GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

GAUTENG DEPARTMENT OF EDUCATION

PREPARATORY EXAMINATION

2021

10611

MATHEMATICS

PAPER 1

TIME: 3 hours

MARKS: 150

9 pages + 1 information sheet

MATHEMATICS: Paper 1

10611E

X05

INSTRUCTIONS AND INFORMATION

1. This question paper consists of 11 questions.
2. Answer ALL the questions.
3. Clearly show ALL calculations, diagrams, graphs, et cetera, that you have used to determine the answers.
4. Answers only will NOT necessarily be awarded full marks.
5. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.
6. Where necessary, answers should be rounded-off to TWO decimal places, unless stated otherwise.
7. Diagrams are NOT necessarily drawn to scale.
8. An information sheet with formulae is included at the end of the question paper.
9. Number the answers correctly according to the numbering system used in the question paper.
10. Write neatly and legibly.

QUESTION 1

1.1 Solve for x:

1.1.1 $3x^2 - 4x = 0$ (2)

1.1.2 $3x^2 + 10x - 4 = 0$ (Correct to TWO decimal places) (3)

1.1.3 $15x - 4 < 9x^2$ (3)

1.1.4 $\sqrt{x^2 - 5} = 2\sqrt{x}$ (4)

1.2 Given: $(3x - y)^2 + (x - 5)^2 = 0$
Solve for x and y. (3)

1.3 Given: $x - 2 = \dfrac{-4}{x - 2} - 4$

If $y = x - 2$:

1.3.1 Show that the given equation can be expressed as: $y^2 + 4y + 4 = 0$. (2)

1.3.2 Hence, show that the equation has real and equal roots. (2)

1.4 Calculate the maximum value of S if: $S = \dfrac{6}{x^2 + 2}$ (2)

[21]

QUESTION 2

2.1 The first FOUR terms of a quadratic pattern are 1; 9; 25; 49.

2.1.1 Write down the value of the 5^{th} term. (1)

2.1.2 Show that the n^{th} term of this sequence can be written as $T_n = (2n - 1)^2$. (5)

2.1.3 Which term of the sequence will be equal to 10 201? (3)

2.2 The first 24 terms of an arithmetic series are: $35 + 42 + 49 + ... + 196$.
Calculate the sum of ALL the natural numbers from 35 to 196 that are NOT divisible by 7. (5)

[14]

QUESTION 3

3.1 Consider the following geometric series:

$$5(3x+1)+5(3x+1)^2+5(3x+1)^3\ldots$$

3.1.1 For which values of x will the series converge? (3)

3.1.2 Calculate the sum to infinity of the series if $x=-\frac{1}{6}$. (4)

3.2 Determine the smallest value of k for which $\sum_{p=1}^{k} 2^{p-4} > 30$ if k is an integer. (4)

[11]

QUESTION 4

4.1 Given: $f(x)=\frac{2}{x+1}-3$

4.1.1 Write down the coordinates of the y-intercept of f. (1)

4.1.2 Calculate the coordinates of the x-intercept of f. (2)

4.1.3 Sketch the graph of f in your ANSWER BOOK clearly showing the asymptotes and the intercepts with the axes. (3)

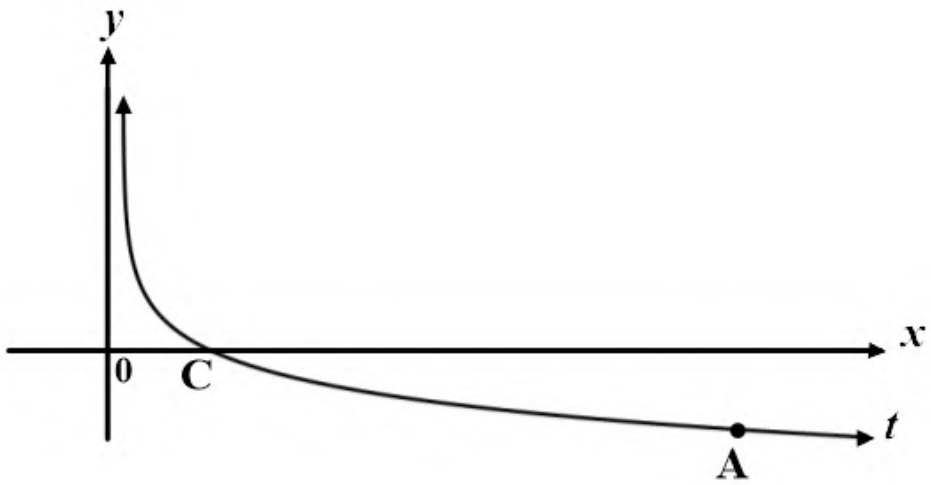
4.1.4 One of the axes of symmetry of f is a decreasing function.

Determine the equation of this axis of symmetry. (2)

4.2 The function defined by $t(x) = \log_a x$ is sketched below.

It is given that:

- Point C is the *x*-intercept of t.
- Point A (5; -1) is on t.



4.2.1 Write down the coordinates of point C. (1)

4.2.2 Write down the range of the graph of t. (1)

4.2.3 Calculate the value of a. (2)

4.2.4 The graph of $h = t(x)$ is transformed by a reflection of t about the line $y = x$.

Determine the equation of h in the form $y =$ … . (2)

4.2.5 Write down the domain of h. (1)

4.2.6 Write down the equation of the asymptote of h. (1)

[16]

QUESTION 5

Given: $f(x) = -ax^2 + bx + 6$

5.1 The gradient of the tangent to the graph of f at the point $\left(-1\,;\ \frac{7}{2}\right)$ is 3.

Show that $a = \frac{1}{2}$ and $b = 2$. (5)

5.2 Calculate the x-intercepts of f. (2)

5.3 Calculate the coordinates of the turning point of f. (3)

5.4 Sketch the graph of f in your ANSWER BOOK. Clearly indicate ALL intercepts with the axes and the turning point. (2)

5.5 Use the graph to determine the values of x for which $f(x) > 6$. (1)

5.6 Sketch the graph of $g(x) = -x - 1$ on the same set of axes as the graph of f in QUESTION 5.4. Clearly indicate ALL intercepts with the axes. (2)

5.7 Write down the values of x for which $f(x).g(x) \leq 0$. (2)

[17]

QUESTION 6

6.1 Janet invests a lump sum of R5 000 into a savings account for exactly 2 years. The investment earns interest at 10% p.a. compounded quarterly.

6.1.1 What is the quarterly interest rate for Janet's investment? (1)

6.1.2 Calculate the amount in Janet's savings account at the end of 2 years. (3)

6.2 Sihle inherits R800 000. He invests his entire inheritance in a fund which earns interest at a rate of 14% p.a., compounded monthly. At the end of each month, Sihle withdraws R10 000 from the fund. His first withdrawal is exactly one month after his initial investment.

6.2.1 How many withdrawals of R10 000 will Sihle be able to make from his fund? (5)

6.2.2 Exactly four years after his initial deposit, Sihle decides to withdraw all the remaining money from his account to use as a deposit towards a house.

(a) What is the value of Sihle's deposit to the closest Rand? (4)

(b) Sihle's deposit is exactly 30% of the purchase price of the house.

What is the purchase price of the house to the nearest Rand? (1)

[14]

QUESTION 7

7.1 Given: $g(x) = 1 - 4x^2$

7.1.1 Determine $f'(x)$ from FIRST PRINCIPLES. (4)

7.1.2 Hence, calculate the gradient of the tangent of f at $x = 2$. (2)

7.2 Determine $f'(x)$ if $f(x) = \sqrt[3]{x^2} + \frac{1}{4x^4}$. (3)

7.3 Given: $h(x) = ax^2$; $x > 0$

Determine the value of a if it is given that $h^{-1}(8) = h'(4)$. (6)

[15]

QUESTION 8

Consider the graph of $g(x) = x^3 - 3x^2$ and $h(x) = -\frac{2}{3}x - \frac{4}{3}$.

8.1 Determine whether the graph of h intersects the graph of g at its point of inflection. Show all necessary calculations. (6)

8.2 Determine the stationary points of $y = g'(x)$.
Classify the stationary point(s) as either MAXIMUM or MINIMUM. (4)

8.3 Hence, or otherwise, determine:

8.3.1 The value(s) for x for which g is concave down (1)

8.3.2 The gradient of the tangent to g at its point of inflection (2)

8.3.3 A student claims that the gradient of g at ANY point will never be less than –3. Is the student correct? Explain. (2)

8.4 Determine the value of k, if the graph of g is shifted so that the values of x for which the new graph $p(x) = (x+k)^3 - 3(x+k)^2$ decreases, is between –3 and –1. (4)

[19]

QUESTION 9

The bracelet below is beaded by using 10 plastic spheres and 10 plastic cylinders.

When completed, the bracelet will be painted. (Ignore the holes in the spheres and cylinders.)

The following formulae are given:

$V = \pi r^2 h$ $\quad$ $V = \frac{4}{3}\pi r^3$

$S = 4\pi r^2$ $\quad$ $S = 2\pi r^2 + 2\pi h$

The following essential properties of the different beads are:

- The radii, r, of the spheres and the cylinders are exactly the same.
- The height of each cylinder is h.

9.1 If the volume of a cylinder is 6 cm^3, write h in terms of r. (1)

9.2 Show that the total surface area (S) of all the painted surfaces on the bracelet is equal to $S(r) = 60\pi r^2 + \frac{120}{r}$. (4)

9.3 Determine the value of r so that the LEAST amount of paint will be used. (3)

[8]

QUESTION 10

Events A, B and C occur as follows, where A and B are independent events:

- P(A) = 0,38
- P(B) = 0,42
- $P(A \cap B) = 0,1596$
- P(C) = 0,28

10.1 Are A and B mutually exclusive events? Motivate your answer. (2)

10.2 By using an appropriate formula, show that the value of $P(A \cup B) = 0,64$. (1)

10.3 Calculate the number of people in the sample space. (2)

10.4 Determine $n(C')$. (2)
[7]

QUESTION 11

11.1 Each of the digits: 1 ; 1 ; 2 ; 3 ; 4 ; 7 is written on a separate card.
The cards are then placed next to each other to create a 6 digit number.

11.1.1 How many numbers start and end with the same digit? (1)

11.1.2 Find the probability that the number is 112347 or 743211. (4)

11.2 n people (numbered 1 ; 2 ; 3 ; 4 ; 5 ; 6 ; … ; n) are arranged randomly in a line.

Find the number of ways, in terms of n, that person 1 and person 2 are standing next to each other. (You do not need to simplify your answer.) (3)
[8]

TOTAL: 150

END

INFORMATION SHEET

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

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

$$\sum_{i=1}^{n} 1 = n \qquad \sum_{i=1}^{n} i = \frac{n(n+1)}{2} \qquad T_n = a + (n-1)d$$

$$S_n = \frac{n}{2}\left(2a + (n-1)d\right) \qquad T_n = ar^{n-1} \qquad S_n = \frac{a\left(r^n - 1\right)}{r-1} \; ; \quad r \neq 1 \qquad S_\infty = \frac{a}{1-r} \; ; \; -1 < r < 1$$

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

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

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

$$y = mx + c \qquad y - y_1 = m(x - x_1) \qquad m = \frac{y_2 - y_1}{x_2 - x_1} \qquad m = \tan\theta \qquad (x-a)^2 + (y-b)^2 = r^2$$

$$In\ \Delta ABC: \quad \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C} \qquad a^2 = b^2 + c^2 - 2bc.\cos A \qquad area\ \Delta ABC = \frac{1}{2}ab.\sin C$$

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

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

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

$$(x\,;\,y) \to (x\cos\theta - y\sin\theta\,;\, y\cos\theta + x\sin\theta)$$

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

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

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

GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

PREPARATORY EXAMINATION

VOORBEREIDENDE EKSAMEN

2021

MARKING GUIDELINES/ *NASIENRIGLYNE*

(10611)

MATHEMATICS (PAPER 1)/*WISKUNDE (VRAESTEL 1)*

25 pages/*bladsye*

INSTRUCTIONS AND INFORMATION/*INSTRUKSIES EN INLIGTING*

- **A** – ACCURACY /*AKKURAATHEID*
- **CA** – CONSISTENT ACCURACY/*VOLGEHOUE AKKURAATHEID*

NOTES:

- If a candidate answered a question TWICE, mark only the first attempt.
- If a candidate crossed OUT an answer and did not redo it, mark the crossed-out answer.
- Consistent accuracy applies to ALL aspects of the marking guidelines.
- Assuming values/answers in order to solve a question is UNACCEPTABLE.

LET WEL:

- *As 'n kandidaat 'n vraag TWEE KEER beantwoord, sien slegs die EERSTE poging na.*
- *As 'n kandidaat 'n antwoord van 'n vraag DOODTREK en nie oordoen nie, sien die doodgetrekte poging na.*
- *Volgehoue akkuraatheid word in ALLE aspekte van die nasienriglyne toegepas.*
- *Aannames van antwoorde/waardes om 'n probleem op te los, word NIE toegelaat NIE.*

QUESTION 1/
VRAAG 1

1.1.1

$3x^2 - 4x = 0$

$x(3x - 4) = 0$

$x = 0$ **or/*of*** $x = \frac{4}{3}$

✓factors/*faktore*

✓both answers/*albei antwoorde*

(2)

1.1.2

$3x^2 + 10x - 4 = 0$

$x = \frac{-10 \pm \sqrt{(10)^2 - 4(3)(-4)}}{2(3)}$

$x = -3{,}69$ **or/*of*** $x = 0{,}36$

NOTE: Penalise 1 mark for incorrect rounding-off in this question ONLY./*Penaliseer 1 punt vir verkeerde afronding SLEGS in hierdie vraag.*

✓substitution into correct formula/ *vervanging in korrekte formule*

✓✓answers/*antwoorde*

(3)

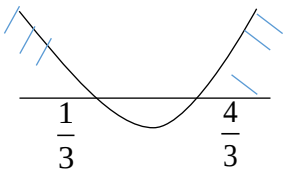
1.1.3

$15x - 4 < 9x^2$

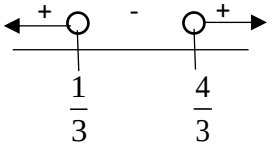
$-9x^2 + 15x - 4 < 0$

$9x^2 - 15x + 4 > 0$

$(3x - 1)(3x - 4) > 0$



OR/*OF*



$x < \frac{1}{3}$ **or/*of*** $x > \frac{4}{3}$

NOTE: OR must be present. If candidate writes AND penalise 1 mark/*OF moet aangedui word. Indien kandidaat EN skryf, penaliseer met 1 punt.*

✓standard form/ *standaardvorm* (in either form/ *in enige vorm)*

✓factors/*faktore*

✓both answers correct/ *albei antwoorde korrek*

(3)

1.1.4

$\sqrt{x^2 - 5} = 2\sqrt{x}$

$x^2 - 5 = 4x$

$x^2 - 4x - 5 = 0$

$(x - 5)(x + 1) = 0$

$x = 5$ **or/*of*** $x \neq 1$

NA/invalid/not a real solution/*NvT/nie reële oplossing/ongeldig*

✓squaring both sides/ *kwadreer albei kante*

✓standard form/ *standaardvorm*

✓factors/*faktore*

✓rejection/*verwerp*

(4)

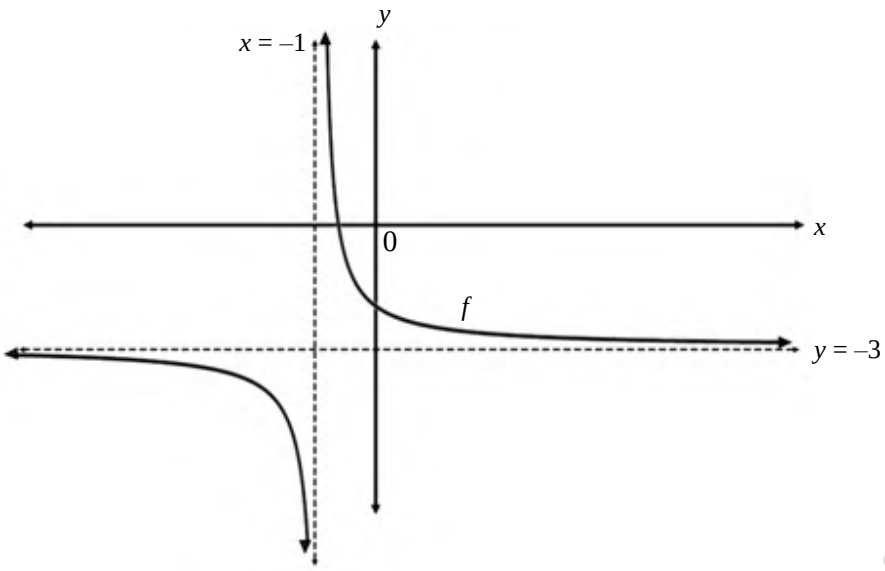
1.2	$(3x-y)^2+(x-5)^2=0$ $(3x-y)^2=0$ and/*en* $(x-5)^2=0$ $3x-y=0$ $x-5=0$ $y=3x$ $x=5$ $\therefore y=3(5)$ $y=15$	✓setting up both equations/*stel beide vergelykings op* ✓value of *x/waarde van x* ✓value of *y/waarde van y* (3)
1.3.1	$x-2=\frac{-4}{x-2}-4$ …. (1) and/*en* $y=x-2$ … (2) substitute/*vervang* (2) into/*in* (1) $y=\frac{-4}{y}-4$ $y+4=\frac{-4}{y}$ $y^2+4y=-4$ $y^2+4y+4=0$	✓setting up new equation for *y* *stel nuwe vergelyking op vir y* ✓simplification/ *vereenvoudiging* (2)
1.3.2	$\Delta = b^2-4ac$ $=4^2-4(1)(4)$ $=16-16$ $=0$ ∴ the roots are real and equal/*wortels is reël en gelyk* **OR/*OF*** $y^2+4y+4=0.$ $(y+2)^2=0$ ∴ $y=-2$ ∴ the roots are real and equal/ *wortels is reël en gelyk*	✓substitution into correct formula/ *vervanging in korrekte formule* ✓ $\Delta = 0$ **OR/*OF*** ✓factors/*faktore* ✓value of *y/waarde van y* (2)

1.4	S will be a maximum if (x^2+2) is a minimum. *S sal 'n maksimum wees indien* (x^2+2) *'n minimum is* The minimum of/*die minimum van* (x^2+2) is 2. ∴ maximum/*maksimum*: $S=\frac{6}{2}$ $S=3$	✓deduction and correct minimum value of/ *aftrekking en korrekte minimum waarde van* (x^2+2) ✓answer/*antwoord* (2)
		[21]
QUESTION 2/ ***VRAAG 2***		
2.1.1	$T_5=81$	✓answer /*antwoord* (1)
2.1.2	1 ; 9 ; 25 ; 49 8 16 24 8 8	✓2nd difference/ *2de verskil*
	$2a=8$ $\quad 3a+b=8$ $\quad a+b+c=1$ $a=4$ $\quad 3(4)+b=8$ $\quad 4-4+c=1$ $b=-4$ $\quad c=1$	✓$a=4$ ✓$b=-4$ ✓$c=1$
	$T_n=4n^2-4n+1$ $T_n=(2x-1)(2x-1)$ $T_n=(2x-1)^2$	✓factors/*faktore* (5)

2.1.3	$(2n-1)^2 = 10201$ $\sqrt{(2n-1)^2} = \sqrt{10201}$ $2n-1 = 101$ $2n = 102$ $n = 51$	✓equating/*gelykstel* ✓simplify/*vereenvoudig* ✓answer/*antwoord* (3)
2.2	$35 + 42 + 49 + \ldots 196.$ Sum of natural numbers between 35 and 196, divisible by 7/ *Som van natuurlike getalle tussen* 35 *en* 196, *deelbaar deur* 7 $S_n = \frac{n}{2}(a+l)$ $S_n = \frac{24}{2}(35+196)$ $S_n = 2772$ $n = 196 - 34$ $n = 162$ Sum of all natural numbers between 35 and 196/ *Som van alle natuurlikegetalle tussen* 35 *en* 196 $S_n = \frac{n}{2}(a+l)$ $S_{162} = \frac{162}{2}(35+196)$ $S_{162} = 18711$ $\therefore S_{\text{not divisible by/}niedeelbaar\ deur\ 7} = 18711 - 2772$ $S_{\text{not divisible by/}nie\ deelbaar\ deur\ 7} = 15939$	✓ $n = 24$ ✓substitution into correct formula AND *vervanging in korrekte formule EN* S_n = 2772 ✓ $n = 162$ ✓S_{162} = 18711 ✓answer/*antwoord* (5)
		[14]

QUESTION 3/ ***VRAAG 3***		
3.1.1	$5(3x+1)+5(3x+1)^2+5(3x+1)^3\ldots$ $r=3x+1$ $-1<r<1$ $-1<3x+1<1$ $-2<3x<0$ $-\frac{2}{3}<x<0$	✓value of *r*/*waarde van r* ✓ $-1<r<1$ ✓answers/*antwoorde* (3)
3.1.2	$3x+1$ $=3\left(-\frac{1}{6}\right)+1$ $=\frac{1}{2}$ $\therefore r=\frac{1}{2}$ $a=5\left(\frac{1}{2}\right)$ $a=\frac{5}{2}$ $S_\infty=\frac{a}{1-r}$ $S_\infty=\frac{\frac{5}{2}}{1-\frac{1}{2}}$ $S_\infty=5$	✓value of *r*/*waarde van r* ✓value of *a*/*waarde van a* ✓substitution into correct formula/ *vervanging in korrekte formule* ✓answer/*antwoord* (4)

3.2	$T_1 = \frac{1}{8}$ $T_2 = \frac{1}{4}$ $T_3 = \frac{1}{2}$ $a = \frac{1}{8}$ and/*en* $r = 2$ $\frac{\frac{1}{8}(2^k - 1)}{2-1} > 30$ $2^k > 241$ $\log_2 241 < k$ $7,912.... < k$ $\therefore k = 8$	✓values of/*waarde van* T_1 T_2 T_3 ✓substitution into correct formula/ *vervanging in korrekte formule* ✓correct use of logs/ *korrekte gebruik van logs* ✓answer/*antwoord* (4)
		[11]
QUESTION 4/ *VRAAG 4*		
4.1.1	*y*-intercept: make $x = 0$ *y*-afsnit: stel $x = 0$ $\therefore y = \frac{2}{0+1} - 3$ $y = -1$ $\therefore (0 ; -1)$ **NOTE: Must be in coordinate form.** **Answer only: full marks/** ***LET WEL: Moet in koördinaatvorm wees.*** ***Antwoord alleenlik: volpunte***	✓answer/*antwoord* (1)

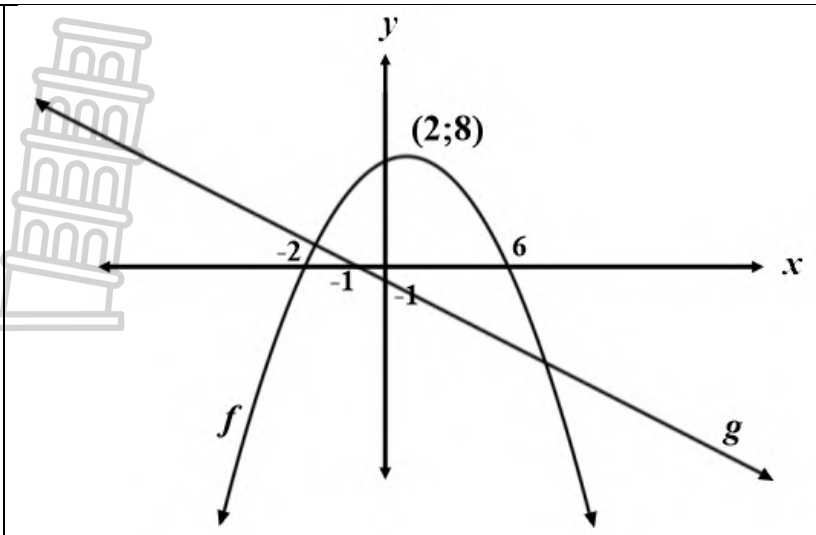
4.1.2	*x*-intercept: make $y = 0$/ *x-afsnit: stel* $y = 0$ $0 = \frac{2}{x+1} - 3$ $3 = \frac{2}{x+1}$ $3(x+1) = 2$ $3x + 3 = 2$ $3x = -1$ $x = -\frac{1}{3}$ $(-\frac{1}{3};\ 0)$ **NOTE: Answer does not need to be in coordinate form.** ***LET WEL: Antwoord hoef nie in koördinaatvorm te wees nie.***	✓valid simplification/ *geldige vereenvoudiging* (either lines 3, 4 or 5/ *óf lyne 3, 4 óf 5*) ✓answer/*antwoord* (2)
4.1.3		✓shape/*vorm* ✓asymptotes/*asimptotes* ✓*x*-inter/*afsnit*. $(-\frac{1}{3}; 0)$ and/*en* *y*- inter/*afsnit* (0 ; –1) (3)

4.1.4	$y = ax + q$ $-3 = -(-1) + q$ $q = -4$ $\therefore y = -x - 4$ **OR/*OF*** $y - y_1 = m(x - x_1)$ $y - (-3) = -1(x - (-1))$ $y + 3 = -(x + 1)$ $y + 3 = -x - 1$ $y = -x - 4$ **OR/*OF*** $y = -(x + 1) - 3$ $y = -x - 1 - 3$ $y = -x - 4$	✓substitute/*vervang* $m = -1$ and point/*en punt* $(-1 ; -3)$ ✓answer/*antwoord* **OR/*OF*** ✓substitute/*vervang* $m = -1$ and point/*en punt* $(-1 ; -3)$ ✓answer/*antwoord* **OR/*OF*** ✓substitute/*vervang* $m = -1$ and point/*en punt* $(-1 ; -3)$ ✓answer/*antwoord* (2)
4.2.1	C(1 ; 0)	✓answer/*antwoord* (1)
4.2.2	Range/*waardeversameling*: $y \in R$ **OR/*OF*** $y \in (-\infty; \infty)$	✓answer/*antwoord* (1)
4.2.3	$y = log_a x$ $-1 = log_a 5$ $a^{-1} = 5$ $a = \frac{1}{5}$	✓correct log equation to exponential equation/ *korrekte log vergelyking na eksponensiële vergelyking* ✓answer/*antwoord* (2)
4.2.4	t: $y = \log_{\frac{1}{5}} x$ h: $x = \log_{\frac{1}{5}} y$ $y = \left(\frac{1}{5}\right)^x$ **OR/*OF*** $y = 5^{-x}$	✓interchange x and y/ *ruil x en y om* ✓answer/*antwoord* (2)

4.2.5	$x \in R$ **OR/*OF*** $x \in (-\infty;\infty)$	✓answer/*antwoord* **OR/*OF*** ✓answer/*antwoord* (1)
4.2.6	$y = 0$	✓answer/*antwoord* (1)
		[16]
QUESTION 5/ ***VRAAG 5***		
5.1	$f(x) = -ax^2 + bx + 6$ $f'(x) = -2ax + b$ $f'(-1) = -2a(-1) + b$ $f'(-1) = 2a + b$ $3 - 2a = b \quad ...(1)$	✓derivative/*afgeleide* ✓equation/*vergelyking* (1)
	$f(x) = -ax^2 + bx + 6$ $\frac{7}{2} = -a(-1)^2 + b(-1) + 6$ $\frac{7}{2} = -a - b + 6$ $b = -a + \frac{5}{2} \quad ... (2)$	✓equation/*vergelyking* (2)
	$(1) = (2)$ $3 - 2a = -a + \frac{5}{2}$ $a = \frac{1}{2}$ $\therefore \quad b = 3 - 2\left(\frac{1}{2}\right)$ $b = 2$	✓equating/*gelykstel* ✓substitution of *a*-value in any correct equation for *b*/*vervanging van a-waarde in enige korrekte vergelyking om b te bepaal*
	OR/*OF*	**OR/*OF***

	$f(x) = -ax^2 + bx + 6$ $f'(x) = -2ax + b$ $f'(-1) = -2a(-1) + b$ $\therefore \quad 3 = 2a + b \quad$ ……..(1) $f(x) = -ax^2 + bx + 6$ $(-1\ ;\ \frac{7}{2})$: $\quad \frac{7}{2} = -a(-1)^2 + b(-1) + 6$ $\frac{7}{2} - 6 = -a - b$ $-\frac{5}{2} = -a - b$……..(2) (1) + (2): $\quad a = \frac{1}{2} \quad$ ……(3) (3) in (1): $\quad 3 = 2(\frac{1}{2}) + b$ $3 = 1 + b$ $b = 2$	✓derivative/*afgeleide* ✓equation/*vergelyking* (1) ✓equation/*vergelyking* (2) ✓method to determine *a*/ *metode om a te bepaal* ✓substitution of *a*-value in correct equation for *b*/ *vervanging van a-waarde in korrekte vergelyking om b te bepaal* (5)
5.2	$f(x) = -\frac{1}{2}x^2 + 2x + 6$ $x-$intercepts/*afsnit* $\therefore f(x) = 0$ $0 = -\frac{1}{2}x^2 + 2x + 6$ $0 = x^2 - 4x - 12$ $0 = (x-6)(x+2)$ $\therefore \quad x = 6 \quad$ or/*of* $\quad x = -2$ $(6;0)$ or/*of* $(-2;0)$ **NOTE: Answer does not have to be in coordinate form./** ***LET WEL: Antwoord hoef nie in koördinaatvorm te wees nie***	✓factors/*faktore* ✓answers/*antwoorde* (2)

5.3	$f(x) = -\frac{1}{2}x^2 + 2x + 6$ $f'(x) = -x + 2$ $0 = -x + 2$ $x = 2$ $f(2) = -\frac{1}{2}(2)^2 + 2(2) + 6$ $f(2) = 8$ $\therefore$ TP $(2;8)$ **OR/*OF*** $f(x) = -\frac{1}{2}x^2 + 2x + 6$ $x = \frac{-(2)}{2(-\frac{1}{2})}$ $x = 2$ $f(2) = -\frac{1}{2}(2)^2 + 2(2) + 6$ $f(2) = 8$ TP $(2;8)$ **OR/*OF*** $x = \frac{-2+6}{2}$ $x = 2$ $f(2) = -\frac{1}{2}(2)^2 + 2(2) + 6$ $f(2) = 8$ TP $(2;8)$ **NOTE: Answer does not have to be in coordinate form./** ***LET WEL: Antwoord hoef nie in koördinaatvorm te wees nie***	✓derivative = 0/ *afgeleide = 0* ✓*x*- value/*x-waarde* ✓*y*- value/*y-waarde* **OR/*OF*** ✓correct subst. into formula/*korrekte vervanging in formule* ✓*x*-value/*x-waarde* ✓*y*- value/*y-waarde* **OR/*OF*** ✓midpoint between *x*-intercepts/*middelpunt tussen x-afsnitte* ✓*x*- value/*x-waarde* ✓*y*-value/*y-waarde* (3)

5.4	 **NOTE: Assessing parabola ONLY./** ***LET WEL: Assesseer ALLEENLIK parabool.***	✓intercepts and turning point/*afsnitte en draaipunt* ✓shape/*vorm* (2)
5.5	$0 < x < 4$	✓answer/*antwoord* (1)
5.6	$y = -x - 1$ x – int/afsnit: $0 = -x - 1$ $x = -1$ y – int/afsnit: $y = 0 - 1$ $y = -1$ **NOTE: Mark the sketch combined with Question 5.4. If candidate does NOT sketch the line but calculates x- and y-intercepts, award 1 mark./** ***LET WEL: Merk die gekombineerde skets by Vraag 5.4. Indien kandidaat NIE die reguitlyn geskets het nie, maar wel die x- en y-afsnitte bereken het, ken 1 punt toe.***	✓x-intercept/x-*afsnit* ✓y-intercept/y-*afsnit* (2)
5.7	$f(x).g(x) \leq 0$ $\therefore x \leq -2$ or/*of* $-1 \leq x \leq 6$ **NOTE: Accuracy marks. Candidate may write answers as separate inequalities./** ***LET WEL: Akkuraatheid punte. Kandidaat mag die antwoord skryf as aparte ongelykhede.***	✓answer/*antwoord* ✓answer/*antwoord* (2)
		[17]

QUESTION 6 ***VRAAG 6***		
6.1.1	$\frac{10\%}{4}$ $= 2,5\%$	✓answer/*antwoord* (1)
6.1.2	$A = P(1+i)^n$ $A = \text{R}5\,000\left(1+\frac{0.1}{4}\right)^8$ $A = \text{R}6\,092,01$ **OR/*OF*** $A = P(1+i)^n$ $= \text{R}5\,000(1+\frac{2,5}{100})^{(2\text{ x }4)}$ $\approx \text{R}6\,092,01$	✓ $n = 8$ ✓substitution into correct formula/ *vervanging in korrekte formule* ✓answer/*antwoord* **OR/*OF*** ✓ $n = 8$ ✓substitution into correct formula/ *vervanging in korrekte formule* ✓answer/*antwoord* (3)
6.2.1	$Pv = \frac{x[1-(1+i)^{-n}]}{i}$ $800\,000 = \frac{10\,000[1-\left(1+\frac{0,14}{12}\right)^{-n}}{\frac{0,14}{12}}$ $0,67 = \left(1+\frac{0,14}{12}\right)^{-n}$ $\log_{\left(1+\frac{0,14}{12}\right)} 0,066... = -n$ $-n = -233,469...$ $n = 233$ $\therefore$ Sihle can make 233 withdrawals of R10 000 $\therefore$ *Sihle kan* 233 *onttrekkings van* R10 000 *maak* **NOTE: Accept 234 withdrawals./** ***LET WEL: Aanvaar 234 onttrekkings.***	✓ $i = \frac{0,14}{12}$ ✓correct subst. in correct formula/*korrekte vervanging in korrekte formule* ✓simplification/*vereen-voudiging* ✓use of logs/*gebruik van logs* ✓answer/*antwoord* (5)

6.2.2(a)	$A = P(1 + i)^n$ $A = \text{R}8\,000\,000\left(1+\frac{0.14}{12}\right)^{48}$ $A = \text{R}1\,396\,005{,}54$ $Fv = \frac{x[(1+i)^n - 1]}{i}$ $Fv = \frac{\text{R}10\,000[(1+\frac{0{,}14}{12})^{48} - 1]}{\frac{0{,}14}{12}}$ $Fv = \text{R}638\,577{,}36$ Remaining money/*Oorblywende geld* = $A - Fv$ R1 396 005,54 – R638 577,36 = R757 428,18 Sihle's deposit is/*Sihle se deposito is* R757 428	✓answer/*antwoord* (A) ✓substitution into correct formula/ *vervanging in korrekte formule* ✓answer/*antwoord* (Fv) ✓answer/*antwoord* (4)
6.2.2(b)	Let purchase price = x/ *Gestel die aankoopprys* = x 30 % × x = R757 428 x = R2 524 760	✓answer/*antwoord* (1)
		[14]

QUESTION 7
VRAAG 7

7.1.1

$f(x) = 1 - 4x^2$

$f(x+h) = 1 - 4(x+h)^2$

$= 1 - 4(x^2 + 2xh + h^2)$

$= 1 - 4x^2 - 8xh - 4h^2$

✓ $f(x+h)$

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

$$= \lim_{h \to 0} \frac{1 - 4x^2 - 8xh - 4h^2 - (1 - 4x)^2}{h}$$

$$= \lim_{h \to 0} \frac{1 - 4x^2 - 8xh - 4h^2 - 1 + 4x^2}{h}$$

✓simplification/
vereenvoudiging

$$= \lim_{h \to 0} \frac{-8xh - 4h^2}{h}$$

$$= \lim_{h \to 0} \frac{h(-8x - 4h)}{h}$$

✓common factor/
gemeenskaplike faktor

$$= \lim_{h \to 0} -8x - 4h$$

$= -8x$

✓answer/*antwoord*

(4)

7.1.2

$f'(x) = -8x$

$f'(2) = -8(2)$

$f'(2) = -16$

✓substitution/
vervanging

✓answer/*antwoord*

(2)

7.2

$$f(x) = \sqrt[3]{x^2} + \frac{1}{4x^4}$$

$$f(x) = x^{\frac{2}{3}} + \frac{1}{4}x^{-4}$$

$$f'(x) = \frac{2}{3}x^{-\frac{1}{3}} - x^{-5}$$

✓simplification/
vereenvoudiging

✓ $\frac{2}{3}x^{-\frac{1}{3}}$

✓ $-x^{-5}$

(3)

7.3	$h'(x) = 2ax$ $h'(4) = 8a$ $y = ax^2 \quad ; \quad x > 0$ $\therefore$ inverse/*omgekeerde* $x = ay^2 \quad ; \quad y > 0$ $y = \sqrt{\frac{x}{a}}$ $h^{-1}(8) = \sqrt{\frac{8}{a}}$ $\therefore \sqrt{\frac{8}{a}} = 8a$ $\frac{8}{a} = 64a^2$ $\frac{1}{8} = a^3$ $a = \frac{1}{2}$	✓derivative/*afgeleide* ✓ $h'(4) = 8a$ ✓ $h^{-1}(x) = \sqrt{\frac{8}{a}}$ ✓equating/*gelykstel* ✓simplification/ *vereenvoudiging* ✓answer/*antwoord* (6)
		[15]

QUESTION 8
VRAAG 8

8.1	$g(x) = x^3 - 3x^2$ $g'(x) = 3x^2 - 6x$ $g''(x) = 6x - 6$ $g''(x) = 0$ $\therefore 6x - 6 = 0$ $\therefore x = 1$ $\therefore g(1) = -2$ point of inflection/*infleksiepunt* : (1; -2) $h(x) = -\frac{2}{3}x - \frac{4}{3}$ $h(1) = -2$ The graph of *h* **DOES INTERSECT** with the point of inflection of *g./Die grafiek van h **SNY** die grafiek van g by die infleksiepunt.* **NOTE: The conclusion mark can only be awarded if the candidate supports this with an appropriate calculation./** ***LET WEL: Die punt vir die gevolgtrekking kan alleenlik toegeken word indien die kandidaat dit ondersteun met die nodige berekeninge.***	✓1st derivative/ 1*ste afgeleide* ✓2nd derivative/ 2*de afgeleide* ✓ $x = 1$ ✓ $g(1) = -2$ ✓ $h(1) = -2$ ✓conclusion/ *gevolgtrekking* (6)
8.2	$y = g'(x) = 3x^2 - 6x$ $\frac{dy}{dx} = 0 \quad \therefore 6x - 6 = 0$ $x = 1$ $g'(1) = 3(1)^2 - 6(1)$ $g'(1) = -3$ $\therefore (1 ; -3)$ $y = 3x^2 - 6x$ is a positive parabola/*is 'n positiewe parabool* $\therefore$ TP(1; –3) is a MINIMUM/*is 'n MINIMUM*	✓derivative = 0/ *afgeleide = 0* ✓value of *x/waarde van x* ✓value of *y/waarde van y* ✓conclusion / *gevolgtrekking* (4)

8.3.1	$g(x) = x^3 - 3x^2$ $g''(x) = 6x - 6$ $g''(x) < 0$ $\therefore 6x - 6 < 0$ $\therefore \quad x < 1$	✓answer/*antwoord* (1)
8.3.2	Point of inflection/*Infleksiepunt* $g''(x) = 0$ $\therefore x = 1$ $m = g'(x) = 3x^2 - 6x$ $g'(1) = 3(1)^2 - 6(1)$ $g'(1) = 3(1)^2 - 6(1)$ $g'(1) = -3$ $\therefore m = -3$ $\therefore$ the gradient of the point of inflection is –3 $\therefore$ *die gradiënt van die infleksiepunt is –3*	✓substitution/ *vervanging* ✓answer/*antwoord* (2)
8.3.3	$g'(x) = 3x^2 - 6x$ $= 3(x^2 - 2x)$ $= 3(x^2 - 2x + 1 - 1)$ $= 3(x - 1)^2 - 3$ $g'(x)$ has a minimum value of –3. The student is correct./ *g′(x) het 'n minimum waarde van –3.* *Die student is korrek* **OR/*OF*** $g'(x) = 3x^2 - 6x$ $g''(x) = 6x - 6$ $0 = 6x - 6$ $x = 1$ $g'(1) = 3(1)^2 - 6(1)$ $g'(1) = -3$ $g'(x)$ has a minimum value of –3/ *g′(x) het 'n minimum waarde van –3.* The student is correct./ *Die student is korrek.* **NOTE: The conclusion mark can only be awarded if the candidate supports this with an appropriate calculation./** ***LET WEL: Die punt vir die gevolgtrekking kan alleenlik toegeken word indien die kandidaat dit ondersteun met die nodige berekeninge.***	✓writing $g'(x)$ in terms of/*skryf* $g'(x)$ *in terme van* $y = a(x-p)^2 + q$ ✓conclusion/*gevolgtrekking* **OR/*OF*** ✓calculate pt/*bereken punt*.(1 ; –3) ✓conclusion/*gevolgtrekking* (2)

8.4	g decreases when $m = g'(x) < 0$ *g neem af wanneer* $m = g'(x) < 0$ $\therefore 3x^2 - 6x < 0$ $3x(x-2) < 0$ $0 < x < 2$ If p decreases between -3 and -1 *Indien p afneem tussen* -3 *en* -1 $p(x) = g(x+k) = (x+k)^3 - 3(x+k)^2$ $\therefore$ g moves 3 units to the left $\therefore$ g *skuif* 3 *eenhede na links* $\therefore k = 3$	✓ $3x^2 - 6x < 0$ ✓ $0 < x < 2$ ✓deduction where p decreases/*afleiding waar p afneem* ✓answer/*antwoord* (4)
		[19]

QUESTION 9
VRAAG 9

9.1	$\pi r^2 h = 6$ $h = \frac{6}{\pi r^2}$	✓answer/*antwoord* (1)
9.2	$S = 10(2\pi r^2 + 2\pi rh) + 10(4\pi r^2)$ $= 10\left(2\pi r^2 + 2\pi rh + 4\pi r^2\right)$ $= 10\left(6\pi r^2 + 2\pi rh\right)$ $= 60\pi r^2 + 20\pi r.\frac{6}{\pi r^2}$ $= 60\pi r^2 + \frac{120}{r}$ **OR/*OF*** $S = 10(2\pi r^2 + 2\pi r + 4\pi r^2)$ $= 10(2\pi rh + 6\pi r^2)$ $= 20\pi rh + 60\pi r^2$ $= 20\pi r\left(\frac{6}{\pi r^2}\right) + 60\pi r^2$ $= 60\pi r^2 + \frac{120}{r}$	✓area of 10 spheres/*oppv. van 10 sferes* ✓area of 10 cylinders/ *oppv. van 10 silinders* ✓simplification/*vereenvoudiging* ✓substitution *h/vervang h* **OR/*OF*** ✓✓combined areas of spheres and cylinders/ *gekombineerde oppervlaktes van sferes en silinders* ✓simplification/*vereenvoudiging* ✓substitution *h/vervang h* (4)
9.3	$S' = 120\pi r - 120r^{-2}$ $120\pi r - \frac{120}{r^2} = 0$ $120\pi r^3 - 120 = 0$ $r^3 = \frac{120}{120\pi}$ $r = \frac{1}{\pi^{\frac{1}{3}}}$ $= 0,68cm$ **NOTE: Derivative = 0 must be stated NOT implied./** ***LET WEL: Afgeleide = 0 moet aangedui word en nie net geïmpliseer word nie.***	✓derivative = 0/*afgeleide = 0* ✓ r^3 as subject/ r^3 *as onderwerp* ✓answer/*antwoord* (3)
		[8]

QUESTION 10 ***VRAAG 10***		
10.1	$P(A \cap B) \neq 0$ $\therefore$ NO, A and B are NOT mutually exclusive $\therefore$ *NEE, A en B is NIE onderling uitsluitend nie* **NOTE: Candidate concludes ONLY, award 0 marks./** ***LET WEL: Indien kandidaat SLEGS afleiding gee, gee 0 punte.***	✓ $P(A \cap B) \neq 0$ ✓conclusion/*gevolgtrekking* (2)
10.2	$P(A \cup B)=P(A) + P(B) - P(A \cap B)$ $P(A \cup B) = 0,38 + 0,42 - 0,1596$ $P(A \cup B) = 0,6404$ $P(A \cup B) = 0,64$	✓formula/*formule* **OR/*OF*** ✓correct substitution/*korrekte vervanging* (1)
10.3	$0,38 \times n(S) = 456$ $\therefore n(S) = \frac{456}{0,38}$ $\therefore n(S) = 1200$	✓setting up any valid equation for *n*(S)/*stel enige geldige vergelyking op vir n(S)* ✓answer/*antwoord* (2)
10.4	$P(C') = 1 - P(C)$ $P(C') = 1 - 0,28$ $P(C') = 0,72$ $n(C') = 0,72 \times n(S)$ $n(C') = 0,72 \times 1200$ $n(C') = 864$	✓$P(C')$ ✓answer/*antwoord* (2)
		[7]

QUESTION 11 ***VRAAG 11***		
11.1.1	If repeated digits are considered **IDENTICAL**(i.e., treated as ONE digit):/*Indien getalle herhaal word, word dit as **IDENTIES** gereken (m.a.w word dit as EEN getal gereken):* $1\times 4!\times 1$ $= 4!$ = 24 ways/*moontlikhede* **OR/*OF*** If repeated digits are **NOT** considered identical:/*Indien herhalende getalle **NIE** as identies gereken word **NIE**:* $2!\times 4!$ $= 2 \times 24$ = 48 ways/*moontlikhede*	✓4! or/*of* 24 ways/*moontlikhede* **OR/*OF*** ✓2!.4! or/*of* 48 ways/*moontlikhede* (1)
11.1.2	If repeated digits are considered **IDENTICAL:/** *Indien herhalende getalle as **IDENTIES** gereken word:* Total number of 6-digit numbers/ *Totale aantal 6-getal nommers* $= \frac{6!}{2!}$ $= 360$ $P(112347 \text{ or } 743211) = \frac{2}{360}$ $= \frac{1}{180}$ or/*of* 0,01 **OR/*OF*** If repeated digits are **NOT** considered identical:/ *Indien herhalende getalle **NIE** as identies gereken word **NIE**:* Total number of 6-digit numbers *Totale aantal 6-getal nommers* $= 6!$ $= 720$ $P(112347 \text{ or } 743211) = \frac{4}{720}$ $= \frac{1}{180}$ or/*of* 0,01	✓$\frac{6!}{2!}$ ✓360 ✓$\frac{2}{360}$ ✓answer/*antwoord* **OR/*OF*** ✓6! ✓720 ✓$\frac{4}{720}$ ✓answer/*antwoord* (4)

11.2	Total number of arrangements of *n* people = *n*!/ *Totale aantal rangskikkings van n persone = n!* Number of arrangements of persons 1 and 2 = 2!/ *Aantal rangskikkings van persone 1 en 2 = 2!* ∴ Number of arrangements of *n* people if 1 and 2 are grouped/ *∴Aantal rangskikkings van n persone indien 1 en 2 saam gegroepeer word:* = (*n* – 1)! ∴2! ×(*n* – 1)! Number of ways that 1 and 2 are NOT next to each other/ *Aantal maniere wat 1 en 2 NIE langs mekaar staan* ***NIE*** ∴*n*! – 2!(*n* – 1)!	✓*n*! ✓2!(*n*-1)! ✓answer/*antwoord* (3)	
			[8]
			TOTAL: 150 ***TOTAAL: 150***