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**PROVINCIAL PREPARATORY EXAMINATION/
PROVINSIALE VOORBEREIDENDE EKSAMEN**

GRADE/GRAAD 12

MATHEMATICS/WISKUNDE

PAPER/VRAESTEL 1

SEPTEMBER 2025

MARKING GUIDELINES/NASIENRIGLYNE

MARKS/PUNTE: 150

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

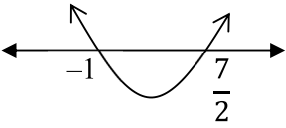


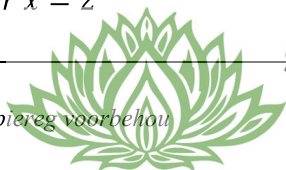
SA EXAM PAPERS

- 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, sien slegs die EERSTE poging na.
 - Volgehoue Akkuraatheid is DEURGAANS op ALLE aspekte van die memorandum van toepassing.

QUESTION 1/VRAAG 1

1.1.1	$x + x^2 = 0$ $x(1 + x) = 0$ $x = 0$ or $x = -1$	✓ factors/ faktore ✓ $x = 0$ or $x = -1$ (2)
1.1.2	$3x^2 - 5x + 1 = 0$ $x = \frac{-(-5) \pm \sqrt{(-5)^2 - 4(3)(1)}}{2(3)}$ $x = 1,43$ or $x = 0,23$ Answer only: full marks/Slegs antwoord: volpunte	✓ substitution into correct formula/ subst. in korrekte formule ✓ $x = 1,43$ ✓ $x = 0,23$ (3)
1.1.3	$2x^2 - 7 \leq 5x$ $2x^2 - 5x - 7 \leq 0$ $(2x - 7)(x + 1) \leq 0$ $-1 \leq x \leq \frac{7}{2}$ 	✓ standard form/standaardvorm ✓ critical values/kritieke waardes ✓ $-1 \leq x$ and/en ✓ $x \leq \frac{7}{2}$ (4)
1.1.4	$3^{2x} - 9 = 24 \cdot 3^x + 72$ $(3^x + 3)(3^x - 3) = 24(3^x + 3)$ $(3^x + 3)(3^x - 27) = 0$ $3^x = 27 = 3^3$ or $3^x \neq -3$ $x = 3$ no solution/geen oplossing OR/OF $3^{2x} - 24 \cdot 3^x - 81 = 0$ $(3^x - 27)(3^x + 3) = 0$ $3^x = 27 = 3^3$ or $3^x \neq -3$ $x = 3$ no solution/geen oplossing	✓ factors/faktore ✓ factors/faktore ✓ both exponential equations/albei ekspo vergelykings ✓ $x = 3$ ✓ standard form/standaardvorm ✓ factors/faktore ✓ both exponential equations/albei ekspo vergelykings ✓ $x = 3$ (4)
1.1.5	$\sqrt{x^2 + 14} = 3\sqrt{x}$ $x^2 + 14 = 9x$ $x^2 - 9x + 14 = 0$ $(x - 7)(x - 2) = 0$ $x = 7$ or $x = 2$	✓ squaring both sides/kwadreer albei kante ✓ factors/faktore ✓ $x = 7$ ✓ $x = 2$ (4)



1.2	$y = 5x - 4$ $x^2 - x + (5x - 4)^2 = 4 - 3(5x - 4)$ $x^2 - x + 25x^2 - 40x + 16 = 4 - 15x + 12$ $26x^2 - 26x = 0$ $26x(x - 1) = 0$ $x = 0 \text{ or } x = 1$ $y = -4 \text{ or } y = 1$ OR/OF $x = \frac{y}{5} + \frac{4}{5}$ $x^2 - x + y^2 = 4 - 3y$ $\left(\frac{y}{5} + \frac{4}{5}\right)^2 - \left(\frac{y}{5} + \frac{4}{5}\right) + y^2 = 4 - 3y$ $\frac{y^2}{25} + \frac{8y}{25} + \frac{16}{25} - \frac{y}{5} - \frac{4}{5} + y^2 = 4 - 3y$ $y^2 + 8y + 16 - 5y - 20 + 5y^2 = 20 - 15y$ $6y^2 + 18y - 24 = 0$ $6(y + 4)(y - 1) = 0$ $y = -4 \text{ or } y = 1$ $x = 0 \text{ or } x = 1$	✓ y-subject/onderwerp ✓ substitution/substitusie ✓ simplification/vereenvoudiging ✓ x-values/waardes ✓ y-values/waardes (5) OR/OF ✓ y-subject/onderwerp ✓ substitution/substitusie ✓ simplification/vereenvoudiging ✓ y-values/waardes ✓ x-values/waardes (5)
1.3	$4^{24} + 8^{16} + 16^{12} + 64^8 = 2^k$ $(2^2)^{24} + (2^3)^{16} + (2^4)^{12} + (2^6)^8 = 2^k$ $2^{48} + 2^{48} + 2^{48} + 2^{48} = 2^k$ $2^{48}(1 + 1 + 1 + 1) = 2^k$ $2^{48}(4) = 2^k$ $2^{48} \cdot 2^2 = 2^k$ $2^{50} = 2^k$ $\therefore 50 = k$ Using calculator: Award only 1 mark $k = 50$/ <i>Gebruik van sakrekenaar: Slegs 1 punt vir $k=50$.</i>	✓ write all terms as base 2/herskryf met grondgetal van 2 ✓ $4 \cdot 2^{48}$ ✓ value of k /waarde van k (3)
		[25]



QUESTION 2/VRAAG 2

2.1.1	$T_n = a + (n - 1)d$ $-121 = 15 + (n - 1) - 2$ $-121 = -15 - 2n + 2$ $-138 = -2n$ $69 = n \text{ terms}$ OR/OF $T_n = -2n + 17$ $-121 = -2n + 17$ $2n = 138$ $n = 69 \text{ terms}$	✓ substitution of a and d into correct formula/ <i>vervang a en d in korrekte formule</i> ✓ equating to/ <i>gelykstel aan</i> -121 ✓ n (3)
2.1.2	$S_n = \frac{n}{2}[2a + (n - 1)d]$ $S_{69} = \frac{69}{2}[2(15) + 68(-2)]$ $= -3657$ $S_{\text{series}} = -3657 + 69(7)$ $= -3174$ OR/OF $S_n = \frac{n}{2}[a + l]$ $S_{69} = \frac{69}{2}[15 + (-121)]$ $= -3657$ $S_{\text{series}} = -3657 + 69(7)$ $= -3174$	✓ subst into correct formula/ <i>subst. in korrekte formule</i> ✓ S_{69} ✓ $69(7)$ ✓ answer/ <i>antwoord</i> OR/OF ✓ subst into correct formula/ <i>subst. in korrekte formule</i> ✓ S_{69} ✓ $69(7)$ ✓ answer/ <i>antwoord</i> (4)

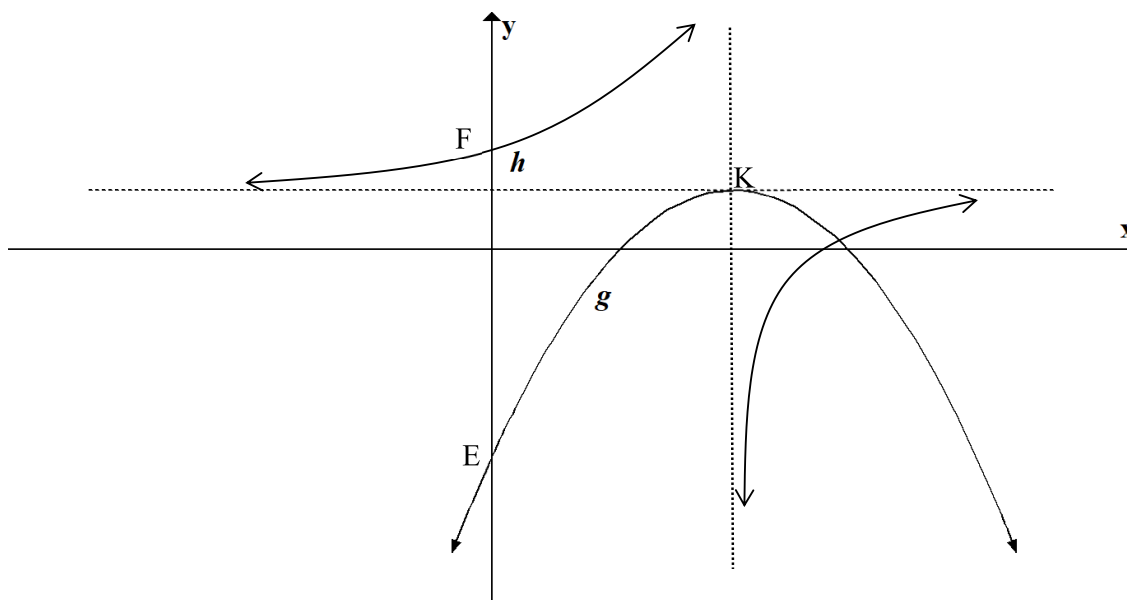


QUESTION 3/VRAAG 3

3.1.1	$r = \frac{243}{729} = \frac{1}{3}$ $T_9 = 729 \left(\frac{1}{3}\right)^{9-1}$ $= \frac{1}{9}$	✓ value of/waarde van r ✓ subst into correct formula/subst. in korrekte formule ✓ answer/antwoord (3)
3.1.2	$S_n = \frac{a(1-r^n)}{1-r}$ $1093\frac{1}{3} = \frac{729\left(1-\left(\frac{1}{3}\right)^m\right)}{1-\frac{1}{3}}$ $\left(\frac{1}{3}\right)^m = \frac{1}{6561}$ $= \left(\frac{1}{3}\right)^8 \quad \text{or} \quad m = \log_{\frac{1}{3}}\left(\frac{1}{6561}\right)$ $m = 8$	✓ subst into correct formula/subst. in korrekte formule ✓ simplification/vereenvoudiging ✓ value of/waarde van m (3)
3.2	$1 + r + r^2 + r^3 \dots$ $T_2 = 2(r^2 + r^3 + r^4 + \dots)$ $= 2\left(\frac{r^2}{1-r}\right)$ $\frac{2r^2}{1-r} = r$ $2r^2 = r - r^2$ $3r^2 - r = 0$ $r(3r - 1) = 0$ $r \neq 0 \quad \text{or} \quad r = \frac{1}{3}$ $1 + \frac{1}{3} + \frac{1}{9} + \dots$ If T_2 is not in terms of r break down/Indien T_2 nie in terme van r afgebreek nie 0 MARKS/PUNTE	✓ T_2 in terms of/ in terme van r $/T_2 = 2S_\infty$ ✓ equating/gelykstelling ✓ factors/faktore ✓ r ✓ 2 nd and 3 rd terms/2 ^{de} en 3 ^{de} terme (5)
		[11]



QUESTION 4/VRAAG 4



4.1	$(3; 2)$	$\checkmark x$ $\checkmark y$ (A) (2)
4.2	$y = -\frac{2}{0-3} + 2$ $y = \frac{8}{3}$ $E(0; -7)$ $FE = \frac{8}{3} - (-7)$ $= \frac{29}{3} \text{ or } 9\frac{2}{3}$	$\checkmark x = 0$ $\checkmark y\text{-coordinate of/}y\text{-koördinaat F}$ $\checkmark y\text{-coordinate of/}y\text{-koördinaat E}$ $\checkmark \text{answer/antwoord}$ (4)
4.3	$y = a(x - 3)^2 + 2$ $-7 = a(0 - 3)^2 + 2$ $-9 = 9a$ $a = -1$ $y = -(x - 3)^2 + 2$ $y = -x^2 + 6x - 9 + 2$ $y = -x^2 + 6x - 7$	$\checkmark \text{subst } (3; 2)$ $\checkmark \text{subst } (0; -7) \text{ (A)}$ $\checkmark \text{value of/waarde van } a$ $\checkmark b = 6$ (4)
4.4	$y \in R; y \neq 5$ OR/OF $y \in (-\infty; \infty) - \{5\}$	$\checkmark \text{value of/waarde van } 5$ $\checkmark \text{range/waardeversameling}$ $y \in R, y \neq 5$ (2) OR/OF $\checkmark \text{value of/waarde van } 5$ $\checkmark \text{range/waardeversameling}$ $y \in R, y \neq 5$ (2)



4.5	$-7 < p < 2$ OR/ OF $p \in (-7; 2)$	✓ critical values/ <i>kritiese waardes</i> ✓ correct interval/ <i>korrekte interval</i> (2) OR / OF ✓ critical values/ <i>kritiese waardes</i> ✓ correct interval/ <i>korrekte interval</i> (2)
4.6	$y = -x + c$ $2 = -3 + c$ $c = 5$ $y = -x + 5$ OR/OF $y - y_1 = -(x - x_1)$ $y - 2 = -(x - 3)$ $y = -x + 5$	✓ $m = -1$ ✓ subst K ✓ equation/ <i>vergelyking</i> (3) OR/OF ✓ $m = -1$ ✓ subst K ✓ equation/ <i>vergelyking</i> (3)
4.7	Reflection about the x-axis/across line $y = 0$ and then 2 units up/ <i>Refleksie in x –afsnit/lyn $y = 0$ en 2 eenhede opwaarts</i> OR/OF 2 units down and then a reflection about the x-axis/across line $y = 0$ / <i>2 eenhede afwaarts en dan refleksie oor x – afsnit/lyn $y = 0$</i>	✓ correct reflection/ <i>korrekte refleksie</i> ✓ 2 units up/ <i>eenhede opwaarts</i> (2) OR/OF ✓ 2 units down/ <i>2 eenhede af</i> ✓ correct reflection/ <i>korrekte refleksie</i> (2)
4.8	$1 = -x^2 + 6x - 7$ $0 = -x^2 + 6x - 8$ $0 = (x - 4)(x - 2)$ $x = 4$ or $x = 2$	✓ equating/ <i>gelykstelling</i> ✓ factors/ <i>faktore</i> ✓ values of x/ <i>waardes van x</i> (3)
		[22]



QUESTION 5/VRAAG 5

5.1	$y = \left(\frac{1}{3}\right)^x$ $x = \left(\frac{1}{3}\right)^y$ $y = \log_{\frac{1}{3}} x$ OR/OR $y = \log_3 \frac{1}{x}$	✓ interchanging x and y / <i>omruiling van x en y</i> ✓ answer/antwoord (2)
5.2		f : ✓ intercept y -axis/ <i>y-afsnit</i> ✓ form /vorm g : ✓ intercept x -axis/ <i>x-afsnit</i> ✓ form/vorm (4)
5.3	$\log_{\frac{1}{3}} x = -1$ $x = 3$ $\therefore 0 < x < 3$ OR/OR $x \in (0 ; 3)$	✓ $x = 3$ ✓ critical values/ <i>kritiese waardes</i> ✓ interval (3)
5.4	$h(x) = 27 \cdot \left(\frac{1}{3}\right)^x$ $= \left(\frac{1}{3}\right)^{x-3}$ $\therefore f$ shifts 3 units to the right/ <i>skuif 3 eenhede na regs</i> OR/OR Enlargement or vertical stretch by a factor of 27/ <i>Vergroting met skaalfaktor van 27</i>	✓ h as a power of/ <i>h as mag van $\frac{1}{3}$</i> ✓ answer/antwoord (2)
		[11]



QUESTION 6/VRAAG 6

6.1.1	$1 + i_{eff} = \left(1 + \frac{i}{m}\right)^m$ $1 + i_{eff} = \left(1 + \frac{0,08}{2}\right)^2$ $i_{eff} = \left(1 + \frac{0,08}{2}\right)^2 - 1$ $i_{eff} = 0,0816$ $i_{eff} = 8,16\%$	✓ subst into correct formula/subst. in korrekte formule ✓ i_{eff} ✓ answer/antwoord (3)
6.1.2	$A = P \left(1 + \frac{i^{(2)}}{2}\right)^{2n}$ $= 3550 \left(1 + \frac{0,08}{2}\right)^{10}$ $= R5254,87$ OR/OF $A = P(1 + i_{eff})^5$ $= 3550(1 + 0,0816)^5$ $= R5254,87$	✓ subst into correct formula/subst. in korrekte formule ✓ answer/antwoord (2)
6.2	$A = P(1 - i)^n$ $48896 = 185000(1 - 0,19)^n$ $(0,81)^n = \frac{48896}{185000}$ $n = \log_{0,81} \left(\frac{48896}{185000}\right)$ $n = 6,31$	✓ subst into correct formula/subst. in korrekte formule ✓ using logs correctly/korrekte gebruik van log ✓ answer/antwoord (3)



6.3.1	$P = \frac{x \left[1 - (1+i)^{-n} \right]}{i}$ $35000 = \frac{x \left[1 - \left(1 + \frac{0,18}{12} \right)^{-48} \right]}{\frac{0,18}{12}}$ $x = R1028,12$	✓ $n = 48$ ✓ subst into correct formula/ subst. in korrekte formule ✓ answer/antwoord (3)
6.3.2	$P_{balance(20th)} = \frac{1028,12 \left[1 - \left(1 + \frac{0,18}{12} \right)^{-28} \right]}{\frac{0,18}{12}}$ $x = R23365,79 \quad (\text{accept: } R23365,91)$ $Balance(23rd) = 23365,79 \left(1 + \frac{0,18}{12} \right)^2$ $= R24072,02 \quad (\text{accept: } R24072,14)$ OR/OF $F = \frac{x \left[(1+i)^n - 1 \right]}{i}$ $F = \frac{1028,12 \left[\left(1 + \frac{0,18}{12} \right)^{20} - 1 \right]}{\frac{0,18}{12}}$ $F = R23773,90$ $Balance(20th) = 35000 \left(1 + \frac{0,18}{12} \right)^{20} - 23773,90$ $= R23366,03$ $Balance(23rd) = 23366,03 \left(1 + \frac{0,18}{12} \right)^2$ $= R24072,26$	✓ $n = 28$ ✓ correct substitution in/korrekte subst. in P_v ✓ Balance after 20th/balans ná 20^{ste} ✓ adding interest/$A = P(1+i)^n$ byvoeging van rente ✓ answer/antwoord (5) OR/OF ✓ $n = 20$ ✓ correct substitution in A and F_v Korrekte substs in A en F ✓ Balance after 20th/Balans ná 20^{ste} ✓ adding interest/$A = P(1+i)^n$ byvoeging van rente ✓ answer/antwoord (5)
		[16]



QUESTION 7/VRAAG 7

Max. of –1 for wrong notation in this question./ Maks. van –1 vir verkeerde notasie in hierdie vraag.		
7.1	$f(x) = -\frac{2}{x}$ $f(x+h) = -\frac{2}{x+h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{1}{h} \left[\frac{-2}{x+h} + \frac{2}{x} \right]$ $= \lim_{h \rightarrow 0} \frac{1}{h} \left[\frac{-2x + 2x + 2h}{x(x+h)} \right]$ $= \lim_{h \rightarrow 0} \frac{2}{x(x+h)}$ $= \frac{2}{x^2}$ OR/OF $f(x) = -\frac{2}{x}$ $f(x+h) = -\frac{2}{x+h}$ $\bar{m} = \frac{f(x+h) - f(x)}{h}$ $= \frac{1}{h} \left[\frac{-2}{x+h} + \frac{2}{x} \right]$ $= \frac{1}{h} \left[\frac{-2x + 2x + 2h}{x(x+h)} \right]$ $= \frac{2}{x(x+h)}$ $f'(x) = \lim_{h \rightarrow 0} \frac{2}{x(x+h)}$ $= \frac{2}{x^2}$	✓ $f(x+h)$ ✓ subst in correct formula/subst. in korrekte formule ✓ $f(x+h) - f(x)$ ✓ simplification/vereenvoudiging ✓ answer/antwoord (5) OR/OF ✓ $f(x+h)$ ✓ $f(x+h) - f(x)$ ✓ simplification/vereenvoudiging ✓ subst in correct formula/subst. in korrekte formule ✓ answer/antwoord (5)

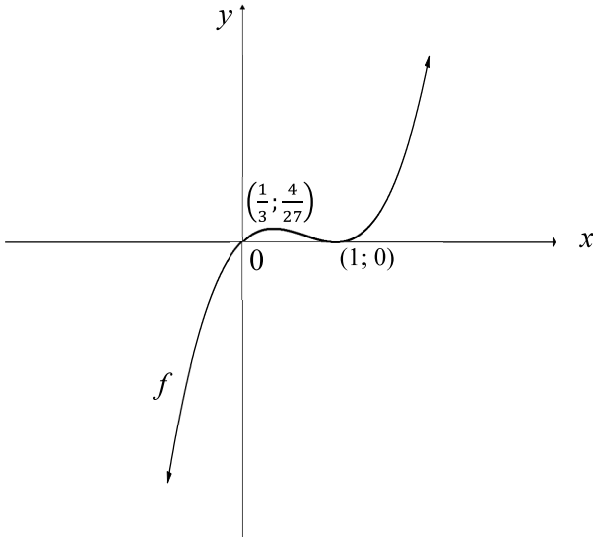




7.2.1	$D_x[3x^2 - 7x + 4]$ $= 6x - 7$	$\checkmark 6x \quad \checkmark -7$ (2)
7.2.2	$k = \frac{3}{x^3} - \frac{x^3}{3}$ $k = 3x^{-3} - \frac{1}{3}x^3$ $\frac{dk}{dx} = -9x^{-4} - x^2$	$\checkmark k \text{ in terms of/in terme van } x$ $\checkmark 3x^{-3}$ $\checkmark -9x^{-4} \quad \checkmark -x^2$ (4)
		[11]



QUESTION 8/VRAAG 8

8.1	$0 = x^3 - 2x^2 + x$ $0 = x(x - 1)(x - 1)$ $x = 0$ or $x = 1$	Answers only: full marks/Slegs antwoorde: volpunte	✓ factors/faktpre ✓ $x = 0$ ✓ $x = 1$ (3)
8.2	$y = x^3 - 2x^2 + x$ $\frac{dy}{dx} = 3x^2 - 4x + 1$ $0 = (3x - 1)(x - 1)$ $x = 1$ or $x = \frac{1}{3}$ $f\left(\frac{1}{3}\right) = \left(\frac{1}{3}\right)^3 - 2\left(\frac{1}{3}\right)^2 + \frac{1}{3} = \frac{4}{27}$ $(1; 0)$ or $\left(\frac{1}{3}; \frac{4}{27}\right)$		✓ $f'(x)$ ✓ $f'(x) = 0$ ✓ x-values/x-waardes ✓ Turning point/draaipunt $(1; 0)$ ✓ Turning point/draaipunt $\left(\frac{1}{3}; \frac{4}{27}\right)$ (5)
8.3			✓ turning points/draaipunte ✓ origin/y-intercept/ oorsprong/y-afsnit ✓ shape/vorm (3)
8.4.1	$\frac{1}{3} < x < 1$ OR $x \in \left(\frac{1}{3}; 1\right)$		✓ critical values/kritiese waardes ✓ interval/interval (2)
8.4.2	$f''(x) = 6x - 4 = 0$ $x = \frac{2}{3}$ $\therefore x < \frac{2}{3}$ OR/OF $x_{\text{inflection}} = \frac{1 + \frac{1}{3}}{2} = \frac{2}{3}$ $x \in \left(-\infty; \frac{2}{3}\right)$		✓ $f''(x) = 0$ ✓ $x = \frac{2}{3}$ ✓✓ answer/antwoord (4) OR/ OF ✓ method/metode ✓ $x = \frac{2}{3}$ ✓✓ answer/antwoord (4)



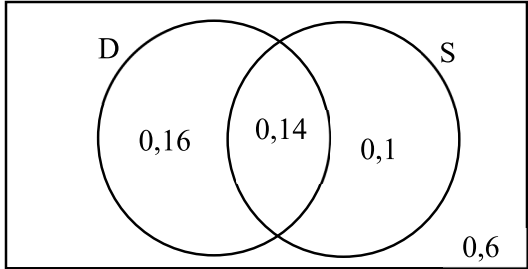
8.5	$f(x-2) = (x-2)(x-2-1)^2$ $= x^3 - 8x^2 + 21x - 18$ $\frac{d}{dx} = 3x^2 - 16x + 21$ $= 3(0)^2 - 16(0) + 21$ $= 21$ OR/OF $f'(-2) = 3(-2)^2 - 4(-2) + 1$ $= 21$	$\checkmark x^3 - 8x^2 + 21x - 18$ $\checkmark \frac{d}{dx}$ $\checkmark \text{ answer/antwoord}$ (3) OR/OF $\checkmark x = -2$ $\checkmark \text{ subst into derivative/subst. in afgeleide}$ $\checkmark \text{ answer/antwoord}$ (3)
		[20]

QUESTION 9/VRAAG 9

	$2r + h = 24$ $h = 24 - 2r$ $V = \pi r^2 h$ $= \pi r^2 (24 - 2r)$ $= 24\pi r^2 - 2\pi r^3$ $V'(r) = 48\pi r - 6\pi r^2$ $0 = 6\pi r(8 - r)$ $r = 8 \text{ units}$	$\checkmark 2r + h = 24$ $\checkmark \text{ subst } h \text{ into } V \text{ formula/subst. } h \text{ in } V\text{-formule}$ $\checkmark \text{ simplification/vereenvoudiging}$ $\checkmark V'(r) = 0$ $\checkmark \text{ common factor/gemene faktor}$ $\checkmark \text{ answer/antwoord}$ (6)
		[6]



QUESTION 10/VRAAG 10

10.1	$P(\text{at least one}) = 1 - 0,6 = 0,4$	✓ answer/antwoord (1)
10.2	$P(S \text{ or } D) = P(S) + P(D) - P(S \text{ and } D)$ $0,4 = 0,24 + P(D) - 0,14$ $P(D) = 0,3$ OR/OF  $P(D) = 0,3$	✓✓ correct subst into correct formula/korrekte substs in korrekte formule ✓ answer/antwoord OR/OF ✓✓ subst into Venn diagram/subst. in Venn-diagram ✓ answer/antwoord (3)
10.3	$P(S) \times P(D)$ $= 0,24 \times 0,3$ $= 0,072$ $P(D \text{ and } S) = 0,14$ $P(D \text{ and } S) \neq P(D) \times P(S)$ $\therefore$ not independent/is nie onafhanklik nie	✓ $P(S) \times P(D)$ ✓ 0,072 ✓ conclusion/slotsom (3)
		[7]

QUESTION 11/VRAAG 11

11.1	$7^3 = 343$	✓ 7^3 (1)
11.2	$7 \times 6 \times 5$ OR $\frac{7!}{4!}$ OR 210	✓✓ answer/antwoord (2)
11.2	$3 \times 7 \times 2 - 1 = 41$ (400 must be excluded/iutgesluit) $P = \frac{41}{343} = 0,12$ Maximum 3 marks if 400 is included/ Maksimum 3 punte as 400 ingesluit is	✓✓ $3 \times 7 \times 2$ ✓ -1 ✓ answer/antwoord (4)
		[7]

