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## NATIONAL SENIOR CERTIFICATE

## GRADE 12

MARKS: 150

TIME: 3 hours

This marking guideline consists of $\mathbf{1 0}$ pages.

NSC Marking Guideline

## QUESTION 1



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| 1.2 | $\begin{aligned} & x^{2}-5 x+4 \geq 0 \\ & (x-1)(x-4) \geq 0 \\ & x \leq 1 \text { or } x \geq 4 \\ & \text { OR } \end{aligned}$ | $\mathrm{A} \checkmark x^{2}-5 x+4 \geq 0$ <br> A $\checkmark$ factors CA $\checkmark$ end points A $\checkmark$ interval OR <br> If graphical solution is used: AA 2 marks for graph A /CA 2 marks for answer | (4) <br> (4) |
| :---: | :---: | :---: | :---: |
| 1.3 | $\begin{array}{cc} x y=12 & \rightarrow(1) \\ x-4=y & \rightarrow(2) \end{array}$ <br> Substituting (2) into (1): $\begin{aligned} & x(x-4)=12 \\ & x^{2}-4 x-12=0 \\ & (x+2)(x-6)=0 \\ & x=-2 \text { or } x=6 \\ & y=-6 \text { or } y=2 \end{aligned}$ | A $\checkmark$ correct substitution CA $\checkmark$ standard form CA $\checkmark$ factors CA $\checkmark x / y$ - values CA $\checkmark y / x$ values | (5) |
|  |  |  | [25] |

QUESTION 2

| 2.1 | $\begin{aligned} & T_{p}=3 p-2=1450 \\ & p=484 \end{aligned}$ <br> Between the $484^{\text {th }}$ and $485^{\text {th }}$ terms | A $\checkmark$ equating $p^{\text {th }}$ term to 1450 CA $\checkmark p$ value CA $\checkmark$ answer | (3) |
| :---: | :---: | :---: | :---: |
| 2.2 | $\begin{aligned} & \text { 1D } \\ & 2 a=3 \quad \therefore a=\frac{3}{2} \\ & 3 a+b=1 \quad \therefore b=-\frac{7}{2} \\ & T_{n}=a n^{2}+b n+c \\ & T_{40}=\frac{3}{2}(40)^{2}-\frac{7}{2}(40)+c=2290 \\ & 2400-140+c=2290 \\ & c=30 \end{aligned}$ | A $\checkmark a$-value <br> $C A \checkmark b-$ value <br> CA $\checkmark$ Substitution <br> CA $\checkmark$ answer | (4) |
|  |  |  | [7] |

## QUESTION 3

| 3.1.1 | $\mathrm{T}_{n}=8 n+57$ | $\mathrm{A} \checkmark$ common difference CA $\checkmark$ answer | (2) |
| :---: | :---: | :---: | :---: |
| 3.1.2 | $\begin{aligned} & \mathrm{T}_{n}=8 n+57 \\ & \mathrm{~T}_{1000}=8(1000)+57 \\ & \mathrm{~T}_{1000}=8057 \end{aligned}$ | CA $\checkmark$ substitution into formula CA $\checkmark$ answer | (2) |
| 3.1.3 | $\begin{aligned} & S_{n}=\frac{n}{2}\left[a+T_{n}\right] \\ & S_{1000}=\frac{1000}{2}[65+8057] \\ & S_{1000}=4061000 \end{aligned}$ | CA $\checkmark$ correct substitution into sum formula CA $\checkmark$ answer | (2) |
| 3.2 | Arithmetic: $5 ; 5+x ; 5+2 x ; \ldots$. <br> Geometric: $5 ; 5 x ; 5 x^{2} ; 5 x^{3} ; \ldots$. <br> Now: $\begin{aligned} & 5 x^{4}=80 \\ & x^{4}=16 \\ & x=-2 \text { or } 2 \end{aligned}$ <br> Sequences are: <br> 5;7;9 or $5 ; 3 ; 1$ | A $\checkmark$ Setting up equation <br> A $\checkmark$ dividing by 5 <br> CA $\checkmark x$-values <br> CA $\checkmark$ sequence <br> CA $\checkmark$ sequence | (5) |
|  |  |  | [11] |

## QUESTION 4

| 4 | $\left.\begin{array}{l} \sum_{p=1}^{5}(4 y+3 p)+\sum_{k=4}^{7} 3 \cdot(2)^{k-1}=\sum_{j=1}^{\infty}\left(\frac{1}{3}\right)^{j-1} \\ 4 y+3+4 y+6+4 y+9+4 y+12+4 y+15 \\ =20 y+45 \end{array}\right\} \begin{aligned} & 3.2^{3}+3.2^{4}+3.2^{5}+3.2^{6}=360 \\ & S_{\infty}=\frac{a}{1-r} \\ & \quad=\frac{1}{1-\frac{1}{3}} \end{aligned} \quad \begin{aligned} & =\frac{3}{2} \\ & 20 y+45+360=\frac{3}{2} \\ & 20 y=-403,5 \\ & y=-20,175 \end{aligned}$ | $\begin{aligned} & \mathrm{A} \checkmark 20 y+45 \\ & \mathrm{~A} \checkmark 360 \end{aligned}$ <br> A $\checkmark$ correct substitution into sum to infinity formula $\mathrm{CA} \sqrt{3} \frac{3}{2}$ <br> CA $\checkmark$ equation <br> CA $\checkmark$ simplifying <br> CA $\checkmark$ answer |  |
| :---: | :---: | :---: | :---: |
|  |  |  | [7] |

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## QUESTION 5

| 5.1 | $x=1$ and $y=2$ | $\begin{array}{\|l} \hline \mathrm{A} \checkmark x=1 \\ \mathrm{~A} \checkmark y=2 \\ \hline \end{array}$ | (2) |
| :---: | :---: | :---: | :---: |
| 5.2 | $\begin{aligned} & y-\text { intercept }:(0 ; 6) \\ & x-\text { intercept: } \frac{4}{x-1}=2 \\ & x-1=2 \\ & x=3 \\ & (3 ; 0) \end{aligned}$ | $\mathrm{A} \checkmark y-$ intercept $\begin{array}{\|l} \text { A } \checkmark x-1=2 \\ \text { CA } \checkmark x- \\ \text { intercept } \\ \text { (co-ordinate } \\ \text { form not } \\ \text { needed) } \\ \hline \end{array}$ | (3) |
| 5.3 |  | CA $\sqrt{x}, y$ intercepts CA $\checkmark$ both asymptotes $\mathrm{A} \checkmark$ shape | (3) |
|  |  |  | [8] |

NSC Marking Guideline

## QUESTION 6

| 6.1 | $\begin{aligned} & f^{\prime}(x)=-2 x+4=0 \quad \text { or } x=-\frac{4}{2(-1)} \\ & x=2 \\ & y=f(2)=-4+8+5=9 \\ & C(2 ; 9) \end{aligned}$ | A $\checkmark$ derivative and equal to $0 /$ <br> Substitution into formula <br> CA $\checkmark$ Axis of symmetry value <br> CA $\checkmark$ Maximum value | (3) |
| :---: | :---: | :---: | :---: |
| 6.2 | $\mathrm{y} \leq 9$ | CA $\checkmark$ answer | (1) |
| 6.3 | $\begin{aligned} & -x^{2}+4 x+5=0 \\ & x^{2}-4 x-5=0 \\ & (x+1)(x-5)=0 \\ & x=-1 \text { or } x=5 \\ & \mathrm{AB}=6 \text { units } \end{aligned}$ | A $\checkmark$ standard form <br> $C A \vee$ factors <br> CA $\checkmark x$-values CA $\checkmark$ answer | (4) |
| 6.4 | $\begin{array}{\|l} \hline m=-1 \text { and } c=5 \\ y=-x+5 \end{array}$ | $\text { CACA } \checkmark \checkmark \text { answer }$ | (2) |
| 6.5 | $T(4 ; 5)$ | $\text { CACA } \checkmark \checkmark \text { answer }$ | (2) |
| 6.6.1 | $m=0$ | A $\checkmark$ answer | (1) |
| 6.6.2 | $\begin{aligned} & 9=-x+5 \\ & x=-4 \\ & E(-4 ; 9) \end{aligned}$ | CA $\checkmark$ Equating equation to 9 CA $\checkmark x-$ value | (2) |
| 6.7 | $\begin{aligned} & f^{\prime}(x)=-2 x+4=-1 \\ & x=\frac{5}{2} \\ & y=-\left(\frac{5}{2}\right)^{2}+4\left(\frac{5}{2}\right)+5=\frac{35}{4} \\ & \frac{35}{4}=-\frac{5}{2}+k \\ & k=\frac{45}{4} \end{aligned}$ | A $\checkmark$ Derivative equal to -1 $\begin{aligned} & \text { CA } \checkmark x \text {-value } \\ & \text { CA } \checkmark y \text {-value } \end{aligned}$ <br> CA $\checkmark$ substitution into equation of line $\text { CA } \checkmark \text { answer }$ | (5) |
|  |  |  | [20] |

## QUESTION 7

| 7.1 | $y=\log _{a} x$ <br> $-1=\log _{a} 0,5$ <br> $a^{-1}=0,5=2^{-1}$ <br> $a=2$ | A $\checkmark$ substitution of point P <br> $\mathrm{CA} \checkmark$ Writing in exponential form <br> $\mathrm{CA} \checkmark$ answer |  |
| :--- | :--- | :--- | :---: |
| 7.2 | $y=2^{x}$ | CACA $\checkmark \checkmark$ | $(3)$ |
| 7.3 | $x \in R$ or $x \in(-\infty ; \infty)$ | $\mathrm{A} \checkmark$ answer | $(2)$ |
| 7.4 | $\log _{2} x=-1$ <br> $x=2^{-1}=\frac{1}{2}$ <br> $0<x \leq \frac{1}{2}$ | CA $\checkmark$ end points <br> A $\checkmark$ interval <br> Can be solved by log inequalities. <br> Answer Only - Full marks | $(2)$ |
|  |  |  | $[8]$ |

## QUESTION 8

| 8.1 | $\begin{aligned} & A=P(1-i)^{n} \\ & =500000(1-8,5 \%)^{12} \\ & =R 172196 \end{aligned}$ | A $\checkmark$ value of $n$ A $\checkmark$ value of $i$ CA $\checkmark$ answer | (3) |
| :---: | :---: | :---: | :---: |
| 8.2.1 | $\begin{aligned} P & =\frac{x\left[1-(1+i)^{-n}\right]}{i} \\ & =\frac{3300\left[1-\left(1+\frac{16 \%}{12}\right)^{-60}\right]}{\frac{16 \%}{12}} \\ & =R 135701,63 \end{aligned}$ | A $\checkmark$ value of $n$ <br> A $\checkmark$ value of $i$ <br> CA $\checkmark$ Substitution into formula <br> CA $\checkmark$ answer | (4) |
| 8.2.2 | $\begin{aligned} & P=\frac{x\left[1-(1+i)^{-n}\right]}{i} \\ & 125701,6304=\frac{x\left[1-\left(1+\frac{16 \%}{12}\right)^{-60}\right]}{\frac{16 \%}{12}} \\ & x=R 3056,82 \end{aligned}$ | $\mathrm{A} \checkmark \mathrm{P}$ value CA $\checkmark$ substitution into formula CA $\checkmark$ answer | (3) |
| 8.2.3 | $\begin{aligned} & \text { No. Deposit: } 60 \times \mathrm{R} 3300=\mathrm{R} 198000,00 \\ & \text { With Deposit: R10 } 000+60 \times \mathrm{R} 3056,82 \\ & =\text { R } 193409,20 \end{aligned}$ <br> Savings: R4590,80 | $\begin{aligned} & \mathrm{A} \checkmark \text { R198 } 000 \\ & \text { A } \checkmark \checkmark 193 \text { 409,20 } \\ & \text { CA } \checkmark \text { answer } \end{aligned}$ | (4) |
|  |  |  | [14] |

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QUESTION 9(penalize 1 mark once for incorrect notation in this question)

| 9.1 | $\begin{aligned} & f^{\prime}(x)=\lim _{h \rightarrow 0} \frac{f(x+h)-f(x)}{h} \\ & f^{\prime}(x)=\lim _{h \rightarrow 0} \frac{(x+h)^{2}+5(x+h)-6-\left(x^{2}+5 x-6\right)}{h} \\ & f^{\prime}(x)=\lim _{h \rightarrow 0} \frac{x^{2}+2 x h+h^{2}+5 x+5 h-x^{2}-5 x+6}{h} \\ & f^{\prime}(x)=\lim _{h \rightarrow 0} \frac{2 x h+h^{2}+5 h}{h} \\ & f^{\prime}(x)=\lim _{h \rightarrow 0} \frac{h(2 x+h+5)}{h} \\ & f^{\prime}(x)=2 x+5 \end{aligned}$ <br> OR $\begin{aligned} & f(x+h)=(x+h)^{2}+5(x+h)-6 \\ & f(x+h)=x^{2}+2 x h+h^{2}+5 x+5 h-6 \\ & f(x+h)-f(x)=2 x h+h^{2}+5 h \\ & \frac{f(x+h)-f(x)}{h}=\frac{2 x h+h^{2}+5 h}{h} \\ & \frac{f(x+h)-f(x)}{h}=\frac{h(2 x+h+5)}{h} \\ & f^{\prime}(x)=\lim _{h \rightarrow 0}(2 x+h+5) \\ & f^{\prime}(x)=2 x+5 \end{aligned}$ | A $\checkmark$ formula A $\checkmark$ substitution CA $\checkmark$ simplification of numerator CA $\checkmark$ factorization CA $\checkmark$ answer OR A $\checkmark$ value of $f(x+h)$ CA $\checkmark$ simplification CA $\checkmark$ factorization A $\checkmark$ formula CA $\checkmark$ answer OR |  |
| :---: | :---: | :---: | :---: |
| 9.2.1 | $\begin{aligned} & f(x)=3 x(\sqrt{x}-4) \\ & f(x)=3 x^{\frac{3}{2}}-12 x \\ & f^{\prime}(x)=\frac{9}{2} x^{\frac{1}{2}}-12 \end{aligned}$ | A $\checkmark$ rewriting in exponential form CACA $\checkmark \checkmark$ derivatives | (3) |
| 9.2.2 | $\begin{aligned} & y=\frac{x^{3}-4 x}{2-x} \\ & y=\frac{x(x-2)(x+2)}{-(x-2)}=-x^{2}-2 x \\ & \frac{d y}{d x}=-2 x-2 \end{aligned}$ | A $\checkmark$ factors <br> A $\checkmark$ simplified expression <br> CACA $\checkmark \checkmark$ each term | (4) |
|  |  |  | [12] |

## QUESTION 10

| 10.1 | $d=4$ | A $\checkmark$ Answer | (1) |
| :---: | :---: | :---: | :---: |
| 10.2 | $\begin{aligned} & 0=-1+b-c+4 \\ & b-c=-3 \\ & f^{\prime}(x)=3 x^{2}+2 b x+c \\ & 0=3(0)^{2}+2 b(0)+c \\ & c=0 \\ & b=-3 \end{aligned}$ | $\mathrm{A} \checkmark$ substitution of point $(-1 ; 0)$ <br> A $\checkmark$ equation <br> A $\checkmark$ derivative <br> A $\checkmark$ substitution of point $(-1 ; 0)$ into derivative | (4) |
| 10.3 | $\begin{aligned} & f(x)=x^{3}-3 x^{2}+4 \\ & f^{\prime}(x)=3 x^{2}-6 x \\ & f^{\prime}(5)=3(5)^{2}-6(5)=45 \\ & f(5)=(5)^{3}-3(5)^{2}+4=54 \\ & 54=45(5)+c \\ & c=-171 \\ & y=45 x-171 \end{aligned}$ | A $\checkmark$ gradient value of tangent A $\checkmark y$-value of tangent <br> CA $r c$-value <br> CA $\checkmark$ answer | (4) |
| 10.4 | $0<k<4$ | AA $\checkmark$ answer | (2) |
| 10.5 | $\begin{aligned} & f^{\prime}(x)=3 x^{2}-6 x=0 \\ & 3 x(x-2)=0 \\ & x=0 \text { or } x=2 \\ & y=4 \text { or } y=0 \\ & \mathrm{~B}(2 ; 0) \\ & \mathrm{B}^{\prime}(-2 ; 3) \end{aligned}$ | $\operatorname{CA} \checkmark x$-values <br> CA $\checkmark y$-values $\text { CA } \checkmark x \text { - value CA } \checkmark y \text {-value }$ | (4) |
|  |  |  | [15] |

## QUESTION 11

| 11.1 |  | A $\checkmark$ Local <br> Maximum point <br> A $\checkmark$ Local <br> Minimum point <br> A $\checkmark x-$ intercept <br> A $\checkmark y$-intercept <br> A $\checkmark$ shape |
| :--- | :--- | :--- | :--- | :--- |

## QUESTION 12

| 12.1 | $8!$ <br> $=40320$ | $\mathrm{A} \checkmark 8!$ <br> $\mathrm{A} \checkmark 40320$ | (2) |
| :--- | :--- | :--- | :---: |
| 12.2 | $1 \times 6!\times 1$ <br> $=720$ | $\mathrm{A} \checkmark \checkmark 1 \times 6!\times 1$ <br> $\mathrm{~A} \checkmark 720$ | (3) |
| 12.3 | Probability of a word starting with P and ending <br> with C <br> $\frac{720}{40 ~ 320}=\frac{1}{56}=1,79 \%=0,0179$ | $\mathrm{CA} \checkmark$ Numerator <br> $\mathrm{CA} \checkmark$ denominator <br> $\frac{720}{40320}$ or $\frac{1}{56}$ or 0,0179 or $1,79 \%$ | (2) |
|  |  | $[7]$ |  |

## QUESTION 13

| 13.1 | 160 | A $\checkmark$ answer | (1) |
| :---: | :---: | :---: | :---: |
| 13.2 | $\mathrm{P}(\text { Male })=\frac{60}{160}=\frac{3}{8}=0,375=37,5 \%$ | $\text { AA } \checkmark \checkmark \frac{60}{160} \text { or } \frac{3}{8} \text { or } 0,375 \text { or } 37,5 \%$ | (2) |
| 13.3 | $\begin{aligned} & \mathrm{P}(\text { Male choosing coffee })=\mathrm{P}(\text { Male }) \times \mathrm{P}(\text { coffee }) \\ & \frac{b}{160}=\frac{60}{160} \times \frac{80}{160} \\ & \frac{b}{160}=\frac{3}{16} \\ & b=30 \end{aligned}$ | A $\checkmark$ Condition for independent events AA $\checkmark \checkmark$ Substitution into equation A $\checkmark$ Answer | (4) |
|  |  |  | [7] |

