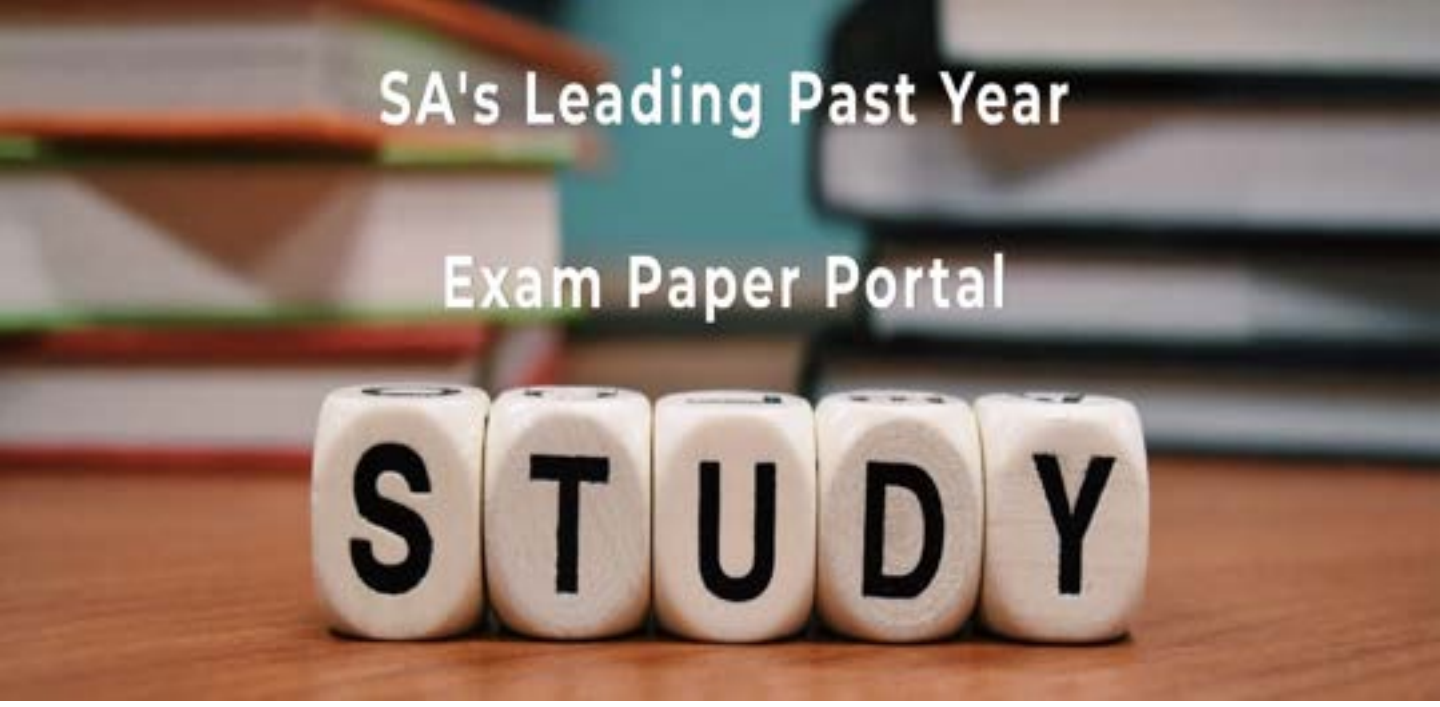

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GRADE 12

MATHEMATICS P1

AUGUST 2022

PRETRIAL EXAMINATION

MARKS: 150

This memorandum consists of 16 pages.

In discussing this memorandum with learners, take note of required steps, mark allocation, indicate how solution are found than what solutions are. Explain between lines reasoning to make sense to these solutions.

QUESTION 1

1.1.1	$(x-2)(x-7)=0$ $x=2 \ or \ x=7$	$x=7$ $x=2$	(2)
1.1.2	$4x+\frac{4}{x}+11=0; x\neq 0$ $4x^2+11x+4=0$ $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$ $x=\frac{-11\pm\sqrt{(11)^2-4(4)4}}{8}$ $x=-0.43 \ or -2,32$	✓ Standard form ✓ Substitution ✓ -0.43 ✓ -2.32	(4)
1.1.3	$3x^2-6x>0$ $3x(x-2)>0$ $0<x<2 \ or \ x\in(0;\ 2)$	✓ Standard form ✓ Factors ✓ Correct solution ✓	(4)
1.1.4	$\sqrt{x-1}=x-3$ $x-1=x^2-6x+9$ $x^2-6x+9-x+1=0$ $x^2-7x+10=0$ $(x-5)(x-2)=0$ $x=5 \ \ or \ \ x=2 \ (N/A)$	✓ Squaring ✓ Standard form ✓ Factors ✓ Solution with rejection	(4)

1.2	$y = 2x + 1$ $x^2 + x(2x+1) - 3x - (2x+1) + 2 = 0$ $3x^2 - 4x + 1 = 0$ $(3x-1)(x-1) = 0$ $x = \frac{1}{3} \quad or \quad x = 1$ $y = \frac{5}{3} \quad or \quad y = 3$	✓ subject of formula ✓ Substitution ✓ standard form ✓ factors ✓ values of x ✓ values of y	(6)
1.3	$5^{2009}2^{2010}.24 = .2^{2009}.2.$ $= 10^{2009}.48$ $= 48\ 000\ 000.....(2009\ zeros)$ $\therefore$ The sum of the digits is 4+8=12	✓ $2^{2009}.2.$ ✓ 10^{2009} ✓ 48 ✓ 12	(4)
			[23]

QUESTION 2

2.1.1	53		(1)
2.1.2	13 20 29 40 7 9 11 2 2 $a = 1$ $3a + b = 7$ $b = 4$ $a + b + c = 13$ $c = 8$ $T_n = n^2 + 4n + 8$	✓ Value of a ✓ Value of b ✓ Value of c ✓ T_n	(4)

2.1.3	$n^2+4n+8=4493$ $n^2+4n-4485=0$ $(n+69)(n-65)=0$ $n=65$ Michael is right. It is term 65	✓ Subst. of 4493 ✓ Standard form ✓ 65 and rejection of -69 ✓ Conclusion.	(4)
2.2.1	$173=5+(n-1)3$ $3n=171$ $n=57$	✓ Subst. of a and d ✓ Subst. of 173 ✓ answer	(3)
2.2.2	Even terms 8; 14; 20; …; 170 There are 28 even and 29 odd terms $S_{28}=\frac{28}{2}(8+170)$ *or* $\frac{28}{2}[(8+170)\}$ $=3492$	✓ 28 ✓ Subst. ✓ answer	(3)
			[15]

QUESTION 3

3.1	$\sum_{n=1}^{\infty}90(\frac{1}{3})^{n-1}$	✓ Correct answer	(1)
3.2	$90\frac{1}{3})^9=\frac{10}{2187}$	✓ Answer as simple fraction	(1)
3.3	$r=\frac{1}{3}$ $-1<r<1$	✓ $r=\frac{1}{3}$ $-1<r<1$	(1)
3.4	$S_\infty=\frac{90}{1-\frac{1}{3}}=135$ =	✓ Subst. in S_∞ Formula ✓ Value of S_∞	

	$S_n = \dfrac{90(1-\frac{1}{3}^n)}{\frac{2}{3}}$ $= 135(1-\frac{1}{3}^n)$ $S_\infty - S_n = 135 - 135(1-\frac{1}{3}^n) = 1$ $135(1-\frac{1}{3}^n) = 134$ $(1-\frac{1}{3}^n) = \frac{134}{135}$ $(\frac{1}{3}^n) = \frac{1}{135}$ $n = \log_{\frac{1}{3}} \frac{1}{135}$ $= 4.4649735$ The largest value of n is 4 OR $S_\infty = \dfrac{90}{1-\frac{1}{3}} = 135$ $S_\infty - S_1 = 135 - 90 = 45$ $S_\infty - S_2 = 135 - (90+30) = 15$ $S_\infty - S_3 = 135 - (90+30+10) = 5$ $S_\infty - S_4 = 135 - (90+30+10+\frac{10}{3}) = \frac{5}{3}$ $S_\infty - S_5 = 135 - (90+30+10+\frac{10}{3}+\frac{10}{9}) = \frac{5}{9}$ So largest value of n is 4	✓ Subst. in formula ✓ Value of the sum ✓ Subst in S_∞-sum ✓ Use of log ✓ Answer OR ✓ Subst. in S_∞ Formula ✓ Value of S_∞ ✓ 45 and 15 ✓ 5 and $\frac{5}{3}$ ✓ $\frac{5}{9}$ ✓ answer	(6)
			[09]

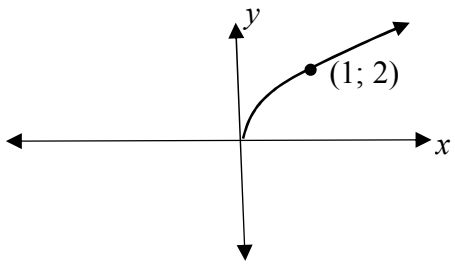
QUESTION 4

4.1.1	P$(-7; 25)$	✓ . ✓ answer	(2)
4.1.2	At D: y=2 At E: y = $-49+25= -24$ DE=26 units	✓ y-value at E ✓ answer	(2)
4.1.3	At C $f = g$ $x+2=-(x+7)^2+25$ $x-23+x^2+14x+49=0$ $x^2+15x+26=0$ $(x+13)(x+2)=0$ $x=-13$ at C or $x=-2$ at A $C\ (-13:\ -11)$	✓ equating ✓ simplification ✓ standard form ✓ factors ✓ values of x at C ✓ value of y at C	(6)
4.2	At B $0=-(x+7)^2+25$ $(x+7)=\pm 5$ $x=-12$ at B or $x=-2$ at A $\therefore 0=1(-12)+c$ $c=1$ $y=x+12$	✓ equating to 0 ✓ standard form or $(x+7)=\pm 5$ ✓ value of x at B ✓ subst. B in line formula ✓ answer	(5)
4.3	$f-g=-(x+7)^2+25-(x+7)$ $=-x^2-14x-49-x-7$ $D_x(f-g)=-2x-14-1$ $D_x(f-g)=0$ $-2x-15=0$ $x=-\frac{15}{2}$ or $7\frac{1}{2}$ so MN is maximum when $x=-\frac{15}{2}$ or $7\frac{1}{2}$	✓ equating ✓ $-x^2-14x-49-x-7$ ✓ Derivative ✓ answer	(4)
			[19]

QUESTION 5

5.1	$-\frac{1}{4}=\frac{-2}{k+3}$ $k+3=8$ $k=5$	✓ subst. ✓ answer	(2)
5.2	$y=0$ $x=0$	✓ vertical asymptote ✓ Horizontal asymptote.	(2)
5.3	$m=-1$ $-\frac{1}{4}=-(5)+c$ $c=-5\frac{1}{4}$ or $-\frac{21}{4}$ $y=-x-\frac{21}{4}$	✓ Value of m ✓ answer	
5.4	$y\neq 2$	✓ answer	(2)

QUESTION 6

6.1		✓ shape ✓ point ✓ intercepts	(3)
6.2	$x\geq 0$	✓ ✓ answer	(2)

6.3	$x+3=4$ $x=1$ $y=\frac{1}{4}(1)^2$ $=\frac{1}{4}$ $\therefore A\left(1;\frac{1}{4}\right)$ coordinates of the image are $\left(\frac{1}{4};1\right)$	✓ x=1 ✓ y coordinate at A ✓ coordinates of the image	(3)
			[8]

QUESTION 7

7.1	$\frac{1}{3}P-P(1-\frac{i}{12})^{72}$ $\sqrt[72]{\frac{1}{3}}=1-\frac{i}{12}$ $\frac{i}{12}=1-\sqrt[71]{\frac{1}{3}}$ $\frac{i}{12}=0.01514268287$ $i=18,2\%$	✓ 72 ✓ $\frac{1}{3}$ ✓ Correct radical sign ✓ Answer as %	(4)
7.2	$Pv=\frac{x\left[1-(1+i\right]^{-n}}{i}$ $650000=\frac{x\left[1-(1+\frac{11.5\%}{12})\right]^{-15\times12}}{\frac{11.5\%}{12}}$ $x=\frac{650000\times\frac{11.5\%}{12}}{\left[1-(1+\frac{11.5\%}{12})\right]^{-15\times12}}$ $=7593.23$	✓ Subst, in Pv formula ✓ Correct value of i ✓ 180 ✓ answer	

7.2.2	Balance after 5 years $Pv = \frac{x\left[1-(1+i\right]^{-n}}{i}$ $= \frac{7593.23\left[1-(1+\frac{11.5\%}{12})\right]^{-10\times12}}{\frac{11.5\%}{12}}$ $= R487061$ $Pv = \frac{x\left[1-(1+i)^{-n}\right]}{i}$ $487061 = \frac{9000\left[1-(1+\frac{11,5\%}{12})^{-n}\right]}{i}$ $\frac{487061}{9000}\times\frac{11.5\%}{12} = \left[1-(1+\frac{11.5\%}{12})^{-n}\right]$ $(1+\frac{11.5\%}{12})^{-n} = 1-\frac{487061}{9000}\times\frac{11.5\%}{12}$ $(\frac{2423}{2400})^{-n} = 0,4813702315$ $n = \frac{\log(0,4813702315)}{\log(\frac{2423}{2400})}$ $-n = -76,65561398$ $n = 77\text{months}$	✓ balance after 5 years ✓ subst. of 9000 and balance in Pv formula ✓ correct use of logs. ✓ 76.65561398 ✓ 77 months	(5)
	Last instalment. $A = Pv(1+i)$ where $Pv = \frac{x\left[1-(1+i)^{-n}\right]}{i}$ $A = \frac{9000\left[1-(1+\frac{11.5}{1200})^{-0.65561398}\right]}{\frac{11.5}{1200}}(1+\frac{11.5}{1200})$ $= R5910,21$	✓ All correct substitutions ✓ answer	(2)
			[15]

QUESTION 8

8.1	$f(x)=2x-x^2$ $f(x+h)=2(x+h)-(x+h)^2$ $=2x+2h-(x^2+2xh+h^2)$ $=2x+2h-x^2-2xh-h^2$ $f(x+h)-f(x)=2x+2h-x^2-2xh-h^2-\left(2x-x^2\right)$ $=2x+2h-x^2-2xh-h^2-2x+x^2$ $f'(x)=\lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$ $=\lim_{h\to 0}\frac{2x+2h-x^2-2xh-h^2-2x+x^2}{h}$ $=\lim_{h\to 0}\frac{2h-2xh-h^2}{h}$ $=\lim_{h\to 0}\frac{h(2-2x-h)}{h}$ $=\lim_{h\to 0}2-2x-h$ $=2-2x$ OR $f'(x)=\lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$ $=\lim_{h\to 0}\frac{(2(x+h)-(x+h)^2)-\left(2x-x^2\right)}{h}$ $=\lim_{h\to 0}\frac{2x+2h-x^2-2xh-h^2-\left(2x-x^2\right)}{h}$ $=\lim_{h\to 0}\frac{2h-2xh-h^2}{h}$ $=\lim_{h\to 0}\frac{h(2-2x-h)}{h}$ $=\lim_{h\to 0}2-2x-h$ $=2-2x$	✓ simplified *f(x+h)* ✓ substitution of *f(x+h)-f(x)* ✓ simplification of *f(x+h)-f(x)* ✓ common factor ✓ answer	(5)

8.2.1	$xy = 3$ $y = \frac{3}{x}$ $y = 3x^{-1}$ $\frac{dy}{dx} = -3x^{-2}$	✓ y subject of formula. ✓ Exponential rules ✓ answer	(3)
8.2.2	$D_x\left[\frac{\sqrt[3]{x^2} - 2x + 1}{x^2}\right] = D_x\left[\frac{x^{\frac{2}{3}} - 2x + 1}{x^2}\right]$ $= D_x\left(x^{\frac{2}{3}-2} - 2x^{1-2} + x^{-2}\right)$ $= D_x\left(x^{\frac{-4}{3}} - 2x^{-1} + x^{-2}\right)$ $= \frac{-4}{3}x^{\frac{-7}{3}} + 2x^{-2} - 2x^{-3}$	✓ $x^{\frac{2}{3}}$ ✓ $\left(x^{\frac{-4}{3}} - 2x^{-1} + x^{-2}\right)$ ✓ $\frac{-4}{3}x^{\frac{-7}{3}}$ ✓ $+2x^{-2} - 2x^{-3}$	(4)
			[11]

QUESTION 9

9.1	B is turning point So $f(3) = -27 + 27 + 27 - 27 = 0$ $(x-3)$ is a factor $f(x) = -(x-3)^2(x+3)$ $x = 3$ B(3;0) OR	✓ Factor theorem ✓ Coordinates of B OR ✓ Derivative equated to 0 ✓ Coordinates of B	(4)

	$f'(x) = -3x^2 + 6x + 9$ $0 = -3x^2 + 6x + 9$ $0 = x^2 - 2x - 3$ $(x-3)(x+1) = 0$ $x = 3$ or $x = -1$ at B; $x = 3$ *so* $y - 0 = \frac{-10-0}{-2-3}(x-3)$ $y = 2(x-3)$ $y = 2x - 6$	✓ Subst. of E and B in line formula ✓ Answer	
9.2.1	F increase between E and B $-32 < x < 3$	✓ answer	(1)
9.2.2	$x = \frac{3-1}{2}$ $= 1$ OR $f'(x) = -3x^2 + 6x + 9$ $f''(x) = -6x + 6$ $-6x + 6 = 0$ $x = 1$ $\therefore$ derivative function decreases when $x > 1$	✓ method to get x=1 ✓ answer	(2)
9.2.3	$x.f'(x) < 0$ $\Rightarrow x > 0$ and $f'(x) < 0$ OR $x < 0$ and $f'(x) > 0$ So $-1 < x < 0$ or $x > 3$ *OR* $-1 < x < 3; x \neq 0$	✓ . ✓ Correct intervals	(2)

9.2.4	Distance is given by $2x-6-(-x^3+3x^2+9x-27)$ $=2x-6+x^3-3x^2-9x+27$ $=x^3-3x^2+7x+21$ Distance is maximun if $3x^2-6x-7=0$ $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$ $=\frac{6\pm\sqrt{(-6)^2+4(3)(7)}}{2(3)}$ $x=2.83$ or $x=-0.83$	✓ Substracting ✓ Derivative ✓ Derivative =0 ✓ Subst in formula ✓ Values of c	(5)

QUESTION 10

10.1	There are four horizontal bars and three vertical bars. $\Rightarrow 4y+3h=12$ $4y=12-3h$ $y=\frac{1}{4}(12-3h)$	✓ $4y+3h$ ✓ $4y+3h=12$	(2)
10.2	$Area=lb$ $=yh$ $=\frac{1}{4}(12-3h)h$ $=3h-\frac{3}{4}h^2$	✓ A=yh ✓ Subst of y ✓ simplification	(3)

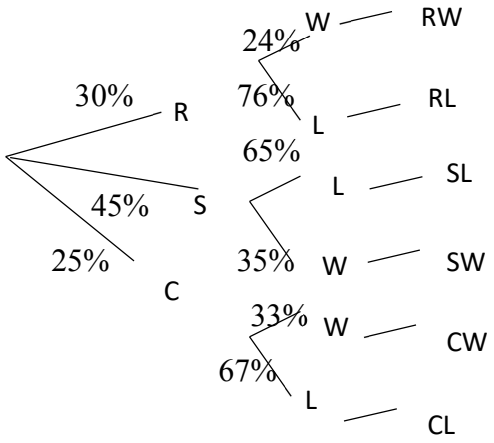
10.3	$Area = 3h - \frac{3}{4}h^2$ $\frac{dA}{dh} = 3 - \frac{3}{2}h$ $\frac{dA}{dh} = 0$ $3 - \frac{3}{2}h = 0$ $h = 2$ $y = \frac{1}{4}(12 - 3(2))$ $= \frac{3}{2}$	✓ derivative ✓ equating to 0 ✓ h =2 ✓ subst of h ✓ value of y	(5)

QUESTION 11

11.1	$\frac{10!}{2.2.2} = 453600$ =	✓ ✓ answer	(2)
11.2	$\frac{8!}{4} = 10080$	✓ answer ✓	(2)
11.3	Same letters are together in 2.2.2.7! ways = Probability $= \frac{8.7!}{\frac{10!}{8}} = \frac{4}{45}$ So required probability is $\frac{41}{45}$ OR Same letters not together is 41380 ways Probability required is $\frac{41}{45}$	✓ Same letters together ✓ Probability of same letters together ✓ Answer OR ✓ Same letters together ✓ Same letters not together ✓ answer	(3)

			[7]

QUESTION 12

12.1.1	$P(\text{A or B}) = P(A) + P(B)$ $0.88 = 0.5 + x$ $x = 0.38$	✓ subst into correct formula ✓ answer	(2)
12.1.2	$P(\text{A or B}) = P(A) + P(B) - P(A).P(B)$ $0.88 = 0.5 + x - 0.5x$ $0.38 = 0.5x$ $x = 0,76$	✓ subst into correct formula ✓ $0.5x$ ✓ answer	(3)
		✓ 25% for C ✓ Correct outcomes to represent win/lose ✓ Correct diagram	
12.2.2	Probability of winning P(W) = P(R and W) or P(S and L) or P(C and W) $=30\% \times 24\% + 45\% \times 65\% + 25\% \times 67\%$	✓ $30\% \times 24\% + 45\% \times 65\% + 25\% \times 67\%$ ✓ . ✓ answer	(3)

	$= 0.9445$ OR $\frac{1889}{2000}$		