basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

SENIORSERTIFIKAAT-EKSAMEN/
NASIONALE SENIORSERTIFIKAAT-EKSAMEN

WISKUNDE V1

2019

PUNTE: 150

TYD: 3 uur

Hierdie vraestel bestaan uit 8 bladsye en 1 inligtingsblad.

INSTRUKSIES EN INLIGTING

Lees die volgende instruksies noukeurig deur voordat die vrae beantwoord word.

1. Hierdie vraestel bestaan uit 11 vrae.

2. Beantwoord AL die vrae.

3. Nommer die antwoorde korrek volgens die nommeringstelsel wat in hierdie vraestel gebruik is.

4. Dui ALLE berekeninge, diagramme, grafieke, ens. wat jy gebruik het om jou antwoorde te bepaal, duidelik aan.

5. Volpunte sal NIE noodwendig aan slegs antwoorde toegeken word NIE.

6. Jy mag 'n goedgekeurde, wetenskaplike sakrekenaar (nieprogrammeerbaar en niegrafies) gebruik, tensy anders vermeld.

7. Indien nodig, rond antwoorde tot TWEE desimale plekke af, tensy anders vermeld.

8. Diagramme is NIE noodwendig volgens skaal geteken NIE.

9. 'n Inligtingsblad met formules is aan die einde van die vraestel ingesluit.

10. Skryf netjies en leesbaar.

VRAAG 1

1.1 Los op vir x:

1.1.1 $x^2 - 5x - 6 = 0$ (2)

1.1.2 $(3x-1)(x-4) = 16$ (korrek tot TWEE desimale plekke) (4)

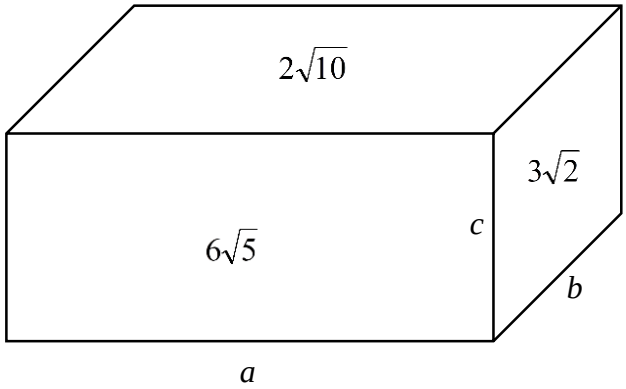
1.1.3 $4x - x^2 \geq 0$ (3)

1.1.4 $\dfrac{5^{2x} - 1}{5^x + 1} = 4$ (3)

1.2 Los gelyktydig op vir x en y:

$x + 3y = 2$ en $x^2 + 4xy - 5 = 0$ (5)

1.3 'n Reghoekige boks het afmetings a, b en c. Die oppervlakte van die vlakke is $2\sqrt{10}$; $3\sqrt{2}$ en $6\sqrt{5}$, soos in die skets hieronder getoon.



Bereken, **sonder die gebruik van 'n sakrekenaar**, die volume van die reghoekige boks. (5)

[22]

VRAAG 2

2.1 Die eerste VIER terme in die kwadratiese patroon is: 15 ; 29 ; 41 ; 51

2.1.1 Skryf neer die waarde van die 5^{de} term. (1)

2.1.2 Bepaal 'n uitdrukking vir die n-de term van die patroon in die vorm $T_n = an^2 + bn + c$. (4)

2.1.3 Bereken die waarde van T_{27} (2)

2.2 Gegee die meetkundige ry: 36 ; –18 ; 9 ; …

2.2.1 Bepaal die waarde van r, die gemeenskaplike verhouding. (1)

2.2.2 Bereken n indien $T_n = \frac{9}{4\,096}$ (3)

2.2.3 Bereken S_∞ (2)

2.2.4 Bereken die waarde van $\frac{T_1 + T_3 + T_5 + T_7 + ... + T_{499}}{T_2 + T_4 + T_6 + T_8 + ... + T_{500}}$ (4)

[17]

VRAAG 3

3.1 Die eerste drie terme van 'n rekenkundige ry is: $2p + 3$; $p + 6$ en $p – 2$.

3.1.1 Toon dat $p = 11$. (2)

3.1.2 Bereken die kleinste waarde van n waarvoor $T_n < -55$. (3)

3.2 Gegee dat $\sum_{k=1}^{6}(x-3k) = \sum_{k=1}^{9}(x-3k)$, bewys dat $\sum_{k=1}^{15}(x-3k) = 0$. (5)

[10]

VRAAG 4

Gegee die eksponensiële funksie: $g(x) = \left(\frac{1}{2}\right)^x$

4.1 Skryf neer die waardeversameling van g. (1)

4.2 Bepaal die vergelyking van g^{-1} in die vorm $y = …$ (2)

4.3 Is g^{-1} 'n funksie? Regverdig jou antwoord. (2)

4.4 Die punt M(a ; 2) lê op g^{-1}.

4.4.1 Bereken die waarde van a. (2)

4.4.2 M$'$, die beeld van M, lê op g. Skryf die koördinate van M$'$ neer. (1)

4.5 Indien $h(x) = g(x + 3) + 2$, skryf die koördinate neer van die beeld van M$'$ op h. (3)

[11]

VRAAG 5

5.1 Gegee: $f(x)=\dfrac{1}{x+2}+3$.

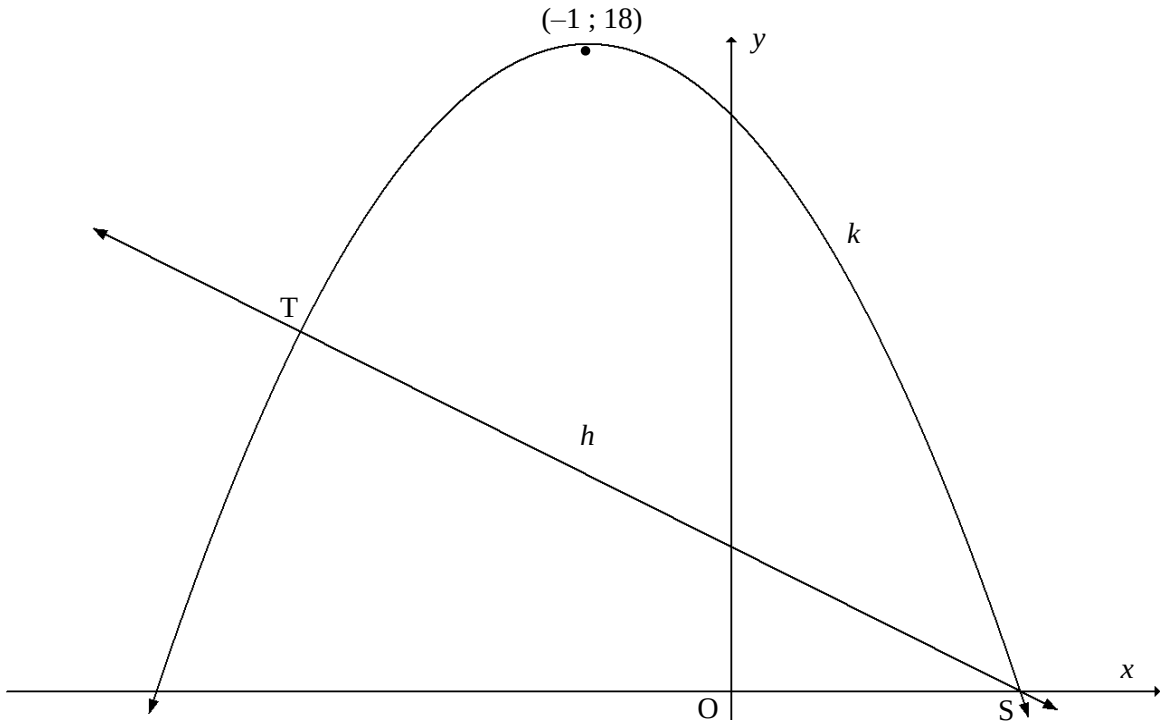
5.1.1 Bepaal die vergelykings van die asimptote van f. (2)

5.1.2 Skryf die y-afsnit van f neer. (1)

5.1.3 Bereken die x-afsnit van f. (2)

5.1.4 Skets die grafiek van f. Dui ALLE afsnitte met die asse en enige asimptote duidelik aan. (3)

5.2 Die grafieke van $k(x)=ax^2+bx+c$ en $h(x)=-2x+4$ is hieronder geskets. Grafiek k het 'n draaipunt by (–1 ; 18). S is die x-afsnit van h en k. Grafiek h en k sny mekaar ook by T.



5.2.1 Bereken die koördinate van S. (2)

5.2.2 Bepaal die vergelyking van k in die vorm $y=a(x+p)^2+q$. (3)

5.2.3 Indien $k(x)=-2x^2-4x+16$, bepaal die koördinate van T. (5)

5.2.4 Bepaal die waarde(s) van x waarvoor $k(x)<h(x)$. (2)

5.2.5 Daar word verder gegee dat k die grafiek van $g'(x)$ is.

(a) Vir watter waardes van x sal die grafiek van g konkaaf op wees? (2)

(b) Skets die grafiek van g en dui die x-waardes van die draaipunte en die buigpunt duidelik aan. (3)

[25]

VRAAG 6

6.1 Sandile het 'n motor vir R180 000 gekoop. Die waarde van die motor het teen 15% per jaar volgens die verminderdesaldo-metode gedepresieer. Die boekwaarde van Sandile se motor is tans R79 866,96.

6.1.1 Hoeveel jaar gelede het Sandile die motor gekoop? (3)

6.1.2 Op presies dieselfde tyd as wat Sandile die motor gekoop het, het Anil R49 000 in 'n spaarrekening met 'n rentekoers van 10% p.j., kwartaalliks saamgestel, gedeponeer. Het Anil nou genoeg geld in sy spaarrekening om Sandile se motor te kan koop? (3)

6.2 'n Bank het presies 10 maande gelede 'n lening van R800 000 teen 'n rentekoers van 10,25% p.j., maandeliks saamgestel, aan Joan toegestaan.
Die bank het bepaal dat die lening:

- Oor 'n tydperk van 20 jaar terugbetaal moet word
- Deur middel van maandelikse paaiemente van R7 853,15, wat een maand na die toestaan van die lening begin, terugbetaal moet word

6.2.1 Hoeveel het Jane geskuld onmiddellik nadat sy haar 6^{de} betaling gemaak het? (4)

6.2.2 As gevolg van finansiële probleme het Jane die 7^{de}, 8^{ste} en 9^{de} paaiemente nie betaal nie. Sy kon weer paaiemente vanaf die einde van die 10^{de} maand maak. Bereken Jane se verhoogde maandelikse paaiement om die lening steeds in die oorspronklike 20 jaar af te betaal. (5)

[15]

VRAAG 7

7.1 Gegee $f(x) = x^2 + 2$.

Bepaal $f'(x)$ vanuit eerste beginsels. (4)

7.2 Bepaal $\frac{dy}{dx}$ indien:

7.2.1 $y = 4x^3 + \frac{2}{x}$ (3)

7.2.2 $y = 4.\sqrt[3]{x} + (3x^3)^2$ (4)

7.3 Indien g 'n liniêre funksie is met $g(1) = 5$ en $g'(3) = 2$, bepaal die vergelyking van g in die vorm $y = \ldots$. (3)

[14]

VRAAG 8

'n Derdegraadse funksie $h(x) = -2x^3 + bx^2 + cx + d$ sny die *x*-as by (–3 ; 0); $\left(-\frac{3}{2};0\right)$ en (1 ; 0).

8.1 Toon dat $h(x) = -2x^3 - 7x^2 + 9$. (3)

8.2 Bereken die *x*-koördinate van die draaipunte van *h*. (3)

8.3 Bepaal die waarde(s) van *x* waarvoor *h* dalend sal wees. (2)

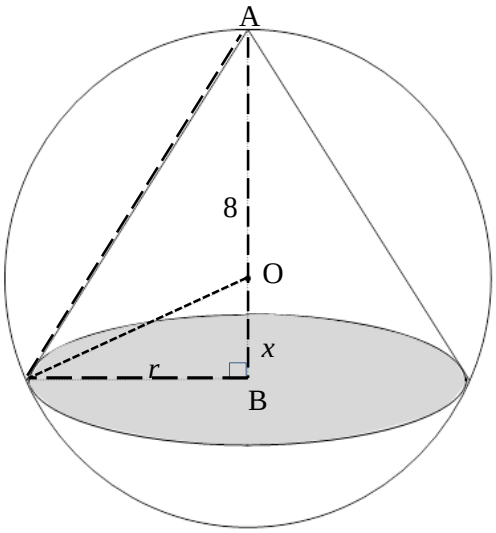
8.4 Vir watter waarde(s) van *x* sal daar 'n raaklyn aan die kurwe van *h* wees wat parallel aan die lyn $y - 4x = 7$ is. (4)

[12]

VRAAG 9

'n Keël met radius *r* cm en hoogte AB is in die sfeer met middelpunt O en 'n radius van 8 cm ingeskryf. OB = *x*.

Volume van sfeer = $\frac{4}{3}\pi r^3$
Volume van keël = $\frac{1}{3}\pi r^2 h$



9.1 Bereken die volume van die sfeer. (1)

9.2 Dui aan dat $r^2 = 64 - x^2$. (1)

9.3 Bepaal die verhouding tussen die grootste volume van hierdie keël en die volume van die sfeer. (7)

[9]

VRAAG 10

10.1 'n Sak het 7 geel balle, 3 rooi balle en 2 blou balle in. 'n Bal word willekeurig uit die sak gekies en nie teruggeplaas nie. 'n Tweede bal word dan gekies. Bepaal die waarskynlikheid dat van die twee balle wat gekies is, een rooi is en die ander blou is. (4)

10.2 Leerders by 'n koshuis kan 'n ete en 'n koeldrank vir middagete kies. Hulle keuses op 'n spesifieke dag is aangeteken en word in die gedeeltelik voltooide tabel hieronder getoon.

		ETE		**TOTAAL**
		TOEBROODJIE (T)	**PASTA (P)**	
KOELDRANK	Vrugtesap (V)	*a*	30	*b*
	Gebottelde Water (W)			
TOTAAL		200		250

Die waarskynlikheid dat 'n leerder vrugtesap en 'n toebroodjie op daardie dag gekies het, is 0,48.

10.2.1 Bepaal die getal leerders wat vrugtesap en 'n toebroodjie vir middagete op daardie dag gekies het. (1)

10.2.2 Is die keuse van vrugtesap onafhanklik van die keuse van 'n toebroodjie vir middagete op daardie dag? Toon AL jou berekeninge om jou antwoord te motiveer. (4)
[9]

VRAAG 11

Twee leerders uit elke graad (graad 8, 9, 10, 11 en 12) word gekies om 'n sportkomitee by 'n hoërskool te vorm.

11.1 Op hoeveel verskillende maniere kan die voorsitter en die ondervoorsitter van die sportkomitee gekies word as daar geen voorwaardes is oor wie verkies mag word nie? (2)

11.2 'n Fotograaf wil 'n foto van die sportkomitee neem. Op hoeveel verskillende maniere kan die lede in 'n reguit ry gerangskik word indien:

11.2.1 Enige lid in enige posisie kan staan? (1)

11.2.2 Lede van dieselfde graad langs mekaar moet staan en die graad 12-lede in die middel moet wees? (3)
[6]

TOTAAL: 150

INLIGTINGSBLAD: WISKUNDE

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$A = P(1+ni) \qquad A = P(1-ni) \qquad A = P(1-i)^n \qquad A = P(1+i)^n$$

$$T_n = a + (n-1)d \qquad S_n = \frac{n}{2}\left[2a + (n-1)d\right]$$

$$T_n = ar^{n-1} \qquad S_n = \frac{a\left(r^n - 1\right)}{r-1} \;;\; r \neq 1 \qquad S_\infty = \frac{a}{1-r} \;;\; -1 < r < 1$$

$$F = \frac{x\left[(1+i)^n - 1\right]}{i} \qquad P = \frac{x\left[1-(1+i)^{-n}\right]}{i}$$

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

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \qquad \mathrm{M}\left(\frac{x_1 + x_2}{2}; \frac{y_1 + y_2}{2}\right)$$

$$y = mx + c \qquad y - y_1 = m(x - x_1) \qquad m = \frac{y_2 - y_1}{x_2 - x_1} \qquad m = \tan\theta$$

$$(x-a)^2 + (y-b)^2 = r^2$$

In ΔABC: $\dfrac{a}{\sin \mathrm{A}} = \dfrac{b}{\sin \mathrm{B}} = \dfrac{c}{\sin \mathrm{C}}$

$$a^2 = b^2 + c^2 - 2bc.\cos A$$

$$\text{oppervlakte } \Delta\mathrm{ABC} = \frac{1}{2}ab.\sin \mathrm{C}$$

$$\sin(\alpha + \beta) = \sin\alpha\cos\beta + \cos\alpha\sin\beta \qquad \sin(\alpha - \beta) = \sin\alpha\cos\beta - \cos\alpha\sin\beta$$

$$\cos(\alpha + \beta) = \cos\alpha\cos\beta - \sin\alpha\sin\beta \qquad \cos(\alpha - \beta) = \cos\alpha\cos\beta + \sin\alpha\sin\beta$$

$$\cos 2\alpha = \begin{cases} \cos^2\alpha - \sin^2\alpha \\ 1 - 2\sin^2\alpha \\ 2\cos^2\alpha - 1 \end{cases} \qquad \sin 2\alpha = 2\sin\alpha.\sin\alpha$$

$$\bar{x} = \frac{\sum x}{n} \qquad \sigma^2 = \frac{\sum_{i=1}^{n}\left(x_i - \bar{x}\right)^2}{n}$$

$$\mathrm{P(A)} = \frac{n(\mathrm{A})}{n(\mathrm{S})} \qquad \mathrm{P(A\ of\ B) = P(A) + P(B) - P(A\ en\ B)}$$

$$\hat{y} = a + bx \qquad b = \frac{\sum(x - \bar{x})(y - \bar{y})}{\sum(x - \bar{x})^2}$$

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MATHEMATICS P1/
WISKUNDE V1

MARKING GUIDELINES/*NASIENRIGLYNE*

2019

MARKS: 150
PUNTE: 150

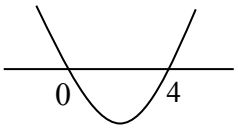
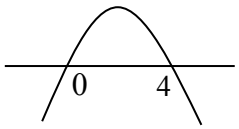
These marking guidelines consist of 15 pages.
Hierdie nasienriglyne bestaan uit 15 bladsye.

NOTE:
- If a candidate answers a question TWICE, only mark the FIRST attempt.
- Consistent Accuracy applies in all aspects of the marking memorandum.

LET WEL:
- *Indien 'n kandidaat 'n vraag TWEE keer beantwoord, merk slegs die EERSTE poging.*
- *Volgehoue akkuraatheid is DEURGAANS op ALLE aspekte van die memorandum van toepassing.*

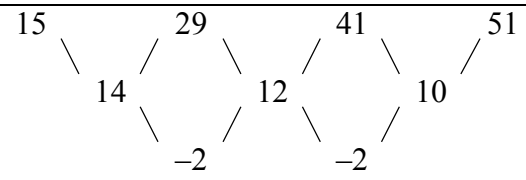
QUESTION/*VRAAG* 1

1.1.1	$x^2-5x-6=0$ $(x-6)(x+1)=0$ $x=6$ or $x=-1$ **OR/*OF*** $x^2-5x-6=0$ $x=\frac{5\pm\sqrt{(-5)^2-4(1)(-6)}}{2(1)}$ $x=\frac{5\pm\sqrt{49}}{2}$ $x=6$ or $x=-1$	✓ factors ✓ both answers (2) **OR/*OF*** ✓ correct subst into correct formula ✓ both answers (2)
1.1.2	$(3x-1)(x-4)=16$ $3x^2-13x-12=0$ $x=\frac{13\pm\sqrt{(-13)^2-4(3)(-12)}}{2(3)}$ $x=\frac{13\pm\sqrt{313}}{6}$ $x=5{,}12$ or $x=-0{,}78$ **OR/*OF*** $3x^2-13x-12=0$ $x^2-\frac{13}{3}x=4$ $x^2-\frac{13}{3}x+\left(-\frac{13}{6}\right)^2=4+\left(-\frac{13}{6}\right)^2$ $\left(x-\frac{13}{6}\right)^2=\frac{313}{36}$ $x=\frac{13\pm\sqrt{313}}{6}$ $x=5{,}12$ or $x=-0{,}78$	✓ standard form ✓ correct subst into correct formula ✓✓ answers (4) **OR/*OF*** ✓ standard form ✓ adding $\left(-\frac{13}{6}\right)^2$ both sides ✓✓ answers (4)

1.1.3	$x(4-x)\geq 0$ $-x(x-4)\geq 0$ or $-x(x-4)\geq 0$ $x(x-4)\leq 0$   $0\leq x\leq 4$ or $x\in[0\,;4]$	✓ factorisation ✓✓ $0\leq x\leq 4$ (3)
1.1.4	$\frac{5^{2x}-1}{5^x+1}=4$ $\frac{(5^x+1)(5^x-1)}{5^x+1}=4$ $5^x-1=4$ $5^x=5$ $x=1$ **OR/*OF*** $\frac{5^{2x}-1}{5^x+1}=4$ $5^{2x}-1=4.5^x+4$ $5^{2x}-4.5^x-5=0$ $(5^x-5)(5^x+1)=0$ $5^x=5$ or $5^x\neq -1$ $x=1$	✓ factors in numerator ✓ $5^x-1=4$ ✓ answer (3) **OR/*OF*** ✓ standard form ✓ factors ✓ answer (3)
1.2	$x=2-3y$ ……..……..(1) $x^2+4xy-5=0$ ……(2) Substitute (1) in (2): $(2-3y)^2+4y(2-3y)-5=0$ $4-12y+9y^2+8y-12y^2-5=0$ $-3y^2-4y-1=0$ $3y^2+4y+1=0$ $(3y+1)(y+1)=0$ $y=-\frac{1}{3}$ or $y=-1$ $x=3$ or $x=5$ **OR/*OF***	✓ $x=2-3y$ ✓ correct subst into correct formula ✓ either standard form ✓ y – values ✓ x – values (5) **OR/*OF***

	$y=\frac{2}{3}-\frac{x}{3}$ ……..……..(1) $x^2+4xy-5=0$ ……(2) Substitute (1) in (2): $x^2+4x\left(\frac{2}{3}-\frac{x}{3}\right)-5=0$ $3x^2+8x-4x^2-15=0$ $-x^2+8x-15=0$ $x^2-8x+15=0$ $(x-5)(x-3)=0$ $x=3$ or $x=5$ $y=-\frac{1}{3}$ or $y=-1$	✓ $y=\frac{2}{3}-\frac{x}{3}$ ✓ correct subst into correct formula ✓ either standard form ✓ x – values ✓ y – values (5)
1.3	$ab=2\sqrt{10}$ $bc=3\sqrt{2}$ $ac=6\sqrt{5}$ $ab.bc.ac=2\sqrt{10}.6\sqrt{5}.3\sqrt{2}$ $(abc)^2=36\sqrt{100}$ $abc=\sqrt{360}=6\sqrt{10}$ **OR/*OF*** $ac=6\sqrt{5}\quad\therefore a=\frac{6\sqrt{5}}{c}$ $bc=3\sqrt{2}\quad\therefore b=\frac{3\sqrt{2}}{c}$ $ab=2\sqrt{10}$ $\left(\frac{6\sqrt{5}}{c}\right)\left(\frac{3\sqrt{2}}{c}\right)=2\sqrt{10}$ $18\sqrt{10}=2\sqrt{10}.c^2$ $c^2=9$ $c=3$ Volume $=abc=2\sqrt{10}.3=\sqrt{360}=6\sqrt{10}$	✓ volume = abc ✓✓ $ab.bc.ac=2\sqrt{10}.6\sqrt{5}.3\sqrt{2}$ ✓ $(abc)^2=36\sqrt{100}$ ✓ answer (5) **OR/*OF*** ✓ $a=\frac{6\sqrt{5}}{c}$ ✓ $b=\frac{3\sqrt{2}}{c}$ ✓ value of c ✓ Volume = abc ✓ answer (5) **[22]**

QUESTION/*VRAAG* 2

2.1.1	59	✓ answer (1)
2.1.2	 $2a = -2$ $a = -1$ $3(-1) + b = 14$ $b = 17$ $(-1) + (17) + c = 15$ $c = -1$ $T_n = -n^2 + 17n - 1$	✓second difference of – 2 ✓ a ✓ b ✓ c (4)
2.1.3	$T_{27} = -(27)^2 + 17(27) - 1$ $= -271$	✓ substitution ✓ answer (2)
2.2.1	$r = \frac{-18}{36} = -\frac{1}{2}$	✓ answer (1)
2.2.2	$T_n = 36\left(-\frac{1}{2}\right)^{n-1}$ $\frac{9}{4096} = 36\left(-\frac{1}{2}\right)^{n-1}$ $\frac{1}{16384} = \left(-\frac{1}{2}\right)^{n-1}$ $\left(-\frac{1}{2}\right)^{14} = \left(-\frac{1}{2}\right)^{n-1}$ $14 = n - 1$ $n = 15$ **OR/*OF*** $36\ ;\ -18\ ;\ 9\ ;\ \frac{-9}{2}\ ;\ \frac{9}{4}\ ;\ \frac{-9}{8}\ ;\ \ldots\ ;\ \frac{9}{4096}$ If you look only at the denominator: 2 ; 4 ; 8 ; … ; 4096 $2^k = 4096$ $2^k = 2^{12}$ $k = 12$ $\therefore n = 15$ terms	✓ $T_n = 36\left(-\frac{1}{2}\right)^{n-1}$ ✓ $\frac{1}{16384} = \left(-\frac{1}{2}\right)^{n-1}$ ✓ answer (3) **OR/*OF*** ✓ $2^k = 4096$ ✓ $k = 12$ ✓ answer (3)

2.2.3	$S_\infty = \frac{a}{1-r}$ $= \frac{36}{1-\left(-\frac{1}{2}\right)}$ $= 24$	✓ correct subst into correct formula with $-1 < r < 1$ ✓ answer if $-1 < r < 1$ (2)
2.2.4	$S_{250\,\text{even}} = \frac{-18\left(\left(\frac{1}{4}\right)^{250} - 1\right)}{\frac{1}{4} - 1}$ $= -24$ $S_{250\ \text{odd}} = \frac{36\left(\left(\frac{1}{4}\right)^{250} - 1\right)}{\frac{1}{4} - 1}$ $= 48$ $\frac{S_{odd}}{S_{even}} = \frac{48}{-24}$ $= -2$ **OR/*OF*** $\frac{T_1 + T_3 + T_5 + T_7 + \ldots + T_{499}}{T_2 + T_4 + T_6 + T_8 + \ldots + T_{500}}$ $= \frac{a + ar^2 + ar^4 + \ldots + ar^{498}}{ar + ar^3 + ar^5 + \ldots + ar^{499}}$ $= \frac{a + ar^2 + ar^4 + \ldots + ar^{498}}{r\left(a + ar^2 + ar^4 + \ldots + ar^{498}\right)}$ $= \frac{1}{r}$ $= -2$	✓ $r = \frac{1}{4}$ and $n = 250$ ✓ $S_{250\,\text{even}} = -24$ ✓ $S_{250\,\text{odd}} = 48$ ✓ answer (4) **OR/*OF*** ✓ $a + ar^2 + ar^4 + \ldots + ar^{498}$ ✓ $ar + ar^3 + ar^5 + \ldots + ar^{499}$ ✓ $r\left(a + ar^2 + ar^4 + \ldots + ar^{498}\right)$ ✓ answer (4) **[17]**

QUESTION/*VRAAG* 3

3.1.1	$p + 6 - (2p + 3) = p - 2 - (p + 6)$ $-p + 3 = -8$ $p = 11$	✓ equating i.t.o p ✓ simplifying (2)
3.1.2	$T_n = 25 + (n-1)(-8) = 33 - 8n$ $33 - 8n < -55$ $-8n < -88$ $n > 11$ $\therefore$ Term 12 will be the first term smaller than -55 $\therefore$ *Term 12 sal die eerste term kleiner as – 55 wees.*	✓ subst into T_n formula ✓ $n > 11$ ✓ $n = 12$ (3)
3.2	$S_6 = \frac{n}{2}[a+l] = \frac{6}{2}[(x-3)+(x-18)]$ $= 6x - 63$ $S_9 = \frac{n}{2}[a+l] = \frac{9}{2}[(x-3)+(x-27)]$ $= 9x - 135$ $6x - 63 = 9x - 135$ $3x = 72$ $x = 24$ $\therefore S_{15} = \frac{n}{2}[a+l] = \frac{15}{2}[(x-3)+(x-45)]$ $= \frac{15}{2}[2x - 48]$ $= \frac{15}{2}[2(24) - 48] = 0 = \text{RHS}$ **OR/*OF*** $\sum_{k=7}^{9}(x - 3k) = 0$ $(x-21)+(x-24)+(x-27) = 0$ $\therefore 3x - 72 = 0$ $3x = 72$ $x = 24$ $\sum_{k=1}^{15}(24 - 3k)$ $= 21 + 18 + 15 + ... + -21.$ $S_n = \frac{n}{2}[a+l)]$ $= \frac{15}{2}[21 - 21]$ $= 0 = \text{RHS}$ **OR/*OF***	✓ $6x - 63$ ✓ $9x - 135$ ✓ 24 ✓ $\frac{15}{2}[(x-3)+(x-45)]$ ✓ substitution of x (5) **OR/*OF*** ✓ expansion ✓ $3x - 72 = 0$ ✓ 24 ✓ substitution of x ✓ sum of 15 terms (5) **OR/*OF***

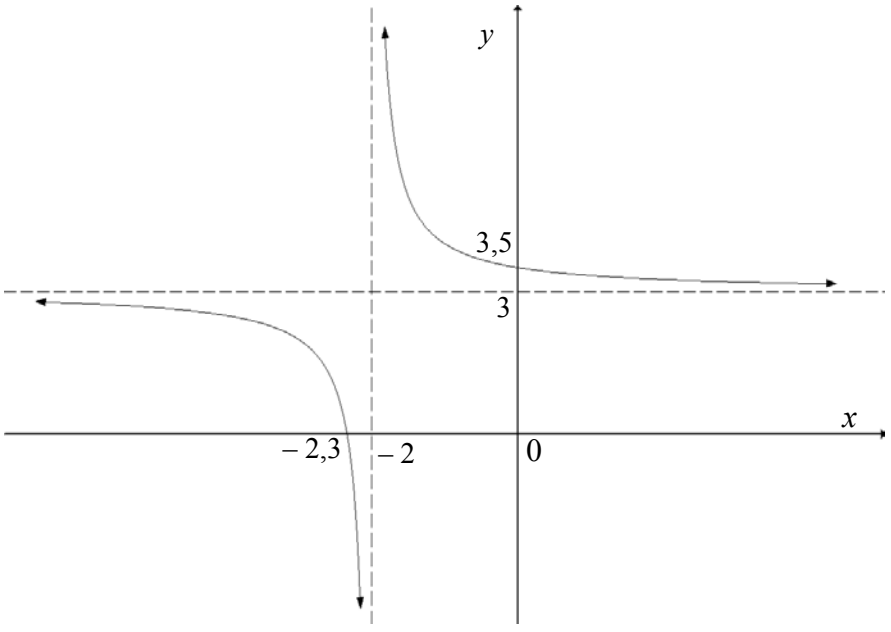
	$(x-3)+(x-6)+(x-9)+(x-12)+(x-15)+(x-18)$ $=(x-3)+(x-6)+(x-9)+(x-12)+(x-15)+(x-18)$ $+(x-21)+(x-24)+(x-27)$ $\therefore 3x-72=0$ $3x=72$ $x=24$ $\sum_{k=1}^{15}(24-3k)$ $=21+18+15+.....+-21.$ $S_n=\frac{n}{2}[a+l]$ $=\frac{15}{2}[21-21]$ $=0=\text{RHS}$	✓ expansion ✓ $3x-72=0$ ✓ 24 ✓ substitution of x ✓ sum of 15 terms (5) **[10]**

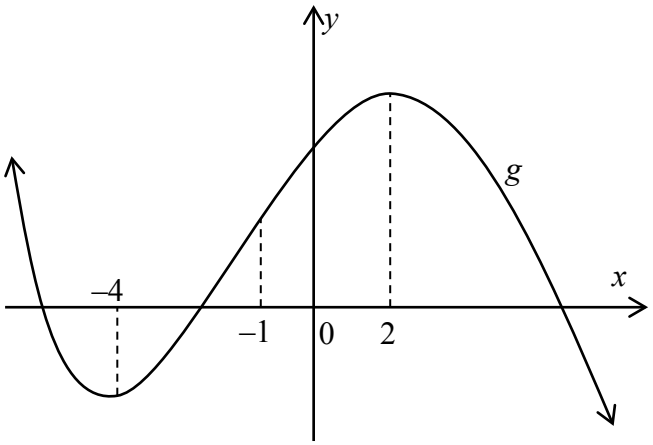
QUESTION/*VRAAG* 4

4.1	$y>0$ **OR/*OF*** $y\in(0\ ;\ \infty)$	✓answer (1) **OR/*OF*** ✓answer (1)
4.2	$g: y=\left(\frac{1}{2}\right)^x$ $g^{-1}: x=\left(\frac{1}{2}\right)^y$ $y=\log_{\frac{1}{2}} x$ or $y=-\log_2 x$ or $y=\log_2 \frac{1}{x}$	✓ $x=\left(\frac{1}{2}\right)^y$ ✓ equation (2)
4.3	Yes. The vertical line test cuts g^{-1} once *Ja. Die vertikale lyn toets sny g^{-1} slegs eenkeer.* **OR/*OF*** Yes. For every *x*-value there is a unique *y*-value *Ja. Vir elke x-waarde is daar 'n unieke y-waarde* **OR/*OF*** Yes. *g* is a one-to-one function / *Ja. g is 'n een-tot-een funksie* **OR/*OF*** Yes. The horizontal line cuts *g* only once *Ja. Die horisontale lyn sny g slegs een keer*	✓ yes ✓ valid reason (2) **OR/*OF*** ✓ yes ✓ valid reason (2) **OR/*OF*** ✓ yes ✓ valid reason (2) **OR/*OF*** ✓ yes ✓ valid reason (2)

4.4.1	$y = -\log_2 x$ $2 = -\log_2 a$ $a = 2^{-2} = \frac{1}{4}$ or $a = \left(\frac{1}{2}\right)^2 = \frac{1}{4}$	✓ correct subst into correct formula (a ; 2) ✓answer (2)
4.4.2	$M'\left(2;\frac{1}{4}\right)$ or $M'(2;a)$	✓ answer (1)
4.5	$M''\left(-1;\frac{9}{4}\right)$	✓ -1 ✓✓ $\frac{9}{4}$ (3)
		[11]

QUESTION/*VRAAG* 5

5.1.1	$x = -2$ $y = 3$	✓ answer ✓ answer (2)
5.1.2	$\left(0\,;\frac{7}{2}\right)$	✓ answer (1)
5.1.3	$\frac{1}{x+2} + 3 = 0$ $1 + 3(x+2) = 0$ $3x = -7$ $x = -\frac{7}{3}$ x-intercept $\left(-\frac{7}{3}\,;0\right)$	✓ $y = 0$ ✓ answer (2)
5.1.4		✓asymptotes at $y = 3$ and $x = -2$ ✓intercepts at $y = 3,5$ and $x = -2,3$ ✓shape (reasonable representation in correct quadrants) (3)

5.2.1	$-2x+4=0$ $2x=4$ $x=2$ $\therefore$ S(2 ; 0)	✓ $y=0$ ✓ $x=2$ (2)
5.2.2	Equation of k: $y=a(x+1)^2+18$ $0=a(2+1)^2+18$ or $0=a(-4+1)^2+18$ $9a=-18$ $a=-2$ $y=-2(x+1)^2+18$	✓ $y=a(x+1)^2+18$ ✓ substitute (2 ; 0) or (– 4 ; 0) ✓ a (3)
5.2.3	$-2x^2-4x+16=-2x+4$ $-2x^2-2x+12=0$ $x^2+x-6=0$ $(x+3)(x-2)=0$ $x=-3$ or $x=2$ $y=-2(-3)+4=10$ T(–3 ; 10)	✓ equating ✓ standard form ✓ factors ✓ choosing $x=-3$ ✓ answer (5)
5.2.4	$x<-3$ or $x>2$ **OR/*OF*** $(-\infty\ ;-3)\cup(2\ ;\infty)$	✓✓ answer (2) **OR/*OF*** ✓✓ answer (2)
5.2.5(a)	$x<-1$ **OR/*OF*** $(-\infty\ ;-1)$	✓✓ answer (2) **OR/*OF*** ✓✓ answer (2)
5.2.5(b)		✓ shape of cubic with local min tp moving to local max tp ✓ turning points at $x=2$ and $x=-4$ ✓ point of inflection at $x=-1$ (3) **[25]**

QUESTION/*VRAAG* 6

6.1.1	$A = P(1-i)^n$ $79866,96 = 180\,000(1-0,15)^n$ $(1-0,15)^n = \frac{79866,96}{180\,000}$ $n = \frac{\log\left(\frac{79866,96}{180\,000}\right)}{\log(1-0,15)}$ $n = 4,999\ldots$ years $n \approx 5$ years	✓ substitution ✓ use of logs ✓ answer (3)
6.1.2	$A = P(1+i)^n$ $= 49\,000\left(1+\frac{0,1}{4}\right)^{20}$ = R80 292,21 The money will be enough to buy the car. *Die geld sal genoeg wees om die motor te koop.*	✓ values of i and n ✓ substitution ✓ conclusion (consistent with answer) (3)
6.2.1	$P = \frac{x\left[1-(1+i)^{-n}\right]}{i}$ $P = \frac{7853,15\left[1-\left(1+\frac{0,1025}{12}\right)^{-234}\right]}{\frac{0,1025}{12}}$ P = R793 749,25 **OR/*OF*** Balance Outstanding / *Uitstaande balans* $= 800\,000\left(1+\frac{0,1025}{12}\right)^{6} - \frac{7853,15\left[\left(1+\frac{0,1025}{12}\right)^{6}-1\right]}{\frac{0,1025}{12}}$ $= 841\,885,56 - 48\,136,62$ $= R793\,748,94$	✓ $n = 234$ ✓ $i = \frac{0,1025}{12}$ ✓ substitution in present value formula ✓ answer (4) **OR/*OF*** ✓ $n = 6$ in both ✓ $i = \frac{0,1025}{12}$ ✓ A – F ✓ R793 748,94 (4)

6.2.2	$A = P(1+i)^n$ $= 793749{,}25\left(1+\frac{0{,}1025}{12}\right)^3$ $=$ R814 263,3052 New instalment/*Nuwe paaiement*: $P = \frac{x\left[1-(1+i)^{-n}\right]}{i}$ $814\,263{,}3052 = \frac{x\left[1-\left(1+\frac{0{,}1025}{12}\right)^{-231}\right]}{\frac{0{,}1025}{12}}$ $x =$ R8 089,20	✓ $793749{,}25\left(1+\frac{0{,}1025}{12}\right)^3$ ✓ $n = 231$ ✓ substitution of new P ✓ substitution of n and i into formula ✓ answer (5) **[15]**

QUESTION/*VRAAG* 7

7.1	$f(x) = x^2 + 2$ $f(x+h) = (x+h)^2 + 2$ $= x^2 + 2xh + h^2 + 2$ $f(x+h) - f(x) = x^2 + 2xh + h^2 + 2 - (x^2 + 2)$ $= 2xh + h^2$ $f'(x) = \lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$ $= \lim_{h\to 0}\frac{2xh+h^2}{h}$ $= \lim_{h\to 0}\frac{h(2x+h)}{h}$ $= \lim_{h\to 0}(2x+h)$ $= 2x$ **OR/*OF*** $f'(x) = \lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$ $= \lim_{h\to 0}\frac{x^2+2xh+h^2+2-(x^2+2)}{h}$ $= \lim_{h\to 0}\frac{2xh+h^2}{h}$ $= \lim_{h\to 0}\frac{h(2x+h)}{h}$ $= \lim_{h\to 0}(2x+h)$ $= 2x$	✓ $x^2 + 2xh + h^2 + 2$ ✓ $\lim_{h\to 0}\frac{2xh+h^2}{h}$ ✓ $\lim_{h\to 0}\frac{h(2x+h)}{h}$ ✓ answer (4) **OR/*OF*** ✓ $x^2 + 2xh + h^2 + 2$ ✓ $\lim_{h\to 0}\frac{2xh+h^2}{h}$ ✓ $\lim_{h\to 0}\frac{h(2x+h)}{h}$ ✓ answer (4)

7.2.1	$y = 4x^3 + 2x^{-1}$ $\frac{dy}{dx} = 12x^2 - 2x^{-2}$	✓ $+2x^{-1}$ ✓ $12x^2$ ✓ $-2x^{-2}$ (3)
7.2.2	$y = 4\sqrt[3]{x} + (3x^3)^2$ $= 4x^{\frac{1}{3}} + 9x^6$ $\frac{dy}{dx} = \frac{4}{3}x^{-\frac{2}{3}} + 54x^5$	✓ $4x^{\frac{1}{3}}$ ✓ $9x^6$ ✓ $\frac{4}{3}x^{-\frac{2}{3}}$ ✓ $54x^5$ (4)
7.3	Point of contact: (1 ; 5) $m = 2$ $y - y_1 = m(x - x_1)$ or $y = 2x + c$ $y - 5 = 2(x - 1)$ $5 = 2 + c$ $c = 3$ $y = 2x + 3$ $y = 2x + 3$	✓ $m = 2$ ✓ substitution of (1 ; 5) ✓ answer (3) **[14]**

QUESTION/*VRAAG* 8

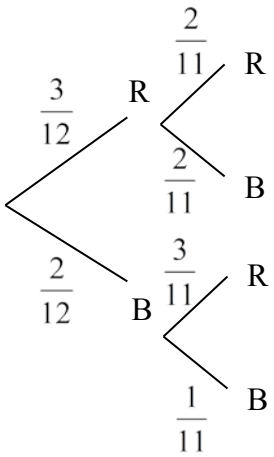
8.1	$h(x) = -2(x + \frac{3}{2})(x - 1)(x + 3)$ $h(x) = -(2x + 3)(x^2 + 2x - 3)$ $h(x) = -2x^3 - 7x^2 + 9$ **OR/*OF*** $h(x) = -(2x + 3)(x - 1)(x + 3)$ $h(x) = -(2x + 3)(x^2 + 2x - 3)$ $h(x) = -2x^3 - 7x^2 + 9$	✓✓ $-2(x + \frac{3}{2})(x - 1)(x + 3)$ ✓correct simplification (3) **OR/*OF*** ✓✓ $-(2x + 3)(x - 1)(x + 3)$ ✓ correct simplification (3)
8.2	$h'(x) = -6x^2 - 14x$ $-6x^2 - 14x = 0$ $-2x(3x + 7) = 0$ $x = 0$ or $x = -\frac{7}{3}$	✓ first derivative ✓ $= 0$ ✓ both answers (3)
8.3	$x < -\frac{7}{3}$ or $x > 0$ **OR/*OF*** $x \in \left(-\infty ; -\frac{7}{3}\right) \cup (0 ; \infty)$	✓✓ answer (2) **OR/*OF*** ✓✓ answer (2)

8.4	$y = 4x + 7$ $-6x^2 - 14x = 4$ $0 = 6x^2 + 14x + 4$ $0 = 3x^2 + 7x + 2$ $0 = (3x + 1)(x + 2)$ $x = -\frac{1}{3}$ or $x = -2$	✓ $y = 4x + 7$ ✓ $h'(x) = 4$ ✓ standard form ✓ both answers (4) **[12]**

QUESTION/*VRAAG* 9

9.1	Volume of Sphere $= \frac{4}{3}\pi(8)^3$ or $= \frac{2048\pi}{3}$ or $= 2144{,}66$	✓ answer (1)
9.2	$r^2 + x^2 = 8^2$ (Pythagoras) $r^2 = 64 - x^2$	✓ substitution or reason Pythagoras (1)
9.3	$V_{cone} = \frac{1}{3}\pi r^2 h$ $= \frac{1}{3}\pi(64 - x^2)(8 + x)$ $= \frac{\pi}{3}(512 + 64x - 8x^2 - x^3)$ $\frac{dV}{dx} = \frac{64\pi}{3} - \frac{16\pi}{3}x - \frac{3\pi}{3}x^2$ $0 = 64 - 16x - 3x^2$ $0 = (8 - 3x)(x + 8)$ $x = \frac{8}{3}$ $x \neq -8$ $\frac{V_{cone}}{V_{sphere}} = \frac{\frac{1}{3}\pi\left(\frac{512}{9}\right)\left(\frac{32}{3}\right)}{\frac{2048\pi}{3}}$ $= \frac{8}{27} = 0{,}3$	✓ $h = 8 + x$ ✓ $\frac{1}{3}\pi(64 - x^2)(8 + x)$ ✓ expansion ✓ $\frac{dV}{dx} = \frac{64\pi}{3} - \frac{16\pi}{3}x - \frac{3\pi}{3}x^2$ ✓ $x = \frac{8}{3}$ ✓ volume of the cone ✓ $\frac{8}{27}$ or 0,3 (7) **[9]**

QUESTION/*VRAAG* 10

10.1	 P(One Red and One Blue) = P(Red, Blue) + P(Blue, Red) $=\left(\frac{3}{12}\right)\times\left(\frac{2}{11}\right)+\left(\frac{2}{12}\right)\times\left(\frac{3}{11}\right)$ $=\frac{1}{11}$	✓ $\left(\frac{3}{12}\right)\times\left(\frac{2}{11}\right)$ ✓ $\left(\frac{2}{12}\right)\times\left(\frac{3}{11}\right)$ ✓ addition of products ✓ answer (4)
10.2.1	$a = 0{,}48 \times 250$ $a = 120$	✓ answer (1)
10.2.2	$b = 150$ P(S) × P(F) $=\frac{200}{250}\times\frac{150}{250}$ $= 0{,}48$ = P(S and F) These events are independent / *Hierdie gebeurtenisse is onafhanklik*	✓ b ✓ P(S) × P(F) ✓ $\frac{200}{250}$ and $\frac{150}{250}$ ✓ conclusion (with realistic probabilities) (4)
		[9]

QUESTION/*VRAAG* 11

11.1	10 × 9 = 90	✓✓ 10 × 9 (2)
11.2.1	10! =3 628 800	✓ 10! (1)
11.2.2	2! × 2! × 2! × 2! × 2! ×4! = 768	✓ 2! × 2! × 2! × 2! × 2! ✓ 4! ✓ 2! × 2! × 2! × 2! × 2!×4! or 768 (3) **[6]**

TOTAL/*TOTAAL*: 150