basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

SENIOR CERTIFICATE EXAMINATIONS/
SENIORSERTIFIKAAT-EKSAMEN
NATIONAL SENIOR CERTIFICATE EXAMINATIONS/
NASIONALE SENIORSERTIFIKAAT-EKSAMEN

MATHEMATICS P1/*WISKUNDE V1*

MARKING GUIDELINES/*NASIENRIGLYNE*

2022

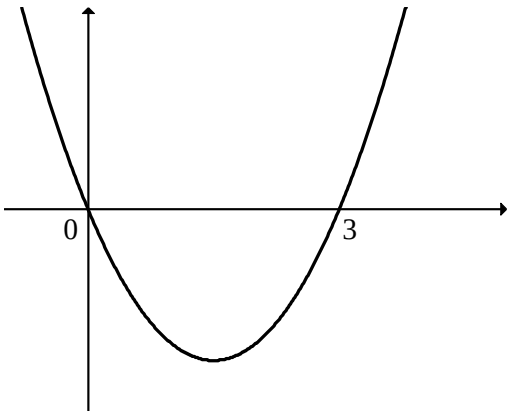
MARKS: 150
PUNTE: 150

These marking guidelines consist of 16 pages.
Hierdie nasienriglyne bestaan uit 16 bladsye.

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

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

QUESTION/*VRAAG* 1

1.1.1	$x^2+2x-15=0$ $(x+5)(x-3)=0$ $x=-5$ or $x=3$	✓ factors ✓ $x=-5$ ✓ $x=3$ (3)
1.1.2	$5x^2-x-9=0$ $x=\frac{-(-1)\pm\sqrt{(-1)^2-4(5)(-9)}}{2(5)}$ $x=\frac{1\pm\sqrt{181}}{10}$ $x=1{,}45$ or $x=-1{,}25$	✓substitution into the correct formula ✓ $x=1{,}45$ ✓ $x=-1{,}25$ (3)
1.1.3	$x^2\le 3x$ $x^2-3x\le 0$ $x(x-3)\le 0$  $0\le x\le 3$ OR $x\in[0;3]$	✓ standard form ✓ factors ✓✓ answer (4)
1.2.1	$a+\frac{64}{a}=16$ $a^2-16a+64=0$ $(a-8)^2=0$ $a=8$	✓ standard form ✓ factors ✓ answer (3)

1.2.2	$2^x + 2^{6-x} = 16$ $2^x + \frac{64}{2^x} = 16$ $2^x = 8$ (from 1.2.1) $2^x = 2^3$ $x = 3$	✓ exp law ✓ $2^x = 8$ ✓ answer	(3)
1.3	$\sqrt{\frac{2^{1002}(1+2^4)}{17(2)^{998}}}$ $= \sqrt{\frac{2^4(17)}{17}}$ $= \sqrt{2^4}$ $= 2^2$ $= 4$	✓common factor ✓second factor ✓simplification ✓answer	(4)
1.4	$2x - y = 2 \quad \ldots(1)$ $\frac{1}{x} - 3y = 1 \quad \ldots(2)$ $y = 2x - 2$ $\frac{1}{x} - 3(2x-2) = 1$ $\frac{1}{x} - 6x + 6 - 1 = 0$ $1 - 6x^2 + 6x - x = 0$ $-6x^2 + 5x + 1 = 0$ $6x^2 - 5x - 1 = 0$ $(6x+1)(x-1) = 0$ $x = -\frac{1}{6}$ or $x = 1$ $y = 2\left(-\frac{1}{6}\right) - 2$ or $y = 2(1) - 2$ $y = -\frac{7}{3}$ or $y = 0$	✓ $y = 2x - 2$ ✓substitution ✓simplification ✓standard form ✓x-values ✓y-values	(6)

OR/*OF*

$x = \frac{2+y}{2} \quad \ldots(1)$

$\frac{1}{x} - 3y = 1 \quad \ldots(2)$

$\frac{1}{\frac{2+y}{2}} - 3y = 1$

$\frac{2}{2+y} - 3y = 1$

$\frac{2-6y-3y^2}{2+y} = 1$

$2 - 6y - 3y^2 = 2 + y$

$-3y^2 - 7y = 0$

$-y(3y+7) = 0$

$y = 0 \quad \text{or} \quad y = -\frac{7}{3}$

$x = 1 \quad \text{or} \quad x = -\frac{1}{6}$

OR/*OF*

✓ $x = \frac{2+y}{2}$

✓substitution

✓simplification

✓standard form

✓*y*-values

✓*x*-values

(6)
[26]

QUESTION/*VRAAG* 2

2.1.1	$a+6d=35$ $-1+6d=35$ $6d=36$ $d=6$ **OR/OF** $\frac{35-(-1)}{7-1}=6$ ANSWER ONLY: FULL MARKS	✓ substitution ✓answer (2) **OR/OF** ✓ substitution ✓answer (2)
2.1.2	$T_n=a+(n-1)d$ $473=-1+(n-1)(6)$ $79=n-1$ $\therefore n=80$ ANSWER ONLY: FULL MARKS	✓substitution into the correct formula ✓ equating to 473 ✓ answer (3)
2.1.3	$S_n=\frac{n}{2}[2a+(n-1)d]$ $S_{40}=\frac{40}{2}[2(-1)+(40-1)(6)]$ $\therefore S_{40}=4\,640$ **OR/*OF*** $T_{40}=6(40)-7$ $=233$ $S_n=\frac{n}{2}(a+l)$ $=\frac{40}{2}(-1+233)$ $=4\,640$	✓ substitution ✓answer (2) **OR/*OF*** ✓ substitution ✓answer (2)
2.2.1	75 53 35 21 –22 –18 –14 4 4 $T_5=11$	✓answer (A) (1)
2.2.2	$T_n=an^2+bn+c$ $2a=4$ $a=2$ $3a+b=-22$ $6+b=-22$ $b=-28$ $a+b+c=75$ $2-28+c=75$ $c=101$ $\therefore T_n=2n^2-28n+101$	✓ $T_n=an^2+bn+c$ ✓ $a=2$ ✓ $b=-28$ ✓ $c=101$ (4)

2.2.3 Minimum value of T_n

$n = -\frac{b}{2a} = -\frac{(-28)}{2(2)}$

$n = 7$ ✓ $n = 7$

Minimum value of $T_n = 2(7)^2 - 28(7) + 101 = 3$ ✓ min value = 3

Each term in the new pattern is $-\frac{1}{5}$ the value of the terms in the old pattern. ✓ $-\frac{1}{5}$ value of term of old pattern

Maximum value of new pattern $= -\frac{3}{5}$ ✓ max value $= -\frac{3}{5}$ (4)

OR/*OF*

OR/*OF*

$T_n' = 4n - 28$

$4n - 28 = 0$

$4n = 28$

$n = 7$ ✓$n = 7$

Minimum value of $T_n = 2(7)^2 - 28(7) + 101 = 3$ ✓ min value = 3

Each term in the new pattern is $-\frac{1}{5}$ the value of the terms in the old pattern. ✓ $-\frac{1}{5}$ value of term of old pattern

Maximum value of new pattern $= -\frac{3}{5}$ ✓ max value $= -\frac{3}{5}$

(4)

OR/OF

OR/OF

$T_n = -\frac{2}{5}n^2 + \frac{28}{5}n - \frac{101}{5}$ ✓✓ $T_n \div (-5)$

$n = -\frac{b}{2a} = \frac{-\frac{28}{5}}{2\left(\frac{-2}{5}\right)}$

$= 7$ ✓$n = 7$

$T_7 = -\frac{3}{5}$ ✓ max value $= -\frac{3}{5}$ (4)

OR/OF

OR/OF

$T_n = -\frac{2}{5}n^2 + \frac{28}{5}n - \frac{101}{5}$

$T'_n = -\frac{4}{5}n + \frac{28}{5}$ ✓✓ $T_n \div (-5)$

$-\frac{4}{5}n + \frac{28}{5} = 0$

$-4n = -28$

$n = 7$ ✓$n = 7$

Minimum value of $T_n = 2(7)^2 - 28(7) + 101 = 3$

Each term in the new pattern is $-\frac{1}{5}$ the value of the terms in the old pattern.

Maximum value of new pattern $= -\frac{3}{5}$

✓ max value $= -\frac{3}{5}$

(4)

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QUESTION/*VRAAG* 3

3.1.1	$T_n = ar^{n-1}$ $T_{10} = 1\,024\left(\frac{1}{4}\right)^{10-1}$ $\therefore T_{10} = \frac{1}{256}$ ANSWER ONLY: FULL MARKS	✓substitution into the correct formula ✓ answer (2)
3.1.2	$\sum_{p=0}^{8} 256\left(4^{1-p}\right) = 1\,024 + 256 + 64 + \ldots$ $S_n = \frac{a\left[1-r^n\right]}{1-r}$ $S_9 = \frac{1024\left[1-\left(\frac{1}{4}\right)^9\right]}{1-\frac{1}{4}}$ $S_9 = \frac{87\,381}{64}$ $= 1\,365{,}33$ **OR/OF** $\sum_{p=0}^{8} 256\left(4^{1-p}\right)$ $= 1\,024 + 256 + 64 + 16 + 4 + 1 + \frac{1}{4} + \frac{1}{16} + \frac{1}{64}$ $S_9 = \frac{87\,381}{64}$ $= 1\,365{,}33$	✓ 1024 ✓ $n = 9$ ✓substitution into the correct formula ✓answer (4) **OR/OF** ✓ 1024 ✓ rest of expansion ✓ n = 9 terms ✓ answer (4)
3.2	$-t^2 - 6t - 9\,;\, \frac{t^3 + 9t^2 + 27t + 27}{2}$ $-\left(t^2 + 6t + 9\right);\ \frac{1}{2}(t+3)\left(t^2 + 6t + 9\right)$ $-(t+3)^2\ ;\ \frac{1}{2}(t+3)^3$ $r = \frac{-(t+3)}{2}$ $-1 < \frac{-t-3}{2} < 1$ $-2 < -t - 3 < 2$ $1 < -t < 5$ $-5 < t < -1$	✓ $r = \frac{\frac{t^3 + 9t^2 + 27t + 27}{2}}{-t^2 - 6t - 9}$ ✓ $-(t^2 + 6t + 9)$ ✓ $\frac{1}{2}(t+3)\left(t^2 + 6t + 9\right)$ ✓ $-1 < \frac{-t-3}{2} < 1$ ✓ answer (5)
		[11]

QUESTION 4

4.1	$10 = a\left(\frac{1}{3}\right)^{-2} + 7$ $3 = 9a$ $\therefore a = \frac{1}{3}$	✓ subs (–2 ; 10) ✓ simplification ✓ answer (3)
4.2	$y = g(0)$ $y = \frac{1}{3} \times \left(\frac{1}{3}\right)^{0} + 7$ $y = \frac{22}{3} = 7,33$ $\therefore \left(0\ ;\ \frac{22}{3}\right)$ ANSWER ONLY: FULL MARKS	✓ substitution of $x = 0$ ✓ answer (2)
4.3.1	Translation by 1 unit to the right and 7 units downwards	✓ 1 unit right ✓ 7 units downwards (2)
4.3.2	$h(x) = \left(\frac{1}{3}\right)^{x}$ h^{-1}: $x = \left(\frac{1}{3}\right)^{y}$ $y = \log_{\frac{1}{3}}(x)$ **OR/*OF*** $y = -\log_{3}(x)$ ANSWER ONLY: FULL MARKS	✓ swap x and y ✓ answer (2)
		[9]

QUESTION 5

5.1	$g(x)=\frac{a}{x+2}+q$ Subs (1 ; 0): $0=\frac{a}{1+2}+q$ $0=a+3q$ Subs $\left(0\ ;-\frac{1}{2}\right)$ $-\frac{1}{2}=\frac{a}{0+2}+q$ $-1=a+2q$ Solving simultaneously: $q=1$ $a=-3$ $\therefore g(x)=\frac{-3}{x+2}+1$	✓ $g(x)=\frac{a}{x+2}+q$ ✓ $0=a+3q$ ✓ $-1=a+2q$ ✓ solving simultaneously ✓ $q = 1$ ✓ $a = –3$ (6)
5.2	$y \in$ R; $y \neq 1$ **OR/*OF*** $(-\infty;1)$ or $(1;\infty)$ **OR/*OF*** $y<1$ or $y>1$	✓ answer (1)
5.3	$y-1=1(x+2)$ **OR/*OF*** $1=1(-2)+c$ $y=x+3$ ANSWER ONLY: FULL MARKS $c = 3$ $y=x+3$	✓ $m = 1$ ✓ subs point (– 2 ; 1) ✓ answer (3)
5.4	K$'$ (–3 ; 4)	✓ x-value ✓ y-value (2)
		[12]

QUESTION 6

6.1	$f(x) = -x^2 - 6x + 7$ $f'(x) = -2x - 6$ $-2x - 6 = 0$ **OR/*OF*** $x = -\frac{(-6)}{2(-1)}$ $x = -3$ E(–3 ; 16) ANSWER ONLY: FULL MARKS	✓ method ✓ *x*-value ✓ *y*-value (3)
6.2	$k = f(-5)$ $k = -(-5)^2 - 6(-5) + 7$ $\therefore k = 12$	✓ answer (A) (1)
6.3	C(0 ; 7) D(–5 ; 12) $m_{CD} = \frac{12 - 7}{-5 - 0}$ $m_{CD} = -1$ Equation of CD: $y = -x + 7$	✓ coordinates of C ✓ substitution ✓ *m* ✓ answer (4)
6.4	$-2x - 6 = -1$ $-2x = 5$ $x = -\frac{5}{2}$ $y = f\left(\frac{-5}{2}\right) = -\left(\frac{-5}{2}\right)^2 - 6\left(\frac{-5}{2}\right) + 7 = \frac{63}{4} = 15,75$ $\therefore \text{P}\left(-\frac{5}{2}; \frac{63}{4}\right)$	✓ $f'(x) = -2x - 6$ ✓ equating to -1 ✓ *x*-value ✓ *y*-value (A) (4)
6.5	Point by symmetry: (–1 ; 12) $-5 < x < -1$ **OR/*OF*** $-x^2 - 6x + 7 > 12$ $-x^2 - 6x - 5 > 0$ $x^2 + 6x + 5 < 0$ $(x + 1)(x + 5) < 0$ $-5 < x < -1$ ANSWER ONLY: FULL MARKS	✓ –1 ✓ answer (2) ✓ –1 ✓ answer (2)
		[14]

QUESTION 7

7.1	$A = P(1+i)^n$ $2 = 1\left(1+\frac{0,085}{4}\right)^{4n}$ $4n = \log_{\left(1+\frac{0,085}{4}\right)} 2$ $n = 8,24$ years	✓ 2 ✓ $\frac{0,085}{4}$ } In correct formula ✓ use of logs ✓ answer in years (4)
7.2.1	$A = P(1-i)^n$ $180\ 000 = 500\ 000(1-i)^5$ $\frac{9}{25} = (1-i)^5$ $\sqrt[5]{\frac{9}{25}} = 1-i$ $i = 0,1848068...$ $r = 18,48\%$	✓ subs into correct formula ✓ simplification ✓ $i = 0,1848\ldots$ ✓ answer (4)
7.2.2	$A = P(1+i)^n$ $A = 500\ 000(1+0,063)^5$ A = R678 635,11	✓ subs into correct formula ✓ answer (2)
7.2.3	Sinking Fund = 678 635,11 – 180 000 = R 498 635,11 $498\ 635,11 = \frac{x\left[\left(1+\frac{0,1025}{12}\right)^{58}-1\right]\left(1+\frac{0,1025}{12}\right)^{3}}{\frac{0,1025}{12}}$ $x = R6\ 510,36$	✓ value of sinking fund ✓ $\frac{0,1025}{12}$ ✓ $n = 58$ (A) ✓ $\left(1+\frac{0,1025}{12}\right)^{3}$ ✓ answer (A) (5)
		[15]

QUESTION/*VRAAG* 8

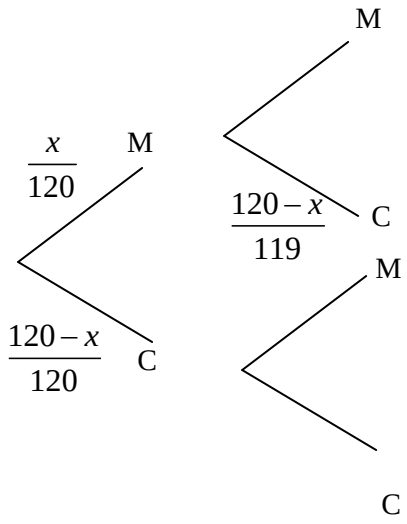
8.1	$f(x)=-x^2$ $f'(x)=\lim\limits_{h\to 0}\dfrac{f(x+h)-f(x)}{h}$ $f'(x)=\lim\limits_{h\to 0}\dfrac{-(x+h)^2+x^2}{h}$ $f'(x)=\lim\limits_{h\to 0}\dfrac{-x^2-2xh-h^2+x^2}{h}$ $=\lim\limits_{h\to 0}\dfrac{-2xh-h^2}{h}$ $=\lim\limits_{h\to 0}\dfrac{h(-2x-h)}{h}$ $=\lim\limits_{h\to 0}(-2x-h)$ $\therefore f'(x)=-2x$	✓ substitution into formula ✓ $-\left(x^2+2xh+h^2\right)$ ✓ $-2xh-h^2$ ✓ $-2x-h$ ✓answer (5)
	OR/*OF* $f(x)=-x^2$ $f(x+h)=-(x+h)^2=-x^2-2xh-h^2$ $f(x+h)-f(x)=-x^2-2xh-h^2-(-x^2)=-2xh-h^2$ $f'(x)=\lim\limits_{h\to 0}\dfrac{f(x+h)-f(x)}{h}$ $=\lim\limits_{h\to 0}\dfrac{-2xh-h^2}{h}$ $=\lim\limits_{h\to 0}\dfrac{h(-2x-h)}{h}$ $=\lim\limits_{h\to 0}(-2x-h)$ $\therefore f'(x)=-2x$	**OR/*OF*** ✓ $-x^2-2xh-h^2$ ✓ $-2xh-h^2$ ✓substitution into the formula ✓ $-2x-h$ ✓answer (5)
8.2.1	$f(x)=4x^3-5x^2$ $f'(x)=12x^2-10x$	✓ $12x^2$ (A) ✓ $-10x$ (A) (2)
8.2.2	$D_x\left[\dfrac{-6\sqrt[3]{x}+2}{x^4}\right]$ $=D_x\left[\dfrac{-6(x)^{\frac{1}{3}}}{x^4}+\dfrac{2}{x^4}\right]$ $=D_x\left[-6x^{-\frac{11}{3}}+2x^{-4}\right]$ $=22x^{-\frac{14}{3}}-8x^{-5}$	✓ $x^{\frac{1}{3}}$ ✓ $-6x^{-\frac{11}{3}}+2x^{-4}$ ✓ $22x^{-\frac{14}{3}}$ ✓ $-8x^{-5}$ (4)
		[11]

QUESTION/*VRAAG* 9

9.1	$f(x)=(x+t)^2(x-3)$ $-3=(0+t)^2(0-3)$ $1=t^2$ $t=\pm 1$ $\therefore t=1$ $f(x)=(x+1)^2(x-3)$ $f(x)=(x^2+2x+1)(x-3)$ $f(x)=x^3-x^2-5x-3$	✓ $f(x)=(x+t)^2(x-3)$ ✓ subs (0 ; –3) ✓ t ✓ $f(x)=(x+1)^2(x-3)$ ✓ expansion (5)
9.2	$f'(x)=3x^2-2x-5$ $0=3x^2-2x-5$ $0=(x+1)(3x-5)$ $x=-1$ or $x=\frac{5}{3}$ $\text{N}\left(\frac{5}{3}\,;-\frac{256}{27}\right)=(1,67\,;-9,48)$	✓ $f'(x)=3x^2-2x-5$ ✓ = 0 ✓ factors ✓ x-value ($x > 0$) ✓ y-value (A) (5)
9.3.1	$x<3\ ;\ x\neq -1$ **OR/*OF*** $x<-1$ or $-1<x<3$ **OR/*OF*** $(-\infty\,;-1)$ or $(-1\,;3)$	✓ $x<3$ ✓ $x\neq -1$ (2) **OR/*OF*** ✓ $x<-1$ ✓ $-1<x<3$ (2) **OR/*OF*** ✓ $(-\infty\,;-1)$ ✓ $(-1\,;3)$ (2)
9.3.2	$x<-1$ or $x>\frac{5}{3}$ OR/OF $x\leq -1$ or $x\geq\frac{5}{3}$ **OR/*OF*** $(-\infty\,;-1)$ or $\left(\frac{5}{3};\infty\right)$ OR/OF $(-\infty\,;-1]$ or $\left[\frac{5}{3};\infty\right)$	✓ $x<-1$ ✓ $x>\frac{5}{3}$ (2) **OR/*OF*** ✓ $(-\infty\,;-1)$ ✓ $\left(\frac{5}{3};\infty\right)$ (2)
9.3.3	$f''(x)>0$ $6x-2>0$ $x>\frac{1}{3}$ or $\left(\frac{1}{3};\infty\right)$ **OR/OF** $\frac{\frac{5}{3}+(-1)}{2}=\frac{1}{3}$ $x>\frac{1}{3}$ or $\left(\frac{1}{3};\infty\right)$	ANSWER ONLY: FULL MARKS ✓ $6x-2$ ✓ $\frac{1}{3}$ ✓ $x>\frac{1}{3}$ (3) **OR/OF** ✓ substitution ✓ $\frac{1}{3}$ ✓ $x>\frac{1}{3}$ (3)

9.4	Distance $= x^3 - x^2 - 5x - 3 - (3x^2 - 2x - 5)$ $= x^3 - 4x^2 - 3x + 2$ $\frac{d\text{Distance}}{dx} = 3x^2 - 8x - 3$ $0 = 3x^2 - 8x - 3$ $0 = (3x + 1)(x - 3)$ $x = 3$ or $x = -\frac{1}{3}$ Max distance $= \left(-\frac{1}{3}\right)^3 - 4\left(-\frac{1}{3}\right)^2 - 3\left(-\frac{1}{3}\right) + 2$ $= \frac{68}{27} = 2{,}52$	✓ $x^3 - 4x^2 - 3x + 2$ ✓ $\frac{d\text{Distance}}{dx} = 3x^2 - 8x - 3$ ✓ factors ✓ *x*-values ✓ $x = -\frac{1}{3}$ ✓ answer (6)
		[23]

QUESTION/*VRAAG* 10

10.1.1	$7! = 5\,040$	✓✓ answer (2)
10.1.2	$4! \times 4!$ $= 576$ P(African flags together) $= \frac{576}{5040} \quad \left(= \frac{4}{35} = 0{,}11\right)$	✓ $4!$ ✓ $4! \times 4!$ ✓ answer (A) (3)
10.2	P(A or B) = P(A) + P(B) – P(A and B) 0,88 = 0,4 + P(B) – P(A and B) 0,88 = 0,4 + P(B) – 0,4P(B) 0,48 = 0,6P(B) P(B) = 0,8	✓subs into rule ✓P(A and B) = 0,4P(B) ✓ answer (3)
10.3	First Passenger Second Passenger  Probability of first passenger choosing meat $= \frac{x}{120}$ Probability of second passenger choosing cheese $= \frac{120-x}{119}$ $\frac{x}{120} \times \frac{120-x}{119} = \frac{18}{85}$ $120x - x^2 = 3\,024$ $x^2 - 120x + 3\,024 = 0$ $(x-84)(x-36) = 0$ $x = 84 \quad \text{or} \quad x = 36$ $\therefore$ P(1st cheese) $= \frac{36}{120} = \frac{3}{10}$	✓ $\frac{x}{120}$ ✓ $\frac{120-x}{119}$ ✓ $\frac{x}{120} \times \frac{120-x}{119} = \frac{18}{85}$ ✓ $x = 84 \quad \text{or} \quad x = 36$ ✓ $\frac{3}{10}$ (5)
		[13]

TOTAL/*TOTAAL*: 150