basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

**NATIONAL
SENIOR CERTIFICATE/**
*NASIONALE
SENIOR SERTIFIKAAT*

GRADE 12/*GRAAD* **12**

TECHNICAL MATHEMATICS P1/*TEGNIESE WISKUNDE V1*

NOVEMBER 2019

MARKING GUIDELINES/*NASIENRIGLYNE*

MARKING CODES/*NASIENKODES*	
A	Accuracy/*Akkuraatheid*
AO	Answer only/*Slegs antwoord*
CA	Consistent accuracy/*Volgehoue akkuraatheid*
M	Method/*Metode*
R	Rounding/*Afronding*
NPR	No penalty for rounding/*Geen penalisering vir afronding nie*
NPU	No penalty for unit/*Geen penalisering vir eenhede weggelaat nie*
S	Simplification/*Vereenvoudiging*
F	Correct formula/*Korrekte formule*
SF	Substitution in correct formula/*Vervanging in korrekte formule*

MARKS/*PUNTE***: 150**

These marking guidelines consist of 24 pages.
Hierdie nasienriglyne bestaan uit 24 bladsye.

NOTE:
- If a candidate answers a question TWICE, only mark the FIRST attempt.
- Consistent accuracy to be applied as indicated on the marking guidelines.
- # Shows questions where Tolerance Range will be applied are Q1.3, Q3.2, Q5.2 and Q5.3.

LET WEL:
- *Indien 'n kandidaat 'n vraag TWEE keer beantwoord, sien slegs die EERSTE poging na.*
- *Volgehoue akkuraatheid sal toegepas word soos op die nasienriglyne aangedui .*
- *# Toon vrae waar Toleransie Wydte (Verdraagsaamheids omvang) toegepas word is V1.3, V3.2, V5.2 en V5.3.*

QUESTION/*VRAAG* 1

1.1.1	$p(x) = 2x^2 - \dfrac{8}{81}$		
	$= 2\left(x^2 - \dfrac{4}{81}\right)$	✓common factor/*gemene faktor* **A**	
	$= 2\left(x - \dfrac{2}{9}\right)\left(x + \dfrac{2}{9}\right)$	✓ both factors/*beide faktore* **CA**	
	OR/*OF*	**OR/*OF***	
	$p(x) = \dfrac{162x^2 - 8}{81}$		
	$= \dfrac{2(81x^2 - 4)}{81}$	✓common factor/*gemene faktor* **A**	
	$= \dfrac{2(9x - 2)(9x + 2)}{81}$	✓ both factors/*beide faktore* **CA** (2)	
1.1.2	$p(x) = 2\left(x - \dfrac{2}{9}\right)\left(x + \dfrac{2}{9}\right) = 0$		
	$\therefore x = \dfrac{2}{9}$ or / *of* $x = -\dfrac{2}{9}$ **OR/*OF***	✓ both values of/*beide waardes van* x **CA**	
	$\therefore x = \pm \dfrac{2}{9}$ **OR / OF** $x \approx \pm 0,22$		
	OR/OF	**OR/OF**	
	$x = \dfrac{-(0) \pm \sqrt{(0)^2 - 4(2)\left(-\dfrac{8}{81}\right)}}{2(2)}$		
	$\therefore x = \dfrac{2}{9}$ or / *of* $x = -\dfrac{2}{9}$ **OR/*OF***	✓ both values of/*beide waardes van* x **CA**	
	$\therefore x = \pm \dfrac{2}{9}$ OR/OF $x \approx \pm 0,22$	(1)	

1.2.1	$(3x-5)(x+2) = -13$		
	$3x^2 + x - 10 + 13 = 0$		
	$3x^2 + x + 3 = 0$	✓ standard form/*standaard vorm* **A**	
	$x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$		
	$x = \dfrac{-(1) \pm \sqrt{(1)^2 - 4(3)(3)}}{2(3)}$	✓ **SF**　　　　　　**CA**	
	$x = \dfrac{-1 \pm \sqrt{-35}}{6}$	✓ **S**　　　　　　**CA**	
	$x = \dfrac{-1 \pm \sqrt{35}\,i}{6}$ **OR/*OF*** $x \approx \dfrac{-1 \pm 5{,}92i}{6}$ **OR/*OF*** $x = -\dfrac{1}{6} + \dfrac{\sqrt{35}}{6}i$ or /*of* $-\dfrac{1}{6} - \dfrac{\sqrt{35}}{6}i$ **OR/*OF*** $x \approx -0{,}17 + 0{,}99i$ or / *of* $x \approx -0{,}17 - 0{,}99i$ **OR/*OF*** $x = -\dfrac{1}{6} \pm \dfrac{\sqrt{35}}{6}i$ **OR/*OF*** $x \approx -0{,}17 \pm 0{,}99i$	✓ $\sqrt{-35} = \sqrt{35}\,i$　**CA** ✓ both *x*-values/*beide x-waardes* **CA**	
		(5)	
1.2.2	$(4-x)(x+3) < 0$ **OR/*OF*** $(x-4)(x+3) > 0$		
	CV : $x = -3$ and $x = 4$	✓ both critical values/ *beide kritiese waardes* **A**	
	$x < -3$ or/*of* $x > 4$ **OR/*OF*** $x \in (-\infty; -3) \cup (4; \infty)$	✓✓ correct notation for each interval/*korrekte notasie vir elke interval* **CA**	
		Accept Number Line/ *Aanvaar getallelyn*	
		(3)	

| 1.3 | $y = 3x - 8$
 $x^2 - xy + y^2 = 39$
 $x^2 - x(3x-8) + (3x-8)^2 = 39$
 $x^2 - 3x^2 + 8x + 9x^2 - 48x + 64 - 39 = 0$
 $7x^2 - 40x + 25 = 0$

 $(x-5)(7x-5) = 0$ **OR/*OF***

 $x = \dfrac{-(-40) \pm \sqrt{(40)^2 - 4(7)(25)}}{2(7)}$

 $\therefore\ x = 5$ or/*of* $\quad x = \dfrac{5}{7}$ **OR / OF** 0,71

 $y = 3(5) - 8 = 7$ or/*of* $\quad y = 3\left(\dfrac{5}{7}\right) - 8 = -\dfrac{41}{7}$
 $\qquad\qquad\qquad\qquad$ **OR / *OF*** $y \approx -5,86$

 $\qquad\qquad\qquad$ **OR/*OF***

 $y = 3x - 8$
 $x^2 - xy + y^2 = 39$
 $x = \dfrac{y+8}{3}$
 $x^2 - xy + y^2 = 39$
 $\left(\dfrac{y+8}{3}\right)^2 - y\left(\dfrac{y+8}{3}\right) + y^2 = 39$

 $\dfrac{y^2 + 16y + 64}{9} - \dfrac{y^2}{3} - \dfrac{8y}{3} + y^2 = 39$

 $y^2 + 16y + 64 - 3y^2 - 24y + 9y^2 = 351$
 $7y^2 - 8y - 287 = 0$
 $(y-7)(7y+41) = 0$ **OR/*OF***
 $x = \dfrac{-(-40) \pm \sqrt{(40)^2 - 4(7)(25)}}{2(7)}$

 $\therefore\ y = 7$ or/*of* $\quad y = -\dfrac{41}{7}$ **OR / *OF*** $y \approx -5,86$

 $x = \dfrac{7+8}{3} = 5$ or/*of* $\quad x = \dfrac{-\dfrac{41}{7}+8}{3} = \dfrac{5}{7}$
 $\qquad\qquad$ **OR / *OF*** $x \approx 0,71$ | ✓ substitution/*vervanging* **A**

 ✓ **S** **CA**
 ✓ standard form/*standaard vorm* **CA**

 ✓ factors or formula/*faktore* **CA**

 ✓both *x*-values/*beide x-waardes* **CA**

 ✓both *y*-values/*beide y-waardes* **CA**

 $\qquad\qquad$ **OR/*OF***

 ✓ substitution/*vervanging* **A**

 ✓ **S** **CA**

 ✓ standard form/*standaard vorm* **CA**
 ✓ factors/ formula/*faktore* **CA**

 ✓ both *y*-values/*beide y-waardes* **CA**

 ✓both *x*-values/*beide x-waardes* **CA**
 $\qquad\qquad\qquad\qquad\qquad$ (6) | |

1.4.1	$V = I \times Z$ $I = \dfrac{V}{Z}$ **OR/*OF*** $I = VZ^{-1}$	✓ dividing by/*deel deur* Z **A** (1)	
1.4.2	$I = \dfrac{V}{Z}$ $= \dfrac{7i}{3-i}$ $= \dfrac{7i}{3-i} \times \dfrac{3+i}{3+i}$ $= \dfrac{21i + 7i^2}{9 - i^2}$ $= \dfrac{21i + 7(-1)}{9 - (-1)}$ $= \dfrac{-7+21i}{10}$ **OR/*OF*** $-0{,}7 + 2{,}1i$ **OR/*OF*** $\dfrac{-7}{10} + \dfrac{21i}{10}$	✓ substitution/*vervanging* **CA** ✓ **M** multiply by/ *vermenigvuldig met* $\dfrac{3+i}{3+i}$ ✓S **A** **CA** ✓ value of/*waarde van* i^2 **A** ✓ value of current/*waarde van.* *stroom* **CA** **NPU** (5)	
1.5	$\begin{array}{rrrr} & 1 & 0 & 1_2 \\ \times & & 1 & 1_2 \\ \hline & 1 & 0 & 1_2 \\ + 1 & 0 & 1 & 0_2 \\ \hline 1 & 1 & 1 & 1_2 \end{array}$ **OR/*OF*** $101_2 \times 11_2 = 5 \times 3 = 15$ **OR / *OF*** 1111_2	✓ **M** **A** ✓ 1111_2 **A** **OR/*OF*** ✓ both/*beide* 5 and/*en* 3 **A** ✓ 1111_2 **OR/*OF*** 15 **A** **AO: Full marks/*Volpunte*** (2) **[25]**	

QUESTION/*VRAAG* 2

2.1.1	$G = \sqrt{\dfrac{p+1}{2p-1}}$ $2p - 1 = 0$ $\therefore p = \dfrac{1}{2}$	$\checkmark\ p = \dfrac{1}{2}$ **A** (1)	
2.1.2	$p + 1 = 0$ $p = -1$	$\checkmark\ \ p = -1$ **A** (1)	
2.2	$x^2 - k + 4 = 5x$ $x^2 - 5x - k + 4 = 0$ $b^2 - 4ac \geq 0$ $(-5)^2 - 4(1)(-k+4) \geq 0$ $25 + 4k - 16 \geq 0$ $4k + 9 \geq 0$ $k \geq -\dfrac{9}{4}$	$\checkmark$standard form/ *standard vorm* **A** $\checkmark$ the discriminant/*die diskriminant* ≥ 0 **A** $\checkmark$ **SF** **A** $\checkmark$**S** **CA** $\checkmark$ values of/*waardes van k* **CA** (5) **[7]**	

QUESTION/*VRAAG* 3

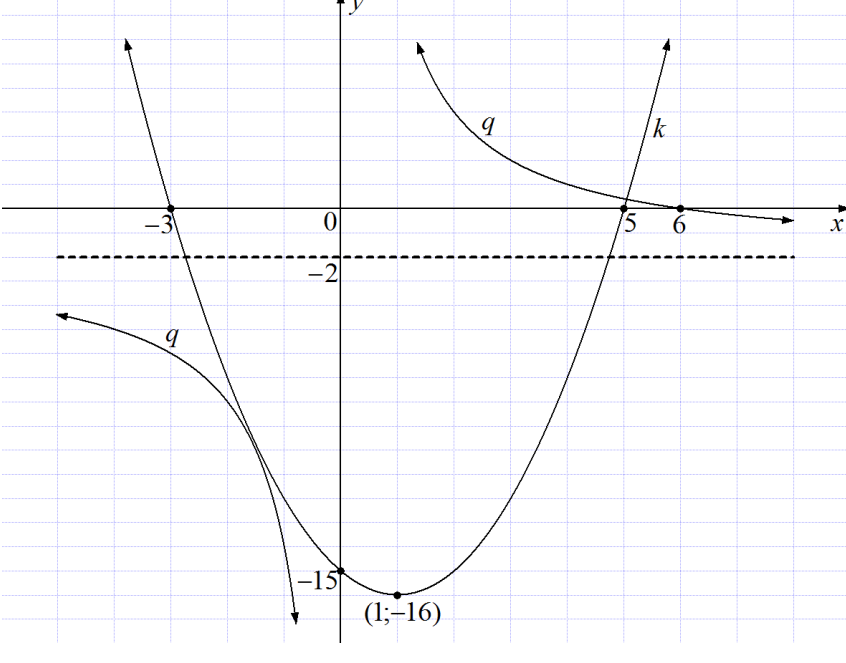| 3.1	$\left(-2\sqrt[4]{a^3}\right)^8$ $= (-2)^8 \left(a^3\right)^{\frac{8}{4}}$ $= 256a^6$	✓ 256 **A** ✓ a^6 **A** (2)	
3.2 #	$\log_2(3x-2)+\log_2 0{,}5 = 3$ $\log_2(3x-2)+\log_2 2^{-1} = 3$ $\log_2(3x-2) - 1 = 3$ $\log_2(3x-2) = 4$ $(3x-2) = 2^4$ $3x-2 = 16$ $x = 6$ **OR/*OF*** $\log_2(3x-2)+\log_2 0{,}5 = 3$ $\log_2 (0{,}5)(3x-2) = 3$ $(0{,}5)(3x-2) = 2^3$ $(0{,}5)(3x-2) = 8$ $3x-2 = 16$ $x = 6$ **OR/*OF*** $\log_2(3x-2)+\log_2 0{,}5 = 3$ $\log_2 (3x-2) = 3 - \log_2 0{,}5$ $\log_2 (3x-2) = 3\log_2 2 - \log_2 0{,}5$ $\log_2 (3x-2) = \log_2 8 - \log_2 0{,}5$ $\log_2(3x-2) = \log_2\left(\dfrac{8}{0{,}5}\right)$ $3x-2 = 16$ $x = 6$ **OR/*OF***	✓ $\log_2 0{,}5 = -1$ **A** ✓ **S** **CA** ✓ exponential form/*eksponent vorm* **CA** ✓ correct value/*korrekte waarde* **CA** **OR/*OF*** ✓ log property/*eienskap* **A** ✓ exponential form/*eksponent vorm* **A** ✓ **S** **CA** ✓ correct value/*korrekte waarde* **CA** **OR/*OF*** ✓ log property/*eienskap* **A** ✓ log property/*eienskap* **A** ✓ **S** **CA** ✓ correct value/*korrekte waarde* **CA**	

$\log_2 0,5(3x-2) = \log_2 2^3$	**OR/*OF***
$\log_2 0,5(3x-2) = \log_2 8$	✓log property/*eienskap* **A**
$0,5(3x-2) = 8$	✓ log property/*eienskap* **A**
$3x-2 = 16$	✓ **S** **CA**
$x = 6$	✓correct value/*korrekte waarde* **CA**
OR/*OF*	**OR/*OF***
$\log_2(3x-2) + \log_2 0,5 = 3$	
$\log_2(3x-2) - \log_2 2 = 3$	✓log property/*eienskap* **A**
$\log_2 \dfrac{(3x-2)}{2} = 3$	
$\dfrac{(3x-2)}{2} = 2^3$	✓ log property/*eienskap* **A**
$3x-2 = 16$	✓ **S** **CA**
$x = 6$	✓correct value/*korrekte waarde* **CA**
	(4)

3.3	$\log\sqrt{0,6}$		
	$=\log\left(0,6\right)^{\frac{1}{2}}$ **OR/*OF*** $\log\left(0,3\times2\right)^{\frac{1}{2}}$ **OR/*OF*** $\log\left(0,2\times3\right)^{\frac{1}{2}}$	✓ exp. form/*eksp. vorm* **A**	
	$=\dfrac{1}{2}\log\left(\dfrac{6}{10}\right)$ **OR/*OF*** $\dfrac{1}{2}\log\left(0,3\times2\right)$ **OR/*OF*** $\dfrac{1}{2}\log\left(0,2\times3\right)$	✓ conversion of / *herleiding van* 0,6 **A**	
	$=\dfrac{1}{2}\log\left(\dfrac{3\times2}{10}\right)$		
	$=\dfrac{1}{2}\left(\log3+\log2-\log10\right)$	✓ log property/*eienskap* **A**	
	$=\dfrac{1}{2}\left(b+a-1\right)$ **OR/*OF*** $\dfrac{1}{2}b+\dfrac{1}{2}a-\dfrac{1}{2}$	✓ $\log10=1$ **CA** ✓ substitution/*vervanging* **CA**	
	OR/*OF*	**OR/*OF***	
	$\log\sqrt{0,6}=\log\sqrt{\dfrac{3}{5}}$	✓ conversion of / *herleiding van* 0,6 **A**	
	$=\dfrac{1}{2}\log3-\dfrac{1}{2}\log5$	✓ log property/*eienskap* **A**	
	$\therefore\log\sqrt{0,6}=\dfrac{1}{2}\log3+\dfrac{1}{2}\left(\log2-\log10\right)$	✓ conversion of log 5 **A**	
	$=\dfrac{1}{2}\left(b+a-1\right)$ **OR/*OF*** $\dfrac{1}{2}b+\dfrac{1}{2}a-\dfrac{1}{2}$	✓ $\log10=1$ **CA** ✓ substitution/*vervanging* **CA**	
		(5)	
3.4.1	$V=2\left(\cos240°+i\sin240°\right)$ **OR/*OF*** $V=2\left(\cos\frac{3}{4}\pi+i\sin\frac{3}{4}\pi\right)$	✓ value of/ *waarde van* V **A** (1)	

3.4.2	$V = 2\left(\cos 240° + i \sin 240°\right)$ **OR/*OF*** $$V = 2\left(\cos \tfrac{3}{4}\pi + i \sin \tfrac{3}{4}\pi\right)$$ $$V = 2\left(-\frac{1}{2} - \frac{\sqrt{3}}{2}i\right)$$ $$\therefore V = -1 - \sqrt{3}\,i$$ **OR/*OF*** $\theta = 60°$ [ref angle/ *verw. hoek*] $$\tan 60° = \sqrt{3} = \frac{-\sqrt{3}}{-1}$$ $$V = -1 - \sqrt{3}\ i$$	**CA from/*vanaf*** **Q/V3.4.1** ✓ value of/*waarde van* $\cos 240°$ OR/*OF* $\cos \dfrac{3}{4}\pi$ **CA** ✓ value of/*waarde van* $\sin 240°$ OR/*OF* $\sin \dfrac{3}{4}\pi$ **CA** ✓ V in rect. form/ *in regh.vorm* **CA** **OR/*OF*** ✓ ref. angle/*verw. hoek* **A** ✓ tan ratio/verhouding **A** ✓ V in rect form/ *in regh.vorm* **CA** **AO: Full marks/*Volpunte*** (3)
3.5	$m + ni = 2(6 - 4i) - (-7i)$ $\quad = 12 - 8i + 7i = 12 - i$ $\quad m = 12$ and/ *en* $n = -1$ **OR/*OF*** $m = 2(6) = 12$ and / *en* $n = 2(-4) - (-7) = -1$	✓ value of *m*/ *waarde van m* **A** ✓ value of *n*/ *waarde van n* **A** **OR/OF** ✓ value of *m*/ *Waarde van m* **A** ✓ value of *n*/ *Waarde van n* **A** (2) **AO: Full marks/*Volpunte***
		[17]

QUESTION/*VRAAG* 4

4.1.1	$(x-5)(x+3)=0$ $x=5$ or/*of* $x=-3$ **OR/OF** $(5;0)$ and /*en* $(-3;0)$	✓ both values of/ *beide waardes van x* **A** (1)	
4.1.2	$q(x)=\dfrac{12}{x}-2$ $\dfrac{12}{x}-2=0$ $2x=12$ $x=6$ **OR /OF** $(6;0)$ **OR/OF** $q(x)=\dfrac{a}{x}+p$ $x=\dfrac{a}{-p}$ $\quad [q(x)=0]$ $\quad =\dfrac{12}{-(-2)}$ $\quad =6$ **OR /OF** $(6;0)$	✓ $y=0$ **A** ✓ x - value/*waarde* **CA** **OR/OF** ✓ $y=0$ **A** ✓ x - value/*waarde* **CA** (2) **AO**: Full marks /*Volpunte*	

4.1.3	$x = \dfrac{5-3}{2} = 1$	✓ **M** **CA**
		✓ $x = 1$ **A**
	$k(1) = (1-5)(1+3) = -16$	✓ $y = -16$ **CA**
	$\therefore$ TP/*DP* $(1; -16)$	
	OR / *OF*	**OR/*OF***
	$(x-5)(x+3) = 0$	
	$x^2 - 2x - 15 = 0$	
	$x = \dfrac{-b}{2a} = \dfrac{-(-2)}{2(1)} = 1$	✓ **M** **CA**
		✓ $x = 1$ **A**
	$k(1) = (1)^2 - 2(1) - 15 = -16$ **OR / *OF***	
	$y = \dfrac{4ac - b^2}{4a} = \dfrac{4(1)(-15) - (-2)^2}{4(1)} = -16$	✓ $y = -16$ **A**
	$\therefore$ TP/*DP* $(1; -16)$	
	OR/*OF*	**OR/*OF***
	$k'(x) = 2x - 2$	✓ **M** **A**
	$2x - 2 = 0$	✓ $x = 1$ **A**
	$\therefore \ x = 1$	✓ $y = -16$ **CA**
	$k(1) = (1)^2 - 2(1) - 15 = -16$	**(3)**
	$\therefore$ TP/*DP* $(1; -16)$	
4.1.4	$y = -2$	✓ $y = -2$ **A**
	$x = 0$	✓ $x = 0$ **A**
		(2)
4.1.5		*Graph / grafiek k*:
		✓ x-intercepts/*afsnitte* **CA**
		✓ y-intercept/*afsnitte* **CA**
		✓ shape/*vorm* **A**
		✓ turning point/ *draaipunt* **CA**
		Graph / grafiek q:
		✓ hor. asympt/*asimpt* **A**
		✓ x-intercepts/*afsnit* **CA**
		✓ shape/*vorm* **A**
		(7)

4.2.1	$d = -4$	✓ value of/*waarde van d* **A** Accept/ Aanvaar $y = -4$ (1)
4.2.2	$h(x) = a^x - 4$ $-2 = a^{-1} - 4$ $a = \dfrac{1}{2}$ $\therefore h(x) = \left(\dfrac{1}{2}\right)^x - 4$	✓ substitution/*vervanging* **CA** ✓ correct value of/ *korrekte waarde van a* **CA** (2)
4.2.3	$h(0) = a^0 - 4$ **OR**/**OF** $h(0) = (0,5)^0 - 4$ $T(0\,;-3)$	✓ $x = 0$ **A** ✓ $y = -3$ **CA** (2)
4.2.4	$y \in [-3\,;0]$ **OR**/**OF** $-3 \le y \le 0$	✓ range/ *waardeversm(terrein)* **CA** (1)
4.2.5	$p(x) = -\sqrt{9 - x^2}$ $\therefore w(x) = \sqrt{9 - x^2}$ **OR**/**OF** $\therefore w(x) = \sqrt{r^2 - x^2}$	✓ equation of/ *vergelyking van p* **CA** ✓ equation of/ *vergelyking van w* **CA** (2) **AO: Full marks/*Volpunte***
4.2.6	$0 < x \le 3$ **OR**/**OF** $x \in (0\,;3]$	✓ endpoints/*eindpunte* **A** ✓ correct notation/ *korrekte notasie* **A** (2) **[25]**

QUESTION/*VRAAG* 5

5.1.1	R11 000	✓ new value/ *nuwe waarde* **A**	
		(1)	
5.1.2	$A = R5\,500 \quad P = R11\,000 \quad n = 5 \quad i = ?$ $$A = P(1 - in)$$ $$R5\,500 = R11\,000(1 - i \times (5))$$ $$i = \frac{\dfrac{R5\,500}{R11\,000} - 1}{-5}$$ $$= 0,10$$ $$= 10\%$$	✓**SF** **CA** ✓ making i the subject/ *maak i die onderwerp* **CA** ✓ interest rate/ *rentekoers* **CA** **AO: Full marks/*Volpunte***	
		(3)	
5.2 #	$$A = P(1 + i)^n$$ $$273 = 200(1 + 3,5\%)^n$$ $$\frac{273}{200} = (1,035)^n$$ $$n = \frac{\log \dfrac{273}{200}}{\log(1,035)} \quad \textbf{OR}/\textit{OF} \quad n = \log_{1,035} \frac{273}{200}$$ $$\approx 9,04 \text{ years}/\textit{jaar}$$ $\therefore$ the year 2018 / *die jaar* 2018 **OR/*OF*** $$A_1 = R200(1 + 3,5\%)^1 \approx R207$$ $$A_2 = R200(1 + 3,5\%)^2 \approx R214,25$$ . . $$A_9 = R200(1 + 3,5\%)^9 \approx R272,58$$ $$A_{10} = R200(1 + 3,5\%)^{10} \approx R282,12$$ $\therefore$ the year 2018 / *die jaar 2018*	✓**SF** **A** ✓**S** **CA** ✓ log property/ *eienskap* **CA** ✓ value of/*waarde van* n **CA** ✓ correct year/ *korrekte jaar* **CA** **OR/*OF*** ✓**SF** **A** ✓**S** **CA** ✓**SF** **A** ✓**S** **CA** ✓ correct year/ *korrekte jaar* **CA** **NOTE/*NOTA*:** **Accept/*Aanvaar* 2019** **NPR**	
		(5)	

5.3
 	
 #
	Value of the investment after initial deposit/
	 waarde van die belegging na die aanvangs deposito:
	
	 $A = P(1+i)^n$
	
	 $= R293\,000\left(1+\dfrac{6,7\%}{4}\right)^{2\times4}$
	
	 $\approx R334\,642,4791$
	
	 $R334\,642,4791 + R95\,000 = R429\,642,4791$
	
	 Value of the investment after adding/*waarde van die belegging na byvoeging van* R95 000 :
	
	 $= 429\,642,4791\left(1+\dfrac{6,7\%}{4}\right)^{2\times4}$
	
	 $\approx R490\,705,2026$
	
	 Value of the investment after change in interest rate/*waarde van die belegging na verandering van rentekoers* :
	
	 $= R490\,705,2026\left(1+\dfrac{7,5\%}{12}\right)^{4\times12}$
	
	 $\approx \quad R661\,764,62 > R660\,580$
	
	 $\therefore$ Yes she has accumulated sufficient funds./*Ja, sy het genoeg fondse geakkumuleer*
	
	 <center>**OR/*OF***</center>
	
	 $A=\left[293\,000\left(1+\dfrac{6,7\%}{4}\right)^{2\times4}+95\,000\right]$
	
	 $\qquad\qquad\times\left(1+\dfrac{6,7\%}{4}\right)^{2\times4}\left(1+\dfrac{7,5\%}{12}\right)^{4\times12}$
	
	 $\approx R661\,764,62 > R660\,580$
	
	 $\therefore$ Yes she has accumulated sufficient funds./
	 Ja, sy het genoeg fondse geakkumuleer
	
	 <center>**OR/*OF***</center>
		✓**SF** **A**
		
		 ✓ **S** **CA**
		
		 ✓ **S** **CA**
		
		 ✓**SF** **A**
		
		 ✓ **S** **CA**
		
		 ✓ value of i and *n/*
		    waarde van i en n
		                  A
		 ✓ **S** **CA**
		
		 ✓ conclusion/
		  gevolgtrekking **CA**
		
		 <center>**OR/*OF***</center>
		 ✓ **M** **A**
		 ✓✓**SF** **A**
		 ✓ value of i and *n/*
		    waarde van i en n
		                  A
		 ✓adding/*byvoeging*
		  R95 000 **A**
		 ✓change of rate/
		  verandering van
		  koers **A**
		 ✓**S** **CA**
		 ✓ conclusion/
		 gevolgtrekking **CA**
		
		 <center>**OR/*OF***</center>	

$$A = R293\,000\left(1+\frac{6,7\%}{4}\right)^{4\times4}\cdot\left(1+\frac{7,5\%}{12}\right)^{4\times12}$$

$$+R95\,000\left(1+\frac{6,7\%}{4}\right)^{2\times4}\left(1+\frac{7,5\%}{12}\right)^{4\times12}$$

✓ **M**	**A**
✓✓**SF**	**A**
✓ value of i and n/ *waarde van i en n*	
	A
✓adding/*byvoeging* R95 000 with interests/*met rente*	
	A
✓change of rate/ *verandering van koers*	**A**
✓**S**	**CA**
✓ conclusion/ *gevolgtrekking*	
	CA

$\approx$ R 661 764 , 62 $>$ R 660 580

$\therefore$ Yes she has accumulated sufficient funds./
Ja, sy het genoeg fondse geakkumuleer

OR/OF

$$P = R660\,580\left(1+\frac{6,7\%}{4}\right)^{-4\times2}\cdot\left(1+\frac{7,5\%}{12}\right)^{-4\times12}$$

$$-R95\,000\left(1+\frac{6,7\%}{4}\right)^{2\times4}\left(1+\frac{7,5\%}{12}\right)^{4\times12}$$

OR/*OF*

✓ **M**	**A**
✓✓**SF**	**A**
✓ value of i and n/ *waarde van i en n*	
	A
✓subtracting R95 000 with interests	**A**
✓change of rate/ *verandering van koers*	**A**
✓**S**	**CA**
✓ conclusion/ *gevolgtrekking*	**CA**

$\approx$ R 282 547 , 91 $<$ R 293 000

Yes she has accumulated sufficient funds./
Ja, sy het genoeg fondse geakkumuleer

OR/*OF*

$$1 + i_{eff} = \left(1+\frac{i_{nom}}{m}\right)^{m} = \left(1+\frac{6,7\%}{4}\right)^{4} \approx 0,068...$$

2 years/ *jaar*:

$$A = P(1+i)^{n} = R293\,000(1+0,068...)^{2} + R95\,000$$

$$\approx R\,429\,642,48$$

4th year/ *jaar*:

$$A = R429\,642,48\,(1+0,068...)^{2} \approx R490\,705,20$$

5 – 8 years/ *jaar*:

$$A = R490\,705,20\left(1+\frac{7,5\%}{12}\right)^{4\times12} \approx R661\,764,62 > R660\,580$$

$\therefore$ Yes she has accumulated sufficient funds./
Ja, sy het genoeg fondse geakkumuleer

OR/OF

OR/OF

✓**SF**	**A**
✓ **S**	**CA**
✓ **SF**	**CA**
✓**S**	**CA**
✓ **S**	**CA**
✓ value of i and n/ *waarde van i en n*	
	A
✓ **S**	**CA**

$$A = P(1+i)^n$$

$$A_0 = R\,293\,000\left(1+\frac{0,067}{4}\right)^{4\times4}$$

$$\approx R\,382\,203,3749$$

$$A_1 = R\,382\,203,3749\left(1+\frac{0,075}{12}\right)^{4\times12}$$

$$\approx R\,515\,439,147$$

$$A_2 = R\,95\,000\left(1+\frac{0,067}{4}\right)^{2\times4}$$

$$\approx R\,108\,501,8277$$

$$A_3 = R\,108\,501,8277\left(1+\frac{0,075}{12}\right)^{4\times12}$$

$$\approx R\,146\,325,4728$$

$$A_1 + A_3 \approx R\,661\,764,62 > R\,660\,580$$

$\therefore$ Yes she has accumulated sufficient funds./
   Ja, sy het genoeg fondse geakkumuleer

✓ conclusion/ *gevolgtrekking* **CA** **OR/OF**	
✓**SF**	**A**
✓ **S**	**CA**
✓**SF**	**A**
✓ **S**	**CA**
✓ **S**	**CA**
✓ value of *i* and *n*/ *waarde van i en n*	**A**
✓ **S**	**CA**

NOTE/*NOTA*:
1) **Max. 4 marks if Simple Interest is used./**
   Maks 4 punte indien enkelvoudige rente
2) **Max. 2 marks if any Depreciation is used./**
   Maks 2 punte indien enkelvoudige rente

(8)
[17]

QUESTION/*VRAAG* 6

6.1	$f(x) = 5 - \dfrac{1}{2}x$ $f'(x) = \displaystyle\lim_{h\to 0} \dfrac{f(x+h) - f(x)}{h}$ $= \displaystyle\lim_{h\to 0} \dfrac{\left[\left(5 - \dfrac{1}{2}(x+h)\right)\right] - \left(5 - \dfrac{1}{2}x\right)}{h}$ $= \displaystyle\lim_{h\to 0} \dfrac{5 - \dfrac{1}{2}x - \dfrac{1}{2}h - 5 + \dfrac{1}{2}x}{h}$ $= \displaystyle\lim_{h\to 0} \dfrac{-\dfrac{1}{2}h}{h}$ $= \displaystyle\lim_{h\to 0}\left(-\dfrac{1}{2}\right)$ $\therefore f'(x) = -\dfrac{1}{2}$	✓ definition/*definisie* **A** ✓ **SF** **A** ✓ **S** **CA** ✓ $\displaystyle\lim_{h\to 0}\dfrac{-\dfrac{1}{2}h}{h}$ **CA** ✓ $-\dfrac{1}{2}$ **CA** **AO: ONLY 1 mark/** **SLEGS 1** *punt* **Penalty of 1 mark for incorrect notation/** *penaliseer 1 punte vir verkeerde notasie* (5)	
	No penalty for notation in the remaining questions/ *Geen penaliseering vir notasie in die*		
6.2.1	$f(x) = a^3 - 0,5x^3 - x^{-1}$ $f'(x) = 0 - 1,5x^2 + x^{-2}$ **OR**/*OF* $-1,5x^2 + x^{-2}$	✓ derivative of/ *afgeleide van* a^3 **A** ✓ $-1,5x^2$ **A** ✓ x^{-2} **A** (3)	
6.2.2	$D_x\left[x\left(\sqrt{x} + 2\right)\right]$ $= D_x\left[x\left(x^{\frac{1}{2}} + 2\right)\right]$ $= D_x\left[x^{\frac{3}{2}} + 2x\right]$ $= \dfrac{3}{2}x^{\frac{1}{2}} + 2$	✓ $x^{\frac{1}{2}}$ **A** ✓ product/*produk* **CA** ✓ $\dfrac{3}{2}x^{\frac{1}{2}}$ **CA** ✓ 2 **CA** (4)	

6.3.1	$xy + 2x^3 = 7x^6$ $$y = \frac{7x^6 - 2x^3}{x} \quad \textbf{OR / OF} \quad y = 7x^5 - 2x^2$$	✓**M** **A** ✓ making y the subject/*maak y die onderwerp* **A** (2)
6.3.2	$y = 7x^5 - 2x^2$ $$\frac{dy}{dx} = 35x^4 - 4x$$	✓ $35x^4$ **CA** ✓ $-4x$ **CA** (2)
6.4.1	$P(300) = 0,8(300)^2 - 200(300)$ $\qquad = R\,12\,000$	✓profit/*wins* **A** (1)
6.4.2	$P(x) = 0,8x^2 - 200x$ $0,8x^2 - 200x = 0$ $x(0,8x - 200) = 0$ $x = 0$ or $x = 250$ $\therefore 250$ light bulbs/*gloeilampe* **OR/OF** $0,8x^2 - 200x = 0$ $0,8x^2 = 200x$ $x = \frac{200x}{0,8x} \quad ; \quad x \neq 0$ $\therefore x = 250$ $\therefore 250$ light bulbs/*gloeilampe*	✓ factors/*faktore* **M** **A** ✓correct value of/*korrekte waarde van* x **CA** **OR/OF** ✓ isolating/ *isoleer* x **M** **A** ✓correct value of/*korrekte waarde van* x **CA** AO: Full marks/*Volpunte* (2)
6.4.3	$P(x) = 0,8x^2 - 200x$ $P'(x) = 1,6x - 200$ $P'(200) = 1,6(200) - 200$ $\qquad = 120$ bulbs per day / *gloeilampe per dag*	✓derivative/*afgeleide* **A** ✓ substitution/*vervanging* **CA** ✓rate/*tempo* **CA** NPU (3) **[22]**

QUESTION/*VRAAG* 7

7.1	$g(x) = 9x + 18$	
	x-intercept/ *afsnit*, $g(x) = 0$	
	$0 = 9x + 18$	✓ $0 = 9x + 18$ **A**
	$-9x = 18$	
	$x = -2$	
	$Q(-2 ; 0)$	✓ coordinates of/*koördinate van* Q **A**
	y-intercept/*afsnit*, $x = 0$	✓ coordinates of/*koördinate van* T **A**
	$T(0 ; 18)$	
	OR / *OF*	**OR/*OF***
	$(x + 2)(x - 3)(x - 3) = 0$	✓ **M** **A**
	$Q(-2 ; 0)$	✓ coordinates of/*koördinate van* Q **A**
	y-intercept/*afsnit*, $x = 0$	
	$T(0 ; 18)$	✓ coordinates of/*koördinate van* T **A**
		(3)
		AO: Full marks/*Volpunte*
7.2	$f(x) = (x + 2)(x - 3)(x - 3)$	✓ repeated factor/*herhalde faktor* **A**
	$\quad = (x + 2)(x^2 - 6x + 9)$ **OR/*OF*** $(x - 3)(x^2 - x - 6)$	✓ quadratic factor/ *kwadratiese faktor* **A**
	$f(x) = x^3 - 4x^2 - 3x + 18$	✓ expanding/ *uitbrei* **A**
	$b = -4 \quad c = -3 \quad d = 18$	
	OR/*OF*	**OR/*OF***
	$f(x) = x^3 + bx^2 + cx + d$	
	$f(x) = x^3 + bx^2 + cx + 18$	✓ $d = 18$ **A**
	$f(-2) = 0: \quad 2b - c = -5 \quad$ ....(1)	
	$f(3) = 0: \quad \quad 3b + c = -15 \quad$ .... (2)	✓ **S** **A**
	$\quad (1) + (2): \quad 5b = -20$	
	$\quad \quad \quad \therefore b = -4$	✓ **S** **A**
	$\quad 2(-4) - c = -5$	
	$c = -3$	
	OR/OF	**OR/OF**

	$f(x) = x^3 + bx^2 + cx + d$ $f(x) = x^3 + bx^2 + cx + 18$ $0 = (3)^3 + b(3)^2 + c(3) + 18$ $0 = 45 + 9b + 3c$ $c = -15 - 3b$ $f'(c) = 3x^2 + 2bx + c$ $f'(3) = 3(3)^2 + 2b(3) + c$ $c = -27 - 6b$ $-15 - 3b = -27 - 6b$ $\therefore b = -4$ $c = -27 - 6(-4)$ $\therefore c = -3$	✓ $d = 18$ **A** ✓ **S** **A** ✓ **S** **A** (3)	
7.3	$f(x) = x^3 - 4x^2 - 3x + 18$ $f'(x) = 3x^2 - 8x - 3 = 0$ $3x^2 - 8x - 3 = 0$ $(3x + 1)(x - 3) = 0$ **OR**/*OF* $x = \dfrac{-(-8) \pm \sqrt{(-8)^2 - 4(3)(-3)}}{2(3)}$ $x = -\dfrac{1}{3}$ or/*of* $x \neq 3$ $y = f\left(-\dfrac{1}{3}\right) = \left(-\dfrac{1}{3}\right)^3 - 4\left(-\dfrac{1}{3}\right)^2 - 3\left(-\dfrac{1}{3}\right) + 18 = \dfrac{500}{27}$ $\therefore R\left(-\dfrac{1}{3}; \dfrac{500}{27}\right)$ **OR**/*OF* $R(-0,33; 18,52)$	✓ $f'(x)$ **CA** ✓ $f'(x) = 0$ **CA** ✓factors/formula/*faktore/form* **CA** ✓ correct value of/*korrekte waarde van* x **CA** ✓ R coordinates/*koördinate* **CA** (5)	
7.4.1	$y = \dfrac{500}{27}$ **OR**/*OF* $y \approx 18,52$	✓equation/*vergelyking* **CA** (1)	
7.4.2	$x > -2$ **OR**/*OF* $x \in (-2; \infty)$	✓correct inequality/*korrekte ongelykheid* **A** (1)	
7.4.3	$-\dfrac{1}{3} < x < 3$ **OR**/*OF* $x \in \left(-\dfrac{1}{3}; 3\right)$	✓ critical values/*kritiese waardes* **CA** ✓ correct notation/*korrekte notasie* **CA** (2) **[15]**	

QUESTION/*VRAAG* 8

8.1	$h = (66 - 2x - x)\,\text{cm}$ $\quad = (66 - 3x)\,\text{cm}$	✓ height/*hoogte* **A** (1) **NPU**	
8.2	$V\left(\text{in cm}^3\right) = \pi r^2 h + \dfrac{1}{2}\left(\dfrac{4}{3}\pi r^3\right)$ $\quad = \pi x^2 (66 - 3x) + \dfrac{1}{2}\left(\dfrac{4}{3}\pi x^3\right)$ $\quad = 66\pi x^2 - 3\pi x^3 + \dfrac{2}{3}\pi x^3$ $\quad = 66\pi x^2 - \dfrac{7}{3}\pi x^3$	✓ **F** **A** ✓ **SF** **CA** ✓ **S** **CA** **NPU** (3)	
8.3	$V\left(\text{in cm}^3\right) = 66\pi x^2 - \dfrac{7}{3}\pi x^3$ $\dfrac{dV}{dx} = -7\pi x^2 + 132\pi x$ $0 = -7\pi x^2 + 132\pi x$ $0 = -\pi x(7x - 132)$ **OR** / **OF** $\ x = \dfrac{-(132\pi) \pm \sqrt{(132\pi)^2 - 4(-7\pi)(0)}}{2(-7\pi)}$ $-\pi x = 0\ \ \text{or/}of\ \ x = \dfrac{132}{7}$ $\qquad x \neq 0$ $\therefore x = \dfrac{132}{7}$	✓ derivative/*afgeleide* **CA** ✓ equating $f^{/}(x)$ to/*stel gelyk aan* 0 **A** ✓ factors/ formula *faktore/form* **CA** ✓ correct value of/ *korrekte waarde van x* **CA** (4)	
8.4	$V\left(\text{in cm}^3\right) = 66\pi x^2 - \dfrac{7}{3}\pi x^3$ $\quad = 66\pi\left(\dfrac{132}{7}\right)^2 - \dfrac{7}{3}\pi\left(\dfrac{132}{7}\right)^3$ $\quad \approx 24\,576{,}74$ **OR/*OF*** $7823{,}02\,\pi$	✓ **SF** **CA** ✓ max/*maks* volume **CA** **NPR** (2) **[10]**	

QUESTION/*VRAAG* 9

9.1.1	$\int m\,x^p\,dx$			
	$= m\left(\dfrac{x^{p+1}}{p+1}\right) + \text{C} \qquad p \neq -1$	✓ $m\left(\dfrac{x^{p+1}}{p+1}\right)$	**A**	
		✓ C	**A**	
	OR/*OF*	**OR/*OF***		
	$= \dfrac{mx^{p+1}}{p+1} + \text{C} \qquad p \neq -1$	✓ $\dfrac{mx^{p+1}}{p+1}$	**A**	
		✓ C	**A**	
			(2)	
9.1.2	$\int\left(\dfrac{x^{-3}+x^2}{x^{-1}} - 2\right)dx$			
	$= \int\left(x^{-2}+x^3-2x^0\right)dx$	✓ S	**A**	
	$= -x^{-1} + \dfrac{x^4}{4} - 2x^1 + \text{C}$	✓ $-1x^{-1}$	**CA**	
		✓ $\dfrac{x^4}{4}$	**CA**	
		✓ $-2x^1 + \text{C}$	**CA**	
			(4)	

9.2	$A = \int_{1,4}^{3,5}\left(-\dfrac{4}{x}\right)dx$	✓area notation using integral/ *oppervlakte notasie deur gebruik van integrasie* **A**
	$= \left[-4\ln x\right]_{1,4}^{3,5}$	✓ integral/*integraal* **A**
	$= \left[-4\ln(3,5)\right] - \left[-4\ln(1,4)\right]$	✓ substitution/*vervanging* **CA** ✓ substitution/*vervanging* **CA** ✓ **S** **CA**
	$\approx -3,67$	
	$\therefore 3,67$ square units *vierkante eenhede*	✓ correct positive value of the bounded area/ *korrekte positiewe waarde van die begrensde oppervlakte* **CA**
	OR/OF	**OR/OF**
	$A = -\int_{1,4}^{3,5}\left(-\dfrac{4}{x}\right)dx$	✓area notation using integral/ *oppervlakte notasie deur gebruik van integrasie* **A**
	$= -\left[-4\ln x\right]_{1,4}^{3,5}$	✓ integral/*integraal* **A**
	$= \left[4\ln(3,5)\right] - \left[4\ln(1,4)\right]$	✓ substitution/*vervanging* **CA** ✓ substitution/*vervanging* **CA**
	$\approx 3,67$	✓ **S** **CA**
	$\therefore 3,67$ square units/ *vierkante eenhede*	✓ correct positive value of the bounded area/*korrekte positiewe waarde van die begrensde oppervlakte* **CA** ✓ correct positive value of the
	OR/OF	**OR/OF**
	$A = \int_{1,4}^{3,5}\left[0-\left(-\dfrac{4}{x}\right)\right]dx$	✓area notation using integral/ *oppervlakte notasie deur gebruik van integrasie* **A**
	$= \int_{1,4}^{3,5}0\,dx + \int_{1,4}^{3,5}\left(\dfrac{4}{x}\right)dx$	✓ integral/*integraal* **A**
	$= \left[4\ln x\right]_{1,4}^{3,5}$	
	$= \left[4\ln(3,5)\right] - \left[4\ln(1,4)\right]$	✓ substitution/*vervanging* **CA** ✓ substitution/*vervanging* **CA**
	$\approx 3,67$	✓ **S** **CA**
	$\therefore 3,67$ square units/ *vierkante eenhede*	✓ correct positive value of the bounded area/*korrekte positiewe waarde van die begrensde oppervlakte* **CA**
		NPR & NPU
		(6)
		[12]

TOTAL/*TOTAAL*: 150