basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 11

MATHEMATICS P1

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MEMORANDUM

MARKS: 150

This memorandum consists of 14 pages.

QUESTION 1

1.1.1	$x=-2$ or $x=\frac{7}{3}$	✓ $x=-2$ ✓ $x=\frac{7}{3}$ (2)
1.1.2	$x^2-5x-2=0$ $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$ $x=\frac{5\pm\sqrt{25-4(1)(-2)}}{2}$ $x=\frac{5\pm\sqrt{33}}{2}$ $x=5{,}37$ or $x=-0{,}37$	✓standard form ✓correct substitution into correct formula ✓ $x=5{,}37$ ✓$x=-0{,}37$ (4)
1.1.3	$\sqrt{x-3}=5+4$ $\left(\sqrt{x-3}\right)^2=(9)^2$ $x-3=81$ $x=84$	✓isolating $\sqrt{}$ ✓squaring both sides ✓ simplify ✓ answer (4)
1.1.4	$2x^2-7x-4\geq 0$ $(2x+1)(x-4)\geq 0$ CV's : $-\frac{1}{2};4$ + 0 − 0 + $-\frac{1}{2}$ 4 $x\leq -\frac{1}{2}$ or $x\geq 4$ **OR** $x\in(-\infty;-\frac{1}{2}]\cup[4;\infty)$	✓ factors ✓method ✓ notation ✓ critical values (4) ✓ notation ✓ critical values

1.2	$x = 2y+1$ .....(1) $x^2 - 2y + 3xy = 6$ .....(2) $(2y+1)^2 - 2y + 3y(2y+1) = 6$ $4y^2 + 4y + 1 - 2y + 6y^2 + 3y - 6 = 0$ $10y^2 + 5y - 5 = 0$ $2y^2 + y - 1 = 0$ $(2y-1)(y+1) = 0$ $y = \frac{1}{2}$ or $y = -1$ $x = 2$ $x = -1$ **OR** $y = \frac{x-1}{2}$ $x^2 - 2\left(\frac{x-1}{2}\right) + 3x\left(\frac{x-1}{2}\right) = 6$ $2x^2 - 2x + 2 + 3x^2 - 3x - 12 = 0$ $5x^2 - 5x - 10 = 0$ $x^2 - x - 2 = 0$ $(x+1)(x-2) = 0$ $x = -1$ or $x = 2$ $y = -1$ $y = \frac{1}{2}$	✓ substitution of $x = 2y+1$ ✓ simplification ✓ standard form ✓ factors ✓ both y values ✓ both x values (6) ✓ substitution of $y = \frac{x-1}{2}$ ✓ simplification ✓ standard form ✓ factors ✓ both x values ✓ both y values (6) **[20]**

Yes !!!

NO !!! Rather

NB

$10y^2 + 5y - 5 = 0$

$(2y-1)(y+1) = 0$

$2y \times y \neq 10y^2$!!!!!

2 marks lost !!!

ie use mode 5 – 3 responsibly !

QUESTION 2

NOTE : Question does NOT say woc !

2.1	$\frac{3^x(3-3^{-1})}{2.3^x}$ $=\frac{3-\frac{1}{3}}{2}$ $=\frac{8}{3}\times\frac{1}{2}$ $=\frac{4}{3}$ **OR** $\frac{3^{x-1}(3^2-1)}{2.3^x}$ $=\frac{3^x.3^{-1}(8)}{2.3^x}$ $=\frac{1}{3}\times 4$ $=\frac{4}{3}$	✓ common factor 3^x ✓ $3-3^{-1}$ ✓ answer (3) ✓ common factor 3^{x-1} ✓simplification ✓ answer (3)
2.2	$(x-2)^{-\frac{3}{2}}=64$ $x-2=\left[64\right]^{\frac{-2}{3}}$ $x-2=\frac{1}{16}$ $x=2+\frac{1}{16}$ $\therefore x=2\frac{1}{16}$ **OR** $\sqrt{(x-3)^{-3}}=64$ $(x-3)^{-3}=4096$ $(x-2)^3=\frac{1}{4096}$ $x-2=\frac{1}{16}$ $x=2\frac{1}{16}$	✓applying exp. law ✓ $4^3=64$ ✓simplifying ✓answer (4) ✓ squaring ✓ applying exp. law ✓ simplification ✓ answer (4)

2.3	$\frac{x.x^{\frac{1}{2}}.x^{\frac{1}{4}}.x^{\frac{1}{8}}}{\sqrt[8]{x^7}}$ $=\frac{x^{\frac{7}{8}}}{x^{\frac{7}{8}}}$ $=x$	✓applying surd law ✓applying surd law ✓simplifying ✓answer (4) **[11]**

QUESTION 3

3	$AC.(x-2)=x^2+2x-8$ $AC.(x-2)=(x+4)(x-2)$ $AC=(x+4)$ cm $\therefore FD=(x+4)$ cm $\therefore ED=x+4-(x-2)$ $ED=6$ cm	✓ statement ✓ factors ✓ $AC=(x+4)$ cm ✓ method ✓ answer (6) **[6]**

QUESTION 4

4.1	$-7 \quad 0 \quad 9 \quad 20$ $7 \quad 9 \quad 11$ $2 \quad 2$ $2a=2$ $a=1$ $3(1)+b=7$ $b=4$ $(1)+(4)+c=-7$ $c=-12$ $\therefore T_n=n^2+4n-12$ **OR** $2a=2$ $a=1$ $T_2=2^2+b(2)+c=0$ $2b+c=-4 \quad (1)$ $T_3=3^2+b(3)+c=9$ $3b+c=0 \quad (2)$ $(2)-(1) \quad b=4$ $\therefore c=-4-2(4)=-12$ $T_n=n^2+4n-12$ *OR* $3(1)+b=7$ $b=4$ $1+a+c=-7$ $c=-12$	✓ $2a=2$ ✓ a value ✓ b value ✓ c value (4) ✓ $2a=2$ ✓ a value ✓ b value ✓ c value (4)

	OR $T_n = T_1 + (n-1)d_1 + \frac{(n-1)(n-2)}{2}.d_2$ $= -7 + (n-1).7 + \frac{(n-1)(n-2)}{2}.2$ $= -7 + 7n - 7 + n^2 - 3n + 2$ $= n^2 + 4n - 12$	✓formula ✓✓substitution ✓simplification (4)
4.2	$n^2 + 4n - 12 = 128$ $n^2 + 4n - 140 = 0$ $(n+14)(n-10) = 0$ $n \neq -14$ or $n = 10$ invalid $\therefore n = 10$	✓ equation ✓factors ✓answers for n ✓$n = 10$ (choice) (4)
4.3	$-7 ; 0 ; 9 ; 20 ; \ldots$ first difference 7 9 11 second difference 2 2 $F_n = 2n + c$ $F_1 = 2(1) + c = 7$ $\therefore c = 5$ $F_n = 2n + 5$ $T_n = a + (n-1)d$ $= 7 + (n-1)(2)$ $= 7 + (2n - 2)$ $= 7 + 2n - 2$ $= 5 + 2n$ →	✓first differences Answer only: Full Marks ✓$c = 5$ (3)
4.4	$F_n = 2n + 5 = 599$ $2n = 594$ $\therefore n = 297$ this difference will be between term 297 and term 298	✓ equating ✓297 ✓298(3) **[14]**

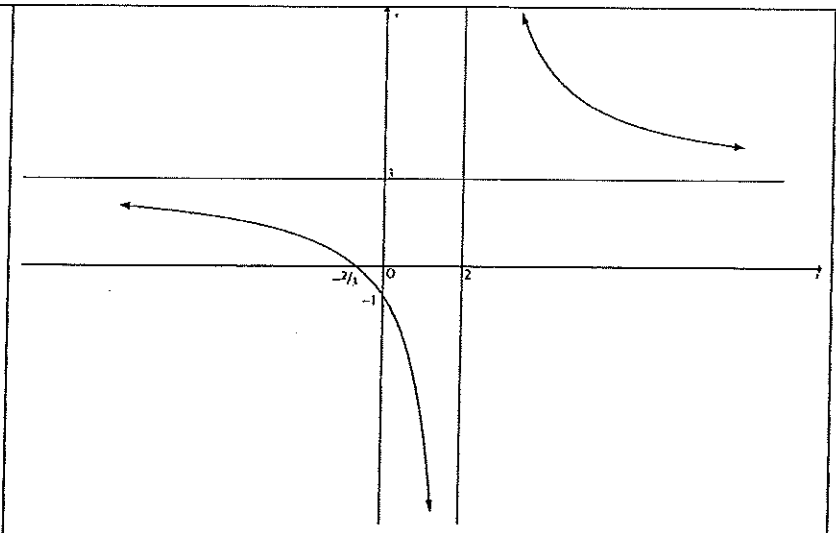
QUESTION 5

5.1	Pattern | 1 | 2 | 3 Grey | 5 | 13 | 25 White | 4 | 12 | 24 $T_n^W = 2n^2 + 2n$ $\therefore T_4^W = 2(4)^2 + 2(4) = 40$ →	white = grey − 1 $T_n^W = T_n - 1$ $= 2n^2 + 2n + 1 - 1$ $= 2n^2 + 2n$ ✓✓answer(2)
5.2	$W_n = 2n^2 + 2n$ $W_{157} = 2(157)^2 + 2(157)$ $= 49612$ ie white always = grey − 1	✓W_n ✓substitution ✓ answer (3)

5.3	$2n^2+2n+1<613$ $2n^2+2n-612<0$ $n^2+n-306<0$ must be shown! $(n-17)(n+18)<0$ + 0 − 0 + −18 17 $-18<n<17$ NB $\therefore n=16$	✓setting up inequality ✓factors ✓method ✓answer (4)
5.4	Total $= T_n + T_n^w$ $= 2n^2+2n+1+2n^2+2n$ $= 4n^2+4n+1$ $= 2(2n^2+2n)+1$ ie 2 (something) + 1 $\hookrightarrow \in \mathbb{Z}$ ∴ odd ∴ Total squares used in the n^{th} pattern is always odd.	✓ $P_n = 4n^2+4n+1$ ✓rewriting P_n ✓conclusion (3) ✓ $P_n = 4n^2+4n+1$ ✓ rewriting P_n ✓ conclusion (3) **[12]**

QUESTION 6

6.1	$x=2$ $y=3$	✓ $x=2$ ✓ $y=3$ (2)
6.2	$x.\text{int}: \frac{8}{x-2}+3=0$ $8+3(x-2)=0$ $3x+2=0$ $\therefore x=-\frac{2}{3}$ $\therefore x-\text{int}\left(-\frac{2}{3};0\right)$ $y=\frac{8}{0-2}+3$ $y=-1$ $y.\text{int}: (0;-1)$	✓ $\frac{8}{x-2}+3=0$ ✓ $\left(-\frac{2}{3};0\right)$ ✓ $(0;-1)$ (3)

6.3		✓asymptotes ✓intercepts with axes ✓shape (3)
6.4	$y=(x-2)+3$ or $y=-(x-2)+3$ $=x+1$ $=-x+5$ but they want $y=x+k$ $\therefore y=x+1$ $\therefore k=1$	✓ substitute ✓ answer (2) ✓ $y=x+1$ ✓answer (2) **[10]**

QUESTION 7

7.1	$q=-6$	✓answer (1)
7.2	$-5\frac{1}{4}=a.2^{-1-1}-6$ $\frac{3}{4}=\frac{1}{4}a$ $a=3$	✓substitute x ✓substitute y ✓simplifying ✓answer (4)
7.3	$x$int : $2^{x-1}=2 \quad \therefore x=2 \therefore (2;0)$ $y$int : $y=3.2^{-1}-6=-4\frac{1}{2} \quad \therefore\left(0;-4\frac{1}{2}\right)$ Average Gradient $=\frac{0+4\frac{1}{2}}{2-0}$ $=\frac{9}{4}$ or $2\frac{1}{4}$	✓$2^{x-1}=2$ ✓$x=2$ ✓$y=-4\frac{1}{2}$ ✓subst. into gradient formula ✓answer (5)
7.4	$y=3.2^{x-3}-6$ $x \to x-2$	✓✓answer (2) **[12]**

QUESTION 8

8.1	C(– 1 ; 0)	✓ C(– 1 ; 0) (1)
8.2	$y=(x-3)(x+1)$ $y=x^2-2x-3$	✓ $(x-3)$ ✓ $(x+1)$ ✓ $y=x^2-2x-3$ (3)
8.3	TP : $y=(1)^2-2(1)-3$ $y=-4$ R: $y\in[-4;\infty)$ **OR** $y\geq -4$	✓ $y=-4$ ✓ $[-4;\infty)$ (2) ✓ $y\geq -4$
8.4	$m=\frac{0+4}{3-1}=2$ $y=2x+c$ Sub (3;0) $0=2(3)+c$ $-6=c$ $\therefore y=2x-6$	✓ substituting into gradient formula ✓ $m=2$ ✓ equation (3)
8.5.1	$x\leq -1$ or $x\geq 3$ **OR** $x\in(-\infty;-1]\cup[3;\infty)$	✓ $x\leq -1$ ✓ $x\geq 3$ (2) ✓ $(-\infty;-1]$ ✓ $[3;\infty)$ (2)
8.5.2	$-1<x<3$ or $x>3$ **OR** $x>-1$; $x\neq 3$ **OR** $(-1;3)\cup(3;\infty)$ $x\in(-1;\infty)$ and $x\neq 3$	✓ critical values ✓ notation (2) ✓ $x>-1$ ✓ $x\neq 3$ (2) ✓ $(-1;3)$ ✓ $(3;\infty)$ (2)
8.5.3	$-1<x<0$ or $x>3$ **OR** $(-1;0)\cup(3;\infty)$	✓ critical values ✓ notation (2) ✓ $(-1;0)$ ✓ $(3;\infty)$ (2)

8.6	$x^2-2x-p=0$ $\Delta=(-2)^2-4(1)(-p)$ $=4+4p$ for non - real roots $\Delta<0$ $4+4p<0$ $4p<-4$ $\therefore p<-1$ **OR** $A(1;-4)$ $x^2-2x-3=0$ $x^2-2x-p=0$ $-p>1$ $\therefore p<-1$	✓ $4+4p<0$ ✓ $p<-1$ (2) ✓ $-p>1$ ✓ $p<-1$ (2)
8.7	$PM=(2x-6)-(x^2-2x-3)$ $=-x^2+4x-3$ $x=-\frac{b}{2a}$ $=-\frac{4}{2(-1)}=2$ $Max.PM=-(2)^2+4(2)-3=1$ unit **OR** $PM=(2x-6)-(x^2-2x-3)$ $=-x^2+4x-3$ $=-(x^2-4x+4-4+3)$ $=-[(x-2)^2-1]$ $=-(x-2)^2+1$ $Max.PM=1$ unit	✓subtraction ✓quadratic expression ✓ method ✓maximum value (4) ✓subtraction ✓quadratic expression ✓method ✓maximum value (4) **[21]**

QUESTION 9

9.1	$A=P(1-i)^n$ $11090,41=120000(1-i)^{12}$ $\therefore i=1-\sqrt[12]{\frac{11090,41}{120000}}$ Thus $i=0,179999...$ Rate of Depreciation $=18\%$	✓substitution ✓making i subject ✓i value as decimal ✓answer (4)

9.2	$1+i_{pa}=\left(1+\frac{i_{nom}}{k}\right)^{k}$ $i_{pa}=\left(1+\frac{0,098}{12}\right)^{12}-1$ $=0,10252.....$ rate $=10,25\%$ $\frac{9,8}{100}=\frac{9,8}{1200}$	✓formula ✓substitution into formula ✓10,25% (3)
9.3	$A=P(1+i_1)^{n_1}(1+i_2)^{n_2}$ $=80000\left(1+\frac{0.075}{4}\right)^{16}\left(1+\frac{0,092}{12}\right)^{36}$ $=R141768,60$ **OR** $A_1=80000\left(1+\frac{0,075}{4}\right)^{16}$ $=107689,1465..$ $A_2=107689,1465\left(1+\frac{0,092}{12}\right)^{36}$ $=$ R141768,60	✓$\left(1+\frac{0.075}{4}\right)^{16}$ ✓$\left(1+\frac{0,092}{12}\right)^{36}$ ✓multiplication ✓answer (4) ✓$\left(1+\frac{0,075}{4}\right)^{16}$ ✓A_1 ✓$\left(1+\frac{0,092}{12}\right)^{36}$ ✓answer (4)
9.4.1	Investment : end of third year : $A=P(1+i)^n$ $=30000\left(1+\frac{0,065}{12}\right)^{96}$ $=R50390,07$	✓$\frac{0,065}{12}$ ✓subst. into correct formula ✓answer (3)
9.4.2	T_0 T_3 T_5 T_8 30000 −10000 +10000 $A=30000\left(1+\frac{0,65}{12}\right)^{96}-10000\left(1+\frac{0,65}{12}\right)^{60}+10000\left(1+\frac{0,65}{12}\right)^{36}$ $A=$ R48708,61 $\therefore$ difference $=48708,61-50390,07$ $=-$R1681,46	✓$30000\left(1+\frac{0,65}{12}\right)^{96}$ ✓$-10000\left(1+\frac{0,65}{12}\right)^{60}$ ✓$10000\left(1+\frac{0,65}{12}\right)^{36}$ ✓R48708,61 ✓subtracting ✓answer (7)

	Investment: end of third year: $A = P(1+i)^n$ $= 30000\left(1+\frac{0,065}{12}\right)^{36}$ = R36440,14881 Principal(new): $R36440,14881 - R10000,00 = R26440,14881$ Investment: end of fifth year: $A = P(1+i)^n$ $= 26440.14881\left(1+\frac{0,065}{12}\right)^{24}$ = R30100,2304 Principal(new): R30100,2304 + R10000,00 = $R40100,2304$ Investment: end of eighth year: $A = P(1+i)^n$ $= 40100,2304\left(1+\frac{0,065}{12}\right)^{24}$ = R48708,61 Tashil had a deficit of R1681,46	✓subst. into formula ✓answer ✓subst. into formula ✓answer ✓subst. into formula ✓answer ✓conclusion(7) **[21]**

QUESTION 10

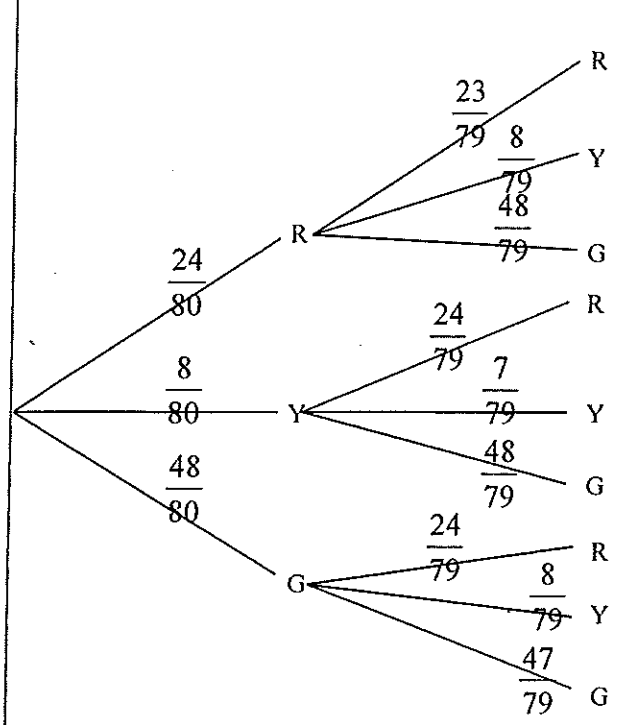
10.1	5 customers	✓answer (1)
10.2	P(C and B) ≠ 0 $B \cap C \neq \phi$ Thus events B and C are not mutually exclusive	✓P(C and B) ≠ 0 ✓ conclusion (2)
10.3.1	P(V only) = $\frac{58}{240} = \frac{29}{120}$	✓ answer (1)
10.3.2	P(C and B) = $\frac{29}{240}$	✓ answer (1)
10.3.3	P(not C) = 1 – P(C) $= 1 - \frac{122}{240} = \frac{59}{120}$ **OR** P(not C) = $\frac{52+3+58+5}{240}$ $= \frac{118}{240} = \frac{59}{120}$	✓ formula ✓ substitution ✓answer (3) ✓✓numerator and denominator ✓answer (3)

10.3.4	P(B or V) = P(B) + P(V) – P(B and V) $=\frac{84}{240}+\frac{82}{240}-\frac{15}{240}$ $=\frac{151}{240}$ **OR** $P(B \text{ or } V)=\frac{17+52+12+3+9+58}{240}$ $=\frac{151}{240}$	✓$\frac{84}{240}$ ✓$\frac{82}{240}$ ✓$\frac{15}{240}$ ✓$\frac{151}{240}$ (4) ✓✓numerator and denominator ✓✓answer (4) **[12]**

QUESTION 11

	$P(A \text{ or } B)=P(A)+P(B)-P(A\cap B)$ $0,428=0,12+0,35-P(A\cap B)$ $P(A\cap B)=0,042$ $P(A)\times P(B)=0,12\times 0,35=0,042$ $\therefore P(A\cap B)=P(A)\times P(B)$ Thus A and B are independent events	✓substitution ✓value of $P(A\cap B)$ ✓value of $P(A)\times P(B)$ ✓conclusion (4) **[4]**

QUESTION 12

12.1	There are 100% – 60% – 10% = 30% red marbles $\therefore \frac{30}{100} \times 80 = 24$ red marbles	✓30% ✓24 (2)
12.2		✓first branch ✓second branch ✓values on diagram (3)
12.3	P(G and Y) = P(G, Y) + P(Y, G) $= \frac{48}{80} \times \frac{8}{79} + \frac{8}{80} \times \frac{48}{79}$ $= \frac{48}{395}$	✓ multiplication rule ✓ addition ✓answer (3) **[8]**
		TOTAL: 150