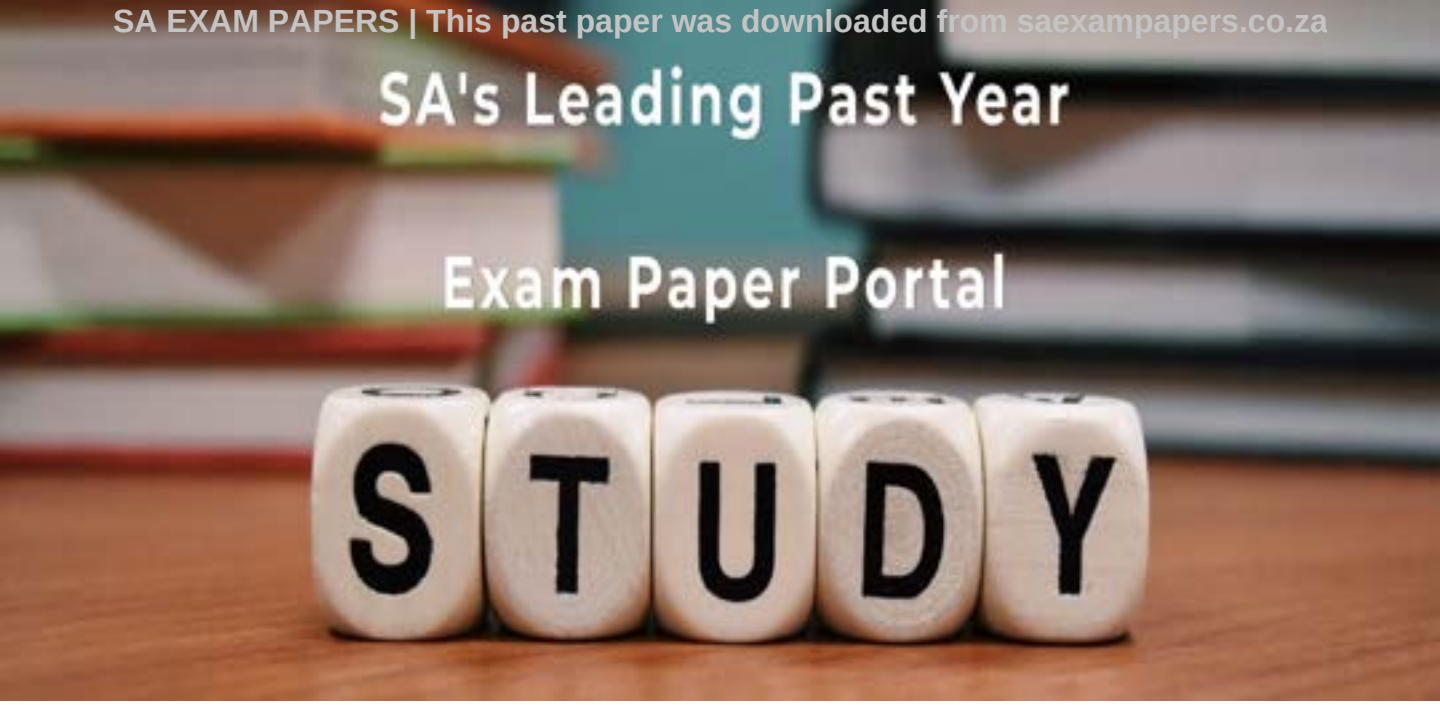


Province of the
EASTERN CAPE
EDUCATION

Iphondo leMpuma Kapa: Isebe leMfundo
Provinsie van die Oos Kaap: Department van Onderwys
Porafensie Ya Kapa Botjahabela: Lefapha la Thuto

NATIONAL SENIOR CERTIFICATE / *NASIONALE SENIORSERTIFIKAAT*

GRADE/*GRAAD* 12

SEPTEMBER 2024

TECHNICAL MATHEMATICS P1/ *TEGNIESE WISKUNDE V1* MARKING GUIDELINE/*NASIENRIGLYN*

MARKS/ *PUNTE*: 150

MARKING CODES/*NASIENKODES*	
A	Accuracy/*Akkuraatheid*
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 units omitted *Geen penalisering vir eenhede weggelaat nie*
S	Simplification/*Vereenvoudiging*
SF	Substitution in correct formula/*Vervanging in korrekte formule*

This marking guideline consist of 14 pages./
Hierdie nasienriglyn bestaan uit 14 bladsye.

NOTE:

- If a candidate answers a question TWICE, only mark the FIRST attempt.
- The method of consistent accuracy marking must be applied to all aspects of the marking guideline where applicable as indicated with the marking code **CA**.
- If a candidate strikes off a response to a question and does not attempt the question again, then the struck off question should be marked.

LET WEL:

- *Indien 'n kandidaat 'n vraag twee keer beantwoord, merk slegs die EERSTE poging.*
- *Die metode van volgehou akkuraatheidnasien moet toegepas word op alle aspekte van die nasienriglyn waar van toepassing soos aangedui met die nasiekode **CA**.*
- *Indien 'n kandidaat 'n antwoord op 'n vraag deurhaal en nie poog om die vraag nie, moet die vraag wat deur gehaal is, gemerk word.*

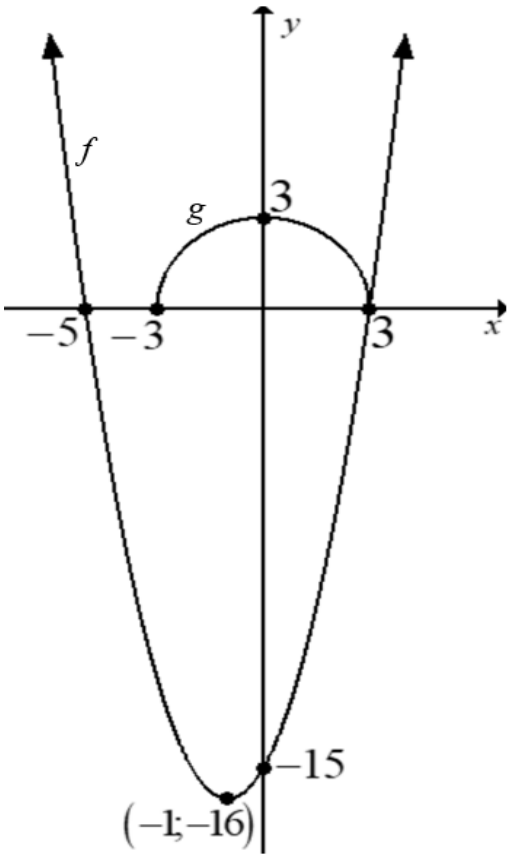
QUESTION/ *VRAAG* 1		
1.1.1	$-x(x+9)=0$ $x=0$ or $x=-9$	✓ $x=0$ **A** ✓ $x=-9$ **A** (2)
1.1.2	$x-\frac{2}{x}=0$ $x^2-2=0$ $x=\frac{-0\pm\sqrt{0^2-4(1)(-2)}}{2(1)}$ $x=\pm1,4$ **OR/*OF*** $x-\frac{2}{x}=0$ $x^2-2=0$ $x^2=2$ $x=\pm\sqrt{2}$ $x=\pm1,4$	✓ Standard form/*standaardvorm* **A** ✓ Substitution/*vervanging* **CA** ✓ $x=\pm1,4$ **CA** **OF/*OF*** ✓ Standard form/*standaardvorm* ✓ Square Root (3)
1.1.3	$2x^2+7\le 9x$ $2x^2-9x+7\le 0$ CVs/*KWs*: $(x-1)(2x-7)=0$ or/*of* $x=\frac{-(-9)\pm\sqrt{(-9)^2-4(2)(7)}}{2(2)}$ $x=1$ and/*en* $x=\frac{7}{2}$ $1\le x\le\frac{7}{2}$	✓ Standard form/*standaardvorm* **A** ✓ Factorisation/*Faktorisering* **SF** **CA** ✓ Both critical values/*beide kritiese waardes* **CA** ✓ Correct notation / *korrekte notasie* **A** (4)

1.2	$2x + 6y = -12$ ……...…...(1) $-2xy + 4y^2 - 10 = 0$ ……..…(2) $x = -3y - 6$ ……..(3) Substitute (3) into (2) *Vervang* (3) *in* (2) $-2(-3y - 6)y + 4y^2 - 10 = 0$ $6y^2 + 12y + 4y^2 - 10 = 0$ $10y^2 + 12y - 10 = 0$ $y = \frac{-(12) \pm \sqrt{(12)^2 - 4(10)(-10)}}{2(10)}$ $y = 0,57$ or/*of* $y = -1,77$ Then/*dan*: $x = -7,71$ or/*of* $x = -0,69$ **OR/*OF*** $2x + 6y = -12$ ……..(1) $-2xy + 4y^2 - 10 = 0$ …….(2) $y = -\frac{x}{3} - 2$.....(3) Substitute (3) into (2): *Vervang* (3) *in* (2) $-2x\left(-\frac{x}{3} - 2\right) + 4\left(-\frac{x}{3} - 2\right)^2 - 10 = 0$ $\frac{2}{3}x^2 + 4x + 4\left(\frac{1}{9}x^2 + \frac{4}{3}x + 4\right) - 10 = 0$ $\frac{2}{3}x^2 + 4x + \frac{4}{9}x^2 + \frac{16}{3}x + 16 - 10 = 0$ $10x^2 + 84x + 54 = 0$ $x = \frac{-(84) \pm \sqrt{(84)^2 - 4(10)(54)}}{2(10)}$ $x = -0,70$ or/*of* $x = -7,70$ $y = -\frac{(-0,70)}{3} - 2$ and/*en* $y = -\frac{(-7,70)}{3} - 2$ $y = -1,77$ and/*en* $y = 0,57$	✓ Equation/*Vergelyking* (3) **A** ✓ Substitution/*vervanging* **CA** ✓ Correct standard form/ *korrekte standaardvorm* **CA** ✓ Factors/*faktore* **CA** ✓ Both *y*–values/*beide y-waardes* **CA** ✓ Both *x*–values/*beide x-waardes* **CA** **OR/*OF*** ✓ Equation/*Vergelyking* (3) **A** ✓ Substitution/*vervanging* **CA** ✓ Correct standard form/ *korrekte standaardvorm* **CA** ✓ Factors/Substitution/*Faktore /Vervanging* **CA** ✓ Both *x*–values/*beide x-waardes* **CA** ✓ Both *y*–values/*beide y-waardes* **CA** **NPR** (6)

<table>
<tr><td>1.3.1</td><td>$W = \frac{1}{2}kx^2$
$2W = kx^2$
$x^2 = \frac{2W}{k}$
$\therefore x = \sqrt{\frac{2W}{k}}$</td><td>✓ $x^2 = \frac{2W}{k}$ A
✓ $x = \sqrt{\frac{2W}{k}}$ CA
(2)</td></tr>
<tr><td>1.3.2</td><td>$250 = \frac{1}{2}(200)x^2$
$x^2 = \frac{250 \times 2}{200}$
$x = \sqrt{\frac{500}{200}}$
$x = 1{,}58\ m$
OR/OF
$x = \sqrt{\frac{2W}{K}}$
$x = \sqrt{\frac{2 \times 250}{200}}$
$x = 1{,}58\ m$</td><td>✓ Substitution/vervanging CA
✓ x = 1,58 m CA
NPU
(2)</td></tr>
<tr><td>1.3.3</td><td>$1{,}58 \times 10^0$</td><td>✓ $1{,}58 \times 10^0$ CA
(1)</td></tr>
<tr><td>1.4.1</td><td>30</td><td>✓ 30 A
(1)</td></tr>
<tr><td>1.4.2</td><td><table><tr><td></td><td>30</td><td>Remain/Res</td></tr><tr><td>2</td><td>15</td><td>0</td></tr><tr><td>2</td><td>7</td><td>1</td></tr><tr><td>2</td><td>3</td><td>1</td></tr><tr><td>2</td><td>1</td><td>1</td></tr><tr><td>2</td><td>0</td><td>1</td></tr><tr><td></td><td></td><td></td></tr></table>$30 = 11110_2$</td><td>✓ Method/metode CA
✓ Answer/antwoord CA
(2)
AO: 2 Marks/ Punte</td></tr>
<tr><td></td><td></td><td>[23]</td></tr>
</table>

QUESTION / *VRAAG* 2		
2.1.1	$x + 9 = 0$ $x = -9$ **AO: 2 Marks/ *Punte***	✓ $x + 9 = 0$ **A** ✓ Answer/*antwoord* **CA** (2)
2.1.2	$-x + 3 < 0$ $x > 3$ **AO: 2 Marks / *Punte***	✓ $-x + 3 < 0$ **A** ✓ $x > 3$ **CA** (2)
2.2	$b^2 - 4ac > 0$ $(2q)^2 - 4(-3)(-1) > 0$ $4q^2 - 12 > 0$ $q^2 > 3$ $q > \pm\sqrt{3}$ $\therefore q > \sqrt{3}$	✓$\Delta > 0$ **A** ✓ Substitution/*Vervanging* **A** ✓ $q > \sqrt{3}$ **CA** (3)
		[7]
QUESTION / *VRAAG* 3		
3.1.1	$= \log_2 2^6$ $= 6\log_2 2$ $= 6$ **AO: NO MARK / *GEEN PUNTE***	✓ $\log_2 2^6$ **A** ✓ Answer/*antwoord* **CA** (2)
3.1.2	$= \dfrac{2^{3x-3}.3^{-x-1}}{\left(\frac{1}{2^2}\right)^{-x}.2^{x-3}.3^{x-3}.\left(3^2\right)^{-x+1}}$ $= \dfrac{2^{3x-3}.3^{-x-1}}{2^{2x}.2^{x-3}.3^{x-3}.3^{-2x+2}}$ $= 2^{3x-3-2x-x+3}.3^{-x-1-x+3+2x-2}$ $= 2^0.3^0$ $= 1$	✓ Prime factors/*priemfaktore* **A** ✓ Simplification/ *vereenvoudiging* **CA** ✓ Same base rule/*dieselfde basis reël* **CA** ✓ Simplification/ *vereenvoudiging* **CA** ✓ 1 **CA** (5)

3.1.3	$\frac{\sqrt{9\times7}-2\sqrt{16\times7}}{\sqrt{4\times7}}$ **OR /** ***OF*** $\frac{\sqrt{3^2\times7}-2\sqrt{2^2\times7}}{\sqrt{2^2\times7}}$ $=\frac{3\sqrt{7}-8\sqrt{7}}{2\sqrt{7}}$ **OR /** ***OF*** $\frac{\sqrt{7}(3-8)}{2\sqrt{7}}$ $=\frac{-5\sqrt{7}}{2\sqrt{7}}$ $=-\frac{5}{2}$	✓ Factors/*Faktore* **A** ✓ S **CA** ✓ $-\frac{5}{2}$ **CA** (3)
3.2	$\log_2(x+1)(x-1)=3$ $x^2-1=2^3$ $x^2-9=0$ $(x+3)(x-3)=0$ $x=-3$ or/*of* $x=3$ $\therefore x=3$	✓ Log property/*eienskap* **A** ✓ Standard form / *standaardvorm* **CA** ✓ Factors/*Faktore*/Substitution /*Vervanging* **CA** ✓ $x=3$ **CA** (4)
3.3.1	$\frac{\pi}{3}\times\frac{180}{\pi}=60^0$	✓ 60° **A** (1)
3.3.2	$z=2\cos60^\circ$ $z=2\cos60^\circ+i\sin60^\circ$ $=2\left(\frac{1}{2}+\frac{\sqrt{3}}{2}i\right)$ $z=1+\sqrt{3}i$	✓ $\frac{1}{2}$ **CA** ✓ $\frac{\sqrt{3}}{2}$ **CA** ✓ $z=1+\sqrt{3}i$ **CA** (3)
3.4	$p+2qi-3qi^2=5-14i$ $p+2qi-3q(-1)=5-14i$ $p+2qi+3q=5-14i$ $2qi=-14i$ $q=-7$ $p+3q=5$ $p+3(-7)=5$ $p=26$	✓ Expand/*Brei uit* **A** ✓ $i^2=-1$ **CA** ✓ Equating/*gelykstelling* **CA** ✓ $q=-7$ **CA** ✓ $p=26$ **CA** (5)
		[23]

QUESTION / *VRAAG* 4		
4.1.1	$(-1; -16)$	✓ $x = -1$ **A** ✓ $y = -16$ **A** (2)
4.1.2	$x^2 + 2x - 15 = 0$ $(x + 5)(x - 3) = 0$ $x = -5$ or/*of* $x = 3$	✓ Standard form/*standaardvorm* **A** ✓ Factors/*Faktore*/Substitution /*Vervanging* **CA** ✓ Both x–values/*Beide x-waardes* **CA** (3)
4.1.3	Range/*Waardevers*: $0 \le y \le 3$ **OR/*OF*** $y \in [0\ ;\ 3]$	✓ Correct notation/*Korrekte notasie* **A** ✓ Critical values/*Kritiese waardes* **A** (2)
4.1.4		$f(x)$: ✓ x–intercepts/*afsnitte* **CA** ✓ y–intercept/*afsnit* **CA** ✓ Turning points/*draaipunte* **CA** ✓ Shape/*vorm* **CA** $g(x)$: ✓ Intercepts / *afsnitte* **CA** ✓ Shape / *vorm* **CA** (6)

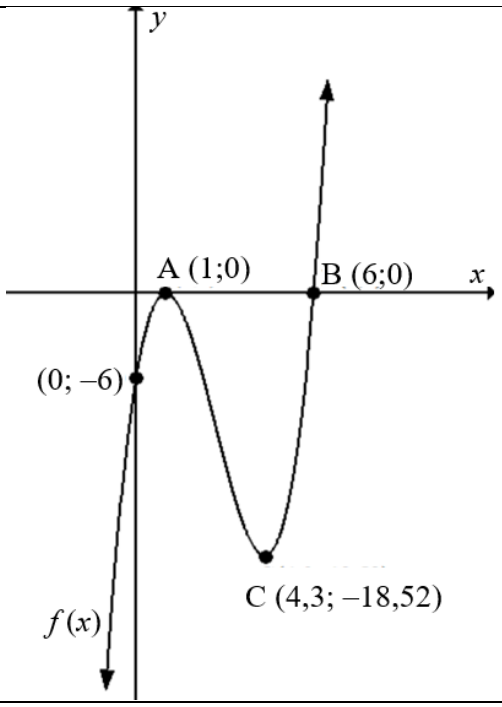
4.1.5	$x > -1$	✓ Critical value/*Kritiese waardes* ✓ Notation/*notasie*	**CA** **A** (2)
4.2.1	(4 ; 0)	✓ $y = 0$ ✓ $x = 4$	**A** **A** (2)
4.2.2	$x + p = 0$ $1 + p = 0$ $p = -1$ $q = 2$	✓ $p = -1$ ✓ $q = 2$	**A** **A** (2)
4.2.3	$k(x) = \frac{m}{x-1} + 2$ $0 = \frac{m}{-4-1} + 2$ $-2 = \frac{m}{-5}$ $m = 10$	✓ Substitution/*vervanging* ✓ Simplification/ *vereenvoudiging* ✓ $m = 10$	**A** **CA** **CA** (3)
4.2.4	$f(x) = g(x)$ $\frac{10}{x-1} + 2 = 2x - 8$ $\frac{10}{x-1} = 2x - 10$ $(x-1)(2x-10) = 10$ $x^2 - 12x + 10 - 10 = 0$ $x^2 - 12x = 0$ $x(x - 12) = 0$ $x = 0$ or/ *of* $x = 12$	✓ Equating/*gelykstelling* ✓ Simplification / vereenvoudiging ✓ Standard form/ *standaardvorm* ✓ Factors/*Faktore* ✓ $x = 0$ ✓ $x = 12$	**A** **CA** **A** **CA** **CA** **CA** (5)

4.3	$y = a^x + 1$ $4 = a^{-1} + 1$ $3 = \frac{1}{a}$ $a = 3^{-1}$ $\therefore y = 3^{-x} + 1$ **OR/*OF*** $y = \left(\frac{1}{3}\right)^x + 1$	✓ $q = 1$ **A** ✓ Substitution/*vervanging* **A** ✓ $y = 3^{-x} + 1$ **CA** (3)
		[29]
QUESTION / *VRAAG* 5		
5.1	$i_{eff} = \left(1 + \frac{i_{nom}}{m}\right)^m - 1$ $0{,}0913 = \left(1 + \frac{i}{4}\right)^4 - 1$ $i_{nom} = \left(\sqrt[4]{1 + 0{,}0913} - 1\right) \times 4$ $i_{nom} = 0{,}088330$ $Rate_{nom} = 8{,}83\%$	✓ Substitution/*vervanging* **A** ✓ Simplification/ *vereenvoudiging* **CA** ✓ Rate/$Koers_{nom} = 8{,}83\%$ **CA** **AO: 1 MARK/*PUNT*** (3)
5.2.1	Deposit/*Deposito* = $\frac{20}{100}$ x R24 000 Balance/*Balans* = R24 000 − R4 800 = R19 200 Interest over 24 months/*Rente oor 24 maande* A = R19 200 (1 + 0,12 × 2) A = R23 808 = $\frac{23\ 808}{24}$ Monthly installments/ Maandelikse paaiement = R992	✓ R4 800 **A** ✓ R19 200 **CA** ✓ Correct formula/*korrekte formule* **A** ✓ R23 808 **CA** ✓ R992 **CA** (5)
5.2.2	Total amount owed/ = R23 808 + R992 *Totale bedrag verskuldig* = R24 800	✓ R24 800 **CA** (1)

5.3	$A = P(1+i)^n$ $6000 = 3000(1+i)^6$ $2 = (1+i)^6$ $1+i = \sqrt[6]{2}$ $i = \sqrt[6]{2} - 1$ Rate/*Koers* = 12,25%	✓ Substitution/*vervanging* **A** ✓ 1 + *i* subject/*onderwerp* **CA** ✓ 12, 25% **A**
5.4	$A = P(1+i)^n$ $R155\,000 = Rx\left(1+\frac{0,12}{2}\right)^{2\times5}\left(1+\frac{0,132}{12}\right)^{12\times5} + R15\,000\left(1+\frac{0,12}{2}\right)^{1\times2}\left(1+\frac{0,132}{12}\right)^{5\times12}$ $155\,000 - R15\,000\left(1+\frac{0,12}{2}\right)^{2}\left(1+\frac{0,132}{12}\right)^{60} = Rx\left(1+\frac{0,12}{2}\right)^{10}\left(1+\frac{0,132}{12}\right)^{60}$ $Rx = \frac{155\,000 - R15\,000\left(1+\frac{0,12}{2}\right)^{2}\left(1+\frac{0,132}{12}\right)^{60}}{\left(1+\frac{0,12}{2}\right)^{10}\left(1+\frac{0,132}{12}\right)^{60}}$ $Rx = R35\,484,41$	✓ $\left(1+\frac{0,12}{2}\right)^{2\times5}\left(1+\frac{0,132}{12}\right)^{12\times5}$ **A** ✓ +R15 000 **A** ✓ $\left(1+\frac{0,12}{2}\right)^{1\times2}$ **A** ✓ Simplification/ *Vereenvoudiging* **CA** ✓ R*x* = R35 484,41 **CA** (5)
		[17]

QUESTION / *VRAAG* 6		
6.1	$f'(x)=\lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$ $=\lim_{h\to 0}\frac{-\frac{1}{3}(x+h)-4-\left(-\frac{1}{3}x-4\right)}{h}$ $=\lim_{h\to 0}\frac{-\frac{1}{3}x-\frac{1}{3}h-4+\frac{1}{3}x+4}{h}$ $=\lim_{h\to 0}\frac{-\frac{1}{3}h}{h}$ $=\lim_{h\to 0}-\frac{1}{3}$ $f'(x)=-\frac{1}{3}$	✓ Definition/*Definisie* **A** ✓ Substitution/*Vervanging* **A** ✓ Simplification/ *vereenvoudiging* **CA** ✓ Further simplification/ *verdere vereenvoudiging* **CA** ✓ $f'(x)=-\frac{1}{3}$ **CA** (5)
6.2.1	$D_x\left[x^5+\frac{1}{2}x^{-6}-x^{-1}\right]$ $=5x^4-3x^{-7}+x^{-2}$	✓ $\frac{1}{2}x^{-6}$ **A** ✓ $-x^{-1}$ **A** ✓ $5x^4$ **CA** ✓ $-3x^7$ **CA** ✓ x^{-2} **CA** (5)
6.2.2	$f(x)=ax^4+2x^{\frac{1}{3}}$ $f'(x)=4ax^3+\frac{2}{3}x^{-\frac{2}{3}}$	✓ $2x^{\frac{1}{3}}$ **A** ✓ $4ax^3$ **A** ✓ $\frac{2}{3}x^{-\frac{2}{3}}$ **CA** (3)
6.3	$f(x)=kx^2-4x+5$ $f'(x)=2kx-4$ $16=2k(-2)-4$ $16+4=-4k$ $k=-5$	✓ Derivative/*afgeleide* **A** ✓ Substitution/*vervanging* **CA** ✓ $k=-5$ **CA** (3)
		[16]

QUESTION / *VRAAG* 7		
7.1	$f(x)=x^3-7x^2+6x-x^2+7x-6$ $f(x)=x^3-8x^2+13x-6$	✓ $f(x)=x^3-8x^2+13x-6$ **A** (1)
7.2	$f(x)=(x-1)(x-1)(x-6)$ $(x-1)(x-1)(x-6)=0$ $x=1$ or/*of* $x=6$ OR/OF $(x-1)or/of\ x=\frac{-(-7)\pm\sqrt{(-7)^2-4(1)(6)}}{2(1)}$ $x=1$ or/*of* $x=6$	✓ Factors/*faktore* **A** ✓ $x=1$ **CA** ✓ $x=6$ **CA** **OR/ *OF*** ✓Substitution/*vervanging* **A** ✓ $x=1$ **CA** ✓ $x=6$ **CA** (3)
7.3	$f'(x)=3x^2-16x+13$ let/*laat* $f'(x)=0$ $3x^2-16x+13=0$ $x=\frac{-(-16)\pm\sqrt{(-16)^2-4(3)(13)}}{2(3)}$ $x=\frac{13}{3}$ or/*of* $x=1$ $y=(1)^3-7(1)^2+6(x)-6$ $y=0$ $y=\left(\frac{13}{3}\right)^3-7\left(\frac{13}{3}\right)^2+6\left(\frac{13}{3}\right)-6$ $y=-18{,}52$	✓ Derivative/*afgeleide* **A** ✓ Derivate/*Afgeleide* = 0 **A** ✓ Factors/*Faktore* Substitution /*Vervanging* **CA** ✓ Both x values/*Beide x-waardes* **CA** ✓ Both y values/*Beide y-waardes* **CA** (5)

7.4		✓ *x*–intercepts/*afsnitte* **CA** ✓ *y*–intercept/*afsnit* **CA** ✓ Turning points/*draaipunte* **CA** ✓ Shape/*vorm* **CA** (4)
7.5	$x = 1$ or/*of* $x \geq 6$	✓ $x = 1$ **A** ✓ $x \geq 6$ **A** (2)
		[15]
QUESTION / *VRAAG* 8		
8.1	$h(0) = -2(0)^2 + 9,2(0) + 2$ $= 2\ ^oC$	✓ $2\ ^oC$ **A** (1)
8.2	$\frac{d(T)}{dt} = -4t + 9,2$ $= -4(3) + 9,2$ $= -2,8\ ^oC$	✓ Derivative/*Afgeleide* **A** ✓ Substitution/*vervanging* **CA** ✓ $-2,8\ ^oC$ **CA** (3)
8.3	Let/*Laat* $\frac{d(T)}{dt} = 0$ $-4t + 9,2 = 0$ $t = \frac{9,2}{4}$ $t = 2,3$ seconds/*sekondes*	✓ Derivative/*Afgeleide* = 0 **A** ✓ $t = 2,3$ sec/*sek* **CA** (2)
8.4	$T(2,3) = 12,58\ ^oC$	✓ $T(2,3) = 12,58\ ^oC$ **CA** (1)
		[7]

QUESTION / *VRAAG* 9		
9.1.1	$\int -4^{2t}\ dt = \frac{-4^{2t}}{2\ln 2} + c$	✓ $\frac{-4^{2t}}{2\ln 2}$ **A** ✓ c **A** (2)
9.1.2	$= \int 2 + \frac{3}{x}\ dx$ $= 2x + 3\,ln\,x + c$	✓ 2 **A** ✓ $\frac{3}{x}$ **A** ✓ $2x$ **CA** ✓ $3\,ln\,x$ **CA** (4)
9.2	$A = \int x^2 - 6x + 5\ dx$ $A_1 = \int_0^1 x^2 - 6x + 5\ dx$ $= \left[\frac{1}{3}x^3 - 3x^2 + 5x\right]_0^1$ $= \left[\frac{1}{3}(1)^3 - 3(1)^2 + 5(1)\right] - \left[\frac{1}{3}(0)^3 - 3(0)^2 + 5(0)\right]$ $= \frac{7}{3}$ $A_2 = -\left[\frac{1}{3}x^3 - 3x^2 + 5x\right]_1^3$ $= -\left[\frac{1}{3}(3)^3 - 3(3)^2 + 5(3)\right] - \left[\frac{1}{3}(1)^3 - 3(1)^2 + 5(1)\right]$ $= -\left(-3 - \frac{7}{3}\right)$ $= \frac{16}{3}$ $A_{total} = A_1 + A_2$ $= \frac{7}{3} + \frac{16}{3}$ $= \frac{23}{3}\,unit^2\ /\ eenhede^2$	✓ Area notation/*notasie* **A** ✓ Integral/*integraal* **A** ✓ Substitution/*vervanging* **CA** ✓ $\frac{7}{3}$ **CA** ✓ Substitution by 1&3/*Vervanging deur 1 & 3* **CA** ✓ $\frac{16}{3}$ **CA** ✓ $\frac{23}{3}$ **CA** (7) **[13]**
		TOTAL/ *TOTAAL*: 150