Province of the
EASTERN CAPE
EDUCATION

NATIONAL SENIOR CERTIFICATE/ *NASIONALE SENIORSERTIFIKAAT*

GRADE/*GRAAD* 12

JUNE/*JUNIE* 2023

MATHEMATICS P1 MARKING GUIDELINE/ *WISKUNDE V1 NASIENRIGLYN*

MARKS/*PUNTE*: **150**

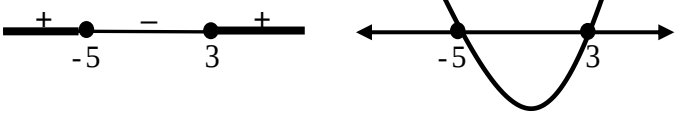
This marking guideline consists of 15 pages./
Hierdie nasienriglyn bestaan uit 15 *bladsye*.

NOTE/*LET OP*:

- If a candidate answered a question TWICE, mark the FIRST attempt ONLY.
  Indien 'n kandidaat 'n vraag TWEE keer beantwoord het, merk SLEGS die EERSTE poging.
- Consistent accuracy(CA) applies in ALL aspects of the memorandum.
  Volgehoue akkuraatheid geld deurgaans in ALLE aspekte van die memorandum.
- If a candidate crossed out an attempt of a question and did not redo the question, mark the crossed-out attempt.
  Indien 'n kandidaat 'n poging vir 'n vraag deurgetrek het en nie die vraag weer beantwoord het nie, merk die poging wat deurgetrek is.
- The mark for substitution is awarded for substitution into the correct formula.
  Die punt vir substitusie word vir substitusie in die korrekte formule toegeken.

QUESTION 1/*VRAAG 1*

1.1.1	$x^2-9=0$ **OR / OF** $x^2-9=0$ $(x+3)(x-3)=0$ $x^2=9$ $x+3=0$ or/*of* $x-3=0$ $x=\pm\sqrt{9}$ $x=-3$ or/*of* $x=3$ $x=\pm 3$ **OR / *OF*** $x^2-9=0$ $x=\dfrac{-b\pm\sqrt{b^2-4ac}}{2a}$ $=\dfrac{-(0)\pm\sqrt{(0)^2-4(1)(-9)}}{2(1)}$ $=\dfrac{\pm\sqrt{36}}{2}$ $x=-3$ or / *of* $x=3$ Answers only – Full marks *Slegs antwoorde - Volpunte*	✓ factors / *faktore* ✓ both answers / *beide antwoorde* **OR / *OF*** ✓ correct substitution into correct formula / *korrekte vervanging in korrekte formule* ✓ both answers / *beide antwoorde* (2)

1.1.2	$x-5+\frac{2}{x}=0$ $x^2-5x+2=0$ $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$ $x=\frac{-(-5)\pm\sqrt{(-5)^2-4(1)(2)}}{2(1)}$ $x=\frac{5\pm\sqrt{17}}{2}$ $\therefore x=4,56 \quad \text{or/}of \quad x=0,44$ Penalise 1 mark for incorrect rounding off. / *Penaliseer* 1 *punt vir verkeerde afronding.*	✓ standard form / *standaardvorm* ✓ substitution / *vervanging* ✓✓ x-values / *waardes* (4)
1.1.3	$x=1+\sqrt{7-x}$ $x-1=\sqrt{7-x}$ $(x-1)^2=\left(\sqrt{7-x}\right)^2$ $x^2-2x+1=7-x$ $x^2-x-6=0$ $(x+2)(x-3)=0$ $\therefore x\neq -2 \ \ or/of \ \ x=3$	✓ isolating surd / *isoleer wortelvorm* ✓ square both sides / *kwadreer beide kante* ✓ standard form / *standaardvorm* ✓ factors / *faktore* ✓ selection / keuse (5)
1.1.4	$x^2+2x-15\geq 0$ $(x+5)(x-3)\geq 0$ critical values/*kritieke waardes* $x=-5$ or/*of* $x=3$  $x\leq -5 \ \ or/of \ \ x\geq 3, \ x\in \mathbf{R}$ **OR/*OF*** $x\in(-\infty;-5] \ \ or/of \ \ x\in[3;\infty), \ x\in \mathbf{R}$	✓ critical values / *kritieke waardes* ✓✓ $x\leq -5 \ \ or/of \ \ x\geq 3, \ x\in \mathbf{R}$ (accuracy / *akkuraatheid*) **OR/*OF*** $x\in(-\infty;-5] \ \ or/of \ \ x\in[3;\infty), \ x\in \mathbf{R}$ (3)

1.2	$y+2x=3$ .....(1) $y^2-y=3x^2-5x$ .....(2) *From / Vanaf* (1): $y=-2x+3$ .....(3) (3) into/*in* (2): $(-2x+3)^2-(-2x+3)=3x^2-5x$ $4x^2-12x+9+2x-3=3x^2-5x$ $4x^2-12x+9+2x-3-3x^2+5x=0$ $x^2-5x+6=0$ $(x-2)(x-3)=0$ $x=2$ or/*of* $x=3$ $y=-1$ or/*of* $y=-3$ **OR / *OF*** $y+2x=3$ .....(1) $y^2-y=3x^2-5x$ .....(2) $x=\frac{3-y}{2}$ .....(3) Subst. / *Verv.* (3) into / *in* (2): $y^2-y=3\left(\frac{3-y}{2}\right)^2-5\left(\frac{3-y}{2}\right)$ $y^2-y=3\left(\frac{9-6y+y^2}{4}\right)-5\left(\frac{3-y}{2}\right)$ $y^2-y=\frac{27-18y+3y^2}{4}+\frac{-15+5y}{2}$ $4y^2-4y-27+18y-3y^2+30-10y=0$ $y^2+4y+3=0$ $(y+1)(y+3)=0$ $y=-1$ or / *of* $y=-3$ $x=2$ or / *of* $x=3$	✓ $y=-2x+3$ ✓ substitution / *vervanging* ✓ standard form / *standaardvorm* ✓ factors / *faktore* ✓ *x*-values / *waardes* ✓ *y*-values / *waardes* **OR / *OF*** ✓ $x=\frac{3-y}{2}$ ✓ substitution / *vervanging* ✓ standard form / *standaardvorm* ✓ factors / *faktore* ✓ *y*-values / *waardes* ✓ *x*-values / *waardes* (6)

1.3	$\sqrt[n]{\frac{10^n + 2^{n+2}}{5^{2n} + 4(5^n)}}$ $= \left[\frac{2^n \times 5^n + 2^n.2^2}{5^n.5^n + 4(5^n)}\right]^{\frac{1}{n}}$ $= \left[\frac{2^n(5^n + 4)}{5^n(5^n + 4)}\right]^{\frac{1}{n}}$ $= \left[\left(\frac{2}{5}\right)^n\right]^{\frac{1}{n}}$ $= \frac{2}{5}$	✓ $\frac{2^n \times 5^n + 2^n.2^2}{5^n.5^n + 4(5^n)}$ ✓ factors / *faktore* ✓ changing surd to exponent / *verandering van wortel na eksponent* ✓ answer / *antwoord* (4)
		[24]

QUESTION 2/*VRAAG 2*

2.1.1	$r = \frac{T_3}{T_2} = \frac{6x}{12}$ $= \frac{x}{2}$	✓ answer / *antwoord* (1)
2.1.2	$-1 < r < 1$ $-1 < \frac{x}{2} < 1$ $-2 < x < 2$	✓ substitution / *vervanging* ✓ answer / *antwoord* (2)
2.1.3	$x = 4 \Rightarrow a = 6 \ \& \ r = 2$ $S_{15} = \frac{a\left(r^n - 1\right)}{r - 1}$ $= \frac{6\left(2^{15} - 1\right)}{2 - 1}$ $= 196\,602$	✓ values of *a* and *r* / *waardes van a en r* ✓ substitution / *vervanging* ✓ answer / *antwoord* (3)
2.2	$T_1 = 6(2)^{-1} = 3$ $T_2 = 6(2)^{-2} = \frac{3}{2}$ $\therefore \ r = \frac{1}{2}$ $S_\infty = \frac{a}{1 - r}$ $= \frac{3}{1 - \frac{1}{2}}$ $= 6$	✓ values of *a* and *r* / *waardes van a en r* ✓ substitution / *vervanging* ✓ answer / *antwoord* (3)

2.3.1	$S_{15} = -(15)^2 + 8(15)$ $= -105$	✓ substitution / *vervanging* ✓ answer / *antwoord* (2)
2.3.2	$T_{15} = S_{15} - S_{14}$ $= -105 - (-84)$ $= -21$	✓ method / *metode* ✓ answer / *antwoord* (2)
2.3.3	$T_1 = S_1 = 7$ $S_2 = -(2)^2 + 8(2) = 12$ $\therefore\ T_2 = 5$ $\Rightarrow d = -2$ $a + (n-1)d = T_n$ $7 + (n-1)(-2) = -169$ $7 - 2n + 2 = -169$ $-2n = -178$ $n = 89$ **OR / *OF*** $S_n - S_{n-1} = T_n$ $-n^2 + 8n - [-(n-1)^2 + 8(n-1)] = -169$ $-n^2 + 8n - [-n^2 + 2n - 1 + 8n - 8] = -169$ $-n^2 + 8n + n^2 - 2n + 1 - 8n + 8 = -169$ $-2n = -178$ $n = 89$	**OR / *OF*** $a + 14d = -21$ $7 + 14d = -21$ $14d = -28$ $d = -2$ ✓ $T_2 = 5$ **OR / OF** $14d = -28$ ✓ $d = -2$ ✓ substitution / *vervanging* ✓ answer / *antwoord* **OR / *OF*** ✓ formula / *formule* ✓ substitution / *vervanging* ✓ simplification / *vereenvoudiging* ✓ answer / *antwoord* (4)
		[17]

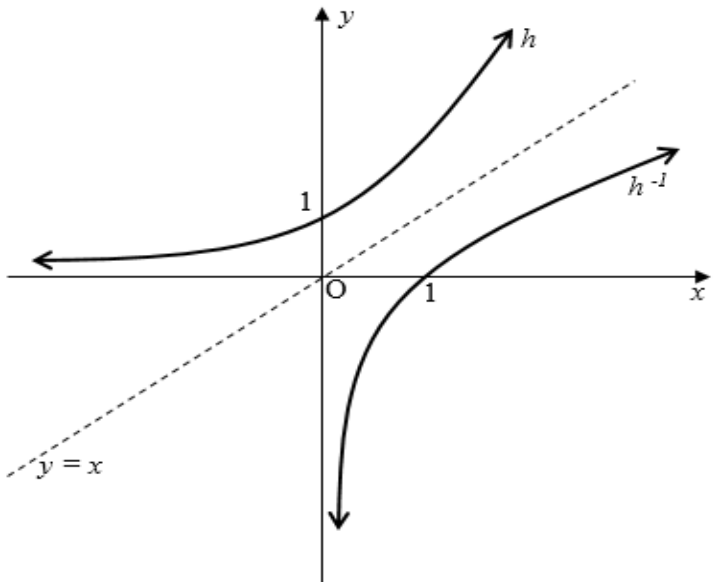
QUESTION 3/*VRAAG 3*

3.1	$95\ ;\ 72\ ;\ y\ ;\ 32\ ;\ ...$ $-23\ ;\ y-72\ ;\ 32-y\ ;\ ...$ (first diff. / *eerste verskille*) $y-49\ ;\ -2y+104$ $\therefore\ y-49=-2y+104$ $3y=153$ $y=51$	✓ equating 2nd differences / *gelykstel van 2de verskille* ✓ answer / *antwoord* (2)
3.2	**95 ; 72 ; 51 ; 32** **– 23 ; – 21 ; – 19** **2 ; 2** $2a=2$ $3(1)+b=-23$ $1-26+c=95$ $a=1$ $b=-26$ $c=120$ $T_n=n^2-26n+120$	✓ 2nd difference / 2de *verskil* ✓ $a=1$ ✓ $b=-26$ ✓ $c=120$ (4)
3.3	$T_{22}=(22)^2-26(22)+120$ $=32$	✓ answer / *antwoord* (1)
3.4	$n^2-26n+120=1040$ $n^2-26n-920=0$ $(n-46)(n+20)=0$ $n=46$ *or / of* $n\neq-20$ **OR / *OF*** $n^2-26n+120=1040$ $n^2-26n-920=0$ $n=\dfrac{-b\pm\sqrt{b^2-4ac}}{2a}$ $=\dfrac{-(-26)\pm\sqrt{(-26)^2-4(1)(-920)}}{2(1)}$ $\therefore n=46$ *or / of* $n\neq-20$	✓ equating / *gelykstel* ✓ standard form / *standaardvorm* ✓ factors / *faktore* ✓ answer / *antwoord* **OR / *OF*** ✓ equating / *gelykstel* ✓ standard form / *standaardvorm* ✓ substitution / *vervanging* ✓ answer / *antwoord* (4)
		[11]

QUESTION 4/*VRAAG 4*

4.1	$S(0;3)$	✓✓ answer / *antwoord* (2)
4.2.1	$x=-\frac{b}{2a}=-\frac{10}{2(-5)}$ $y=5(-1)^2+10(-1)+3$ $x=-1$ $y=-2$ $T(-1;-2)$	✓ method /*metode* ✓ *x*-coordinate / *x-koördinaat* ✓ substitution / *vervanging* ✓ *y*-coordinate / *y-koördinaat* (4)
4.2.2	$p=1$ and / *en* $q=-2$	✓ $p=1$ ✓ $q=-2$ (2)
4.2.3	$\frac{5}{x+1}-2=0$ $\therefore\ x=\frac{3}{2}$ $\Rightarrow \text{OR}=1,5\,\text{units / } eenhede$	✓ equating to 0 / *stel gelyk aan* 0 ✓ answer / *antwoord* (2)
4.2.4	$y\geq -2\ ;\ y\in$	✓✓ answer / *antwoord* (2)
4.3.1	$m=10x+10$ $y-y_1=m(x-x_1)$ $=10(0)+10$ $y-3=10(x-0)$ $=10$ $y=10x+3$	✓ m = 10 ✓ substitution into eqn of line / *vervanging in verg. van lyn* ✓ answer / antwoord (3)
4.3.2	$y=(x+1)-2$ $y=x+k$ $y=x-1$ **OR / *OF*** $-2=-1+k$ $k=-1$ $\therefore\ y=x-1$	✓ substitution / *vervanging* ✓ answer / *antwoord* (2)
4.4	$x\geq\frac{3}{2}$	✓✓ answer / *antwoord* (A) (2)
		[19]

QUESTION 5/*VRAAG 5*

5.1	$h(x)=a^x$ $\frac{1}{2}=a^{-1}$ $\therefore\ a=2$	✓ substitution / *vervanging* ✓ answer / *antwoord* (2)
5.2	$y=2^x$ $x=2^y$ $\therefore\ h^{-1}(x): y=\log_2 x$	✓ interchanging x and y / *omruil van x en y* ✓ answer / *antwoord* (2)
5.3		✓ y-intercept for h / *y-afsnit vir h* ✓ shape and asymptote of h *vorm en asimptoot van h* ✓ x-intercept for h^{-1} / *x-afsnit vir* h^{-1} ✓ shape and asymptote of h^{-1} *vorm en asimptoot van* h^{-1} (4)
5.4	$x>0\ ;\ x\in\mathbb{R}$	✓ answer / *antwoord* (1)
5.5	$x>2\ ;\ x\in\mathbb{R}$ **OR / *OF*** $\log_2 x>1$ $\therefore\ x>2$ (algebraically/*algebraïes*)	✓ answer / *antwoord* **OR / *OF*** ✓ answer / *antwoord* (1)
5.6.1	$t(x)=\left(\frac{1}{2}\right)^x-1$ $=2^{-x}-1$ $\Rightarrow$ reflection about the y-axis / *refleksie om die y – as* shift of 1 unit down / *skuif van 1 eenheid af*	✓ reflection / *refleksie* ✓ shift / *skuif* (2)
5.6.2	$y=-1$	✓ answer / *antwoord* (1)
		[13]

QUESTION 6/*VRAAG 6*

6.1	$A = P(1-i)^n$ $A = 980\,000(1-9,2\%)^7$ $A = R498\,685,82$	✓ formula / *formule* ✓ substitution / *vervanging* ✓ answer / *antwoord* (3)
6.2	$A = P(1+i)^n$ $20\,020,28 = 13\,500(1+8,2\%)^n$ $1,4829837037 = 1,082^n$ $\therefore n = \log_{(1,082)}[1,4829837037]$ $n = 5$ years / *jaar*	✓ substitution / *vervanging* ✓ simplification / *vereenvoudiging* ✓ use of logs / *gebruik van logs* ✓ answer / *antwoord* (4)
6.3	Amount in savings account / *Bedrag in spaarrekening* : $= 3500\left(1+\frac{0,07}{4}\right)^8\left(1+\frac{0,08}{12}\right)^{36} + 5700\left(1+\frac{0,08}{12}\right)^{24}$ $= R11793,19$ **OR / *OF*** $A_1 = 3500\left(1+\frac{7\%}{4}\right)^8 = R4\,021,08624$ $A_2 = 4\,021,08624\left(1+\frac{8\%}{12}\right)^{12} = R4\,354,834415$ $A_3 = 4\,354,83441 + 5\,700 = R10\,054,834415$ Final Amount / *Finale Bedrag* $= 10\,054,83441\left(1+\frac{8\%}{12}\right)^{24}$ $= R11793,19$	✓ n = 8 and / *en* i = 0,07/4 ✓ substitution / *vervanging* ✓ n = 36 and / *en* i = 0,08/12 ✓ substitution / *vervanging* ✓ addition / *optelling* ✓ answer / *antwoord* **OR / *OF*** ✓ n = 8 and / *en* i = 0,07/4 ✓ substitution / *vervanging* ✓ n = 12 and / *en* i = 0,08/12 ✓ addition / *optelling* ✓ substitution / *vervanging* ✓ answer / *antwoord* (6)
		[13]

QUESTION 7/*VRAAG 7*

Penalise 1 mark for incorrect notation in this question
Penaliseer 1 punt vir verkeerde notasie in hierdie vraag

7.1

$$f'(x)=\lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$$

$$=\lim_{h\to 0}\frac{5-2(x+h)^2-\left(5-2x^2\right)}{h}$$

$$=\lim_{h\to 0}\frac{5-2x^2-4xh-2h^2-5+2x^2}{h}$$

✓ $5-2x^2-4xh-2h^2$

$$=\lim_{h\to 0}\frac{-4xh-2h^2}{h}$$

✓ simplification / *vereenvoudiging*

$$=\lim_{h\to 0}\frac{h(-4x-2h)}{h}$$

✓ factorisation / *faktorisering* (dividing by h / *deel deur* h)

$$=\lim_{h\to 0}\left(-4x-2h\right)$$

Answer ONLY: 0 marks
SLEGS antwoord: 0 *punte*

$$=-4x$$

✓ answer / *antwoord*

(4)

7.2.1

$$f(x)=2x^5-7\sqrt{x}+\frac{1}{x}$$

$$=2x^5-7x^{\frac{1}{2}}+x^{-1}$$

✓ $2x^5-7x^{\frac{1}{2}}+x^{-1}$

✓ $10x^4$

$$f'(x)=10x^4-\frac{7}{2}x^{-\frac{1}{2}}-x^{-2}$$

✓ $-\frac{7}{2}x^{-\frac{1}{2}}$

✓ $-x^{-2}$

$$=10x^4-\frac{7}{2\sqrt{x}}-\frac{1}{x^2}$$

(4)

7.2.2

$$\frac{d}{dx}\left[\frac{2x^2-x-6}{2x+3}\right]$$

$$\frac{d}{dx}\left[\frac{(2x+3)(x-2)}{(2x+3)}\right]$$

✓ factors / *faktore*

$$\frac{d}{dx}\left[x-2\right]$$

✓ simplification / *vereenvoudiging*

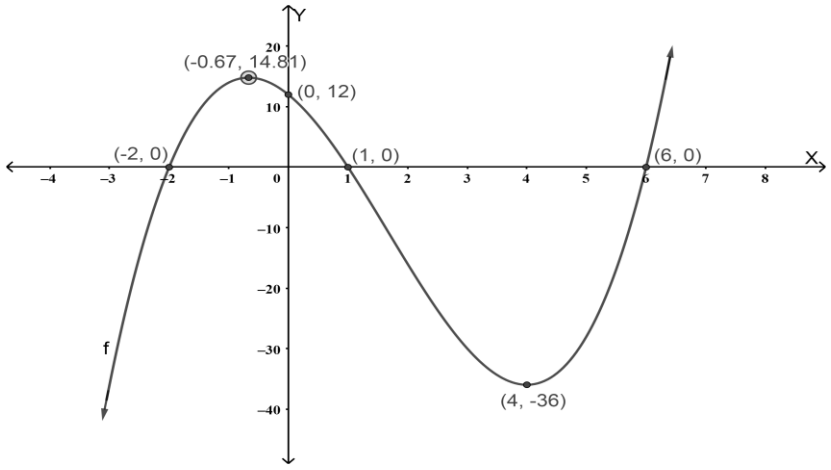
$$=1$$

✓ answer / *antwoord*

(3)

[11]

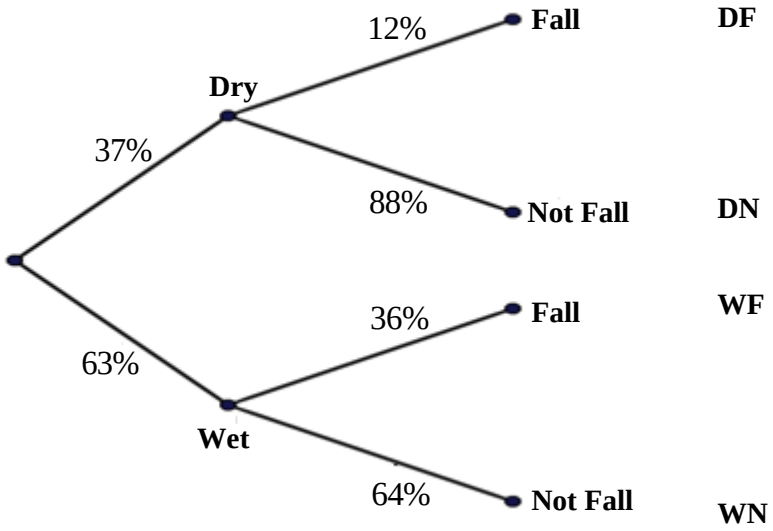
QUESTION 8/*VRAAG 8*

8.1	$f'(x)=3x^2-10x-8=0$ $(3x+2)(x-4)=0$ $x=-\frac{2}{3}$ or / *of* $x=4$ $y=\frac{400}{27}\ (14,81)$ or / *of* $y=-36$ $\mathrm{L}\left(-\frac{2}{3};\frac{400}{27}\right)$ *and* / *en* $\mathrm{M}(4;-36)$	✓ $f'(x)=0$ ✓ factors / *faktore* ✓ *x*-values / *x-waardes* ✓ *y*-values / *y-waardes* (4)
8.2	$f(x)=x^3-5x^2-8x+12=0$ $(x-6)(x-1)(x+2)=0$ $\therefore\ x=6\ ;\ x=1\ ;\ x=-2$	✓ factors / *faktore* ✓ $x = 1$ ✓ $x = -2$ (3)
8.3		✓ *x*-intercepts / *x-afsnitte* ✓ *y*-intercept / *y-afsnit* ✓ turning points / *draaipunte* ✓ shape / *vorm* (4)
8.4	$m=\frac{0-(-16)}{6-2}=4$ $y-y_1=m(x-x_1)$ $y-0=4(x-6)$ $y=4x-24$ $\therefore a=4$ and / *en* $q=-24$	✓ $a=4$ ✓ $q=-24$ (2)
8.5	$f''(x)=6x-10$ $f''(2)=6(2)-10$ $=2>0$ $\Rightarrow$ concave up / *konkaaf op*	✓ $f''(x)$ ✓ substitution / *vervanging* ✓ conclusion / *gevolgtrekking* (3)
8.6	$4x-24=-36$ $x=-3$ $\therefore -3\le x\le 2$ or / *of* $x\ge 6$	✓ equating / *gelyk stel* ✓ $x = -3$ ✓✓ answer /*antwoord* (4)
		[20]

QUESTION 9/*VRAAG 9*

9.1	Hourly cost = fuel cost + other costs *Uurlikse koste = brandstofkoste + ander koste* $= 4x^2 + 1000$ Duration of trip/*Tydsduur van reis* $= \frac{\text{distance/}afstand}{\text{speed/}spoed} = \frac{500}{x}$ Total cost/*Totale koste* = (hourly cost/*uurlikse koste*) × (number of hours/*aantal ure*) $C(x) = (4x^2 + 1000) \times \left(\frac{500}{x}\right)$ $= 2000x + \frac{500\,000}{x}$	✓ $4x^2 + 1000$ ✓ $\frac{500}{x}$ ✓ $\left(4x^2 + 1000\right) \times \left(\frac{500}{x}\right)$ (3)
9.2	$C'(x) = 2000 - \frac{500\,000}{x^2} = 0$ $2000x^2 - 500\,000 = 0$ $2000x^2 = 500\,000$ $x^2 = 250$ $x = \sqrt{250} = 15,81 km/h$	✓ $C'(x)$ ✓ $C'(x) = 0$ ✓ standard form / *standaardvorm* ✓ simplification / *vereenvoudiging* ✓ answer / *antwoord* (5)
		[8]

QUESTION 10/*VRAAG 10*

10.1	$P(A \text{ or / } of\ B) = P(A) + P(B)$ $0,64 = 3P(B) + P(B)$ $0,64 = 4P(B)$ $\therefore\ P(B) = 0,16$	✓ rule / *reël* ✓ substitution / *vervanging* ✓ answer / *antwoord* (3)
10.2.1		✓ 37% and / *en* 63% ✓ 12% and / *en* 88% ✓ 36% and / *en* 64% ✓ outcomes / *uitkomste* (4)
10.2.2	$(37\% \times 88\%) + (63\% \times 64\%)$ $= 0,7288 \approx \frac{73}{100}$	✓ $(37\% \times 88\%) + (63\% \times 64\%)$ ✓ answer / *antwoord* (2)
10.3.1	$182 + x + 4 + 30 = 240$ **OR / OF** $x + 182 = 206$ **OR / OF** $x + 4 = 28$ $x = 240 - 216$ $x = 24$ $x = 24$ $x = 24$	✓ equation / *vergelyking* ✓ answer / *antwoord* (2)
10.3.2	For independent events *Vir onafhanklike gebeurtenisse* $P(R) \times P(C) = P(R \cap C)$ $P(R \text{ and / } en\ C) = \frac{24}{240} = 0,10$ $P(R) \times P(C)$ $= \left(\frac{206}{240}\right) \times \left(\frac{28}{240}\right)$ $= 0,10$ $\therefore$ Yes, the events are independent. *Ja, die gebeurtenisse is onafhanklik.*	✓ $P(R \cap C) = 0,10$ ✓ $P(R) \times P(C) = 0,10$ ✓ conclusion / *gevolgtrekking* (3)
		[14]
		TOTAL/*TOTAAL*: 150