ Subs (-2;3) $3 = 2(-2) + k$ $k = 7$ ✓ OR $-x^2 - 2x + 3 = 2x + k$ ✓ $-x^2 - 4x + 3 - k = 0$ ✓ For equal roots: $\Delta = 0$ ✓ $(-4)^2 - 4(-1)(3 - k) = 0$ ✓ $16 + 12 - 4k = 0$ $4k = 28$ $k = 7$ ✓	(5)
4.6	$y = 2x + 6$ $x = 2y + 6$ ✓ $2y = x - 6$ $y = \frac{x-6}{2} = \frac{x}{2} - 3$ ✓	(2)

4.7	$2x + 6 \geq \frac{x-6}{2} \checkmark$ $4x + 12 \geq x - 6 \checkmark$ $3x \geq -18$ $x \geq -6 \checkmark$	(3) [19]
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QUESTION 5

5.1	$r = 2 \checkmark$	(1)
5.2	$g(x) = 2^x + 2$ $g(0) = 2^0 + 2 = 3 \checkmark$ B(0;3)	(1)
5.3	Subs B(0;3) $3 = \frac{3}{0-p} + 2 \checkmark$ $p = -3 \checkmark$	(2)
5.4	At A: $x = -3 \checkmark$ $y = 2^{-3} + 2 = \frac{17}{8} = 2\frac{1}{8} = 2,125 \checkmark$ A(-3; $\frac{17}{8}$) OR A(-3; $2\frac{1}{8}$) OR A(-3; 2,125)	(2)
5.5	$-3 < x \leq 0$ OR $x \in (-3; 0] \checkmark \checkmark$	(2)
5.6	<div style="text-align: center;"> </div> <p style="text-align: right; margin-top: 20px;">$h(x) \checkmark \checkmark$ $h^{-1}(x) \checkmark \checkmark$</p>	(4) [12]

QUESTION 6

6.1	$A = \frac{P}{2} \checkmark$ $\frac{P}{2} = P(1 - 0,07)^n \checkmark$ $\frac{1}{2} = (0,93)^n$ $n = \log_{0,93} \left(\frac{1}{2} \right) \checkmark$ $n = 9,55 \text{ years} \checkmark$	(4)
6.2.1	$A = x(1 - 0,2)^5$ $A = 0,328x \checkmark$	(1)
6.2.2	$A = x(1 + 0,18)^5$ $A = 2,288x \checkmark$	(1)
6.2.3	$i = \frac{0,1}{12} \checkmark \text{ and } n = 60 \checkmark$ $F = \frac{8000 \left[\left(1 + \frac{0,1}{12} \right)^{60} - 1 \right]}{\frac{0,1}{12}} \checkmark$ $F = R619\,496,58 \checkmark$	(4)
6.2.4	<p>Sinking fund = New tractor price – Scrap value</p> $619\,496,58 = (2,288)x - (0,328)x \checkmark$ $619\,496,58 = (1,96)x$ $x = \frac{619\,496,58}{1,96} \checkmark$ $x = R316\,069,68$ $x = R316\,000 \checkmark$ <p>OR</p> $619\,496,58 = (1 + 0,18)^5 x - (1 - 0,2)x \checkmark$ $619\,496,58 = (1,18)^5 x - (0,8)x$ $x = \frac{619\,496,58}{[(1,18)^5 - (0,8)^5]} \checkmark$ $x = R316\,057,15$ $x = R316\,000 \checkmark$	(3) [13]

QUESTION 7

7.1	$f(x) = 3x^2 - 5$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{3(x+h)^2 - 5 - (3x^2 - 5)}{h} \checkmark$ $f'(x) = \lim_{h \rightarrow 0} \frac{3x^2 + 6xh + 3h^2 - 5 - 3x^2 + 5}{h} \checkmark$ $f'(x) = \lim_{h \rightarrow 0} \frac{6xh + 3h^2}{h} \checkmark$ $f'(x) = \lim_{h \rightarrow 0} \frac{h(6x + 3h)}{h} \checkmark$ $f'(x) = \lim_{h \rightarrow 0} (6x + 3h)$ $f'(x) = 6x \checkmark$	(5)
7.2.1	$y = 4x^6 + \frac{5}{x^3}$ $y = 4x^6 + 5x^{-3} \checkmark$ $\frac{dy}{dx} = 24x^5 - 15x^{-4} \checkmark \checkmark$	(3)
7.2.2	$y = (\sqrt{x} - x^2)^2$ $y = x - 2x^2\sqrt{x} + x^4$ $y = x - 2x^2\left(x^{\frac{1}{2}}\right) + x^4$ $y = x - 2x^{\frac{5}{2}} + x^4 \checkmark \checkmark$ $\frac{dy}{dx} = 1 - 5x^{\frac{3}{2}} + 4x^3 \checkmark \checkmark$ <p>OR</p> $y = \left(x^{\frac{1}{2}} - x^2\right)^2$ $y = x - 2x^{\frac{5}{2}} + x^4 \checkmark \checkmark$ $\frac{dy}{dx} = 1 - 5x^{\frac{3}{2}} + 4x^3 \checkmark \checkmark$	(4) [12]

QUESTION 8

8.1	$y = 12$ ✓	(1)
8.2	Subs (0;12) $12 = (0-2)^2(0-n)$ ✓ $12 = -4n$ $n = -3$ $(x-2)^2(x+3) = 0$ ✓ $x = -3$ ✓ A(-3;0)	(3)
8.3	$f(x) = (x-2)^2(x+3)$ $f(x) = (x^2 - 4x + 4)(x+3)$ $f(x) = x^3 + 3x^2 - 4x^2 - 12x + 4x + 12$ $f(x) = x^3 - x^2 - 8x + 12$ ✓ $f'(x) = 3x^2 - 2x - 8$ ✓ $3x^2 - 2x - 8 = 0$ ✓ $(3x+4)(x-2) = 0$ ✓ $x = -\frac{4}{3}$ or $x = 2$ ✓ $f(x) = \left(-\frac{4}{3}\right)^3 - \left(-\frac{4}{3}\right)^2 - 8\left(-\frac{4}{3}\right) + 12$ $y = \frac{500}{27} = 18\frac{14}{27} = 18,52$ ✓ $C\left(-\frac{4}{3}; \frac{500}{27}\right)$ OR $C\left(-\frac{4}{3}; 18\frac{14}{27}\right)$ OR $C\left(-\frac{4}{3}; 18,52\right)$	(6)
8.4.1	$f''(x) = 6x - 2$ ✓ $6x - 2 < 0$ $x < \frac{1}{3}$ ✓	(2)
8.4.2	$x < -\frac{4}{3}$ or $x > 2$ OR $x \in \left(-\infty; -\frac{4}{3}\right) \cup (2; \infty)$ ✓✓	(2)
8.5	$0 < p < \frac{500}{27}$ OR $p \in \left(0; \frac{500}{27}\right)$ ✓✓ OR $0 < p < 18\frac{14}{27}$ OR $p \in \left(0; 18\frac{14}{27}\right)$ OR $0 < p < 18,52$ OR $p \in (0; 18,52)$	(2)
		[16]

QUESTION 9

9.1	$340 = \pi r^2 h \checkmark$ $h = \frac{340}{\pi r^2} \checkmark$	(2)
9.2	$A = 2\pi r^2 + 2\pi r \left(\frac{340}{\pi r^2} \right) \checkmark$ $A = 2\pi r^2 + \frac{680}{r}$ $A = 2\pi r^2 + 680r^{-1} \checkmark$ $A'(r) = 4\pi r - 680r^{-2} \checkmark$ $4\pi r - \frac{680}{r^2} = 0 \checkmark$ $4\pi r^3 = 680$ $r^3 = \frac{680}{4\pi} = \frac{170}{\pi} \checkmark$ $r = 3,78 \text{ cm} \checkmark$	(6) [8]

QUESTION 10

10.1.1 (a)	$P(\text{Male}) = \frac{80}{150} = \frac{8}{15} = 0,53 \checkmark$	(1)
10.1.1 (b)	$P(\text{Female and plays tennis}) = \frac{20}{150} = \frac{2}{15} = 0,13 \checkmark$	(1)
10.1.2	$P(\text{Female}) = \frac{70}{150}$ $P(\text{Plays tennis}) = \frac{70}{150} \quad \left. \vphantom{\begin{matrix} P(\text{Female}) \\ P(\text{Plays tennis}) \end{matrix}} \right\} \checkmark$ $P(\text{Female}) \times P(\text{Plays tennis}) = \frac{70}{150} \times \frac{70}{150} = \frac{4900}{22500} = \frac{49}{225} = 0,22 \checkmark$ $P(\text{Female and plays tennis}) = \frac{20}{150} = \frac{2}{15} = 0,13$ $P(\text{Female}) \times P(\text{Plays tennis}) \neq P(\text{Female and plays tennis}) \checkmark$ <p>Therefore the events 'female' and 'plays tennis' are not independent</p>	(3)
10.2.1	$P(A \text{ and } C) = 0 \checkmark$	(1)
10.2.2	$P(B \text{ and } C) = (0,4)(0,2) = 0,08 \checkmark$	(1)
10.2.3	$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$ $= 0,3 + 0,4 - (0,3)(0,4) \checkmark$ $= 0,3 + 0,4 - 0,12$ $= 0,58 \checkmark$	(2) [9]

QUESTION 11

11.1	$2 \times 2! \times 7! = 20160$ ✓✓	(2)
11.2	All seated in $9! = 362880$ ways ✓ Girls seated together in $4! = 24$ ways With the girls as one unit they can all be seated in $4! \times 6! = 17280$ ways ✓ $P(\text{All girls seated together}) = \frac{17280}{362880} = \frac{1}{21}$ ✓	(3) [5]

TOTAL : 150