

Metro North Education District

Grade 12

Mathematics P1

MEMO

September 2019

MARKS: 150

TIME: 3 hours

NOTE:

- If a candidate answers a question TWICE, only mark the FIRST attempt.
- Consistent accuracy applies in ALL aspects of the marking guidelines.

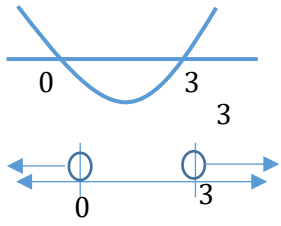
LET WEL:

- Indien 'n kandidaat 'n vraag TWEE KEER beantwoord, merk slegs die EERSTE poging.
- Volgehoue akkuraatheid is op ALLE aspekte van die nasienriglyne van toepassing.

QUESTION 1

1.1.1	$(x - 3)(3x + 2) = 0$ $x = 3 ; x = -\frac{2}{3}$	$\checkmark x = 3$ $\checkmark x = -\frac{2}{3}$	(2) K
1.1.2	$2x(2x - 1) = 3$ $4x^2 - 2x - 3 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $x = \frac{-(-2) \pm \sqrt{(-2)^2 - 4(4)(-3)}}{2(4)}$ $x = \frac{2 \pm \sqrt{52}}{8}$ $x = 1,15$ or $x = -0,65$	$\checkmark$ standard form $\checkmark$ subst. into correct formula B/D if a,b,c incorrect $\checkmark x = 1,15$ $\checkmark x = -0,65$ -1 rounding	(4) R

1.1.3	$3^{x+1} - 3^{x-1} - 7 = 2^{-x} \cdot 2^x$ $3^{x+1} - 3^{x-1} - 7 = 2^0$ $3^{x+1} - 3^{x-1} = 1 + 7$ $3^x(3^1 - 3^{-1}) = 8$ $3^x\left(\frac{8}{3}\right) = 8$ $3^x = 3$ $x = 1$	$\checkmark 2^0 = 1$ $\checkmark 3^x(3^1 - 3^{-1})$ $\checkmark 3^x = 3$ $\checkmark \text{answer}$	(4) R
1.1.4	$\sqrt{2-x} = \frac{x^2-x-2}{\sqrt{2-x}}$ $2-x = x^2-x-2$ $0 = x^2-4$ $0 = (x+2)(x-2)$ $x = -2 \text{ or } x \neq 2$ OR $(\sqrt{2-x})^2 = \left(\frac{x^2-x-2}{\sqrt{2-x}}\right)^2$ $2-x = \frac{x^4-2x^3-3x^2+4x+4}{2-x}$ $4-4x+x^2 = x^4-2x^3-3x^2+4x+4$ $0 = x^4-2x^3-4x^2+8x$ $0 = x^3(x-2)-4x(x-2)$ $0 = (x-2)(x^3-4x)$ $0 = x(x-2)(x^2-4)$ $0 = x(x-2)(x-2)(x+2)$ $x \neq 0; x \neq 2; x = -2$	$\checkmark 2-x = x^2-x-2$ $\checkmark \text{standard form}$ $\checkmark \text{factors}$ CA $\checkmark x = -2$ CA $\checkmark x \neq 2$ A $\checkmark \text{squaring both sides}$ $\checkmark 0 = x^4-2x^3-4x^2+8x$ $\checkmark \text{factors}$ CA $\checkmark x = -2$ CA $\checkmark x \neq 2/0$ A	(5) C

1.2	Given $f(x) = -x^2 + 7x + 8$ and $g(x) = -3x + 24$		
	$f(x) = g(x)$ $-x^2 + 7x + 8 = -3x + 24$ $-x^2 + 10x - 16 = 0$ $x^2 - 10x + 16 = 0$ $(x - 8)(x - 2) = 0$ $x = 8 \text{ or } x = 2$ $y = 0 \text{ or } y = 18$	$\checkmark -x^2 + 7x + 8 = -3x + 24$ $\checkmark \text{ standard form}$ $\checkmark \text{ factors}$ CA $\checkmark \text{ both values for } x$ CA $\checkmark y = 0 \quad \checkmark y = 18$ CA	(6) R
1.3.1	$k = 2$ $\therefore \Delta = 2(3 - 2)$ $\Delta = 2$ • Real / Reëel • Irrational / irrasionaal • Unequal / ongelyk	$\checkmark \text{ real and irrational /}$ $\text{reël en irrasionaal}$ $\checkmark \text{ unequal / ongelyk}$	(2) K
1.3.2	$k(3 - k) < 0$ $k(k - 3) > 0$ $k < 0 \text{ or } k > 3$ OR $x \in (-\infty; 0) \text{ or } x \in (3; \infty)$	 $\checkmark < 0$ $\checkmark \text{ critical values}$ $\checkmark \text{ notation}$ CA	(3) R
			[26]

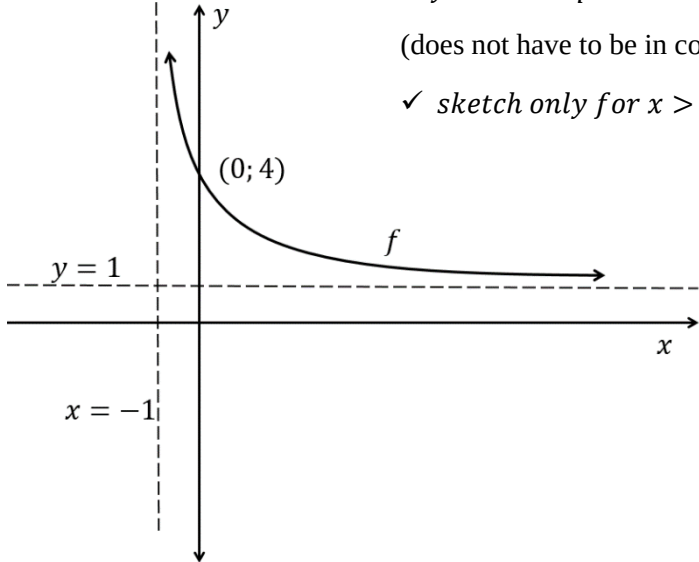
QUESTION 2

2.1.1	$6; 8; 10; 12; \dots$ $T_n = a + (n - 1)d$ $= 6 + (n - 1)(2)$ $= 6 + 2n - 2$ $= 2n + 4$	$\checkmark$ <i>subst. into correct formula</i> $\checkmark$ <i>answer</i> Or $\checkmark\checkmark$ Answer only	(2) K
2.1.2	$2n + 4 = 164$ $2n = 160$ $n = 80$	$\checkmark$ $2n + 4 = 164$ CA from 2.1.1 $\checkmark$ <i>answer</i> Or $\checkmark\checkmark$ Answer only	(2) R
2.1.3	$2a = 2$ $3a + b = 6$ $a = 1$ $3(1) + b = 6$ $b = 3$ $\therefore T_n = 1n^2 + 3n + c$ $39 = (5)^2 + 3(5) + c$ $39 = 25 + 15 + c$ $-1 = c$	$\checkmark$ $a = 1$ $\checkmark$ $b = 3$ $\checkmark$ <i>subst</i> $\checkmark$ $c = -1$ CA	
OR / OF			
$2a = 2$ $3a + b = 6$ $a + b + c = 3$ $a = 1$ $3(1) + b = 6$ $1 + 3 + c = 3$ $b = 3$ $c = -1$		$\checkmark$ $a = 1$ $\checkmark$ $b = 3$ $\checkmark$ $a + b + c = 3$ $\checkmark$ $c = -1$	(4) P

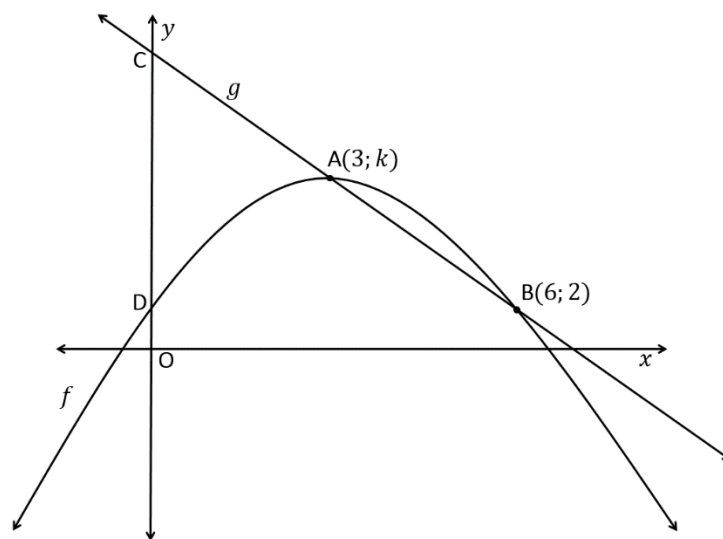
2.2	$\frac{p}{p-1} = \frac{p+2}{p}$ $p^2 = (p-1)(p+2)$ $p^2 = p^2 + p - 2$ $p - 2 = 0$ $p = 2$	✓ ratio ✓ $p^2 + p - 2$ ✓ <i>answer</i>	(3) R
2.3	$\sum_{k=1}^n \frac{1}{32} (2)^{k-1} > 900$ $T_1 = \frac{1}{32} (2)^{1-1} = \frac{1}{32}$ $T_2 = \frac{1}{32} (2)^{2-1} = \frac{1}{16}$ $T_3 = \frac{1}{32} (2)^{3-1} = \frac{1}{8}$ $S_n = \frac{a(r^n - 1)}{r - 1}$ $\frac{\frac{1}{32} (2^n - 1)}{2 - 1} = 900$ $\frac{1}{32} (2^n - 1) = 900$ $2^n - 1 = 28800$ $2^n = 28801$ $n = \log_2 28801$ $n = 14,81$ $\therefore n = 15$	✓ $a = \frac{1}{32}$ ✓ $r = 2$ ✓ <i>subst. into correct form.</i> ✓ $2^n = 28801$ ✓ <i>answer</i>	(5)C
2.4	$\sum_{p=15}^n (2p - 5) = m - 140$	✓✓ <i>answer</i>	(2) P
			[18]

3.1	$T_1 = \frac{1}{2}\pi(1)^2 = \frac{\pi}{2}$ $T_2 = \frac{1}{2}\pi\left(\frac{1}{2}\right)^2 = \frac{\pi}{8}$ $T_3 = \frac{1}{2}\pi\left(\frac{1}{4}\right)^2 = \frac{\pi}{32}$ $S_\infty = \frac{a}{1-r}$ $S_\infty = \frac{\frac{\pi}{2}}{1-\frac{1}{4}}$ $S_\infty = \frac{\frac{\pi}{2}}{\frac{3}{4}}$ $S_\infty = \frac{2\pi}{3}$	✓ $a = \frac{\pi}{2}$ ✓ $r = \frac{1}{4}$ ✓ subst into correct formula ✓ answer in terms of π	(4) P
			[4]

QUESTION 4

	$f(x) = \frac{3}{x+1} + 1$		
4.1	$x = -1$ and $y = 1$	$\checkmark x = -1$ A $\checkmark y = 1$ A	(2) K
4.2	$f(0) = \frac{3}{0+1} + 1$ $= 4$	$\checkmark x = 0$ $\checkmark y = 4$	(2) R
4.3	$\checkmark\checkmark$ 1 for each asymptote $\checkmark$ y – intercept (does not have to be in coordinate form.) $\checkmark$ sketch only for $x > -1$ (only 1 arm) 		(4) R
4.4	$-1 < x \leq 0$ OR $x \in (-1; 0]$	$\checkmark$ critical values CA from 4.1 $\checkmark$ inequalities	(2) P
			[10]

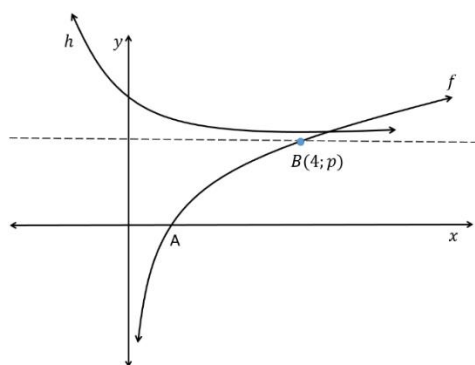
QUESTION 5

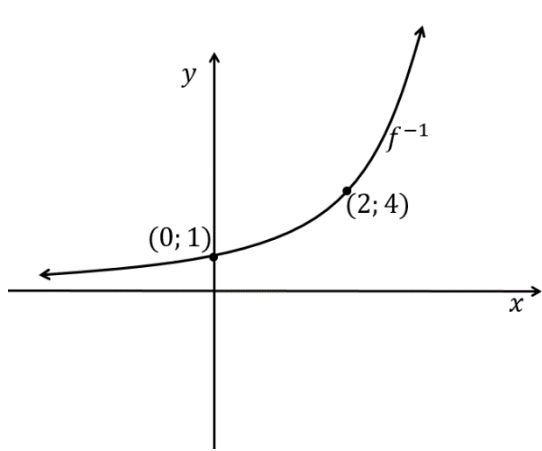


5.1	$g(x) = -3x + 20$ $g(3) = -3(3) + 20 = 11$ $\therefore k = 11$	$\checkmark$ subst. $x = 3$ $\checkmark 11$	(2) R
5.2	$y \geq -11$ OR $x \in [-11; \infty)$	$\checkmark \checkmark$ answer CA from 5.1 Only 1 mark if $y > -11$	(2) K
5.3	$y = a(x - 3)^2 + 11$ subst. (6; 2) $2 = a(6 - 3)^2 + 11$ $-9 = 9a$ $-1 = a$ $y = -1(x - 3)^2 + 11$ $y = -(x^2 - 6x + 9) + 11$ $y = -x^2 + 6x + 2$ $\therefore a = -1 ; b = 6$ and /en $c = 2$ OR	$\checkmark y = a(x - 3)^2 + 11$ CA from 5.1 $\checkmark$ subst. (6; 2) $\checkmark a = -1$ $\checkmark (x^2 - 6x + 9)$ $\checkmark y = -x^2 + 6x + 2$ $\checkmark$ answer CA	(6) C

	$f'(3) = 0$ $f'(x) = 2ax + b$ $f'(3) = 6a + b = 0$ $b = -6a \dots (1)$ $f(3) = 11$ $11 = 9a + 3b + c \dots (2)$ Subst (1) in (2) $11 - 9a - 18a + c$ $11 + 9a = c \dots (3)$ $f(6) = 2$ $2 = 36a + 6b + c \dots (4)$ Subst (1) and (3) in (4) $2 = 36a + 6(-6a) + 11 + 9a$ $2 = 11 + 9a$ $-9 = 9a$ $-1 = a$ Subst in (1): $b = -6(-1) = 6$ Subst in (3): $11 + 9(-1) = c$ $2 = c$	$\checkmark b = -6a$ $\checkmark 11 = 9a + 3b + c$ $\checkmark 11 + 9a = c$ $\checkmark 2 = 36a + 6b + c$ $\checkmark a = -1$ $\checkmark b = 6 \text{ and } c = 2$	(6) C
5.4	$3 < x < 6$ OR $x \in (3; 6)$	$\checkmark$ critical values $\checkmark$ inequalities	(2) K
5.5	- Real <i>Reëel</i> - Rational <i>Rasionaal</i> - Equal <i>Gelyk</i>	$\checkmark$ Real and rational / <i>Reëel en rass</i> $\checkmark$ Equal / <i>gelyk</i>	(2) C
5.6	$x > 3$ OR $x \in (3; \infty)$	$\checkmark\checkmark$ answer If = 1 mark	(2) P
			[16]

QUESTION 6



6.1	$A(1; 0)$	✓ answer	(1) K
6.2	$x \in \mathbb{R}; x > 0$ or $x \in (0; \infty)$	✓ $x > 0$ or $x \in (0; \infty)$	(1) K
6.3	$x = \log_2 y$ $y = 2^x$	✓ $x = \log_2 y$ ✓ answer OR ✓✓ answer only	(2) K
6.4	 ✓ shape and asymptote ✓ y – intercept (does not have to be in coordinate form.) ✓ coordinates of any other point		(3) R
6.5	$p = \log_2 4 = 2$ $\therefore y = 2$	✓ subst ✓ answer OR ✓✓ answer only	(2) C
6.6	Reflection in the y – axis and translate 2 units down.	✓ reflect in the y – axis ✓ Translate 2 units down	(2) C
			[11]

QUESTION 7

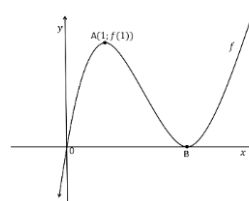
7.1	$A = p(1 - i)^n$ $\frac{1}{2}x = x(1 - i)^{\frac{7}{2}}$ $1 - i = \sqrt{\frac{1}{2}}$ $1 - i = 0,82 \dots$ $-i = -0,17966 \dots$ $i = 0,17966 \dots$ $r = 17,97 \%$	$\checkmark n = \frac{7}{2}$ $\checkmark$ subst into correct formula $\checkmark 0,17966 \dots$ $\checkmark$ answer	(4) C
7.2.1	$P = \frac{x[1 - (1 + i)^{-n}]}{i}$ $90\,000 = \frac{3000[1 - (1 + \frac{14}{1200})^{-12n}]}{\frac{14}{1200}}$ $\log_{\frac{607}{600}} \frac{13}{20} = 12n$ $37,13 \dots = 12n$ $3,09 = n$ $\therefore n = 3 \text{ years. Or 4 years}$	$\checkmark \frac{14}{1200}$ $\checkmark$ subst into correct formula $\checkmark$ using logs $\checkmark 37,13$ $\checkmark$ answer $n = 3$	(5) R
7.2.2	$P = \frac{x[1 - (1 + i)^{-n}]}{i}$ $P = \frac{3000[1 - (1 + \frac{14}{1200})^{-12}]}{\frac{14}{1200}}$ $P = 33\,412,37$ OR $\text{Balance} = A - F$ $= 90\,000(1 + \frac{14}{1200})^{24}$ $- \frac{3000[(1 + \frac{14}{1200})^{24} - 1]}{\frac{14}{1200}}$ $= 118\,888,84 - 82\,539,54$ $= 36\,349,30$	$\checkmark n = -12$ CA from 7.2.1 - 24 - ,,,,,, $\checkmark$ subst into correct formula $\checkmark$ answer Accurate $\checkmark 90\,000(1 + \frac{14}{1200})^{24}$ $\checkmark \frac{3000[(1 + \frac{14}{1200})^{24} - 1]}{\frac{14}{1200}}$ $\checkmark$ answer Accurate	(3) C

7.2.3	$F = \frac{x[(1+i)^n - 1]}{i}$ $90\,000 = \frac{x\left[\left(1 + \frac{10}{1200}\right)^{36} - 1\right]}{\frac{10}{1200}}$ $2154,05 = x$	$\checkmark \frac{10}{1200}$ $\checkmark n = 36$ $\checkmark$ <i>subst into correct formula</i> $\checkmark$ <i>answer</i>	(4) R [16]
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QUESTION 8

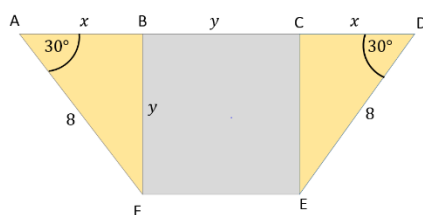
8.1	$f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{1 - 3(x+h)^2 - (1 - 3x^2)}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{1 - 3x^2 - 6xh - 3h^2 - 1 + 3x^2}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{-6xh - 3h^2}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{h(-6x - 3h)}{h}$ $f'(x) = -6x$	✓ subst into correct formula ✓ $1 - 3x^2 - 6xh - 3h^2 - 1 + 3x^2$ ✓ simplification $-6xh - 3h^2$ ✓ factorising $h(-6x - 3h)$ ✓ answer = $-6x$ -1 notation	(5) K
Q8.2 – Q8.3 – 1 notation only once			
8.2	$g(x) = \frac{x^4 - x}{x} \text{ at } x = -2.$ $g(x) = x^3 - 1$ $g'(x) = 3x^2$ $g'(-2) = 3(-2)^2 = 12$	✓ simplification ✓ $3x^2$ CA ✓ subst CA ✓ 12 CA	(4) C
8.3.1	$y = \sqrt[3]{x} + \frac{5}{x^2}$ $y = x^{\frac{1}{3}} + 5x^{-2}$ $\frac{dy}{dx} = \frac{1}{3}x^{-\frac{2}{3}} - 10x^{-3}$	✓ $x^{\frac{1}{3}}$ ✓ $5x^{-2}$ ✓ $\frac{1}{3}x^{-\frac{2}{3}}$ ✓ $-10x^{-3}$ CA	(4) R
8.3.2	$x = \sqrt{y} + \frac{1}{x}$ $x - \frac{1}{x} = \sqrt{y}$ $\left(x - \frac{1}{x}\right)^2 = y$ $y = x^2 - 2 + \frac{1}{x^2}$ $y = x^2 - 2 + x^{-2}$ $\frac{dy}{dx} = 2x - 2x^{-3}$	✓ making y the subject of the formula ✓ simplification of binomial ✓ $2x$ ✓ $-2x^{-3}$ CA (does not have to be in positive exponent form)	(4) P
			[17]

QUESTION 9



9.1	$d = 0$	✓ answer	(1) K
9.2	$f(x) = 3x^3 + bx^2 + 27x$ $f'(x) = 9x^2 + 2bx + 27$ $f'(1) = 9(1)^2 + 2b(1) + 27$ $9(1)^2 + 2b(1) + 27 = 0$ $9 + 2b = -27$ $2b = -36$ $b = -18$	$\checkmark f'(x) = 9x^2 + 2bx + 27$ $\checkmark \text{subst. } x = 1$ $\checkmark f'(x) = 0$ $\checkmark 2b = -36 \text{ (simplify)}$ answer given	(4) C
9.3	$f(x) = 3x^3 - 18x^2 + 27x$ $f'(x) = 9x^2 - 36x + 27$ $9x^2 - 36x + 27 = 0$ $x^2 - 4x + 3 = 0$ $(x - 3)(x - 1) = 0$ $x = 3; x = 1$ $\therefore B(3; 0)$ OR / OF $f(x) = 3x^3 - 18x^2 + 27x$ $3x(x^2 - 6x + 9) = 0$ $3x(x - 3)^2 = 0$ $x = 0 \text{ or } x = 3$ $\therefore B(3; 0)$	$\checkmark f'(x) = 9x^2 - 36x + 27$ $\checkmark f'(x) = 0$ $\checkmark \text{factors}$ $\checkmark \therefore B(3; 0)$ $\checkmark f(x) = 0$ $\checkmark \checkmark \text{factors}$ $\checkmark \therefore B(3; 0)$	(4) R
9.4	$x < 1 \text{ or } x > 3$ OR $x \in (-\infty; 1) \text{ or } x \in (3; \infty)$	$\checkmark x < 1 \quad x \in (-\infty; 1)$ $\checkmark x > 3 \quad x \in (3; \infty)$ CA from 9.3	(2) C
9.5	$f(x) = 3x^3 - 18x^2 + 27x$ $f'(x) = 9x^2 - 36x + 27$ $f''(x) = 18x - 36$ $18x - 36 = 0$ $x = 2$	$\checkmark f''(x) = 18x - 36$ $\checkmark f''(x) = 0$ $\checkmark \text{answer}$ OR $\checkmark \checkmark \checkmark \text{answer only}$	(3) R
9.6	$f''(x) < 0$ $18x - 36 < 0$ $x < 2$	$\checkmark f''(x) < 0$ $\checkmark \text{answer CA from 9.5}$ OR $\checkmark \checkmark \text{answer only CA from 9.5}$	(2) K
			[16]

QUESTION 10



10.1	$y^2 = 8^2 - x^2$ <i>Pythagoras</i> Area of square = y^2 $= 64 - x^2$ Area of $\Delta ABF = \frac{1}{2}(8)(x)\sin 30^\circ$ Area of floor: $A = 2[\frac{1}{2}(8)(x)\sin 30^\circ] + 64 - x^2$ $A = 8x\sin 30^\circ + 64 - x^2$	$\checkmark y^2 = 8^2 - x^2$ $\checkmark \Delta ABF = \frac{1}{2}(8)(x)\sin 30^\circ$ $\checkmark \text{method}$	(3) P
10.2	$A = 8x\sin 30^\circ + 64 - x^2$ $A = 8x(\frac{1}{2}) + 64 - x^2$ $A = 4x + 64 - x^2$ For a maximum $\frac{dA}{dx} = 0$ $4 - 2x = 0$ $x = 2$	$\checkmark A = 4x + 64 - x^2$ $\checkmark 4 - 2x = 0$ $\checkmark \text{answer}$	(3) R

OR

10.2	$\sin 30^\circ = \frac{y}{8}$ $\cos 30^\circ = \frac{x}{r}$ $\therefore y = 4$ $\therefore x = 4\sqrt{3}$ Area of floor: $A = 2[\frac{1}{2}(x)(4)] + 16$ $A = 4x + 16$ $\frac{dA}{dx} = 4$ $\neq 0$ $\therefore \text{Max not defined.}$	$\checkmark y = 4 \text{ or } x = 4\sqrt{3}$ $\checkmark \checkmark \therefore \frac{dA}{dx} \neq 0$	(3)
			[6]

QUESTION 11

11.1	Number of different gift baskets = $5 \times 3 \times 4 \times 6$ = 360	✓ $5 \times 3 \times 4 \times 6$ ✓ <i>answer</i>	(2) R
11.2	$P(M \text{ or } E) = P(M) + P(E) - P(M \text{ and } E)$ $0,7 = 0,6 + 0,3 - x$ $x = 0,2$ or 20% or $\frac{1}{5}$	✓ <i>subst</i> ✓ <i>answer</i>	(2) R
11.3.1	Number of ways the RCL be arranged in a row = 5! = 120	✓ 5! ✓ <i>answer</i> OR ✓✓ <i>answer only</i>	(2) R
11.3.2	$P(E) = \frac{4! \times 2!}{5!}$ $= \frac{48}{120}$ $= \frac{2}{5}$ or 0,4 or 40%	✓ $4! \times \checkmark 2!$ ✓ $\div 5!$ or 120 CA from 11.3.1 ✓ <i>answer</i>	(4) C
			[10]

TOTAL 150

K	R	C	P
20%	35%	30%	15%
26	62	41	21
17%	41%	27%	14%

Algebra	Patterns	Finance	Functions	Calculus	Prob
25 ± 3 marks	25 ± 3 marks	15 ± 3 marks	35 ± 3 marks	35 ± 3 marks	15 ± 3 marks
26	22	16	37	39	10
17%	15%	11%	25%	26%	7%

Weighting of Content Areas			
Description	Grade 10	Grade 11	Grade. 12
PAPER 1 (Grades 12:bookwork: maximum 6 marks)			
Algebra and Equations (and inequalities)	30 ± 3	45 ± 3	25 ± 3
Patterns and Sequences	15 ± 3	25 ± 3	25 ± 3
Finance and Growth	10 ± 3		
Finance, growth and decay		15 ± 3	15 ± 3
Functions and Graphs	30 ± 3	45 ± 3	35 ± 3
Differential Calculus			35 ± 3
Probability	15 ± 3	20 ± 3	15 ± 3
TOTAL	100	150	150

GRADE 12 SEPT 2019 exam

QUESTIONS	MARK DISTRIBUTION(end-of-year paper)							TOTAL	COGNITIVE LEVELS					TOTAL
	PAPER 1(150 MARKS)								PAPER 1(150 MARKS)					
	Algebra;equatio ns, inequalities (25±3)	Patterns & sequences (25±3)	Finance, growth and decay (15±3)	Functions and graphs (35±3)	Calculus (35±3)	Probability (15±3)			Knowledge(20%)	Routine procedures(35%)	Complex procedures(30%)	Problem Solving(15%)		
1	26							150	Knowledge(20%)	Routine procedures(35%)	Complex procedures(30%)	Problem Solving(15%)	150	
2		18						26	4	17	5	0	26	
3		4						18	2	5	5	6	18	
4				10				4				4	4	
5				16				10	2	6		2	10	
6				11				16	4	2	8	2	16	
7			16					11	4	3	4		11	
8					17			16		9	7		16	
9					16			17	5	4	4	4	17	
10					6			16	3	7	6		16	
11						10		6		3		3	6	
12								10		6	4		10	
								0					0	
TOTAL	26	22	16	37	39	10	0	150	26	62	41	21	150	
%	17	15	11	25	26	7	0	100	17	41	27	14	100	