basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NASIONALE SENIOR SERTIFIKAAT

GRAAD 12

WISKUNDE V1

NOVEMBER 2022

PUNTE: 150

TYD: 3 uur

Hierdie vraestel bestaan uit 9 bladsye en 1 inligtingsblad.

INSTRUKSIES EN INLIGTING

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

1. Hierdie vraestel bestaan uit 10 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 $(3x-6)(x+2)=0$ (2)

1.1.2 $2x^2-6x+1=0$ (korrek tot TWEE desimale plekke) (3)

1.1.3 $x^2-90>x$ (4)

1.1.4 $x-7\sqrt{x}=-12$ (4)

1.2 Los gelyktydig vir x en y op:

$2x-y=2$
$xy=4$ (5)

1.3 Toon dat $2.5^n-5^{n+1}+5^{n+2}$ ewe is vir alle positiewe heelgetalwaardes van n. (3)

1.4 Bepaal die waardes van x en y as: $\frac{3^{y+1}}{32}=\sqrt{96^x}$ (4)

[25]

VRAAG 2

2.1 Die eerste term van 'n meetkundige reeks is 14 en die 6^{de} term is 448.

2.1.1 Bereken die waarde van die konstante verhouding, r. (2)

2.1.2 Bepaal die aantal opeenvolgende terme wat by die eerste 6 terme van die reeks getel moet word om 'n som van 114 674 te kry. (4)

2.1.3 Indien die eerste term van 'n ander reeks 448 en die 6^{de} term 14 is, bereken die som tot oneindig van die nuwe reeks. (3)

2.2 Indien $\sum_{p=0}^{k}\left(\frac{1}{3}p+\frac{1}{6}\right)=20\frac{1}{6}$, bepaal die waarde van k. (5)

[14]

VRAAG 3

Daar word gegee dat die algemene term van 'n kwadratiese getalpatroon $T_n = n^2 + bn + 9$ is en dat die eerste term van die eerste verskille 7 is.

3.1 Toon dat $b = 4$. (2)

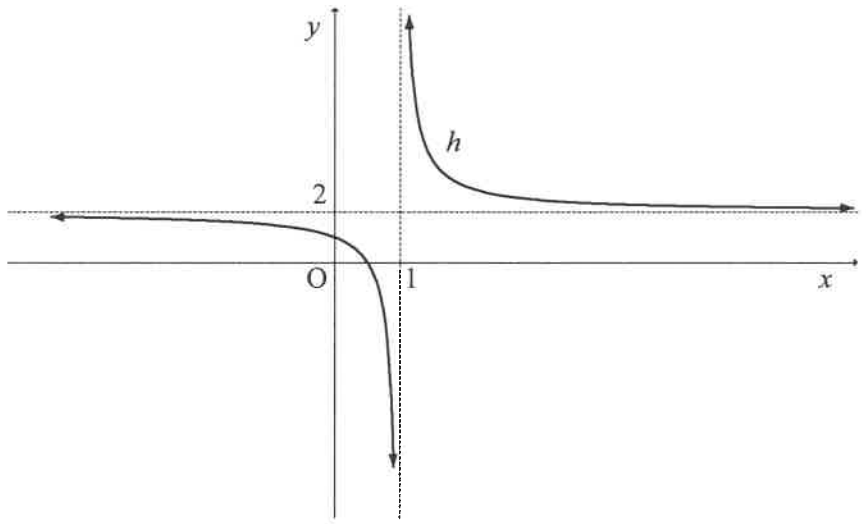
3.2 Bepaal die waarde van die 60^{ste} term van hierdie getalpatroon. (2)

3.3 Bepaal die algemene term vir die ry van eerste verskille van die kwadratiese getalpatroon. Skryf jou antwoord in die vorm $T_p = mp + q$. (3)

3.4 Watter TWEE opeenvolgende terme in die kwadratiese getalpatroon het 'n eerste verskil van 157? (3)
[10]

VRAAG 4

4.1 Die grafiek van $h(x) = \frac{1}{x+p} + q$ is hieronder geskets. Die asimptote van h sny by $(1\ ;\ 2)$.



4.1.1 Skryf die waardes van p en q neer. (2)

4.1.2 Bereken die koördinate van die x-afsnit van h. (2)

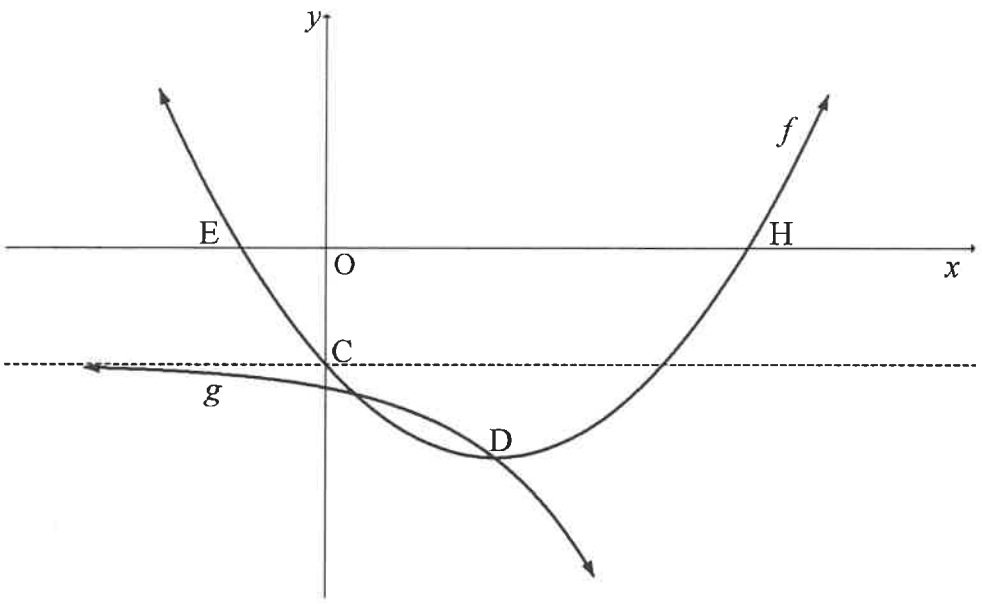
4.1.3 Skryf die x-koördinaat van die x-afsnit van g neer, indien $g(x) = h(x+3)$. (2)

4.1.4 Die vergelyking van 'n simmetrie-as van h is $y = x + t$. Bepaal die waarde van t. (2)

4.1.5 Bepaal die waardes van x waarvoor $-2 \leq \frac{1}{x-1}$. (3)

4.2 Die grafieke van $f(x)=x^2-4x-5$ en $g(x)=a.2^x+q$ is hieronder geskets.

- E en H is die x-afsnitte van f.
- C is die y-afsnit van f en lê op die asimptoot van g.
- Die twee grafieke sny by D, die draaipunt van f.



4.2.1 Skryf die y-koördinaat van C neer. (1)

4.2.2 Bepaal die koördinate van D. (2)

4.2.3 Bepaal die waardes van a en q. (3)

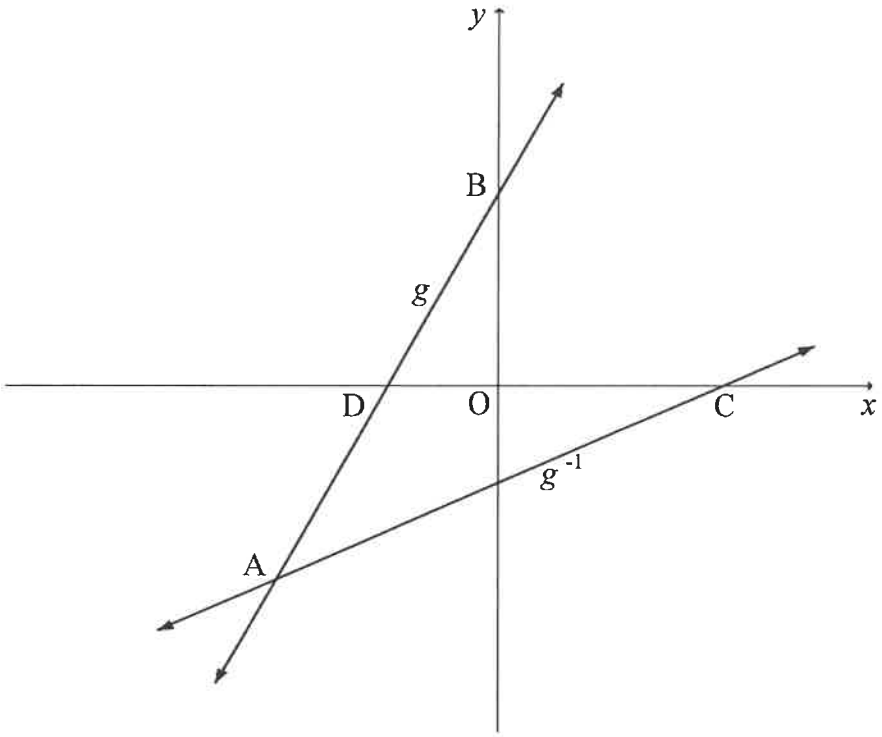
4.2.4 Skryf die waardeversameling van g neer. (1)

4.2.5 Bepaal die waardes van k waarvoor die waarde van $f(x) - k$ altyd positief sal wees. (2)
[20]

VRAAG 5

Die grafieke van $g(x) = 2x + 6$ en g^{-1}, die inverse van g, word in die diagram hieronder getoon.

- D en B is onderskeidelik die x- en y-afsnitte van g.
- C is die x-afsnit van g^{-1}.
- Die grafieke van g en g^{-1} sny by A.



5.1 Skryf die y-koördinaat van B neer. (1)

5.2 Bepaal die vergelyking van g^{-1} in die vorm $g^{-1}(x) = mx + n$. (2)

5.3 Bepaal die koördinate van A. (3)

5.4 Bereken die lengte van AB. (2)

5.5 Bereken die oppervlakte van ΔABC. (5)
[13]

VRAAG 6

6.1 R12 000 is in 'n fonds belê wat rente teen $m\%$ p.j., kwartaalliks saamgestel, betaal het. Na 24 maande was die waarde van die belegging R13 459.

Bepaal die waarde van m. (4)

6.2 Op 31 Januarie 2022 het Tino R1 000 in 'n rekening gedeponeer wat rente teen 7,5% p.j., maandeliks saamgestel, betaal het. Hy het aangehou om R1 000 op die laaste dag van elke maand te deponeer. Hy sal die laaste deposito op 31 Desember 2022 maak.

Sal Tino op 1 Januarie 2023 genoeg geld in die rekening hê om 'n rekenaar wat R13 000 kos, te kan koop? Motiveer jou antwoord deur 'n toepaslike berekening te gebruik. (4)

6.3 Thabo beplan om 'n kar wat R250 000 kos, te koop. Hy sal 'n deposito van 15% betaal en 'n lening vir die balans uitneem. Die rente op die lening is 13% p.j., maandeliks saamgestel.

6.3.1 Bereken die waarde van die lening. (1)

6.3.2 Die eerste terugbetaling sal gemaak word 6 maande nadat die lening toegestaan is. Die lening sal oor 'n tydperk van 6 jaar nadat dit toegestaan is, afbetaal word. Bereken die MAANDELIKSE paaiement. (5)

[14]

VRAAG 7

7.1 Bepaal $f'(x)$ vanuit eerste beginsels indien $f(x) = x^2 + x$. (5)

7.2 Bepaal $f'(x)$ indien $f(x) = 2x^5 - 3x^4 + 8x$. (3)

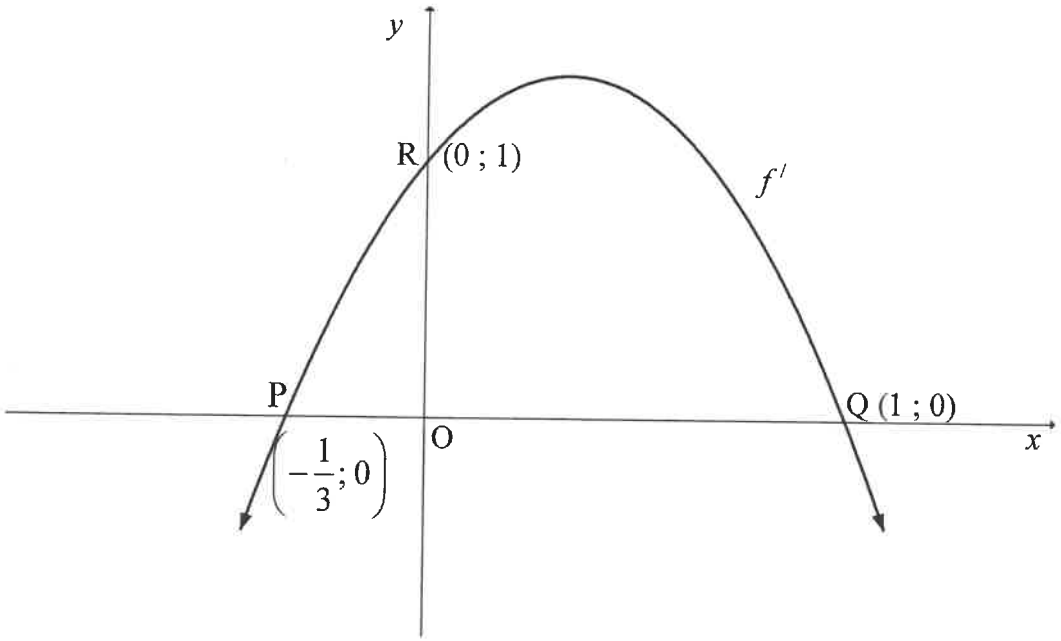
7.3 Die raaklyn aan $g(x) = ax^3 + 3x^2 + bx + c$ het 'n minimum helling (gradiënt) by die punt $(-1 ; -7)$. Vir watter waardes van x sal g konkaaf op wees? (4)

[12]

VRAAG 8

Die grafiek van $y = f'(x) = mx^2 + nx + k$ is hieronder geteken.

Die grafiek gaan deur die punte $P\left(-\frac{1}{3}; 0\right)$, $Q(1; 0)$ en $R(0; 1)$.



8.1 Bepaal die waardes van m, n en k. (6)

8.2 Indien dit verder gegee word dat $f(x) = -x^3 + x^2 + x + 2$:

8.2.1 Bepaal die koördinate van die draaipunte van f. (3)

8.2.2 Skets die grafiek van f. Dui die koördinate van die draaipunte en die afsnitte met die asse op jou grafiek aan. (5)

8.3 Punte E en W is twee veranderlike punte op f' en is op dieselfde horisontale lyn.

- h is 'n raaklyn aan f' by E.
- g is 'n raaklyn aan f' by W.
- h en g sny by D(a ; b).

8.3.1 Skryf die waarde van a neer. (1)

8.3.2 Bepaal die waarde(s) van b waarvoor h en g nie meer raaklyne aan f' sal wees nie. (2)

[17]

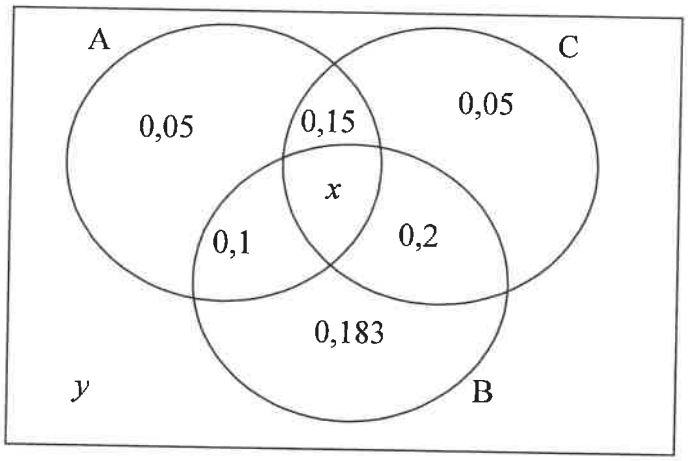
VRAAG 9

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

Bepaal die minimum afstand tussen die punt $(10 ; 2)$ en 'n punt op f. **[8]**

VRAAG 10

10.1 A, B en C is drie gebeurtenisse. Die waarskynlikhede dat hierdie gebeurtenisse (of enige kombinasie daarvan) sal plaasvind, word in die Venn-diagram hieronder gegee.



10.1.1 Indien daar gegee word dat die waarskynlikheid dat ten minste een van die gebeurtenisse sal plaasvind, 0,893 is, bereken die waarde van:

(a) y, die waarskynlikheid dat nie een van hierdie gebeurtenisse sal plaasvind nie. (1)

(b) x, die waarskynlikheid dat al drie gebeurtenisse sal plaasvind. (1)

10.1.2 Bepaal die waarskynlikheid dat ten minste twee van die gebeurtenisse sal plaasvind. (2)

10.1.3 Is gebeurtenisse B en C onafhanklik? Motiveer jou antwoord. (5)

10.2 'n Viersyferkode word benodig om 'n kombinasieslot oop te maak. Die kode moet 'n ewe getal wees en mag nie die syfers 0 of 1 bevat nie. Syfers mag nie herhaal word nie.

10.2.1 Hoeveel moontlike 4-syfer-kombinasies is daar om die slot oop te maak? (3)

10.2.2 Bereken die waarskynlikheid dat jy die slot met die eerste poging sal oopmaak as daar gegee word dat die kode groter as 5 000 is en dat die derde syfer 2 is. (5)

[17]

TOTAAL: 150

INLIGTINGSBLAD

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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NATIONAL SENIOR CERTIFICATE/ *NASIONALE SENIOR SERTIFIKAAT*

GRADE 12/*GRAAD 12*

MATHEMATICS P1/*WISKUNDE V1*

NOVEMBER 2022

MARKING GUIDELINES/*NASIENRIGLYNE*

MARKS/*PUNTE*: 150

These marking guidelines consist of 21 pages.
Hierdie nasienriglyne bestaan uit 21 bladsye.

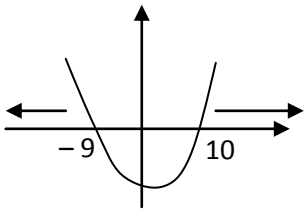
NOTE:

- 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, sien slegs die EERSTE poging na.*
- *Volgehoue akkuraatheid is DEURGAANS op ALLE aspekte van die nasienriglyne van toepassing.*

QUESTION1/*VRAAG* 1

1.1.1	$(3x-6)(x+2)=0$ $x=2$ or $x=-2$	✓ $x=2$ ✓ $x=-2$ (2)
1.1.2	$2x^2-6x+1=0$ $x=\dfrac{-b\pm\sqrt{b^2-4ac}}{2a}$ $x=\dfrac{6\pm\sqrt{(-6)^2-4(2)(1)}}{2(2)}$ $x=2,82$ or $x=0,18$	✓ correct substitution into correct formula ✓ 2,82 ✓ 0,18 (3)
1.1.3	$x^2-90>x$ $x^2-x-90>0$ $(x+9)(x-10)>0$ CV: $x=-9$ or $x=10$  $x<-9$ or $x>10$ **OR/OF** $(-\infty;-9)$ or $(10;\infty)$	✓ standard form ✓ critical values ✓✓ $x<-9$ or $x>10$ (4)

1.1.4	$x-7\sqrt{x}=-12$ $x+12=7\sqrt{x}$ $(x+12)^2=\left(7\sqrt{x}\right)^2$ $x^2+24x+144=49x$ $x^2-25x+144=0$ $(x-16)(x-9)=0$ $x=16$ or $x=9$ **OR/*OF*** $x-7\sqrt{x}+12=0$ $\left(\sqrt{x}-3\right)\left(\sqrt{x}-4\right)=0$ or let $\sqrt{x}=k$ $\sqrt{x}=3$ or $\sqrt{x}=4$ $x=9$ or $x=16$	✓ isolating the root ✓ squaring both sides ✓ standard form ✓ both answers (4) **OR/*OF*** ✓ standard form ✓ factors ✓ answers ✓ both answers for x (4)
1.2	$2x-y=2$ $y=2x-2$ ……(1) $xy=4$ ……(2) (1) in (2): $x(2x-2)=4$ $2x^2-2x-4=0$ $x^2-x-2=0$ $(x-2)(x+1)=0$ $x=2$ or $x=-1$ $y=2$ $y=-4$	✓ eq 1 ✓ substitution ✓ standard form ✓ x-values ✓ y-values (5)

	OR/*OF*	**OR/*OF***
	$2x-y=2$	
	$x=\frac{1}{2}y+1$ .....(1)	✓ eq 1
	$xy=4$ .....(2)	
	(1) in (2):	
	$y\left(\frac{1}{2}y+1\right)=4$	✓ substitution
	$\frac{1}{2}y^2+y-4=0$	✓ standard form
	$y^2+2y-8=0$	
	$(y+4)(y-2)=0$	
	$y=-4$ or $y=2$	✓ *y*-values
	$x=-1$ $x=2$	✓ *x*-values (5)
	OR/OF	**OR/OF**
	$2x-y=2$ .....(1)	
	$y=\frac{4}{x}$ .....(2)	✓ eq 2
	(2) in (1):	
	$2x-\frac{4}{x}=2$	✓ substitution
	$2x^2-2x-4=0$ $x^2-x-2=0$	✓ standard form
	$(x-2)(x+1)=0$	
	$x=2$ or $x=-1$ $y=2$ $y=-4$	✓ *x*-values ✓ *y*-values (5)

	OR/OF $2x-y=2$ ……(1) $x=\frac{4}{y}$ ……(2) (2)in (1): $2\left(\frac{4}{y}\right)-y=2$ $8-y^2-2y=0$ $y^2+2y-8=0$ $(y+4)(y-2)=0$ $y=-4$ or $y=2$ $x=-1$ $x=2$	**OR/OF** ✓ eq 2 ✓ substitution ✓ standard form ✓ *y*-values ✓ *x*-values (5)
1.3	$2.5^n-5^{n+1}+5^{n+2}=2.5^n-5^n.5^1+5^n.5^2$ $=5^n(2-5+25)$ $=5^n(22)$ $2\left(5^n(11)\right)$ **OR/OF** Any integer multiplied by an even number will be even	✓ exp law ✓common factor ✓answer/explanation (3)
1.4	$\frac{3^{y+1}}{32}=\sqrt{96^x}$ $\frac{3^{y+1}}{2^5}=(96)^{\frac{x}{2}}$ $3^{y+1}.2^{-5}=2^{\frac{5x}{2}}.3^{\frac{x}{2}}$ $-5=\frac{5x}{2}$ $\therefore x=-2$ $y+1=\frac{x}{2}$ $y+1=\frac{-2}{2}$ $\therefore y=-2$	✓ $\frac{3^{y+1}}{2^5}=(96)^{\frac{x}{2}}$ ✓ $3^{y+1}.2^{-5}=2^{\frac{5x}{2}}.3^{\frac{x}{2}}$ ✓ $x=-2$ ✓ $y=-2$ (4)

	OR/OF $\frac{3^{y+1}}{32} = \sqrt{96^x}$ $\left(\frac{3^{y+1}}{2^5}\right)^2 = \left(\sqrt{(96)^x}\right)^2$ $\frac{3^{2y+2}}{2^{10}} = 2^{5x}.3^x$ $3^{2y+2}.2^{-10} = 2^{5x}.3^x$ $-10 = 5x$ $\therefore x = -2$ $2y + 2 = -2$ $\therefore y = -2$	**OR/OF** ✓ $\left(\frac{3^{y+1}}{2^5}\right)^2 = \left(\sqrt{(96)^x}\right)^2$ ✓ $3^{2y+2}.2^{-10} = 2^{5x}.3^x$ ✓ $x = -2$ ✓ $y = -2$ (4)
		[25]

QUESTION 2/*VRAAG* 2

2.1.1	$a = 14$ $T_6 = 14r^5 = 448$ $r^5 = 32$ $\therefore r = 2$ Answer only: full marks	✓ $T_6 = 14r^5 = 448$ ✓ $r = 2$ (2)
2.1.2	$T_n = 14(2)^{n-1}$ $S_n = \frac{14(2^6 - 1)}{2 - 1}$ $S_6 = 882$ 114 674 – 882 = 113 792 $113\,792 = 896\left(2^n - 1\right)$ $128 = 2^n$ $n = 7$ **OR/OF** $S_n = \frac{a(r^n - 1)}{r - 1}$ $114\,674 = \frac{14(2^n - 1)}{2 - 1}$ $8\,191 = 2^n - 1$ $2^n = 8\,192$ $n = \log_2 8\,192$ $n = 13$ $\therefore$ 7 more terms must be added to the first 6 terms.	✓ substitution into correct formula ✓ $S_6 = 882$ ✓ $128 = 2^n$ ✓ 7 (4) **OR/OF** ✓ substitution into correct formula ✓ $2^n = 8\,192$ ✓ $n = 13$ ✓ 7 (4)
2.1.3	$r = \frac{1}{2}$ OR $448r^5 = 14$ $\therefore r = \frac{1}{2}$ $S_\infty = \frac{a}{1 - r}$ $S_\infty = \frac{448}{1 - \frac{1}{2}}$ $S_\infty = 896$	✓ $r = \frac{1}{2}$ ✓ substitution ✓ answer (3)

2.2	$\sum_{p=0}^{k}\left(\frac{1}{3}p+\frac{1}{6}\right)=20\frac{1}{6}$	
	$T_1=\frac{1}{6}\qquad T_2=\frac{1}{3}+\frac{1}{6}=\frac{3}{6}$	✓ $T_1=\frac{1}{6}$
	$d=\frac{3}{6}-\frac{1}{6}=\frac{1}{3}$	✓ d
	$\frac{121}{6}=\frac{n}{2}\left[2\left(\frac{1}{6}\right)+(n-1)\left(\frac{1}{3}\right)\right]$	✓ substitution
	$\frac{121}{3}=n\left[\frac{1}{3}+\frac{1}{3}n-\frac{1}{3}\right]$	
	$\frac{121}{3}=\frac{1}{3}n^2$ $121=n^2$	
	$n=11$ $\therefore k=10$	✓ value of n ✓ value of k (5)
	OR/*OF*	**OR/*OF***
	$\sum_{p=0}^{k}\left(\frac{1}{3}p+\frac{1}{6}\right)=20\frac{1}{6}$	
	$a=\frac{1}{6}$	✓ $a=\frac{1}{6}$
	$l=\frac{1}{3}k+\frac{1}{6}$	✓ l
	$n=k+1$ $S_n=\frac{n}{2}[a+l]$	✓ $n=k+1$
	$\frac{121}{6}=\frac{k+1}{2}\left[\frac{1}{6}+\frac{1}{3}k+\frac{1}{6}\right]$	
	$\frac{121}{6}=\frac{k+1}{2}\left[\frac{1}{3}k+\frac{1}{3}\right]$	
	$\frac{121}{6}=\frac{k+1}{2}\left[\frac{k+1}{3}\right]$ $\frac{121}{6}=\frac{(k+1)^2}{6}$	
	$k+1=\pm\sqrt{121}$ $k+1=11$ $k=10$	✓ $\frac{121}{6}=\frac{(k+1)^2}{6}$ ✓ value of k (5)
		[14]

QUESTION 3/*VRAAG* 3

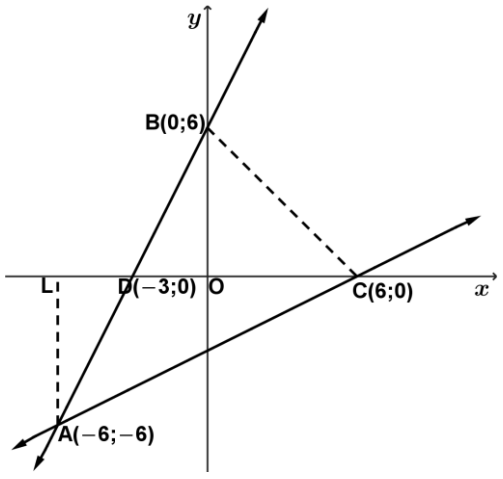
3.1	$3a+b=7$ $3+b=7$ $b=4$ **OR/OF** $T_2-T_1=7$ $4+2b+9-(1+b+9)=7$ $b=4$	✓ $3a+b=7$ ✓ $3+b=7$ (2) **OR/OF** ✓ $T_2-T_1=7$ ✓ substitution (2)
3.2	$T_n=n^2+4n+9$ $T_{60}=(60)^2+4(60)+9$ $=3849$ Answer only: full marks	✓ substitution ✓ answer (2)
3.3	14 ; 21 ; 30 ; 41; First difference: 7 ; 9 ; 11 ; … Common 2nd difference: 2 $T_p=2p+5$ Answer only: full marks **OR/*OF*** First difference: 7 ; 9 ; 11 ; … $T_n=a+(n-1)d$ $T_p=7+(p-1)(2)$ $T_p=2p+5$	✓first difference ✓ 2 ✓ $2p+5$ (3) **OR/*OF*** ✓first difference ✓ 2 ✓ $2p+5$ (3)
3.4	$157=2p+5$ $p=76$ ∴ Between T_{76} and T_{77} **OR/OF** $T_{n+1}-T_n=157$ $(n+1)^2+4(n+1)+9-(n^2+4n+9)=157$ $n^2+2n+1+4n+4+9-n^2-4n-9=157$ $2n=152$ $n=76$ ∴ Between T_{76} and T_{77}	✓$157=2p+5$ ✓ $p=76$ ✓ T_{76} and T_{77} (3) **OR/OF** ✓$T_{n+1}-T_n=157$ ✓ $n=76$ ✓ T_{76} and T_{77} (3)
		[10]

QUESTION 4/*VRAAG* 4

4.1.1	$p = -1$ and $q = 2$	✓ $p = -1$ ✓ $q = 2$ (2)
4.1.2	$\frac{1}{x-1} + 2 = 0$ $-2x + 2 = 1$ $x = \frac{1}{2}$ $\left(\frac{1}{2}\,;\,0\right)$	✓ = 0 ✓ answer (2)
4.1.3	$x = \frac{1}{2} - 3$ $= \frac{-5}{2}$ Answer only: full marks	✓ –3 ✓ $x = \frac{-5}{2}$ (2)
4.1.4	$y = x + t$ $2 = 1 + t$ $t = 1$	✓subst (1 ; 2) ✓ $t = 1$ (2)
4.1.5	$-2 \le \frac{1}{x-1}$ Answer only: full marks $\frac{1}{x-1} + 2 \ge 0$ $\therefore x \le \frac{1}{2}$ or $x > 1$ **OR/*OF*** $x \in \left(-\infty\,;\,\frac{1}{2}\right]$ or $(1\,;\,\infty)$	 ✓ $\frac{1}{x-1} + 2 \ge 0$ ✓ $x \le \frac{1}{2}$ ✓ $x > 1$ (3)
4.2.1	$y = -5$	✓ answer (1)
4.2.2	$x = \frac{-b}{2a} = \frac{-(-4)}{2(1)} = 2$ $f(2) = 2^2 - 4(2) - 5 = -9$ $\therefore$ D(2 ; –9) **OR/*OF*** $f'(x) = 2x - 4$ $2x - 4 = 0$ $x = 2$ $f(2) = 2^2 - 4(2) - 5 = -9$ $\therefore$ D(2 ; –9)	✓ $x = 2$ ✓ $y = -9$ (2) **OR/*OF*** ✓ $x = 2$ ✓ $y = -9$ (2)

4.2.3	$q = -5$ $-9 = a(2)^2 - 5$ $-4 = 4a$ $a = -1$ $\therefore g(x) = -2^x - 5$	✓ $q = -5$ ✓ substitution of $(2\ ;-9)$ ✓ $a = -1$ (3)
4.2.4	$y \in (-\infty\ ;-5)$ OR $y < -5; y \in R$	✓answer (1)
4.2.5	$k < -9$	✓-9 ✓ $k < -9$ (2)
		[20]

QUESTION 5/*VRAAG* 5

5.1	$g(x) = 2x + 6$ $y = 6$	✓ $y = 6$ (1)
5.2	$y = 2x + 6$ $x = 2y + 6$ $y = \frac{1}{2}x - 3$ Answer only: Full marks	✓ swop x and y ✓ equation (2)
5.3	$\frac{1}{2}x - 3 = 2x + 6$ $x - 6 = 4x + 12$ $3x = -18$ $x = -6$ $A(-6;-6)$ **OR/*OF*** $2x + 6 = x$ $x = -6$ $y = -6$	✓equating ✓$x = -6$ ✓ $y = -6$ (3) **OR/*OF*** ✓equating ✓$x = -6$ ✓$y = -6$ (3)
5.4	$AB = \sqrt{(6)^2 + (12)^2}$ $= \sqrt{180} = 6\sqrt{5} = 13{,}42$	✓substitution ✓answer (2)
		

5.5	$BC = \sqrt{6^2 + 6^2} = \sqrt{72} = 6\sqrt{2}$ AB = AC = $\sqrt{180}$ symmetry of g and g^{-1} $\perp h = (\sqrt{180})^2 - \left(\frac{\sqrt{72}}{2}\right)^2$ $= \sqrt{162} = 9\sqrt{2}$ area of $\Delta ABC = \frac{1}{2} BC \times h$ $= \frac{1}{2} \times \sqrt{72} \times \sqrt{162} = 54 \text{ units}^2$ **OR/*OF*** $\tan B\hat{D}C = 2$ $\therefore B\hat{D}C = 63{,}43°$ $\tan D\hat{C}A = \frac{1}{2}$ $\therefore D\hat{C}A = 26{,}57°$ $\therefore D\hat{A}C = 36{,}86°$ (ext angle triangle) Area of $\Delta ABC = \frac{1}{2}\left(\sqrt{180}\right)\left(\sqrt{180}\right)\sin 36{,}86°$ $= 53{,}99 \text{ units}^2$ **OR/OF** Area of ΔABC = Area of ΔBDC + Area of ΔADC $= \frac{1}{2} DC.BO + \frac{1}{2} DC.height$ $= \frac{1}{2}(9)(6) + \frac{1}{2}(9)(6)$ $= 54 \text{ units}^2$	✓ BC ✓ AB = AC /midpoint (3 ; 3) ✓ $\perp h$ (A) ✓ substitution ✓ answer (A) (5) **OR/*OF*** ✓ $B\hat{D}C = 63{,}43°$ ✓ $D\hat{A}C = 36{,}86°$ ✓ AC = $\sqrt{180}$ ✓ substitution into the correct formula ✓ answer (A) (5) **OR/OF** ✓ Areas ($\Delta BDC + \Delta ADC$) ✓ $\frac{1}{2} DC.BO$ ✓ $\frac{1}{2} DC.height$ ✓ substitution ✓ answer (A) (5)
		[13]

QUESTION 6/*VRAAG* 6

6.1	$A = P(1+i)^n$ $13\,459 = 12\,000\left(1+\frac{m}{400}\right)^8$ $\left(1+\frac{m}{400}\right)^8 = 1{,}121...$ $1+\frac{m}{400} = \sqrt[8]{1{,}121..}$ $\frac{m}{400} = 0{,}0144...$ $\therefore m = 5{,}78\%$	✓ 8 ✓ subst into correct formula ✓ $1+\frac{m}{400} = \sqrt[8]{1{,}121..}$ ✓ 5,78 % (4)
6.2	$F = \frac{x\left[(1+i)^n - 1\right]}{i}$ $F = \frac{1\,000\left[\left(1+\frac{0{,}075}{12}\right)^{12} - 1\right]}{\frac{0{,}075}{12}}$ = R12 421,22 He won't be able to buy the computer because R13 000 – R12 421,22 = R578,78 **OR/OF** He won't be able to buy the computer because R12 421,22 < R13 000	✓ $\frac{0{,}075}{12}$ ✓ 12 ✓ answer ✓ conclusion (4)
6.3.1	Loan amount = 85% × R250 000 = R212 500 **OR/OF** Loan amount = R250 000 – (15% × R250 000) = R212 500	✓ answer (1) **OR/OF** ✓ answer (1)
6.3.2	$A = 212\,500\left(1+\frac{0{,}13}{12}\right)^5$ $A = 224\,262{,}53$ $P = \frac{x\left[1-(1+i)^{-n}\right]}{i}$ $224\,262{,}53 = \frac{x\left[1-\left(1+\frac{0{,}13}{12}\right)^{-67}\right]}{\frac{0{,}13}{12}}$ $\therefore x = R4\,724{,}96$	✓ $A = 212\,500\left(1+\frac{0{,}13}{12}\right)^5$ ✓answer ✓ substitution into correct formula ✓ – 67 ✓ answer (5)
		[14]

QUESTION 7/*VRAAG* 7

7.1	$f(x)=x^2+x$ $f'(x)=\lim\limits_{h\to 0}\dfrac{f(x+h)-f(x)}{h}$ $f'(x)=\lim\limits_{h\to 0}\dfrac{(x+h)^2+(x+h)-(x^2+x)}{h}$ $f'(x)=\lim\limits_{h\to 0}\dfrac{x^2+2xh+h^2+x+h-x^2-x}{h}$ $=\lim\limits_{h\to 0}\dfrac{2xh+h^2+h}{h}$ $=\lim\limits_{h\to 0}\dfrac{h(2x+h+1)}{h}$ $\therefore f'(x)=2x+1$	✓substitution into the formula ✓ $x^2+2xh+h^2+x+h$ ✓ $2xh+h^2+h$ ✓common factor ✓answer (5)
	OR/*OF* $f(x)=x^2+x$ $f(x+h)=(x+h)^2+(x+h)=x^2+2xh+h^2+x+h$ $f(x+h)-f(x)=x^2+2xh+h^2+x+h-x^2-x$ $=2xh+h^2+h$ $f'(x)=\lim\limits_{h\to 0}\dfrac{f(x+h)-f(x)}{h}$ $=\lim\limits_{h\to 0}\dfrac{2xh+h^2+h}{h}$ $=\lim\limits_{h\to 0}\dfrac{h(2x+h+1)}{h}$ $\therefore f'(x)=2x+1$	**OR/*OF*** ✓ $x^2+2xh+h^2+x+h$ ✓ $2xh+h^2+h$ ✓substitution into the formula ✓common factor ✓answer (5)
7.2	$f(x)=2x^5-3x^4+8x$ $f'(x)=10x^4-12x^3+8$	✓$10x^4$ ✓$-12x^3$ ✓8 (3)
7.3	$g(x)=ax^3+3x^2+bx+c$ $g'(x)=3ax^2+6x+b$ $g''(x)=6ax+6$ $g''(-1)=6a(-1)+6=0$ $\therefore a=1$ For concave up $g''(x)>0$ $6x+6>0$ $x>-1$	✓ $g'(x)=3ax^2+6x+b$ ✓ $g''(-1)=6a(-1)+6=0$ ✓ $a=1$ ✓ $x>-1$ (4)

OR/OF

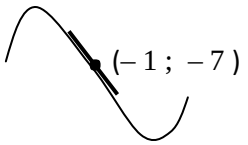
Min gradient at $(-1\ ;-7)$ implies:

at $x = -1$ - point of inflection
and g will be positive cubic
hence $a > 0$

Since g is concave up

$x > -1$

OR/OF



Since g is concave up
$x > -1$

$(-1\ ;\ y)$

Since g is concave up
$x > -1$

Answer only: $\frac{1}{4}$

OR/OF

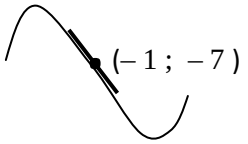
Min gradient at $(-1\ ;-7)$ implies:

at $x = -1$ - point of inflection
and g will be positive cubic
hence $a > 0$

Since g is concave up

$x > -1$

OR/OF

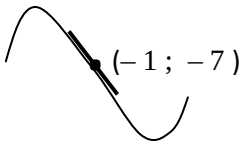


Since g is concave up
$x > -1$

$(-1\ ;\ y)$

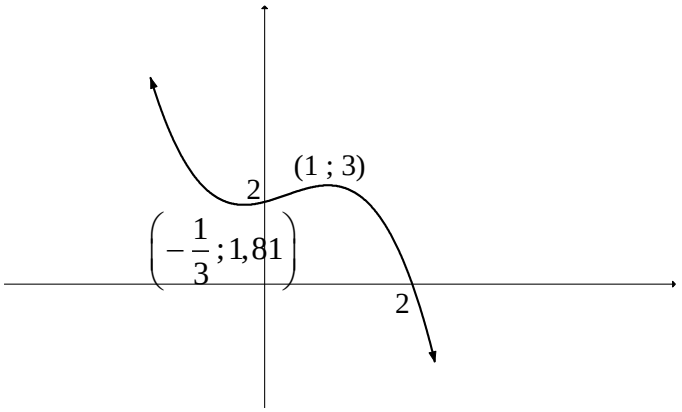
Since g is concave up
$x > -1$

Answer only: $\frac{1}{4}$

	OR/OF Min gradient at (– 1 ; – 7) implies: at $x = -1$ - point of inflection and g will be positive cubic hence $a > 0$ Since g is concave up $x > -1$ **OR/OF**  Since g is concave up $x > -1$  (– 1 ; y) Since g is concave up $x > -1$ Answer only: $\frac{1}{4}$	**OR/OF** ✓ point of inflection ✓✓ $a > 0$ ✓ $x > -1$ (4) **OR/OF** ✓✓pos graph ✓point of inflection ✓ $x > -1$ (4)
		[12]

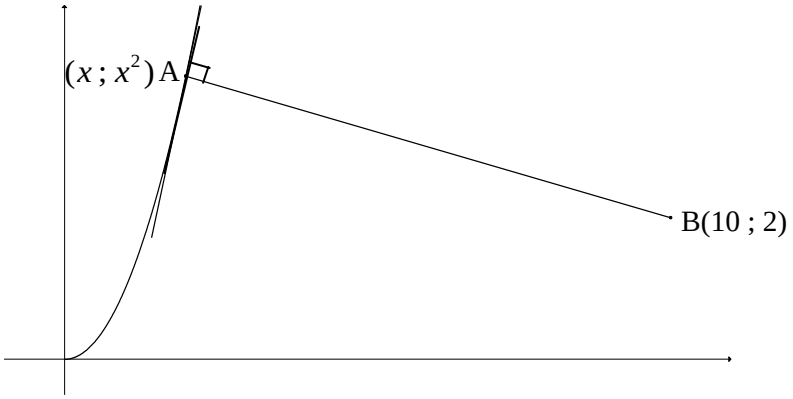
QUESTION 8/*VRAAG* 8

8.1	$f'(x) = mx^2 + nx + k$ $f'(x) = m\left(x + \frac{1}{3}\right)(x-1)$ $1 = m\left(0 + \frac{1}{3}\right)(0-1)$ $1 = -\frac{1}{3}m$ $\therefore m = -3$ $f'(x) = -3\left(x + \frac{1}{3}\right)(x-1)$ $f'(x) = -3\left(x^2 - \frac{2}{3}x - \frac{1}{3}\right)$ $f'(x) = -3x^2 + 2x + 1$ $\therefore n = 2$ $\therefore k = 1$ **OR/OF** $k = 1$ $0 = m + n + 1$ and $\frac{1}{9}m - \frac{1}{3}n + 1 = 0$ $m + n = -1 \quad (1)$ $m - 3n = -9 \quad (2)$ $(1) - (2)$ $4n = 8$ $\therefore n = 2$ $m + 2 = -1$ $\therefore m = -3$	✓ substitution of $\left(-\frac{1}{3}; 0\right)$ and $(1\ ;\ 0)$ ✓ substitution of $(0\ ;\ 1)$ ✓ $m = -3$ ✓ $f'(x) = -3\left(x^2 - \frac{2}{3}x - \frac{1}{3}\right)$ ✓ $n = 2$ ✓ $k = 1$ (6) **OR/OF** ✓ $k = 1$ ✓ $m + n = -1$ ✓ $m - 3n = -9$ ✓ $4n = 8$ ✓ $n = 2$ ✓ $m = -3$ (6)
8.2.1	$f(x) = -x^3 + x^2 + x + 2$ $f\left(-\frac{1}{3}\right) = \frac{49}{27} = 1{,}81$ $\text{T.P}\left(-\frac{1}{3}; \frac{49}{27}\right)$ $f(1) = 3$ $\text{T.P}(1\ ;\ 3)$	✓ x-coordinates of the TP ✓ $\text{T.P}\left(-\frac{1}{3}; \frac{49}{27}\right)$ ✓ $\text{T.P}(1\ ;\ 3)$ (3)

8.2.2	$f(x)=-x^3+x^2+x+2$ $-x^3+x^2+x+2=0$ $(x-2)(-x^2-x-1)=0$ $x=2$ or no solution  	✓ $x=2$ ✓one x-intercept ✓ two turning points ✓y-intercept ✓ shape: neg cubic (5)
8.3.1	$a=\frac{-\frac{1}{3}+1}{2}$ $=\frac{1}{3}$ **OR/OF** $f'(x)=-3x^2+2x+1$ $f''(x)=-6x+2$ $f''(a)=-6a+2=0$ $-6a=-2$ $a=\frac{1}{3}$	✓ answer (1) **OR/OF** ✓ answer (1)
8.3.2	$b<\frac{4}{3}$ units	✓$\frac{4}{3}$ ✓ $b<\frac{4}{3}$ (2)
		[17]

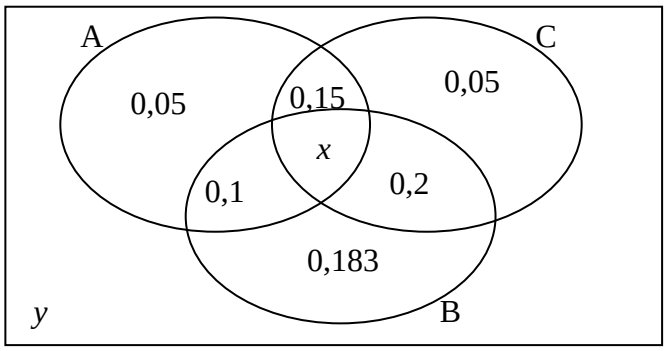
QUESTION9/*VRAAG* 9

9.1	Any point on f : $(x\,;\,x^2)$ $\text{distance} = \sqrt{(x-10)^2+(x^2-2)^2}$ $= \sqrt{x^2-20x+100+x^4-4x^2+4}$ $= \sqrt{x^4-3x^2-20x+104}$ For min distance $\frac{d}{dx}\left(x^4-3x^2-20x+104\right)=0$ $4x^3-6x-20=0$ $(x-2)(4x^2+8x+10)=0$ $\Delta = 8^2-4(4)(10) = -96 \quad \therefore$ no roots $\therefore x = 2$ $d = \sqrt{2^4-3(2)^2-20(2)+104} = 2\sqrt{17} = 8{,}25$	✓$(x\,;\,x^2)$ ✓ substitution ✓ simplification ✓ answer ✓$4x^3-6x-20$ ✓ derivative = 0 ✓$x = 2$ ✓answer (A) (8)



9.2	$m_{AB} = \frac{y_2-y_1}{x_2-x_1} = \frac{x^2-2}{x-10}$ $\therefore m_{\tan g} = -\frac{x-10}{x^2-2}$ $f'(x) = 2x$ $\therefore 2x = -\frac{x-10}{x^2-2}$ $-2x^3+4x = x-10$ $2x^3-3x-10=0$ $x = 2$ $y = (2)^2 = 4$ $\therefore AB = \sqrt{(2-10)^2+(4-2)^2}$ $= 2\sqrt{17} = 8,25$	✓ m_{AB} ✓ $m_{\tan g} = -\frac{x-10}{x^2-2}$ ✓ $f'(x) = 2x$ ✓ equating ✓ standard form ✓$x = 2$ ✓substitute into distance ✓answer (A) (8)
		[8]

QUESTION 10/*VRAAG* 10



10.1.1(a)	$y = 1 - 0,893 = 0,107$ (0,11)	✓ $y = 1 - 0,893$ (1)
10.1.1(b)	$x = 0,893 - 0,733$ $= 0,16$	✓ $x = 0,893 - 0,733$ (1)
10.1.2	P(at least 2 events) = 0,1 + 0,15 + 0,16 + 0,2 = 0,61 Answer only: Full Marks	✓ values ✓ answer (2)
10.1.3	P(B) = 0,643 P(C) = 0,56 P(B and C) = 0,36 P(B) × P(C) = 0,643 × 0,56 = 0,36 ∴ P(B and C) = P(B) × P(C) ∴ B and C are independent	✓ P(B) = 0,643 ✓ P(C) = 0,56 ✓ P(B and C) = 0,36 ✓ P(B) × P(C) = 0,36 ✓ independent because P(B and C) = P(B) × P(C) (5)
10.2.1	$7 \times 6 \times 5 \times 4 = 840$	✓ 4✓ 7 ✓ $7 \times 6 \times 5 \times 4 = 840$ (3)
10.2.2	start with 5, 7, 9 or start with 6 or start with 8 $(3 \times 5 \times 1 \times 3) + (1 \times 5 \times 1 \times 2) + (1 \times 5 \times 1 \times 2)$ $= 45 + 10 + 10$ $= 65$ $P = \frac{65}{840} = \frac{13}{168} = 0,08$ **OR/*OF*** ends in 4 or ends in 6 or ends in 8 $(5 \times 5 \times 1 \times 1) + (4 \times 5 \times 1 \times 1) + (4 \times 5 \times 1 \times 1)$ $= 25 + 20 + 20$ $= 65$ $P = \frac{65}{840} = \frac{13}{168} = 0,08$	✓ $(3 \times 5 \times 1 \times 3) = 45$ ✓ $(1 \times 5 \times 1 \times 2) = 10$ ✓ $(1 \times 5 \times 1 \times 2) = 10$ ✓65 ✓ answer (5) **OR/*OF*** ✓ $(5 \times 5 \times 1 \times 1) = 25$ ✓ $(4 \times 5 \times 1 \times 1) = 20$ ✓ $(4 \times 5 \times 1 \times 1) = 20$ ✓65 ✓ answer (5)
		[17]

TOTAL/*TOTAAL*: 150