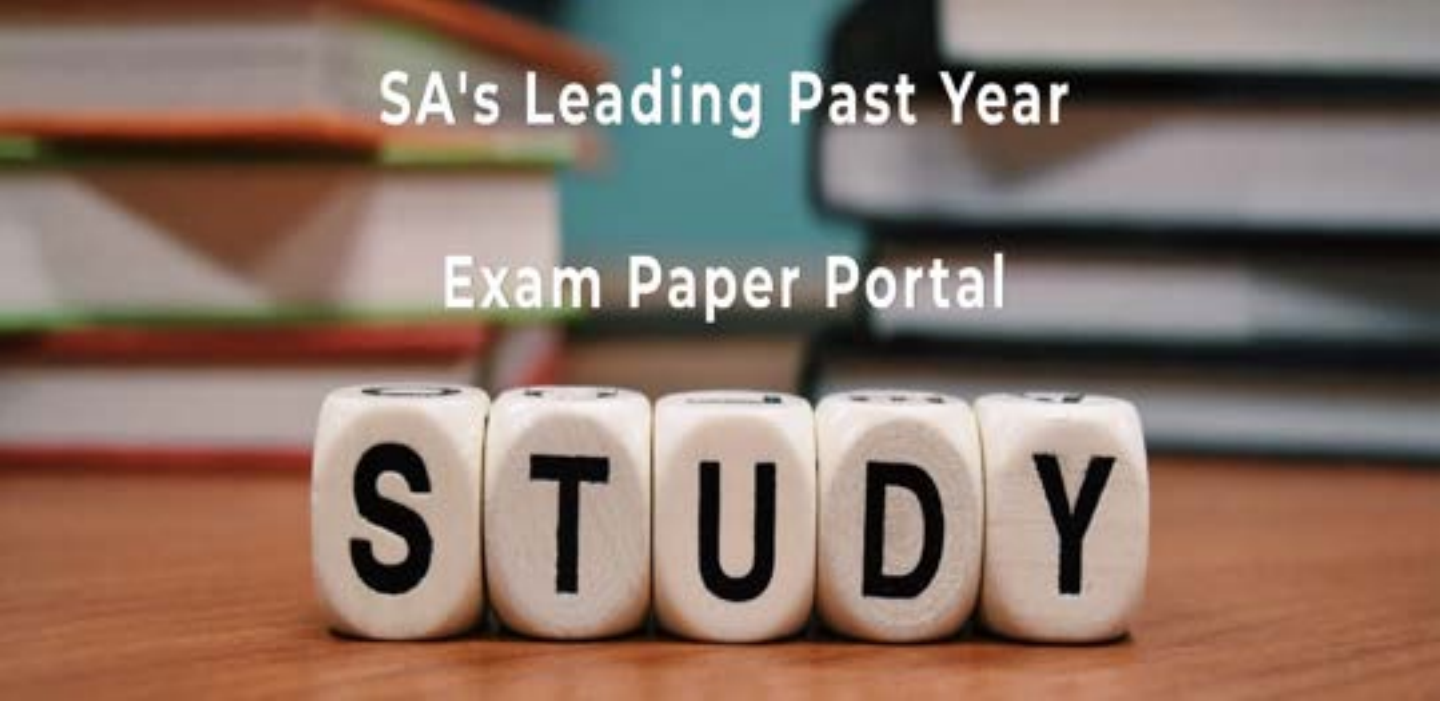

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GRADE 12

MATHEMATICS PAPER 1

SEPTEMBER 2018

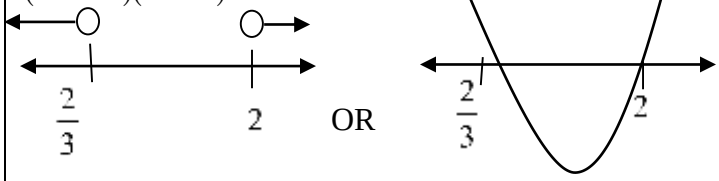
MARKING GUIDELINES

MARKS: 150

TIME: 3 hours

These marking guidelines consist of 12 pages

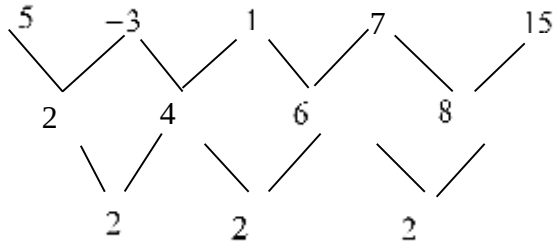
QUESTION 1 **[26]**

1.1.1	$x^2+5x+6=0$ $(x+2)(x+3)=0$ $x=-2 \text{ or } x=-3$	✓ Factors ✓ Answers (2)
1.1.2	$x(2x-5)+1=0$ $2x^2-5x+1=0$ $x=\frac{-(-5)\pm\sqrt{(5)^2-4(2)(1)}}{2(2)}$ $x=\frac{5\pm\sqrt{17}}{6}$ $x=1{,}52 \text{ or } x=0{,}15$	✓Standard form ✓ Substitution into correct formula ✓ $\sqrt{17}$ ✓ ✓Answers (5)
1.1.3	$3x^2-8x+4>0$ $(3x-2)(x-2)>0$  $x<\frac{2}{3} \text{ or } x>2$ OR $x\in\left(-\infty;\frac{2}{3}\right)\cup(2;\infty)$	✓ Critical Values ✓ Method ✓ Notation (3)
1.1.4	$3^x-3^{x-2}=24$ $3^x\left(1-3^{-2}\right)=24$ $3^x\left(\frac{8}{9}\right)=24$ $3^x=27$ $3^x=3^3$ $x=3$	✓Common factor ✓ Simplification ✓ Exponential Law ✓ Answer (4)
1.2	$y+\frac{1}{2}x=2$ $x^2+y^2+6x=4y-4$	

	$y=-\frac{1}{2}x+2$	✓ y the subject
	Substitute $y=-\frac{1}{2}x+2$ in $x^2+y^2+6x=4y-4$	
	$x^2+\left(-\frac{1}{2}x+2\right)^2+6x=4(-\frac{1}{2}x+2)-4$	✓ Substitution
	$x^2+4-2x+\frac{1}{4}x^2+6x=8-2x-4$	
	$\frac{5}{4}x^2+6x=0$	✓Standard form
	$x\left(\frac{5}{4}x+6\right)=0$	✓Factors
	$x=0$ *or* $\frac{5}{4}x=-6$	
	$x=-\frac{24}{5}$	✓ x-values
	Substitute $x=0$ in $y=-\frac{1}{2}x+2$	✓ Substitution
	$y=-\frac{1}{2}(0)+2=2$	
	Substitute $x=-\frac{24}{5}$ in $y=-\frac{1}{2}x+2$	
	$y=-\frac{1}{2}(\frac{-24}{5})+2=\frac{22}{5}$	✓ y-values (7)
	OR	
	$y+\frac{1}{2}x=2$	
	$x^2+y^2+6x=4y-4$	
	$2y=-x+4$	
	$x=-2y+4$	✓ x the subject
	Substitute $x=-2y+4$ in $x^2+y^2+6x=4y-4$	
	$(4-2y)^2+y^2+6(4-2y)=4y-4$	✓ Substitution
	$16-16y+4y^2+y^2+24-12y=4y-4$	
	$5y^2-32y+44=0$	✓Standard form
	$(5y-22)(y-2)=0$	✓Factors
	$y=\frac{22}{5}$ *or* $y=2$	✓ y - values
	$x=-2\left(\frac{22}{5}\right)+4=-\frac{24}{5}$	✓ Substitution
	$x=-2(2)+4=0$	✓ y-values

1.3	$px^2 + x(p-2) + p = 0$ $0 = (p-2)^2 - 4(p)(p)$ $0 = p^2 - 4p + 4 - 4p^2$ $-3p^2 - 4p + 4 = 0$ $3p^2 + 4p - 4 = 0$ $(3p-2)(p+2) = 0$ $p = \frac{2}{3}$ *or* $p = -2$	✓ $\Delta = 0$ ✓ substitution in Δ ✓ Simplification ✓ Factors ✓ answer (5)

QUESTION 2 **[26]**

2.1	....; ....; 1 ; 7 ; 15 ; 25;	
2.1.1	 $\therefore T_1 = -5$	✓ Differences ✓ Answer (2)
2.1.2	$2a = 2$ $a = 1$ $3a + b = 2$ $3(1) + b = 2$ $b = -1$ $1 - 1 + c = -5$ $c = -5$ $\therefore T_n = n^2 - n - 5$	✓ Value of a ✓ Value of b ✓ Value of c ✓ General term (4)
2.1.3	$T_n = n^2 - n - 5$ $415 = n^2 - n - 5$ $n^2 - n - 420 = 0$ $(n-21)(n+20) = 0$ $\therefore n = 21$	✓ Standard Form ✓ Factors ✓ Correct n value (3)

2.2	$x\ ;\ x+3\ ;\ 3x-1$	
2.2.1	$\frac{x+3}{x}=\frac{3x-1}{x+3}$ $3x^2-x=x^2+6x+9$ $2x^2-7x-9=0$ $(2x-9)(x+1)=0$ $x=\frac{9}{2}\ \ or\ \ x=-1$	✓ Ratio ✓ Standard Form ✓ Factors ✓ Correct x values (4)
2.2.2	$-1\ ;\ 2\ ;\ -4$ $S_n=\frac{a(r^n-1)}{(r^n-1)}$ $S_{20}=\frac{-1((-2)^{20}-1)}{-2-1}$ $S_{20}=349525$	✓ Sequence ✓ Substitution into the correct formula ✓Answer (3)
2.2.3	$\frac{9}{2}\ ;\ \frac{15}{2}\ ;\ \frac{25}{2}$ $r=\frac{5}{3}$ Will not converge r is not between -1 and 1	✓ value of r ✓ Reason (2)
2.3	$T_n=a+(n-1)d$ $T_k=a+(k-1)d=m$ $a=m-(k-1)d$ $T_m=a+(m-1)d=k$ $a=k-(m-1)d$ $m-d(k-1)=k-d(m-1)$ $-d(k-1)+d(m-1)=k-m$ $d[(m-1)-(k-1)]=k-m$ $d=\frac{k-m}{m-k}$	✓ Substitution into correct formula ✓ Substitution into correct formula ✓ Equating ✓ Factors ✓ Answer (5)
2.4	$1+q+2+q+3+q+4+q+5+q=15k$ $5q+15=15k$ $5q=15k-15$ $q=3k-3$	✓ Equation ✓ Simplification ✓ Answer (3)

QUESTION 3 **[21]**

3.1	$y = -x^2 + 2x + 3$ $y = -(x^2 - 2x + 1 - 1) + 3$ $y = -(x-1)^2 + 4$ TP (1 ; 4) OR $x = \frac{-b}{2a}$ $\quad y = -(1)^2 + 2(1) + 3$ $\quad = 4$ $x = \frac{-2}{2(-1)}$ $x = 1$ TP (1 ; 4)	✓ Completing of the square ✓ Value of x ✓ Value of y ✓ Turning point (4) ✓ Formula for x ✓ Value of x ✓ Value of y ✓ Turning point
3.2	$-x^2 + 2x + 3 = 0$ $x^2 - 2x - 3 = 0$ $(x-3)(x+1) = 0$ $x = 3$ *or* $x = -1$ AB = 4units	✓ Factors ✓ Correct x values ✓ Answer (3)
3.3	$EF = -x^2 + 2x + 3 - (-x + 3)$ $\quad = -x^2 + 3x$ $Max: -2x + 3 = 0$ OR $x = \frac{-b}{2a}$ $x = \frac{3}{2}$ $\quad x = \frac{-3}{2(-1)} = \frac{3}{2}$	✓ $f(x) - g(x)$ ✓ Derivative OR formula ✓ Value of x (3)
3.4	$p(x) = -(x-1)^2 + 4 - 2$ $p(x) = -(x-1)^2 + 2$ $y \leq 2;\ y \in R$ OR $(-\infty ; 2]$	✓✓ Answer (2)
3.5.1	Four units down One unit to the left Reflection over the x-axis	✓ Translation ✓ Translation ✓ Reflection (3)

3.5.2	$x \geq 0 \quad or \quad x \leq 0$	✓✓ Answers (2)
3.6.1	$B(3\,;\,0)$ $0 < x < 3$	✓ Critical values ✓ Notation (2)
3.6.2	$x > 1$	✓✓ Answer (2)

QUESTION 4 **[12]**

4.1.1	$y = a^x$ OR $\frac{1}{3} = a^1$ $9 = a^{-2}$ $a = \frac{1}{3}$ $a = \frac{1}{3}$	✓ Substitution ✓ Answer (2)
4.1.2	$g(x) = \frac{k}{x+p} + q$ $g(x) = \frac{k}{x+2} + 1$ $\frac{1}{3} = \frac{k}{1+2} + 1$ $\frac{-2}{3} = \frac{k}{3}$ $k = -2$ $g(x) = \frac{-2}{x+2} + 1$	✓ Substitution of p and q ✓ Substitution of $\left(1;\frac{1}{3}\right)$ ✓ Value of k ✓ Equation (4)
4.2	$y = \log_{\frac{1}{3}} x$	✓ Answer (1)
4.3	$h(x) = x + c$ $9 = -2 + c$ $c = 11$	✓ Substitution of (–2; 9) ✓ Answer (2)
4.4	$0 < x \leq 1$ OR $x \ \varepsilon (0;1]$	✓✓ Answer (2)

QUESTION 5		**[15]**
5.1	$A = P(1-i)^n$ $x = 2x(1-0,075)^n$ $\frac{1}{2} = (1-0,075)^n$ $\log\frac{1}{2} = n\log 0,925$ $n = \frac{\log\frac{1}{2}}{\log 0,925}$ $n = 8,89$ n = 8 years 11 months	✓ Substitution into correct formula ✓ Substitute A & P ✓Use of logs ✓ Answer ✓ Rounding to months (5)
5.2.1	$\frac{30}{100}(18\ 480)$ = R5 544	✓ Answer (1)
5.2.2	$P = \frac{x\left[1-(1+i)^{-n}\right]}{i}$ $P = \frac{5544\left[1-\left(1+\frac{0,08}{12}\right)^{-300}\right]}{\frac{0,08}{12}}$ $P = R718\,305,71$	✓ Substitution in correct Formula ✓value of n ✓ value of i ✓ Answer (4)
5.3	$A = P(1+i)^n$ $A = 1000\left(1+\frac{0,15}{12}\right)^{18}$ $A = R\ 1\ 250,58$ $F = \frac{x\left[(1+i)^n-1\right]}{i}$ $= \frac{700\left[\left(1+\frac{0,15}{12}\right)^{18}-1\right]}{\frac{0,15}{12}}$ x = R 14 032,33 Total: R 15 282,91	✓ Substitution in correct Formula ✓ Value of A ✓ Substitution into correct formula ✓ Value of F ✓ answer (5)

QUESTION 6	Penalty of –1 for notation in Question 6	**[13]**
6.1	$f(x) = -2x^2 + 5$ $f(x+h) = -2(x+h)^2 + 5$ $f(x+h) = -2x^2 - 4xh - 2h^2 + 5$ $f'(x) = \lim_{h\to 0} \frac{f(x+h)^2 - f(x)}{h}$ $f'(x) = \lim_{h\to 0} \frac{-2x^2 - 4xh - 2h^2 + 5 - \left(-2x^2 + 5\right)}{h}$ $f'(x) = \lim_{h\to 0} \frac{-2x^2 - 4xh - 2h^2 + 5 + 2x^2 - 5}{h}$ $f'(x) = \lim_{h\to 0} \frac{-4xh - 2h^2}{h}$ $f'(x) = \lim_{h\to 0} \frac{h(-4x - 2h)}{h}$ $= -4x$	✓ Finding $f(x+h)$ ✓ Simplification ✓ Correct substitution into Formula and notation ✓ Common factor ✓ Answer (5)
6.2	$y = 5x + \frac{6}{\sqrt{x}}$ $y = 5x + \frac{6}{x^{\frac{1}{2}}}$ $y = 5x + 6x^{-\frac{1}{2}}$ $\frac{dy}{dx} = 5 - 3x^{-\frac{3}{2}}$	✓ $x^{½}$ ✓ Exponent Law ✓ ✓ Derivative (4)
6.3.1	$g(x) = \frac{2x^3 + x^2 - 3x}{x-1}$ $= \frac{x(2x+3)(x-1)}{x-1}$ $= x(2x+3) = 2x^2 + 3x$ $g'(x) = 4x + 3$ $g'(2) = 11$	✓ Factorise ✓ Simplify ✓ Derivative ✓ Answer (4)

QUESTION 7		**[16]**
7.1	$y = a(x - x_1)(x - x_2)(x - x_3)$ $y = 2(x+1)\left(x - \frac{1}{2}\right)(x-3)$ $y = 2\left(x^2 - 2x - 3\right)\left(x - \frac{1}{2}\right)$ $y = 2\left(x^3 - \frac{5}{2}x^2 - 2x + \frac{3}{2}\right)$ $y = 2x^3 - 5x^2 - 4x + 3$	✓ Substitution of x values into correct formula ✓ Simplification ✓ Simplification ✓ Answer (4)
7.2	$y = 2x^3 - 5x^2 - 4x + 3$ $6x^2 - 10x - 4 = 0$ $3x^2 - 5x - 2 = 0$ $(x - 2)(3x + 1) = 0$ $x = 2 \quad or \quad x = -\frac{1}{3}$ $y = 2\left(-\frac{1}{3}\right)^3 - 5\left(-\frac{1}{3}\right)^2 - 4\left(-\frac{1}{3}\right) + 3$ $y = \frac{100}{27}$ $A\left(-\frac{1}{3}; \frac{100}{27}\right)$	✓ Derivative ✓ = 0 ✓ Factors ✓ x - values ✓ select one value ✓ y – value (6)
7.3	$f(x) = 2x^3 - 5x^2 - 4x + 3$ $f(x) = 2(-2)^3 - 5(-2)^2 - 4(-2) + 3 = -25 \quad \therefore D(-2;-25)$ $f'(x) = 6x^2 - 10x - 4$ $f'(x) = 6(-2)^2 - 10(-2) - 4 = 40$ $y - y_1 = m(x - x_1)$ $y + 25 = 40(x + 2)$ $y = 40x + 55$	✓ Value of $f(-2)$ ✓ Value of $f'(-2)$ ✓ Substitution into correct formula ✓ Answer (4)

7.4	$12x - 10 > 0$ $x > \frac{5}{6}$	✓ Inequality ✓ Answer (2)
QUESTION 8		**[7]**
8.1	Area = 2(½b x H) + Lx B + Lx B+ Lx B $600 = 5x.12x + 5xy + 12xy + 13xy$ $= 60x^2 + 30xy$ $\therefore y = \frac{600 - 60x^2}{30x}$ $= \frac{20 - 2x^2}{x}$	✓ area ✓ method ✓ Answer (3)
8.2	Volume = area of base x h $= ½\ 5x.\ 12x\ .\ \frac{20 - 2x^2}{x}$ $= 600x - 60x^3$ Max : $600 - 180x^2 = 0$ $x^2 = \frac{10}{3}$ $\therefore \quad x = \sqrt{\frac{10}{3}}$	✓ Volume ✓ simplification ✓ $f'(x) = 0$ ✓answer (4)

QUESTION 9 **[15]**

9.1.1	Event A : 1,2 B: 2,4,6 C : 6 P(A) = $\frac{2}{6}=\frac{1}{3}$ P(B) = $\frac{3}{6}=\frac{1}{2}$ P(A or B) = P(A) + P(B) – P(A and B) = $\frac{2}{6}+\frac{1}{2}-\frac{1}{6}$ = $\frac{2}{3}$	✓ P(A) ✓P(B) ✓ Substitution into correct formula ✓ Answer (4)
9.1.2	A and C are mutually exclusive P(A and C) = 0	✓ Events ✓ Reason (2)
9.1.3	P(B) x P(C)= $\frac{1}{2}\times\frac{1}{6}=\frac{1}{12}$ $P(B\cap C)=\frac{1}{6}$ $P(B)\times P(C)\neq P(B\cap C)$ B and C are not independent events	✓ P(B) x P(C) ✓ $P(B\cap C)$ ✓Conclusion (3)
9.2.1	6! = 720	✓ 6! ✓ Answer (2)
9.2.2	1!4!1! = 24	✓ 1!4!1! ✓ Answer (2)
9.2.3	2! × 4! ×5 = 240 $P(Visits)=\frac{240}{720}=\frac{1}{3}$	✓2! × 4! ×5 ✓ Answer (2)

TOTAL: 150