DEPARTMENT OF EDUCATION

DEPARTEMENT VAN ONDERWYS

LEFAPHA LA THUTO

ISEBE LEZEMFUNDO

PROVINCIAL PREPARATORY EXAMINATION/ PROVINSIALE VOORBEREIDINGSEKSAMEN

GRADE/GRAAD 12

MATHEMATICS P1/WISKUNDE V1

MARKING GUIDELINES/NASIENRIGLYNE

SEPTEMBER 2021

MARKS/PUNTE: 150
TIME/TYD: 3 hours/uur

This memorandum consists of 18 pages

Hierdie memorandum bestaan uit 18 bladsye.

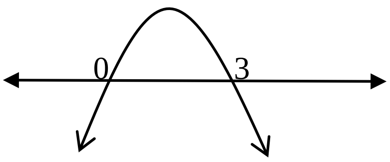
NOTE:

- If a candidate answered a question TWICE, mark only the FIRST attempt.
- If a candidate has crossed out an attempt to answer a question and did not redo it, mark the crossed-out version.
- Consistent accuracy applies in ALL aspects of the marking memorandum. Stop marking at the second calculation error.
- (A) is an accuracy mark.
- Assuming answers/values in order to solve a problem is NOT acceptable.

LET WEL:

- *Indien 'n kandidaat 'n vraag TWEE keer beantwoord het, sien slegs die EERSTE poging na.*
- *As 'n kandidaat 'n poging om 'n vraag te beantwoord, doodgetrek en nie oorgedoen het nie, sien die dood getrekte poging na.*
- *Volgehoue akkuraatheid is op ALLE aspekte van die memorandum van toepassing. Staak nasien by die tweede berekeningsfout.*
- *Om antwoorde/waardesom 'n probleem op te los, te veronderstel, word NIE toegelaat NIE.*

QUESTION/*VRAAG* 1

1.1.1	$x^2 - x - 6 = 0$ $(x-3)(x+2) = 0$ $x = 3 \ or \ x = -2$	✓factors ✓✓ answers (3)
1.1.2	$x(x+6)+1=0$ $x^2+6x+1=0$ $x = \frac{-6+\sqrt{(6)^2-4(1)(1)}}{2(1)}$ $x = -0{,}17 \quad or \quad x = -5{,}83$ Penalise 1 mark for incorrect rounding	✓Standard form ✓substitution into formula ✓ $x = -0{,}17$ ✓ $x = -5{,}83$ (4)
1.1.3	$6x - 2x^2 \leq 0$ $-2x(-3+x) = 0$ $x = 0 \ or \ x = 3$  If 'and' instead of 'or' penalise 1 mark $x \leq 0 \quad or \quad x \geq 3$	✓Critical value(s) ✓ method ✓ answer (3)
1.1.4	$\left(\sqrt{\sqrt{2}-x}\right)\left(\sqrt{\sqrt{2}+x}\right) = x$ $\sqrt{2-x^2} = x$ $\left(\sqrt{2-x^2}\right)^2 = x^2$ $2 - x^2 = x^2$ $2x^2 - 2 = 0$ $x^2 - 1 = 0$ $(x+1)(x-1) = 0$ $x = -1 \quad or \quad x = 1$ $\therefore x = 1$	✓ $\sqrt{2-x^2}$ ✓squaring both Sides ✓standard form ✓factors ✓selection (5)

1.2	$x-y=3 \quad and \quad x^2-3y^2=13$ $x=3+y$ $(3+y)^2-3y^2=13$ $9+6y+y^2-3y^2-13=0$ $-2y^2+6y-4=0$ $y^2-3y+2=0$ $(y-1)(y-2)=0$ $y=1 \ or \ y=2$ $\therefore x=3+1 \quad or \quad x=3+2$ $x=4 \quad or \quad x=5$ OR $x-y=3 \ and \ x^2-3y^2=13$ $y=x-3$ $x^2-3(x-3)^2=13$ $x^2-3(x^2-6x+9)-13=0$ $x^2-3x^2+18x-27-13=0$ $-2x^2+18x-40=0$ $x^2-9x+20=0$ $(x-4)(x-5)$ $x=4 \quad or \quad x=5$ $y=4-3 \quad or \quad y=5-3$ $y=1 \qquad\qquad y=2$	✓ $x=3+y$ ✓substitution ✓ standard form ✓ factors ✓y-values ✓x-values OR ✓ $y=x-3$ ✓substitution ✓ standard form ✓ factors ✓x-values ✓y-values (6)
1.3	$x^2=7$ $x=\sqrt{7}$ $x^5=x^2.x^2.x$ $x^5=7.7.\sqrt{7}$ $x^5=49\sqrt{7}$	✓ $x=\sqrt{7}$ ✓ $x^5=x^2.x^2.x$ ✓ Answer (3)
		[24]

QUESTION/*VRAAG* 2

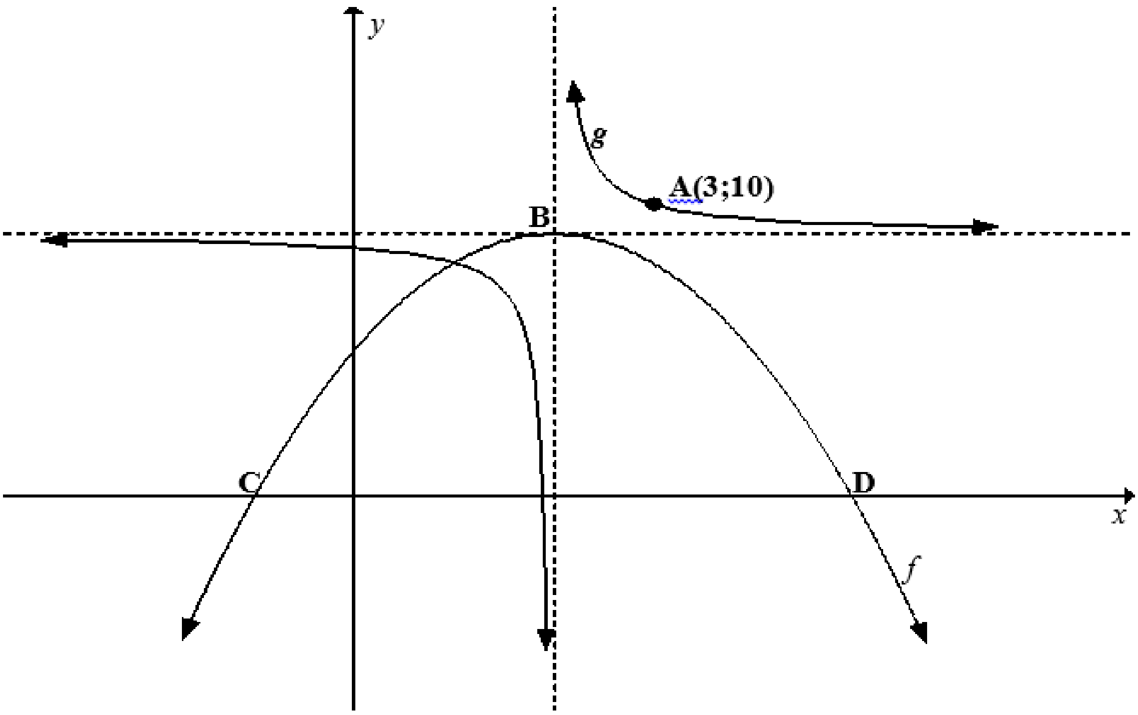
2.1.1	171 282 387 486 ..... 111 105 99 -6 -6 $2^{nd}\ diff = -6$	✓✓Answer (2)
2.1.2	$2a = -6$ $a = -3$ $3a + b = 111$ $3(-3) + b = 111$ $b = 111 + 9$ $b = 120$ $-3 + 120 + c = 171$ $c = 171 - 117$ $c = 54$ $T_n = -3n^2 + 120n + 54$	✓ $a = -3$ ✓ $b = 120$ ✓ $c = 54$ ✓answer (4)
2.1.3	$T_n = -3n^2 + 120n + 54 \quad and \quad P_n = -60n + 2754$ $-3n^2 + 120n + 54 = -60n + 2754$ $3n^2 - 180n + 2700 = 0$ $n^2 - 60n + 900 = 0$ $(n - 30)^2 = 0$ $n = 30$	✓equating the equations ✓standard form ✓factors ✓answer (4)
2.2.1	$\frac{1}{8} + \frac{1}{16} + \frac{1}{32}........$ $a = \frac{1}{8} \quad r = \frac{1}{2}$ $S_{16} = \frac{\frac{1}{8}\left(\left(\frac{1}{2}\right)^{16} - 1\right)}{\frac{1}{2} - 1}$ $S_{16} = 0.2499\ \ or\ \ 0.25\ \ or\ \ 0.250\ or\ 0.2500$	✓value of a and r ✓substitution ✓answer (3)

2.2.2	$S_\infty - T_n = \frac{1023}{4096}$ $\frac{\frac{1}{8}}{1-\frac{1}{2}} - \frac{1}{8}\left(\frac{1}{2}\right)^{n-1} = \frac{1023}{4096}$ $\frac{1}{4} - \frac{1}{8}\left(\frac{1}{2}\right)^{n-1} = \frac{1023}{4096}$ $-\frac{1}{8}\left(\frac{1}{2}\right)^{n-1} = \frac{1023}{4096} - \frac{1}{4}$ $\left(\frac{1}{2}\right)^{n-1} = \frac{1}{512}$ $\left(\frac{1}{2}\right)^{n-1} = \left(\frac{1}{2}\right)^{9}$ *or* $n-1 = \log_{\frac{1}{2}}\left(\frac{1}{512}\right)$ $n-1=9$ $n=10$	✓substitution ✓ $S_\infty = \frac{1}{4}$ ✓ $\left(\frac{1}{2}\right)^{n-1} = \frac{1}{512}$ ✓ $\left(\frac{1}{2}\right)^{n-1} = \left(\frac{1}{2}\right)^{9}$ or $n-1 = \log_{\frac{1}{2}}\left(\frac{1}{512}\right)$ ✓ $n=10$ (5)
		[18]

QUESTION/*VRAAG* 3

3.1	$\sum_{k=1}^{n} 6k+13$ $19+25+31+..........6n+13$ $a=19 \quad d=6$ $S_n=\frac{n}{2}(19+6n+13)$ $S_n=\frac{n}{2}(6n+32)$ $S_n=3n^2+16n$ OR $\sum_{k=1}^{n} 6k+13$ $19+25+31+..........6n+13$ $a=19 \quad d=6$ $S_n=\frac{n}{2}(2(19)+(n-1)6)$ $S_n=\frac{n}{2}(38+6n-6)$ $S_n=\frac{n}{2}(6n+32)$ $S_n=3n^2+16n$	✓19+25+31+… ✓a and d ✓ substitution into correct formula (3)
3.2	$S_n=3n^2+16n$ $S_{34}-S_{33}=3(34)^2+16(34)-(3(33)^2+16(33))$ $=4012-3795$ $=217$	✓correct substitution ✓answer (2)
3.3	T_1 ; T_2; T_3; T_4 ; 120 $\quad T_k=6k+13$ 19 25 31 37 $T_4=120-37$ $T_4=83$ $T_3=83-31$ $T_3=52$	✓sequence of first differences . ✓$T_4=83$ ✓$T_3=52$
		[8]

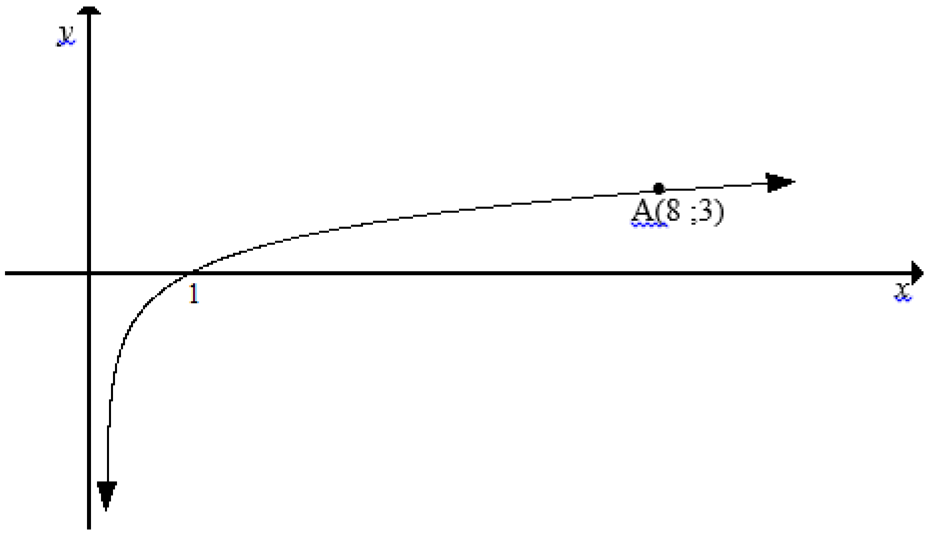
QUESTION/*VRAAG* 4

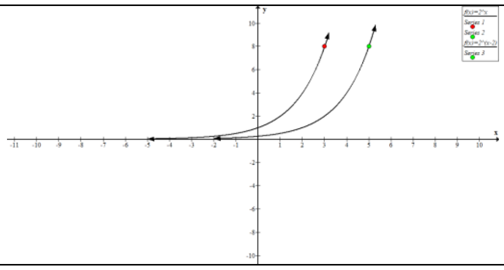


4.1	$f(x) = -x^2 + 4x + 5$ $x = \frac{-4}{2(-1)}$ *OR* $f^{/}(x) = -2x + 4$ $x = 2$ $0 = -2x + 4$ $x = 2$ $y = -(2)^2 + 4(2) + 5$ $y = 9$ $B(2;9)$	✓ substitution / derivative ✓ x-value ✓ $y = 8$ (3)
4.2	$p = -2$ *and* $q = 9$	✓ $p = -2$ ✓ $q = 9$ (2)
4.3	The graph of *f* reflects over the *x*-axis and shifts 10 units up to form the graph of $t(x) = -f(x) + 10$. The roots will be non-real. **OR** $t(x) = -f(x) + 10$	✓✓answer (2)

	The roots will be non-real.	
4.4	The graph shifted 2 units to the right and 6 units down $\therefore\ m=-2 \quad and \quad n=-6$	✓ $m=-2$ ✓ $n=-6$ (2)
4.5	$y=8x+k$ $f(x)=-x^2+4x+5$ $f^{/}(x)=-2x+4$ $8=-2x+4$ $4=-2x$ $x=-2$ $y=-(-2)^2+4(-2)+5$ $y=-7$ $\therefore P(-2;-7)$	✓derivative ✓ $6=-2x+4$ ✓x-value ✓y-value (4)
4.6.1	$2<x<3$ or $x\in(2;3)$	✓critical value(s) ✓notation (2)
4.6.2	$0=-x^2+4x+5$ $0=x^2-4x-5$ $(x-5)(x+1)=0$ $x=-1 \ or \ x=5$ $\therefore x<-1 \ or \ x>5$	✓standard form=0 ✓Critical value(s) ✓ $x<-1$ ✓ $x>5$ (4)
		[19]

QUESTION/*VRAAG* 5

5.1	$f(x)=b^x$ $8=b^x$ $2^3=b^3$ $b=2$ $f(x)=2^x$	✓substitution ✓answer (2)
5.2	$y=2^x$ $x=2^y$ $y=\log_2 x$ **Answer only full marks**	✓ $x=2^y$ ✓ $y=\log_2 x$ (2)
5.3		✓shape ✓asymptote ✓ point A(8;3) OR (1;0) (3)
5.4	$\log_2 x \ < 4$ $x<2^4$ $0<x<16$ **Answer only full marks**	✓16 ✓✓answer (3)
5.5	$h(x)=\frac{1}{4}f(x)$ $=2^{-2}(2^x)$ $=2^{x-2}$ x The graph shifted 2 units to the right	✓ 2^{x-2} ✓2nits ✓right (3)

		
		[13]

QUESTION/*VRAAG* 6

6.1.1	$F=\dfrac{x\left[(1+i)^{n}-1\right]}{i}$ $F=\dfrac{4100\left[\left(1+\dfrac{0.06}{4}\right)^{4\times 20}-1\right]}{\dfrac{0.06}{4}}$ $F=\ 626\ 114{,}50$	✓ substitution into correct formula ✓ 80 ✓ answer (3)
6.1.2	$A=626114{,}50\left(1+\dfrac{0.062}{2}\right)^{2\times 5}$ $=849\ 650{,}68$	✓ substitution ✓ answer (2)
6.2.1	$P=\dfrac{x\left[1-(1+i)^{-n}\right]}{i}$ $660\ 000=\dfrac{x\left[1-\left(1+\dfrac{0.11}{12}\right)^{-180}\right]}{\dfrac{0.11}{12}}$ $x=\dfrac{660000\left(\dfrac{0.11}{12}\right)}{1-\left(1+\dfrac{0.11}{12}\right)^{-180}}$ $x=7\ \ 501{,}54$	✓substitution into correct formula ✓ $\dfrac{0.11}{12}$ ✓ answer (3)
6.2.2	Outstanding balance after the 84th payment $P=\dfrac{7\,501{,}54\left[1-\left(1+\dfrac{0.11}{12}\right)^{-96}\right]}{\dfrac{0.11}{12}}$ Outstanding Balance $=477\ 548{,}81$	✓-96 ✓substitution into correct formula ✓477 548,81 (3)

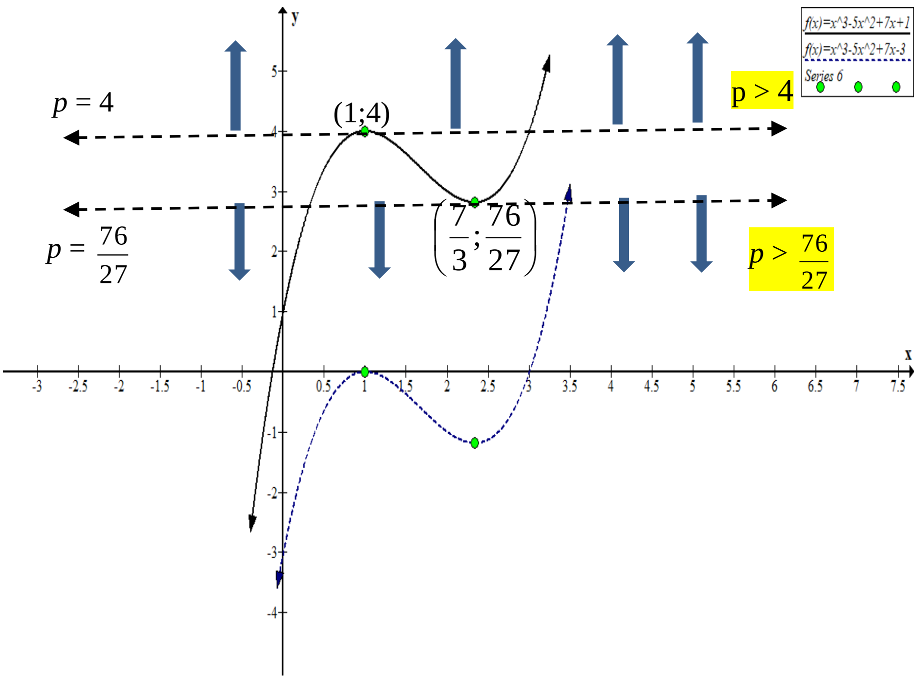
	OR $\text{Outstanding Balance} = 660\ 000\left(1+\frac{0.11}{12}\right)^{84} - \frac{7501{,}54\left(\left(1+\frac{0.11}{12}\right)^{84}-1\right)}{\frac{0.11}{12}}$ $= R\,477\ 548{,}77$	OR ✓✓Substitution (A) ✓ answer (3)
6.2.3	$\therefore 477\ 548{,}81\ \frac{10\ 000\left[1-\left(1+\frac{0.11}{12}\right)^{-n}\right]}{\frac{0.11}{12}}$ $\frac{477\ 548{,}81\left(\frac{0.11}{12}\right)}{10000}-1=-\left(1+\frac{0.11}{12}\right)^{-n}$ $-0.5622469242=-\left(1+\frac{0.11}{12}\right)^{-n}$ $-n=\log_{\left(1+\frac{0.11}{12}\right)}(0.5622469242)$ $-n=-63{,}10$ $n=64\ \ payments$ $\therefore 96-64=32\ \ payments\ sooner$	✓Substitution (A) ✓Application of logs ✓64 payments ✓32 payments sooner (4)
		[15]

QUESTION/*VRAAG* 7 : PENALISE -1 FOR NOTATION ONLY IN 7.1

7.1	$f(x)=4x^2-3$ $f(x+h)=4(x+h)^2-3$ $f(x+h)=4x^2+8xh+4h^2-3$ $f'(x)=\lim\limits_{h\to 0}\dfrac{f(x+h)-f(x)}{h}$ $=\lim\limits_{h\to 0}\dfrac{4x^2+8xh+4h^2-3-(4x^2-3)}{h}$ $=\lim\limits_{h\to 0}\dfrac{8xh+4h^2}{h}$ $=\lim\limits_{h\to 0}\dfrac{h(8x+4h)}{h}$ $=\lim\limits_{h\to 0}(8x+4h)$ $=8x+4(0)$ $=8x$	✓ $4x^2+8xh+4h^2-3$ ✓ substitution ✓simplification ✓ common factor ✓ answer (5)
7.2.1	$y=(3x-4)(5x+2)$ $=15x^2+6x-20x-8$ $=15x^2-14x-8$ $\dfrac{dy}{dx}=30x-14$	✓$15x^2-14x-8$ ✓ $30x-14$ (2)
7.2.2	$\dfrac{d}{dx}\left(x\sqrt{x}-\dfrac{2}{x^2}\right)$ $\dfrac{d}{dx}\left(x^{\frac{3}{2}}-2x^{-2}\right)$ $=\dfrac{3}{2}x^{\frac{1}{2}}+4x^{-3}$ C.A only if exponent is a rational	✓ $x^{\frac{3}{2}}$ ✓ $-2x^{-2}$ ✓ $\dfrac{3}{2}x^{\frac{1}{2}}$ ✓ $+4x^{-3}$ (4)
		[11]

QUESTION/*VRAAG* 8

8.1.1	$x^3-5x^2+7x-3=0$ $f(1)=0$ $(x-1)^2(x-3)=0$ $A(1\,;0)\quad B(3\,;0)$ Does not have to be in a coordinate form. Accept $x=1$ *or* $x=3$	✓$(x-3)$ ✓ $A(1;0)$ ✓ $B(3;0)$ (3)
8.1.2	$h(x)=x^3-5x^2+7x-3$ $h^{/}(x)=3x^2-10x+7$ $0=3x^2-10x+7$ $0=(3x-7)(x-1)$ $at\ C\ \ x=\frac{7}{3}$ $f\left(\frac{7}{3}\right)=\left(\frac{7}{3}\right)^3-5\left(\frac{7}{3}\right)^2+7\left(\frac{7}{3}\right)-3$ $=\frac{-32}{27}$ $C\left(\frac{7}{3}\,;-\frac{32}{27}\right)$	✓Derivative ✓Equation derivation to 0. ✓x-value ✓y-value (4)
8.2.1	$x=\frac{1+\frac{7}{3}}{2}$ $x=\frac{5}{3}$ **OR** $x<\frac{-b}{3a}$ $x<\frac{5}{3}$ $x<\frac{-(-5)}{3(1)}$ $x<\frac{5}{3}$ **OR** $h(x)=x^3-5x^2+7x-3$ $h^{/}(x)=3x^2-10x+7$ $h^{/}(x)=6x-10<0$ $6x-10<0$ $\therefore x<\frac{5}{3}$	✓substitution ✓x-value ✓Answer (3) **OR** ✓✓Second derivative <0 ✓answer (3)

8.2.2	$h(x)>0 \quad for \;\; x>3$ since $\;h(-x)\; is \;\; a \;\; reflection \; over \; y-axis$ $\therefore x<-3$	✓✓answer (2)
8.3	$h(x)+4=p$ the turning points of $h(x)+4$ are $A(1;4)$ and $\left(\frac{7}{3};\frac{76}{27}\right)$ $p>4 \quad$ or $\quad p<\frac{76}{27}$ OR 	✓✓ $p>4$ ✓ $p=0$ ✓ $p<\frac{76}{27}$ (4)
		[12]

QUESTION/*VRAAG* 9

9.1	$S.A = 2.l.w + 2l.h + 2w.h$ $= 2(x.5x + h.5x + x.h)$ $720 = 2(5x^2 + 6xh)$ $360 = 5x^2 + 6xh$ $360 - 5x^2 = 6xh$ $h = \frac{60}{x} - \frac{5}{6}x$ $V = 5x.x\left(\frac{60}{x} - \frac{5}{6}x\right)$ $V = 300x - \frac{25}{6}x^3$	✓formula ✓substitution ✓simplification ✓ $h = \frac{60}{x} - \frac{5}{6}x$ ✓substitution (5)
9.2	$V = 300x - \frac{25}{6}x^3$ $\frac{dV}{dx} = 300 - \frac{25}{2}x^2$ $0 = 300 - \frac{25}{2}x^2$ $\frac{25}{2}x^2 = 300$ $x^2 = 24$ $x = 2\sqrt{6} \quad \therefore v = 300(2\sqrt{6}) + \frac{25}{2}(2\sqrt{6})^3 = 2939,39$	✓derivative ✓equating the derivative to 0. ✓x-value ✓substitution ✓Answer (5)
		[10]

QUESTION/*VRAAG* 10

Events A and B are given such that $P(A\ or\ B)=\frac{3}{5}$ and $P(A)=\frac{2}{5}$.

10.1.1	$P(A\ OR\ B)=P(A)+P(B)$ $\frac{3}{5}=\frac{2}{5}+P(B)$ $P(B)=\frac{3}{5}-\frac{2}{5}$ $P(B)=\frac{1}{5}$	✓substitution ✓answer (2)
10.1.2	$P(A\ or\ B)=P(A)+P(B)-P(A).P(B)$ $\frac{3}{5}=\frac{2}{5}+P(B)-\frac{2}{5}P(B)$ $\frac{1}{5}=\frac{3}{5}P(B)$ $P(B)=\frac{1}{3}$	✓substitution ✓ simplification ✓answer (3)
10.2	$P(A\ or\ B)=P(A)+P(B)-P(A).P(B)$ $0.84=y+y-y.y$ $0.84=2y-y^2$ $y^2-2y+0.84=0$ $y=\frac{-(-2)\pm\sqrt{(-2)^2-4(1)(0.84)}}{2(1)}$ $y=1.4\quad OR\quad y=0.6$ $\therefore y=0,6$	✓substitution ✓standard form ✓substitution into formula/factors ✓ answers ✓selection (5)
		[10]

QUESTION/*VRAAG* 11

11.1	$7\times7\times7\times7=2401\ codes$ OR 7^4 **NOTE: Answer only award full marks** **Also if left as** $7^4\ or\ 7\times7\times7\times7$ **award full marks**	✓ $7\times7\times7\times7$ ✓ 2401 (2)
11.2	Case 1 : The code must start with 2 and end with 0 2 ___ ___ 0 5 4 1 way Number of codes starting with 2 and ending with 0 is $1\times5\times4\times1=20$ Case 2 : number of codes starting with 2 and ending with 4 2 ___ ___ 4 1 way 5 4 1 way $1\times5\times4\times1=20$ Case 3: number of codes starting with 2 and ending wil 6 $1\times5\times4\times1=20$ Total number of codes =20+20+20=60 codes **OR** $1\times5\times4\times1\times3=60$	✓ $1\times5\times4\times1$ ✓ $1\times5\times4\times1$ ✓ $1\times5\times4\times1$ ✓ 60 OR ✓✓ $1\times5\times4\times1\times3$ ✓✓ 60 **NOTE: Answer only 2 marks** (4)
		[6]

TOTAL:150