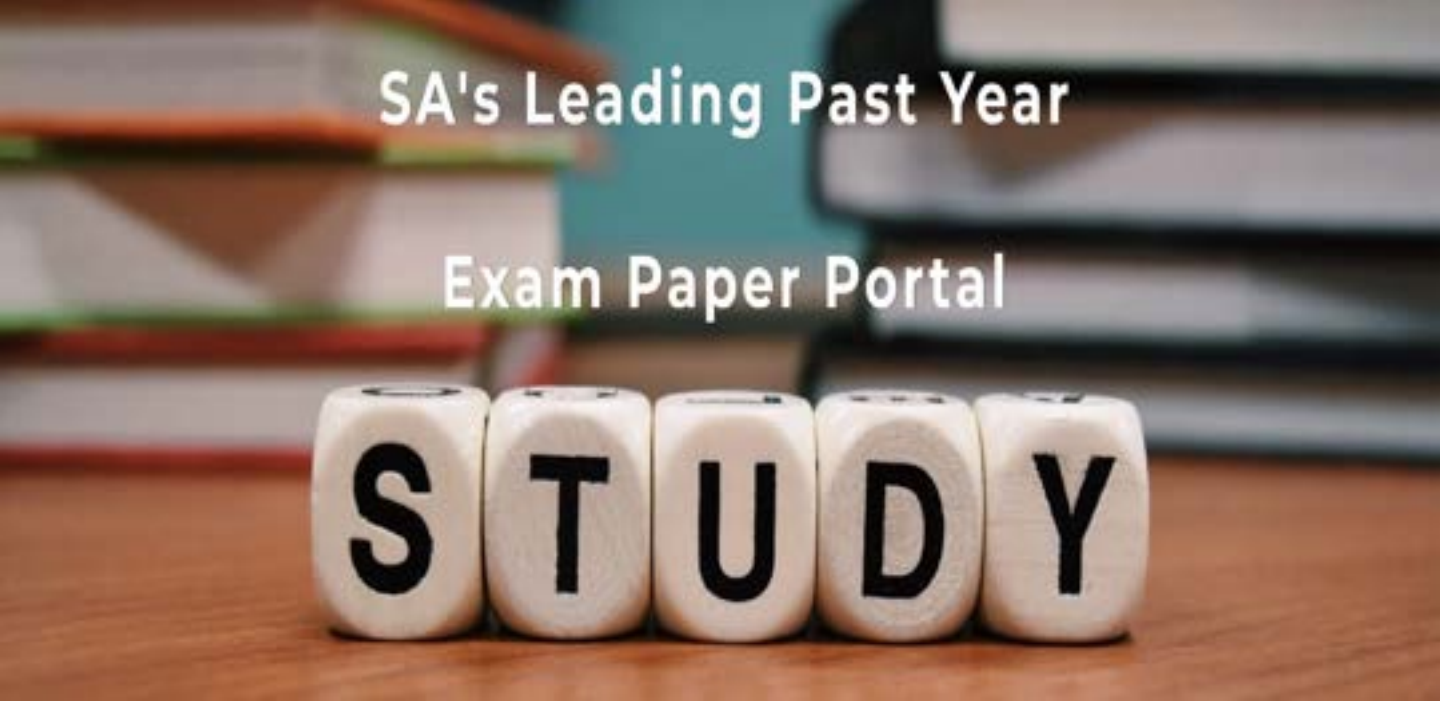

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SA EXAM PAPERS

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.

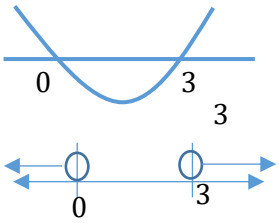
LET WEL:
• *Indien 'n kandidaat 'n vraag TWEE KEER beantwoord, merk slegs die EERSTE poging.*
• *Volgehoue akkuraatheid is op ALLE aspekte van die nasienriglyne van toepassing.*

QUESTION 1

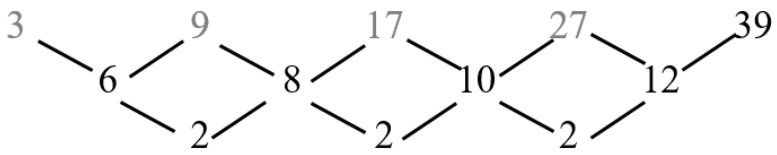
1.1.1	$(x-3)(3x+2)=0$ $x=3\,;x=-\frac{2}{3}$	✓ $x=3$ ✓ $x=-\frac{2}{3}$	(2) K
1.1.2	$2x(2x-1)=3$ $4x^2-2x-3=0$ $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$ $x=\frac{-(-2)\pm\sqrt{(-2)^2-4(4)(-3)}}{2(4)}$ $x=\frac{2\pm\sqrt{52}}{8}$ $x=1{,}15$ or $x=-0{,}65$	✓ *standard form* ✓ *subst. into correct formula* **B/D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

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

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



QUESTION 2

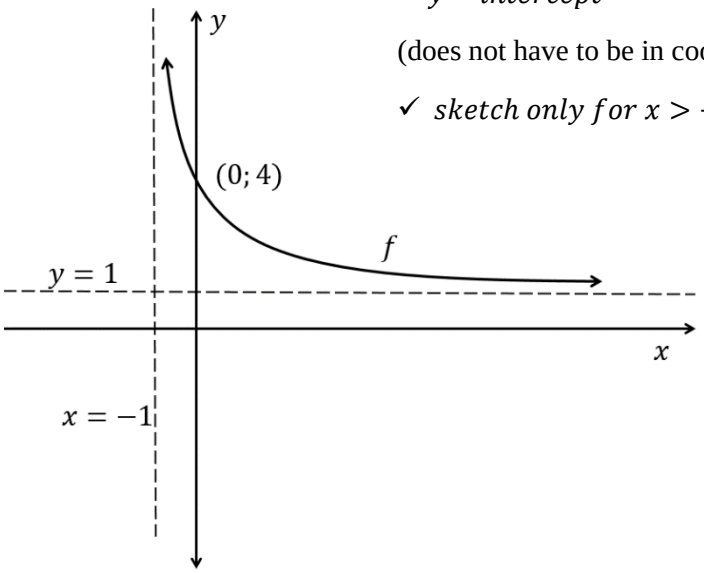
2.1.1	6 ; 8 ; 10 ; 12 ; … $T_n = a + (n-1)d$ $= 6 + (n-1)(2)$ $= 6 + 2n - 2$ $= 2n + 4$	✓ *subst. into correct formula* ✓ *answer* Or ✓✓Answer only	(2) K
2.1.2	$2n + 4 = 164$ $2n = 160$ $n = 80$	✓ $2n + 4 = 164$ **CA from 2.1.1** ✓ *answer* Or ✓✓Answer only	(2) R
2.1.3	$2a = 2 \qquad 3a + b = 6$ $a = 1 \qquad 3(1) + b = 6$ $b = 3$ $\therefore T_n = 1n^2 + 3n + c$ $39 = (5)^2 + 3(5) + c$ $39 = 25 + 15 + c$ $-1 = c$	✓ $a = 1$ ✓ $b = 3$ ✓ *subst* ✓ $c = -1$ **CA**	
	OR / OF		
			
	$2a = 2 \quad 3a + b = 6 \quad a + b + c = 3$ $a = 1 \quad 3(1) + b = 6 \quad 1 + 3 + c = 3$ $b = 3 \qquad c = -1$	✓ $a = 1$ ✓ $b = 3$ ✓$a + b + c = 3$ ✓ $c = -1$	(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 ✓*answer*	(3) R
2.3	$\sum_{k=1}^{n}\frac{1}{32}(2)^{k-1}>900$ $T_1=\frac{1}{32}(2)^{1-1}=\frac{1}{32}$ $T_2=\frac{1}{32}(2)^{2-1}=\frac{1}{16}$ $T_3=\frac{1}{32}(2)^{3-1}=\frac{1}{8}$ $S_n=\frac{a(r^n-1)}{r-1}$ $\frac{\frac{1}{32}(2^n-1)}{2-1}=900$ $\frac{1}{32}(2^n-1)=900$ $2^n-1=28800$ $2^n=28801$ $n=\log_2 28801$ $n=14{,}81$ $\therefore n=15$	✓$a=\frac{1}{32}$ ✓ $r=2$ ✓ *subst. into correct form.* ✓ $2^n=28801$ ✓ *answer*	(5)C
2.4	$\sum_{p=15}^{n}(2p-5)=m-140$	✓✓ *answer*	(2) P
			[18]

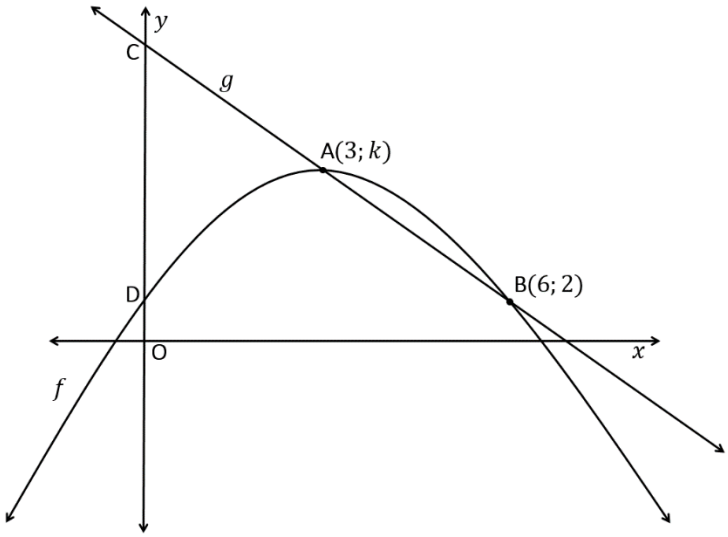
QUESTION 3

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

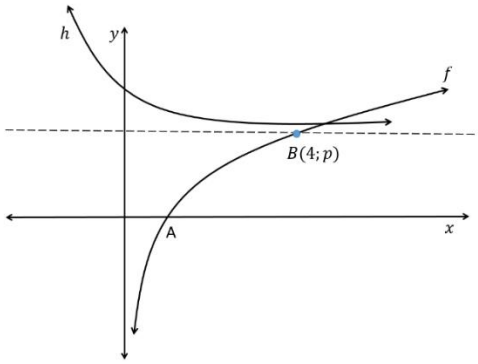
QUESTION 5

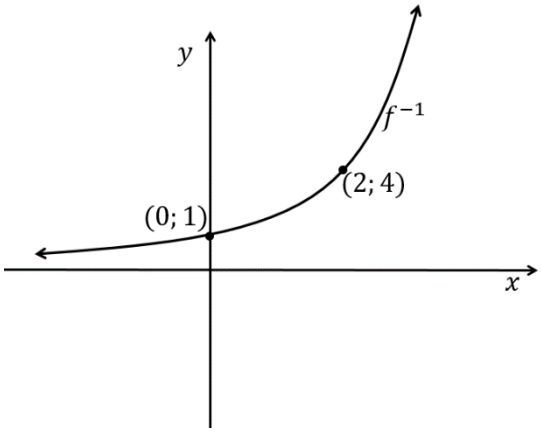


5.1	$g(x) = -3x + 20$ $g(3) = -3(3) + 20 = 11$ $\therefore k = 11$	✓ $subst. x = 3$ ✓ 11	(2) R
5.2	$y \geq -11$ OR $x \in [-11; \infty)$	✓✓ *answer* **CA from 5.1** Only 1 mark if $y > -11$	(2) K
5.3	$y = a(x-3)^2 + 11$ $subst.(6; 2)$ $2 = a(6-3)^2 + 11$ $-9 = 9a$ $-1 = a$ $y = -1(x-3)^2 + 11$ $y = -(x^2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

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

QUESTION 6



6.1	$A(1;0)$	✓ *answer*	(1) K
6.2	$x \in R\ ;\ x > 0$ 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

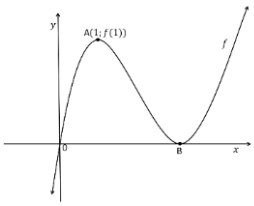
7.1	$A = p(1-i)^n$ $\frac{1}{2}x = x(1-i)^{\frac{7}{2}}$ $1-i = \sqrt[\frac{7}{2}]{\frac{1}{2}}$ $1-i = 0{,}82$ .... $-i = -0{,}17966$ .... $i = 0{,}17966$ ... $r = 17{,}97\ \%$	✓ $n = \frac{7}{2}$ ✓ *subst into correct formula* ✓ 0,17966… ✓ *answer*	(4) C
7.2.1	$P = \frac{x[1-(1+i)^{-n}]}{i}$ $90\ 000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

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

QUESTION 8

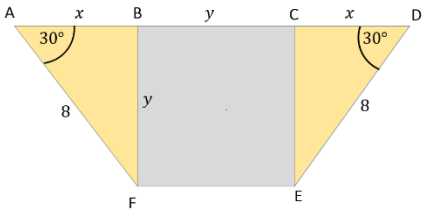
8.1	$f'(x) = \lim_{h\to 0} \frac{f(x+h)-f(x)}{h}$ $f'(x) = \lim_{h\to 0} \frac{1-3(x+h)^2-(1-3x^2)}{h}$ $f'(x) = \lim_{h\to 0} \frac{1-3x^2-6xh-3h^2-1+3x^2}{h}$ $f'(x) = \lim_{h\to 0} \frac{-6xh-3h^2}{h}$ $f'(x) = \lim_{h\to 0} \frac{h(-6x-3h)}{h}$ $f'(x) = -6x$	✓ *subst into correct formula* ✓ $1-3x^2-6xh-3h^2-1+3x^2$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

QUESTION 9



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

QUESTION 10



10.1	$y^2 = 8^2 - x^2$ *Pythagoras* Area of square $= y^2$ $= 64 - x^2$ Area of Δ ABF$= \frac{1}{2}(8)(x)sin30°$ Area of floor: A$= 2[\frac{1}{2}(8)(x)sin30°] + 64 - x^2$ A$= 8xsin30° + 64 - x^2$	✓ $y^2 = 8^2 - x^2$ ✓ Δ ABF$= \frac{1}{2}(8)(x)sin30°$ ✓*method*	(3) P
10.2	A$= 8xsin30° + 64 - x^2$ A$= 8x(\frac{1}{2}) + 64 - x^2$ $A = 4x + 64 - x^2$ For a maximum $\frac{dA}{dx} = 0$ $4 - 2x = 0$ $x = 2$	✓ $A = 4x + 64 - x^2$ ✓ $4 - 2x = 0$ ✓*answer*	(3) R

OR

10.2	$sin30° = \frac{y}{8}$ $cos30° = \frac{x}{r}$ $\therefore y = 4$ $\therefore x = 4\sqrt{3}$ Area of floor: A$= 2[\frac{1}{2}(x)(4)] + 16$ A$= 4x + 16$ $\frac{dA}{dx} = 4$ $\neq 0$ $\therefore$ *Max not defined.*	✓ $y = 4$ or $x = 4\sqrt{3}$ ✓✓$\therefore \frac{dA}{dx} \neq 0$	(3)
			[6]

QUESTION 11

11.1	Number of different gift baskets $= 5 \times 3 \times 4 \times 6$ $= 360$	✓ $5 \times 3 \times 4 \times 6$ ✓*answer*	(2) R
11.2	$P(Mor\ E) = P(M) + P(E) - P(MandE)$ $0{,}7 = 0{,}6 + 0{,}3 - x$ $x = 0{,}2$ or 20% or $\frac{1}{5}$	✓*subst* ✓*answer*	(2) R
11.3.1	Number of ways the RCL be arranged in a row $= 5!$ $= 120$	✓ $5!$ ✓*answer* **OR** ✓✓ *answer only*	(2) R
11.3.2	$P(E) = \frac{4! \times 2!}{5!}$ $= \frac{48}{120}$ $= \frac{2}{5}$ *or* 0,4 *or* 40%	✓ $4! \times$ ✓$2!$ ✓ $\div 5!$ *or* 120 **CA from 11.3.1** ✓ *answer*	(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 ±3marks**	**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) PAPER 1(150 MARKS)							TOTAL	COGNITIVE LEVELS PAPER 1(150 MARKS)				TOTAL
	Algebra;equations; inequalities (25±3)	Patterns & sequences (25±3)	Finance, growth and decay (15±3)	Functions and graphs (35±3)	Calculus (35±3)	Probability (15±3)		150	Knowledge(20%)	Routine procedures(35%)	Complex procedures(30%)	Problem Solving(15%)	150
1	26							26	4	17	5	0	26
2		18						18	2	5	5	6	18
3		4						4				4	4
4				10				10	2	6		2	10
5				16				16	4	2	8	2	16
6				11				11	4	3	4		11
7			16					16		9	7		16
8					17			17	5	4	4	4	17
9					16			16	3	7	6		16
10					6			6		3		3	6
11						10		10		6	4		10
12								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