



basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

MATHEMATICS P1

NOVEMBER 2025

MARKS: 150

TIME: 3 hours

**This question paper consists of 11 pages, 1 information sheet and
an answer book of 23 pages.**



INSTRUCTIONS AND INFORMATION

Read the following instructions and information carefully before answering the questions.

1. This question paper consists of 11 questions.
2. Answer ALL the questions in the SPECIAL ANSWER BOOK provided.
3. Clearly show ALL calculations, diagrams, graphs, etc. that you have used in determining your 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. If necessary, round off answers 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. Write neatly and legibly.



QUESTION 11.1 Solve for x :

1.1.1 $(x+5)(x-2) = 0$ (2)

1.1.2 $5x^2 + 2 = -9x$ (correct to TWO decimal places) (4)

1.1.3 $8x^2 > 2x$ (4)

1.1.4 $2.2^{2x} - 9.2^x + 4 = 0$ (4)

1.1.5 $\sqrt{\sqrt{\frac{1}{x}} + 2} = \frac{1}{\sqrt{x}}$ (5)

1.2 Calculate the values of x and y if:

- x is the sum of 2 and y
 - Five times the product of x and y , is 6 more than the square of x
- (6)
-
- [25]

QUESTION 22.1 Given the infinite geometric series: $(t+10) + (t-2) + (t+4) + \dots$

2.1.1 Show that $t = -2$ (3)

2.1.2 Calculate the value of T_{25} . Write your answer in the form $T_n = b^x$ (3)

2.1.3 Calculate the sum of the infinite series. (2)

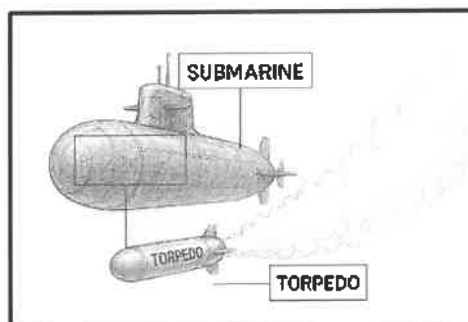
2.2 Given $\sum_{p=k}^{117} (4p-1) = 26\,675$

2.2.1 Write down the difference between T_6 and T_{14} (2)

2.2.2 Calculate the value of k . (5)
[15]

QUESTION 3

The depth of a torpedo below sea level forms a quadratic pattern, where 0 metres is at sea level. A submarine tracked a torpedo in one-second intervals.



The depth (in metres) that the torpedo reached is given in the table below.

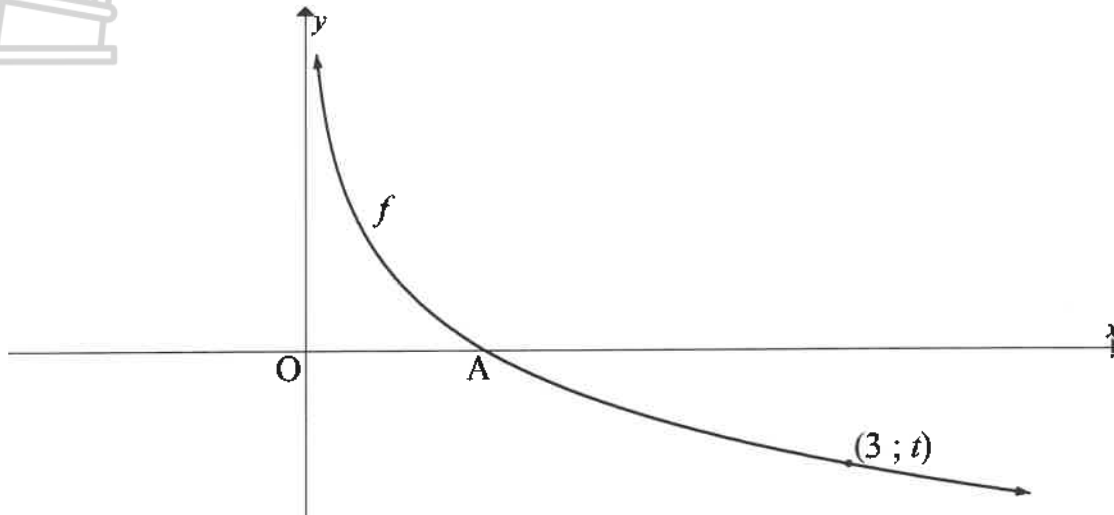
	Depth (in metres)
At the end of the first second	36
At the end of the first 2 seconds	71
At the end of the first 3 seconds	104

- 3.1 Calculate the depth of the torpedo at the end of the first 5 seconds. (2)
- 3.2 Show that the depth of the torpedo at the end of n seconds was $T_n = -n^2 + 38n - 1$ (3)
- 3.3 Calculate the maximum depth that the torpedo reached. (3)
- 3.4 After how many seconds was the torpedo at 104 m below sea level for the second time? (2)
- [10]**



QUESTION 4

The graph of $f(x) = \log_{\frac{1}{3}} x$ is drawn below. Point A is the x -intercept of f and $(3; t)$ lies on f .



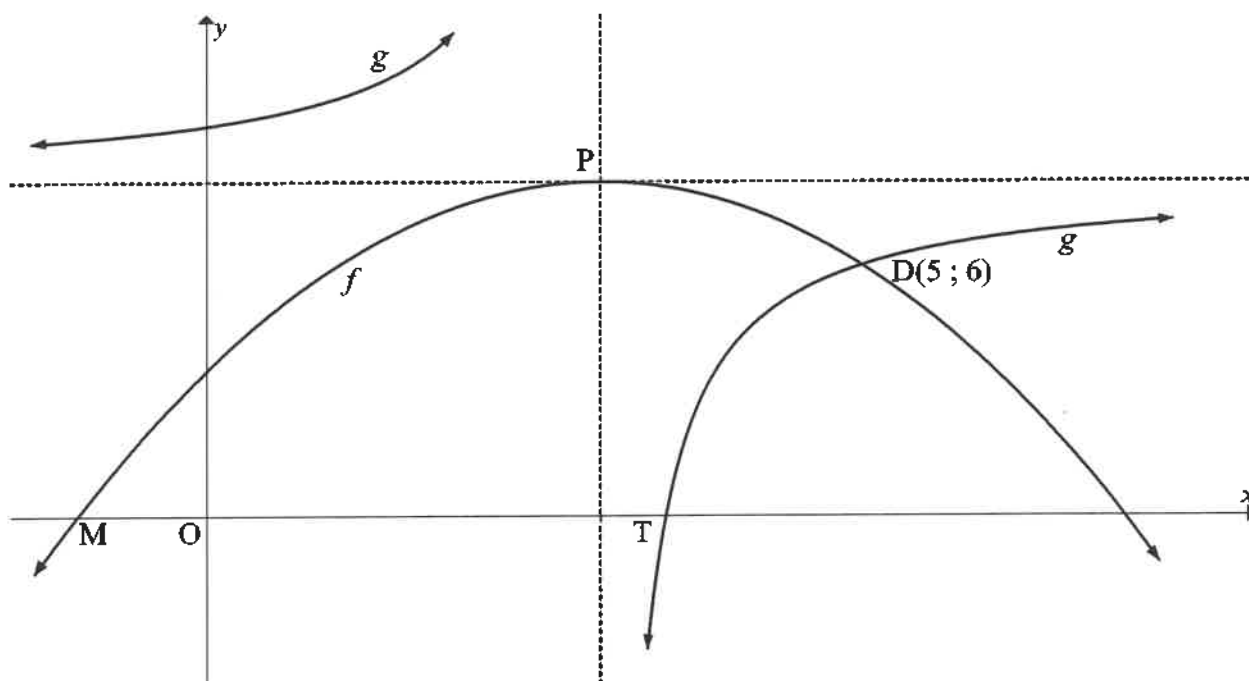
- 4.1 Calculate the value of t (1)
- 4.2 Write down the coordinates of A. (1)
- 4.3 Determine the equation of f^{-1} , the inverse of f , in the form $y = \dots$ (2)
- 4.4 Write down the equation of the asymptote of f^{-1} (1)
- 4.5 Draw the graph of f^{-1} on the set of axes provided in the ANSWER BOOK. Clearly indicate the intercepts with the axes, the coordinates of ONE other point and the asymptotes. (3)
- 4.6 The graph of h is obtained when f^{-1} is translated 5 units to the right. Determine the y -values of h where $x > 4$. (2)
- [10]**

QUESTION 5

The graphs of $f(x) = ax^2 + bx + c$ and $g(x) = \frac{-4}{x-3} + 8$ are drawn below.

P is the turning point of f and the point of intersection of the asymptotes of g .

The graphs intersect at $D(5; 6)$. M and T are x -intercepts of f and g respectively.

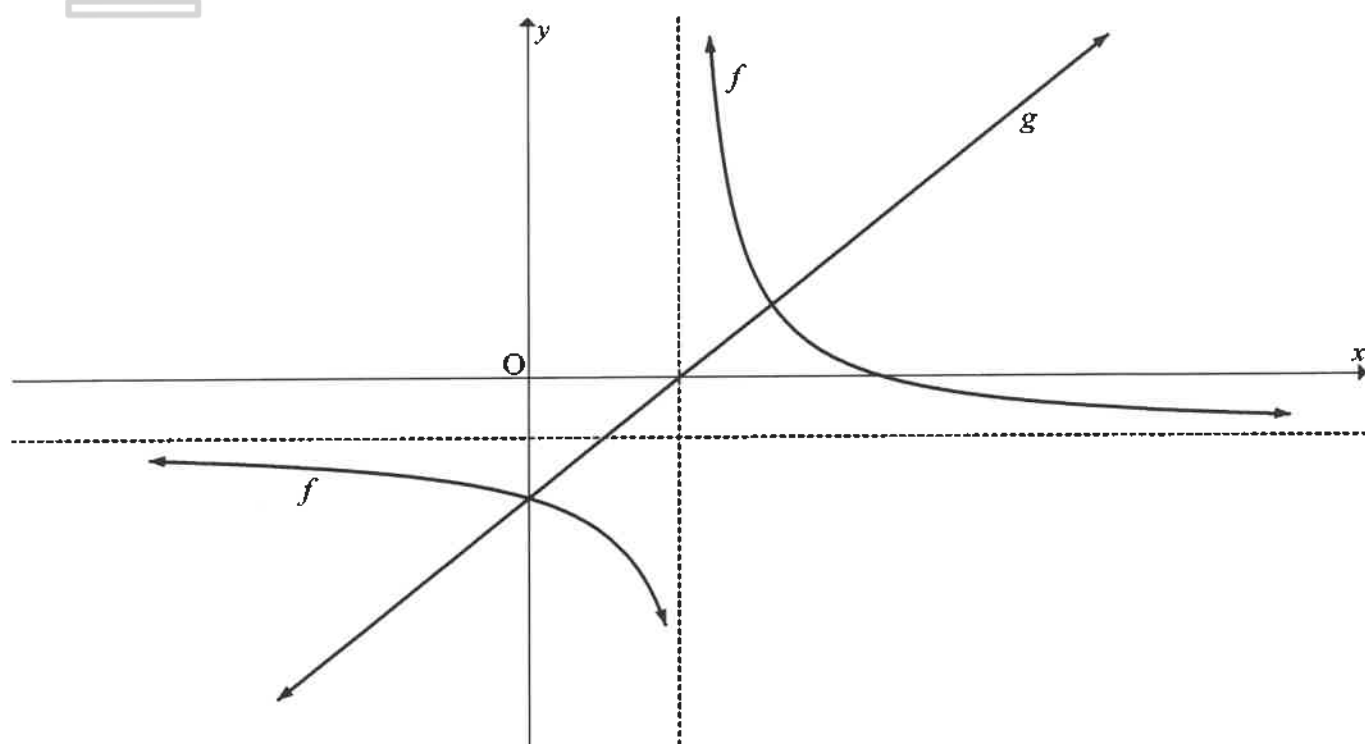


- 5.1 Write down the domain of g . (1)
- 5.2 Write down the range of f . (1)
- 5.3 Determine the values of x for which:
 - 5.3.1 $g(x) \leq f(x)$ (2)
 - 5.3.2 $f(x) < 6$ (2)
- 5.4 Show that the equation of the parabola is $f(x) = -\frac{1}{2}x^2 + 3x + \frac{7}{2}$. (3)
- 5.5 Calculate the length of MT. (6)
- 5.6 Determine the equation of the tangent to f at D. (3)

[18]

QUESTION 6

The graphs of $g(x) = x + c$ and $f(x) = \frac{a}{x+p} + q$ are drawn below. Graph g and the vertical asymptote of f intersect at the x -axis.



- 6.1 Write down the coordinates of the x -intercept of g in terms of p . (1)
- 6.2 Graph g intersects the horizontal asymptote of graph f at $x = 1$ and the graph f at $x = 3$. Graphs f and g also intersect on the y -axis. Determine the equation of f . (5)
- 6.3 Describe the transformation that g must undergo to become an axis of symmetry of f that cuts f at two points. (2)
- [8]

QUESTION 7

- 7.1 A travel company informs Robert that a holiday to a certain destination costs R40 000 now. The company predicts that the cost of this holiday will increase by 7,8% per annum. What will this holiday cost in 5 years' time? (2)
- 7.2 Sarah opened a savings account that paid interest at a rate of 5,8% p.a., compounded quarterly. She deposited R2 300 into the account on 1 January 2020 and continued to make deposits of R2 300 at the beginning of each quarter thereafter. She made her last deposit on 1 October 2025. Calculate the accumulated amount in the account on 1 January 2026. (4)
- 7.3 The bank granted Rajesh a loan of R900 000 on 28 February 2024 at an interest rate of 6,8% p.a., compounded monthly.
- 7.3.1 Rajesh was unable to make the first three payments. He made his first repayment of R10 000 on 30 June 2024. He continued to make monthly repayments of R10 000 at the end of each month thereafter. How long, in completed months, will it take Rajesh to repay the loan from the time the loan was granted? (5)
- 7.3.2 Calculate the value of the final payment. (4)
- [15]

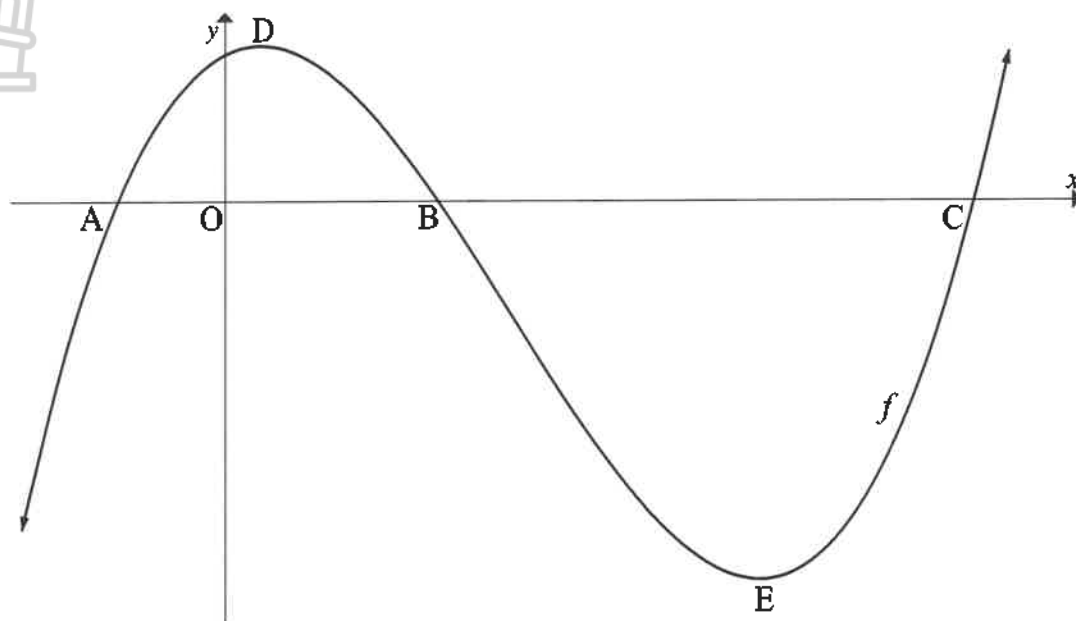
QUESTION 8

- 8.1 Determine $f'(x)$ from first principles if it is given that $f(x) = -2x + 3$. (4)
- 8.2 Determine:
- 8.2.1 $g'(x)$ if $g(x) = -3x^4 + 2x$ (2)
- 8.2.2 $\frac{dy}{dx}$ if $y = \frac{2x^4 + 1}{x^2}$ (4)
- [10]



QUESTION 9

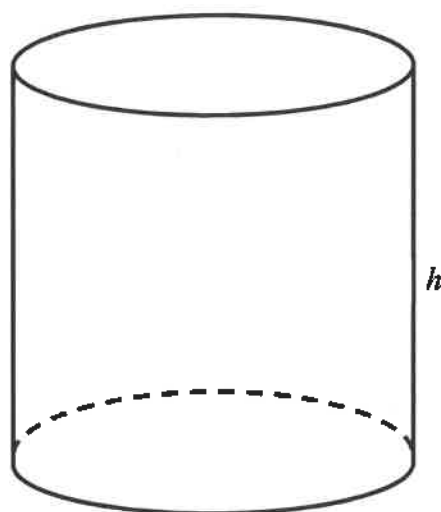
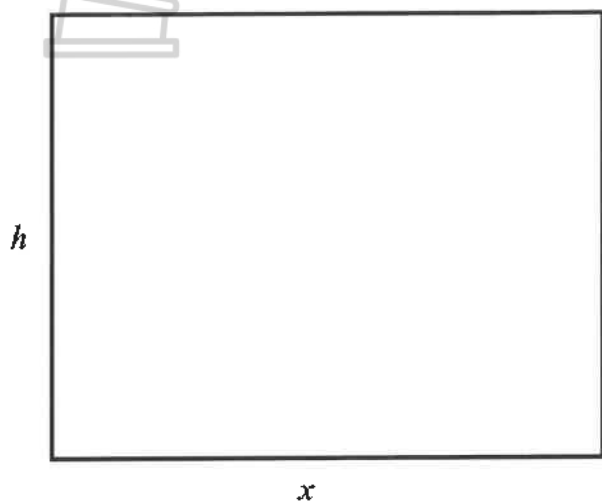
Sketched below is the graph of $f(x) = x^3 - 8x^2 + 5x + 14$. A, B and C are the x -intercepts of f . D and E are the turning points of f .



- 9.1 Calculate the coordinates of E. (4)
 - 9.2 For which values of x is f concave down? (3)
 - 9.3 The coordinates of B are $(2; 0)$. Use the graph to determine the values of x for which $f(x) \cdot f''(x) < 0$ (4)
 - 9.4 For which values of t will $y = -11x + t$ intersect f at 3 distinct points? (6)
- [17]

QUESTION 10

A rectangular metal sheet has dimensions x and h units, with $x > h$, and a perimeter of 50 units. The metal sheet is rolled into a cylinder with two open ends (top and bottom) and height h units.



10.1 Show that the volume of the cylinder is given by $V = \frac{25x^2}{4\pi} - \frac{x^3}{4\pi}$ (3)

10.2 Calculate the value of x that will maximise the volume of the cylinder. (3)
[6]



QUESTION 11

- 11.1 A survey was conducted among female and male learners at a school about which type of cold drink they preferred. The data from the survey is presented in the table below.

	JUICE	ENERGY DRINKS	TOTAL
Female	a	b	c
Male	36	54	f
Total	e	d	210

- 11.1.1 The events male and preferring juice are independent. Show that $e = 84$. (3)

- 11.1.2 Calculate the probability that a female learner, chosen at random from the group, will like energy drinks. (3)

- 11.2 At a kiosk, 120 people buy either a cup of coffee or a bottle of water. The chance of rain on any given day is 75%. The chance of a person buying a cup of coffee on a rainy day is three times the chance of the person buying coffee on a non-rainy day.

The probability of a person buying coffee on any given day is $\frac{7}{12}$.

- Calculate the number of cups of coffee that will be sold on a non-rainy day. (4)

- 11.3 Eight runners compete in a race where there are no tied finishes. Bongi and Andrew are two of the competitors.

- 11.3.1 Calculate the total number of possible ways in which the 8 runners can finish the race if Bongi finishes in a position immediately after Andrew. (2)

- 11.3.2 Calculate the probability that TWO OR MORE runners finish the race after Andrew and before Bongi. (4)
[16]

TOTAL: 150

INFORMATION SHEET

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

$$A = P(1 + i)^n$$

$$A = P(1 - ni)$$

$$A = P(1 - i)^n$$

$$A = P(1 + i)^n$$

$$T_n = a + (n - 1)d$$

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

$$T_n = ar^{n-1}$$

$$S_n = \frac{a(r^n - 1)}{r - 1} ; r \neq 1$$

$$S_\infty = \frac{a}{1 - r} ; -1 < r < 1$$

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

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

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

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$M\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$$

$$y = mx + c$$

$$y - y_1 = m(x - x_1)$$

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$m = \tan \theta$$

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

$$\text{In } \triangle ABC: \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

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

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

$$\sin(\alpha + \beta) = \sin \alpha \cos \beta + \cos \alpha \sin \beta$$

$$\sin(\alpha - \beta) = \sin \alpha \cos \beta - \cos \alpha \sin \beta$$

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

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

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

$$\sin 2\alpha = 2 \sin \alpha \cos \alpha$$

$$\bar{x} = \frac{\sum_{i=1}^n x_i}{n}$$

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

$$P(A) = \frac{n(A)}{n(S)}$$

$$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$

$$\hat{y} = a + bx$$

$$b = \frac{\sum (x - \bar{x})(y - \bar{y})}{\sum (x - \bar{x})^2}$$

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REPUBLIC OF SOUTH AFRICA

Candidate Barcode Label/Stafeskodeplakker

NSC Answer Book
NSS-antwoordeboek

National Senior Certificate/Nasionale Senior Sertifikaat (Grade 12/Graad 12) – November 2025 Confidential/Vertroulik

CENTRE NUMBER SENTRUMNOMMER							
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[illegible]

Sequence No. on mark sheet
Volunteer to participate

DATE DATUM	
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BOOK NUMBER BOEKNOMMER	OF VAN	BOOKS BOEKE
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SUBJECT CODE VARCODE					
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PAPER NUMBER VRAESTELNOMMER	1
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SUBJECT NAME VAKNAAM	MATHEMATICS/WISKUNDE
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[illegible]

**CONTROLLED AND CERTIFIED CORRECT
(SURNAME AND INITIALS OF EA)
GEKONTROLEER EN AS KORREK
GESERTIFISEER (VAN EN VOORLETTERS
VAN EA)**

READ INSTRUCTIONS ON THE NEXT PAGE.
LEES INSTRUKSIES OP DIE VOLGENDE BLADSY.

This answer book consists of 23 pages./Hierdie antwoordeboek bestaan uit 23 bladsye.



Copyright reserved/Kopiereg voorbehoud

Please turn over/*Blaai om asseblief*

PLEASE FOLLOW THESE INSTRUCTIONS CAREFULLY	VOLG ASSEBLIEF HIERDIE INSTRUKSIES NOUKEURIG
1. Clearly write your examination number and centre number in the space provided and attach your barcode label in the space provided. 2. Remember that your own name (or the name of your school) may not appear anywhere on or in this answer book. 3. Answer ALL questions in the spaces provided. 4. No pages may be torn from this answer book. 5. Read the instructions printed on your timetable carefully as well as any other instructions which may be given in each examination paper. 6. Candidates may not retain an answer book or remove it from the examination room. 7. Answers must be written in black/blue ink as distinctly as possible. Do not write in the margins. 8. Write the numbers of the questions you have answered on the front cover of the answer book where marks are to be recorded. 9. If you require additional space for your answers: 9.1 Use the additional space provided at the end of the answer book. 9.2 When answering a question in the additional space, indicate clearly the question number in the column on the LHS. 9.3 Rule off after each answer. 10. Draw a neat line through any work/rough work that must not be marked.	1. Skryf jou eksamennommer en sentrumnummer duidelik in die ruimtes soos verskaf en plak jou stafieskodeplakker in die ruimte soos verskaf. 2. Onthou dat jou eie naam (of die naam van jou skool) nie op of in hierdie antwoordeboek mag voorkom nie. 3. Beantwoord ALLE vrae in die ruimtes wat voorsien is. 4. Geen bladsye mag uit hierdie antwoordeboek geskeur word nie. 5. Lees die instruksies wat op jou eksamenrooster gedruk is, sorgvuldig deur, asook enige ander instruksies wat op elke eksamenvraestel gegee word. 6. Geen antwoordeboek mag deur die kandidaat behou of uit die eksamenlokaal verwyder word nie. 7. Skryf die antwoorde so duidelik moontlik met swart/blou ink. Laat die kantlyne oop. 8. Skryf die nommers van die vrae wat jy beantwoord het op die voorblad van die antwoordeboek waar die punte aangebring word. 9. In geval jy addisionele ruimte benodig vir jou antwoorde: 9.1 Gebruik die addisionele ruimte wat aan die einde van die antwoordeboek voorsien word. 9.2 As 'n vraag in die addisionele ruimte beantwoord word, dui duidelik die vraagnommer in die kolom aan die LK aan. 9.3 Trek 'n lyn na elke antwoord. 10. Trek 'n netjiese lyn deur enige werk/rofwerk wat nie nagesien moet word nie.



QUESTION/VRAAG 1.

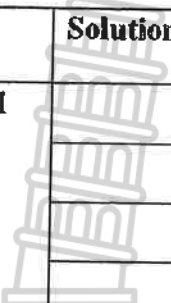
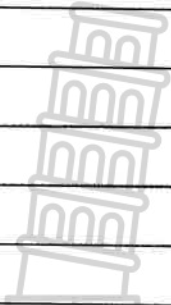
	Solution/Oplissing	Marks Punte
1.1.1		(2)
1.1.2		(4)
1.1.3		(4)
1.1.4		(4)



	Solution/Oplissing	Marks Punte
1.1.5		(5)
1.2		(6)
		[25]



QUESTION/VRAAG 2

	Solution/Oplossing	Marks Punte
2.1.1		(3)
2.1.2		(3)
2.1.3		(2)



	Solution/Oplissing	Marks Punte
2.2.1		(2)
2.2.2		(5)
		[15]

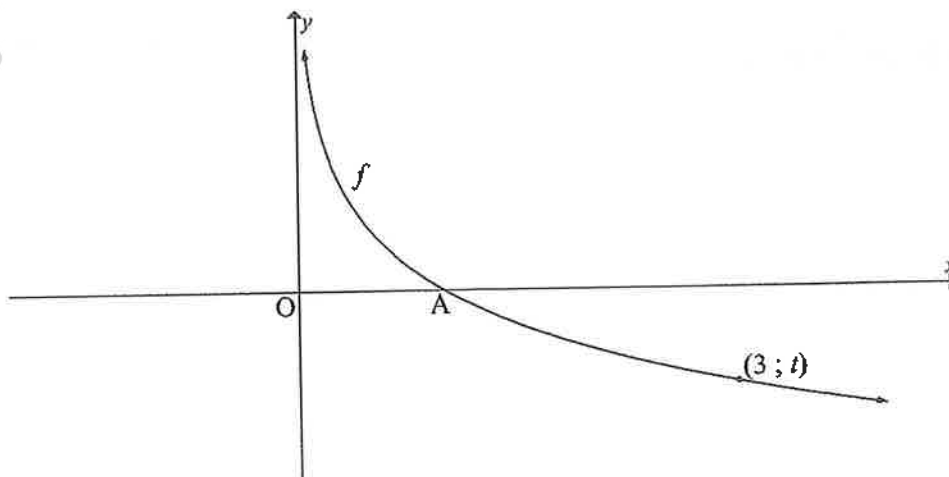


QUESTION/VRAAG 3

	Solution/Oplissing	Marks Punte
3.1		(2)
3.2		(3)
3.3		(3)
3.4		(2)
		[10]



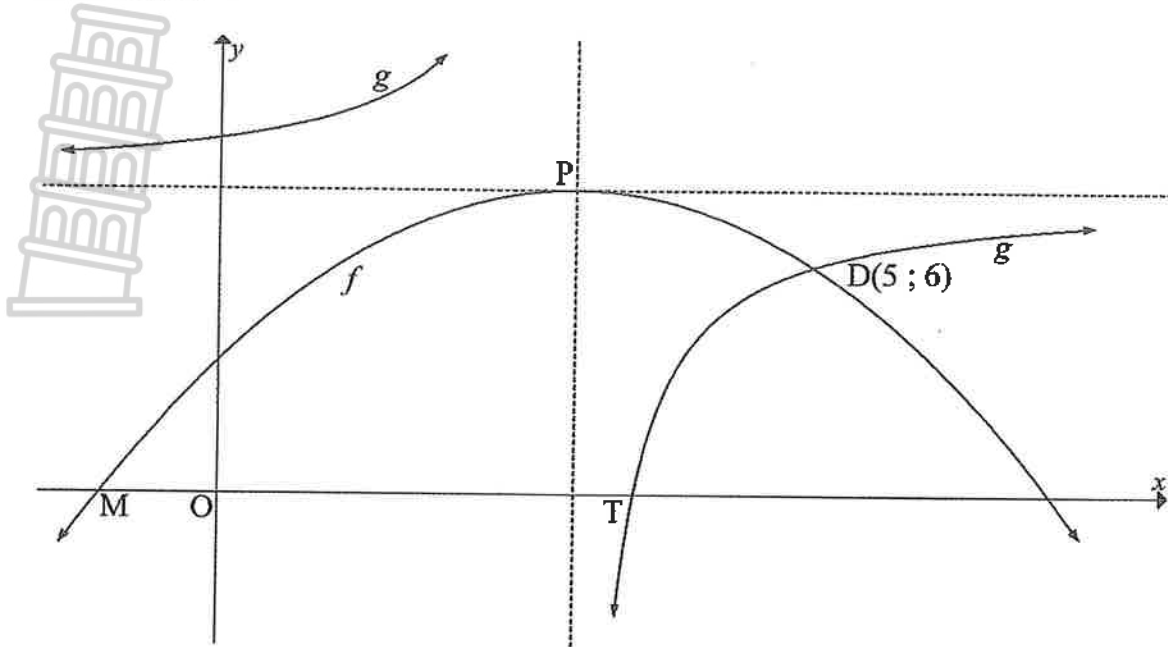
QUESTION/VRAAG 4



	Solution/Oplossing	Marks Punte
4.1		(1)
4.2		(1)
4.3		(2)
4.4		(1)
4.5		(3)
4.6		(2)
		[10]



QUESTION/VRAAG 5



	Solution/Oplissing	Marks Punte
5.1		(1)
5.2		
5.3.1		(2)
5.3.2		
5.4		(3)



5.5



(6)

5.6

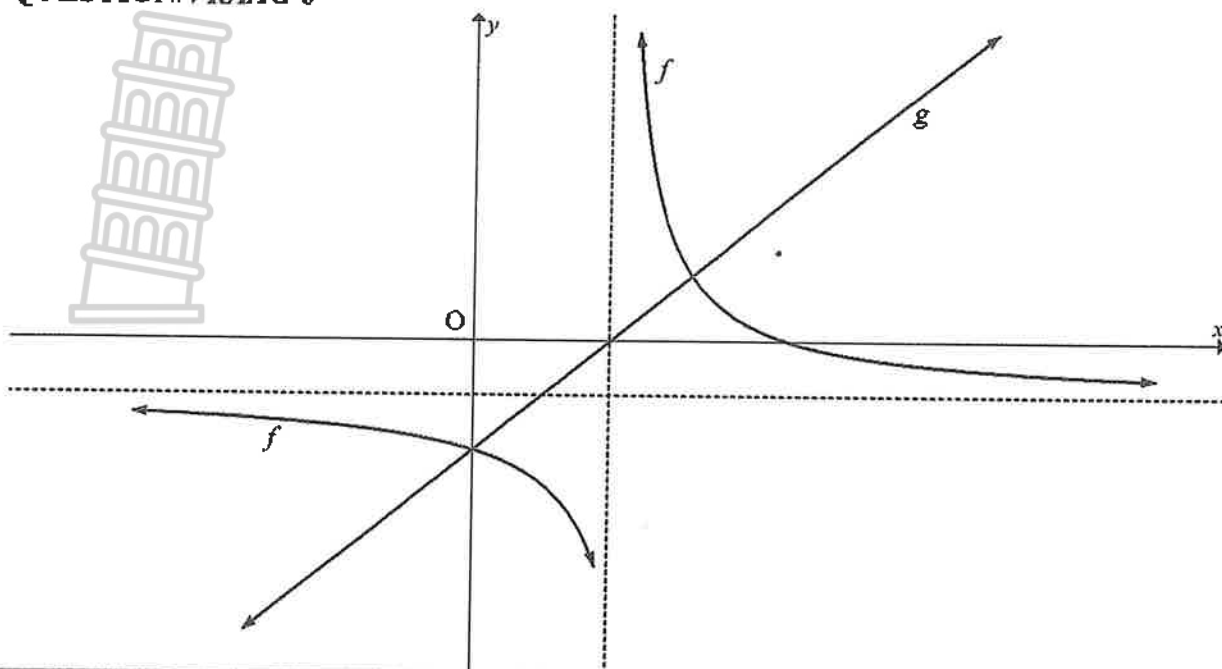


(3)

[18]



QUESTION/VRAAG 6



	Solution/Oplissing	Marks Punte
6.1		(1)
6.2		



6.2
(cont.)



(5)

6.3

(2)

[8]



QUESTION/VRAAG 7

	Solution/Oplissing	Marks Punte
7.1		(2)
7.2		(4)
7.3.1		(5)



	Solution/Oplissing	Marks Punte
7.3.2		
		(4)
		[15]

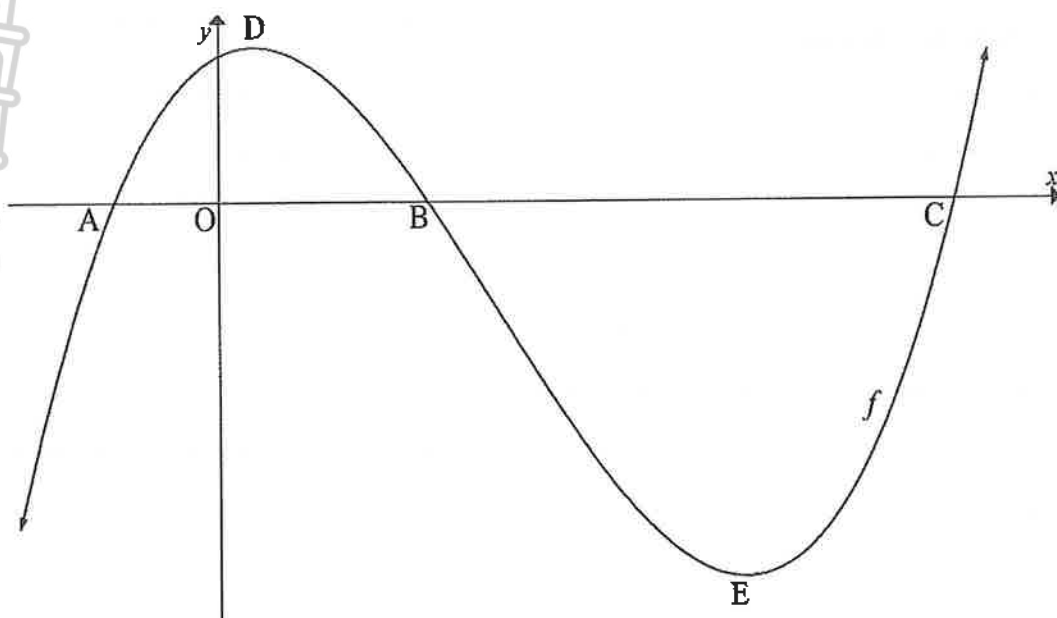


QUESTION/VRAAG 8

	Solution/Oplossing	Marks Punte
8.1		
		(4)
8.2.1		
		(2)
8.2.2		
		(4)
		[10]



QUESTION/VRAAG 9



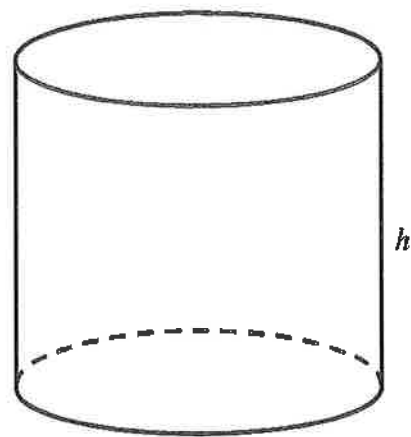
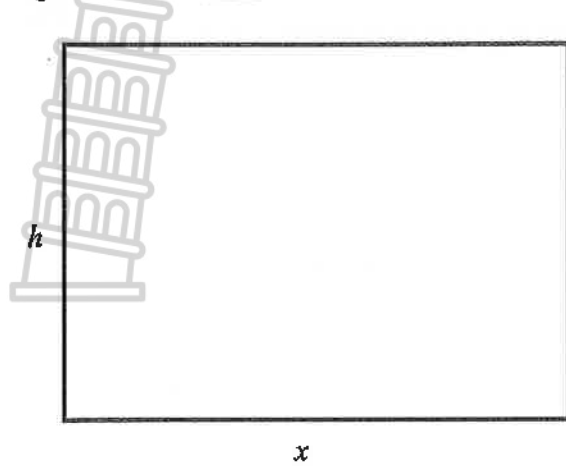
	Solution/Oplissing	Marks Punte
9.1		(4)
9.2		(3)



	Solution/Oplissing	Marks Punte
9.3		(4)
9.4	 Stanmorephysics.com	(6)



QUESTION/VRAAG 10



	Solution/Oplissing	Marks Punte
10.1		(3)
10.2		(3)
		(3)
		[6]



QUESTION/VRAAG 11

Solution/Oplossing					Marks Punte
11.1		JUICE/ SAP	ENERGY DRINKS/ ENERGIEDRANKIES	TOTAL/ TOTAAL	
	Female/ Vroulik	a	b	c	
	Male/ Manlik	36	54	f	
	Total/ Totaal	e	d	210	
11.1.1					(3)
11.1.2					(3)



(4)

[16]



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Additional space/ <i>Bykomende ruimte</i>	Marks <i>Punte</i>

TOTAL/TOTAAL: 150

[illegible]



basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

**NATIONAL
SENIOR CERTIFICATE/
NASIONALE SENIOR
SERTIFIKAAT**

GRADE 12/GRAAD 12

MATHEMATICS P1/WISKUNDE V1

NOVEMBER 2025

MARKING GUIDELINES/NASIENRIGLYNE

MARKS/PUNTE: 150

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



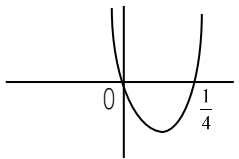
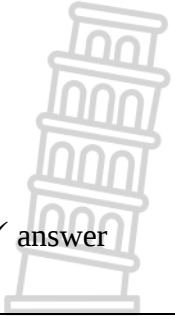
NOTE:

- 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.

QUESTION 1/VRAAG 1

1.1.1	$(x+5)(x-2) = 0$ $x = -5$ or $x = 2$	$\checkmark x = -5$ $\checkmark x = 2$ (2)
1.1.2	$5x^2 + 2 = -9x$ $5x^2 + 9x + 2 = 0$ $x = \frac{-9 \pm \sqrt{(9^2) - 4(5)(2)}}{2(5)}$ $x = \frac{-9 \pm \sqrt{41}}{10}$ $x = -0,26$ or $x = -1,54$	$\checkmark$ standard form $\checkmark$ substitution into the correct formula $\checkmark$ answer $\checkmark$ answer (4)
1.1.3	$8x^2 > 2x$ $8x^2 - 2x > 0$ $2x(4x-1) > 0$ CV: 0 ; $\frac{1}{4}$  $x < 0$ or $x > \frac{1}{4}$	$\checkmark$ standard form $\checkmark$ critical values/factors  $\checkmark \checkmark$ answer (4)
1.1.4	$2 \cdot 2^{2x} - 9 \cdot 2^x + 4 = 0$ $(2 \cdot 2^x - 1)(2^x - 4) = 0$ $2^x = \frac{1}{2}$ or $2^x = 4$ $2^x = 2^{-1}$ $2^x = 2^2$ $x = -1$ $x = 2$	$\checkmark$ factors $\checkmark$ both equations $\checkmark$ answer $\checkmark$ answer (4)

	OR/OF $2 \cdot 2^{2x} - 9 \cdot 2^x + 4 = 0$ Let $k = 2^x$ $2k^2 - 9k + 4 = 0$ $(2k - 1)(k - 4) = 0$ $k = \frac{1}{2} \text{ or } k = 4$ $\therefore 2^x = \frac{1}{2} \text{ or } 2^x = 4$ $\therefore x = -1 \text{ or } x = 2$	OR/OF ✓ factors ✓ both equations ✓ answer ✓ answer (4)
1.1.5	$\sqrt{\sqrt{\frac{1}{x}} + 2} = \frac{1}{\sqrt{x}}$ $\left(\sqrt{\sqrt{\frac{1}{x}} + 2}\right)^2 = \left(\frac{1}{\sqrt{x}}\right)^2$ $\sqrt{\frac{1}{x}} + 2 = \frac{1}{\sqrt{x}}$ $\frac{1}{\sqrt{x}} = \frac{1}{\sqrt{x}} - 2$ $\left(\frac{1}{\sqrt{x}}\right)^2 = \left(\frac{1}{\sqrt{x}} - 2\right)^2$ $\frac{1}{x} = \frac{1}{x^2} - \frac{4}{x} + 4$ $\frac{1}{x^2} - \frac{5}{x} + 4 = 0$ $4x^2 - 5x + 1 = 0$ $(4x - 1)(x - 1) = 0$ $x = \frac{1}{4} \text{ or } x \neq 1$ OR/OF	✓ squaring both sides ✓ isolation of surd ✓ squaring both sides only after isolation of surd ✓ standard form ✓ answer with selection (5) OR/OF

1.5

Let $x = \sqrt{k+2}$

$\sqrt{k+2}$

$k+2$

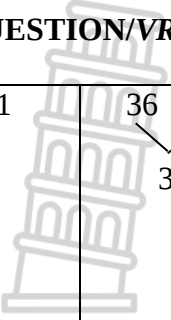
$k^2 -$

QUESTION/VRAAG 2

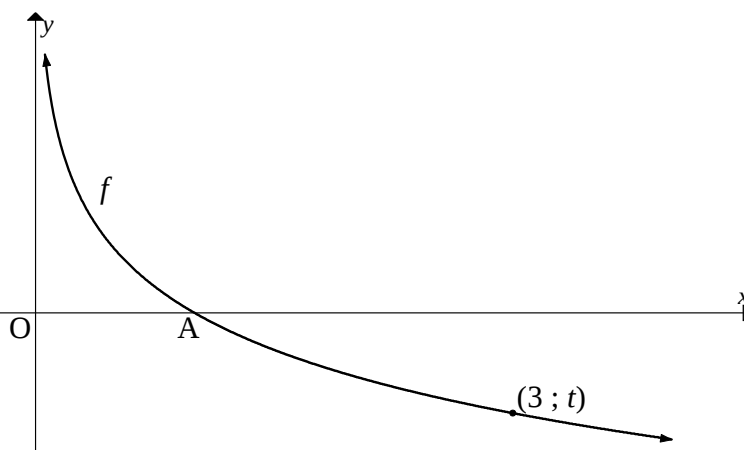
2.1.1	$(10+t) + (t-2) + (t+4)$ $\frac{t-2}{t+10} = \frac{t+4}{t-2}$ $(t-2)^2 = (t+4)(t+10)$ $t^2 - 4t + 4 = t^2 + 14t + 40$ $-18t = 36$ $\therefore t = -2$	✓ equating the ratios ✓ cross multiplication ✓ expansion (3)
2.1.2	$8; -4; \dots$ $r = \frac{-4}{8} = -\frac{1}{2}$ $T_{25} = 8 \left(-\frac{1}{2} \right)^{24}$ $T_{25} = \left(\frac{1}{2} \right)^{21} \text{ or } T_{25} = (2)^{-21} \text{ or } T_{25} = (8)^{-7} \text{ or}$ $T_{25} = (128)^{-3} \text{ or } T_{25} = (2\,097\,152)^{-1}$	✓ 8 and -4 ✓ r ✓ answer in exponential form (3)
2.1.3	$S_{\infty} = \frac{a}{1-r}$ $S_{\infty} = \frac{8}{1 - \left(-\frac{1}{2} \right)}$ $S_{\infty} = \frac{16}{3} = 5,33$	✓ substitution ✓ answer (2)
2.2.1	$T_{14} - T_6$ $= 4 \times 8$ $= 32$ OR/OF $T_{14} - T_6$ $= (4(14) - 1) - (4(6) - 1)$ $= 55 - 23$ $= 32$ OR/OF $T_{14} - T_6$ $= (4(k+13) - 1) - (4(k+5) - 1)$ $= 4k + 51 - (4k + 19)$ $= 32$	✓ ✓ answer (2) OR/OF ✓ subs ✓ answer (2) OR/OF ✓ subs ✓ answer (2)

2.2.2	$n = 118 - k$ $T_{117} = 467$ $S_{118-k} = \frac{118-k}{2} [4k - 1 + 467]$ $26\,675 = (118 - k) [2k + 233]$ $26\,675 = 236k + 27494 - 2k^2 - 233k$ $2k^2 - 3k - 819 = 0$ $(k - 21)(2k + 39) = 0$ $\therefore k = 21 \text{ or } k \neq -\frac{39}{2}$ OR/OF $n = 118 - k$ $S_{118-k} = \frac{118-k}{2} [2(4k - 1) + (118 - k - 1)(4)]$ $26\,675 = \frac{118-k}{2} [8k - 2 + 468 - 4k]$ $53\,350 = (118 - k) [4k + 466]$ $53\,350 = 472k + 54\,988 - 4k^2 - 466k$ $4k^2 - 6k - 1638 = 0$ $2k^2 - 3k - 819 = 0$ $(k - 21)(2k + 39) = 0$ $\therefore k = 21 \text{ or } k \neq -\frac{39}{2}$ OR/OF $T_1 = 3 \quad T_2 = 7$ $S_{117} - S_{k-1} = 26\,675$ $S_{117} = \frac{n}{2} [2a + (n-1)d]$ $= \frac{117}{2} [2(3) + (116)4]$ $= 27\,495$ $\therefore S_{k-1} = 27\,495 - 26\,675 = 820$ $820 = \frac{n}{2} [2(3) + 4n - 4]$ $0 = 2n^2 + n - 820$ $(2n + 41)(n - 20) = 0$ $\therefore n = 20$ $\therefore k - 1 = 20$ $k = 21$	✓ number of terms ✓ last term ✓ substitution ✓ standard form ✓ answer with selection (5) OR/OF ✓ number of terms ✓ substitution ✓ simplification ✓ standard form ✓ answer with selection (5) ✓ 27 495 ✓ difference ✓ substitution ✓ standard form ✓ answer with selection (5) [15]
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QUESTION/VRAAG 3

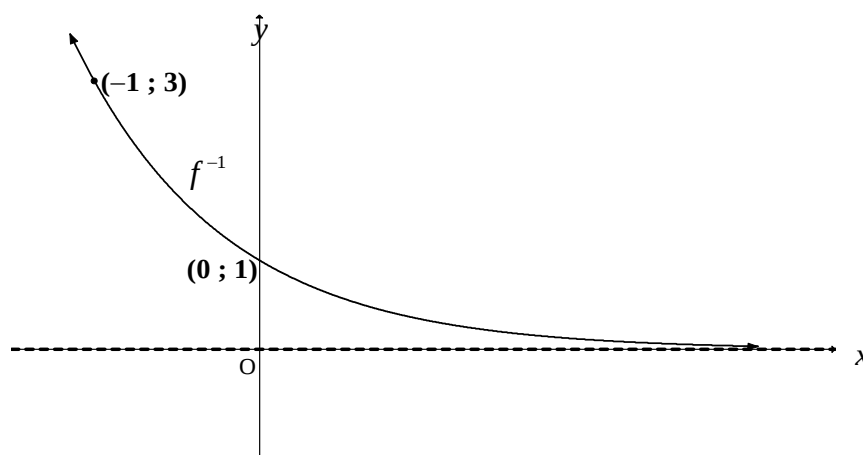
3.1	 $36 ; 71 ; 104 ; 135 ; 164$ $\begin{array}{ccccccc} & \swarrow & & \swarrow & & \swarrow & \\ & 35 & & 33 & & 31 & \\ & & \swarrow & & \swarrow & & \\ & & -2 & & & & \end{array}$ $T_5 = 164$	✓ first differences ✓ answer (2)
3.2	$2a = -2$ $a = -1$ $3(-1) + b = 35$ $b = 38$ $-1 + 38 + c = 36$ $c = -1$ $T_n = -n^2 + 38n - 1$	✓ $2a = -2$ ✓ $3(-1) + b = 35$ ✓ $-1 + 38 + c = 36$ (3)
3.3	$n = \frac{-38}{2(-1)} = 19$ $T_{19} = -(19)^2 + 38(19) - 1 = 360$ OR/OF $T'_n = -2n + 38 = 0$ $\therefore n = 19$ $T_{19} = -(19)^2 + 38(19) - 1 = 360$	✓ method ✓ n ✓ answer (3) OR/OF ✓ method ✓ n ✓ answer (3)
3.4	$\frac{n+3}{2} = 19$ $n+3 = 38$ $n = 35$ OR/OF $-n^2 + 38n - 1 = 104$ $n^2 - 38n + 105 = 0$ $(n-35)(n-3) = 0$ $n = 35$	✓ method ✓ answer (2) ✓ method ✓ answer (2)
		[10]

QUESTION/VRAAG 4



4.1	$t = \log_{\frac{1}{3}} 3$ $t = -1$	✓ answer (1)
4.2	$A(1; 0)$	✓ answer (1)
4.3	$f(x) = \log_{\frac{1}{3}} x$ $y = \log_{\frac{1}{3}} x$ $x = \log_{\frac{1}{3}} y$ $y = \left(\frac{1}{3}\right)^x = 3^{-x}$	✓ swopping ✓ answer (2)
4.4	$y = 0$	✓ answer (1)

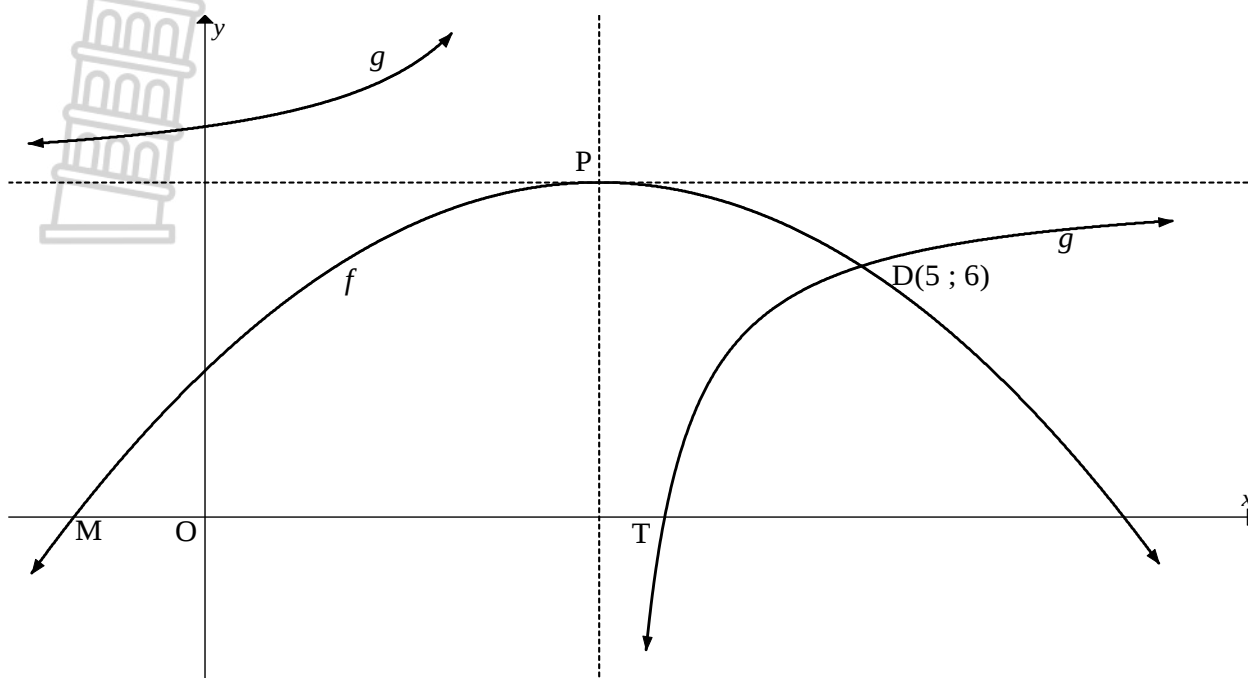
4.5



- ✓ decreasing exponential shape with asymptote $y = 0$
- ✓ y-intercept $(0; 1)$
- ✓ any point

4.6	$(4; 3)$ is a point on h $0 < y < 3$ or $y \in (0; 3)$	✓✓ answer (2)
		[10]

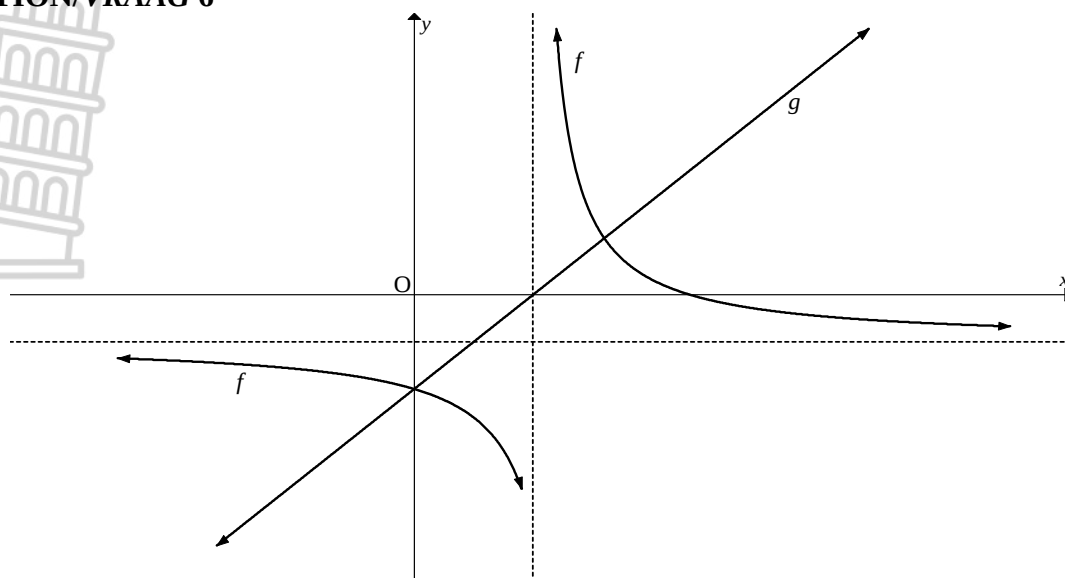
QUESTION/VRAAG 5



5.1	$x \in \mathbb{R}, x \neq 3$	✓ answer (1)
5.2	$y \leq 8$	✓ answer (1)
5.3.1	$3 < x \leq 5$ OR/OF $x \in (3; 5]$	✓✓ answer (2)
5.3.2	$x < 1$ or $x > 5$ OR/OF $x \in (-\infty; 1)$ or $x \in (5; \infty)$	✓ $x < 1$ ✓ $x > 5$ (2)
5.4	$y = a(x - 3)^2 + 8$ $6 = a(5 - 3)^2 + 8$ $-2 = 4a$ $\therefore a = -\frac{1}{2}$ $y = -\frac{1}{2}(x - 3)^2 + 8$ $y = -\frac{1}{2}(x^2 - 6x + 9) + 8$ $y = -\frac{1}{2}x^2 + 3x + \frac{7}{2}$	✓ p and q values ✓ substitution (5 ; 6)  ✓ simplification (3)

5.5	$y = -\frac{1}{2}x^2 + 3x + \frac{7}{2}$ $x^2 - 6x - 7 = 0$ $(x - 7)(x + 1) = 0$ $x = 7 \quad \text{or} \quad x = -1$ $M(-1; 0)$ $0 = \frac{-4}{x-3} + 8$ $-8x + 24 = -4$ $x = \frac{7}{2}$ $T\left(\frac{7}{2}; 0\right)$ $MT = \frac{7}{2} + 1 = \frac{9}{2} = 4,5$	✓ solve for x ✓ x-values ✓ coordinates of M ✓ solve for x ✓ x-value ✓ MT (6)
5.6	$f(x) = -\frac{1}{2}x^2 + 3x + \frac{7}{2}$ $f'(x) = -x + 3$ $m = f'(5)$ $= -5 + 3$ $= -2$ $6 = -2(5) + c$ $c = 16$ $\therefore y = -2x + 16$	✓ $f'(x) = -x + 3$ ✓ $m = f'(5)$ ✓ answer (3)
		[18]

QUESTION/VRAAG 6



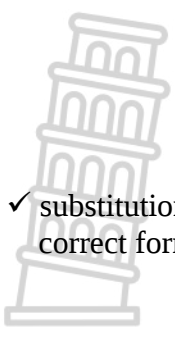
6.1	$(-p; 0)$	✓ $(-p; 0)$ (1)
6.2	$g(x) = x + c$ $q = 1 + c$ $f(x) = \frac{a}{x+c} + 1 + c$ Point $(0; c)$ $c = \frac{a}{0+c} + 1 + c$ $-1 = \frac{a}{c}$ $a = -c$ Point $(3; 3 + c)$ $3 + c = \frac{a}{3+c} + 1 + c$ $3 + c = \frac{-c}{3+c} + 1 + c$ $9 + 6c + c^2 = -c + 3 + 4c + c^2$ $3c = -6$ $c = -2$ $a = 2$ $q = -1$ $f(x) = \frac{2}{x-2} - 1$	✓ $q = 1 + c$ ✓ $f(x) = \frac{a}{x+c} + 1 + c$ ✓ $3 + c = \frac{a}{3+c} + 1 + c$ ✓ $a = 2$ ✓ $q = -1$ (5)

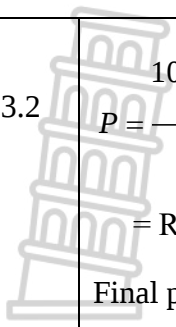
OR/OF

OR/OF



QUESTION/VRAAG 7

7.1	$A = P(1+i)^n$ $A = 40\,000(1+7,8\%)^5$ $A = R58\,230,94$	✓ substitution into correct formula ✓ answer (2)
7.2	$F = \frac{x[(1+i)^n - 1]}{i}$ $F = \frac{2\,300 \left[\left(1 + \frac{0,058}{4} \right)^{24} - 1 \right]}{\frac{0,058}{4}} \times \left(1 + \frac{0,058}{4} \right)$ $F = R66\,411,60$ OR/OF $F = \frac{2\,300 \left[\left(1 + \frac{0,058}{4} \right)^{25} - 1 \right]}{\frac{0,058}{4}} - 2300$ $F = R66\,411,60$	✓ i ✓ substitution into correct formula ✓ future value $\times (1+i)^1$ ✓ answer (4) OR/OF ✓ i ✓ substitution into correct formula ✓ -2300 ✓ answer (4)
7.3.1	$A = P(1+i)^n$ $A = 900\,000 \left(1 + \frac{0,068}{12} \right)^3$ $= R915\,386,86$ $P = \frac{x[1 - (1+i)^{-n}]}{i}$ $915\,386,86 = \frac{10\,000 \left[1 - \left(1 + \frac{0,068}{12} \right)^{-n} \right]}{\frac{0,068}{12}}$ $\left(1 + \frac{0,068}{12} \right)^{-n} = 0,4812...$ $-n = \log_{1,005...} 0,4812...$ $n = 129,419... \text{ months}$ $\therefore 132,419 \text{ months since loan was granted}$ $\therefore 133 \text{ months since loan was granted}$	✓ answer  ✓ substitution into correct formula ✓ correct use of logs ✓ answer of n ✓ final answer (5)

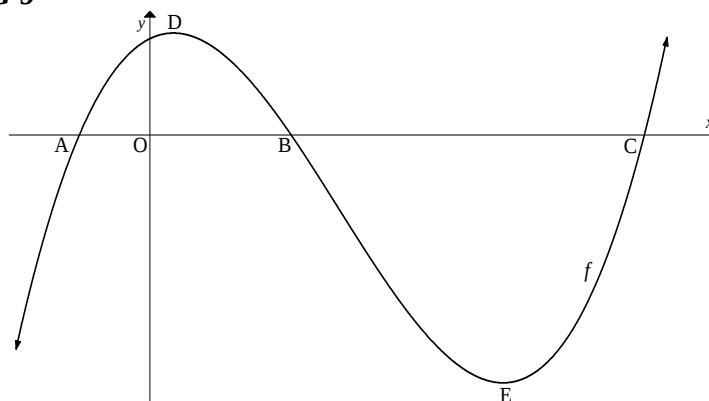
7.3.2	 $P = \frac{10\,000 \left[1 - \left(1 + \frac{0,068}{12} \right)^{-0,419...} \right]}{\frac{0,068}{12}}$ = R4 173,55... Final payment = $4\,173,55... \left(1 + \frac{0,068}{12} \right)^1 = R4\,197,21$ OR/OF $A = 915\,386,86 \left(1 + \frac{0,068}{12} \right)^{129}$ = R1 897 482,712 $F = \frac{10\,000 \left[\left(1 + \frac{0,068}{12} \right)^{129} - 1 \right]}{\frac{0,068}{12}}$ = R1 893 309,16 Balance after 129 months = R4 173,552 Final payment = $4\,173,552 \left(1 + \frac{0,068}{12} \right)^1 = R4\,197,21$	✓ substitution ✓ <i>n</i> ✓ balance ✓ final payment (4) OR/OF ✓ answer ✓ answer ✓ balance ✓ final payment (4) [15]
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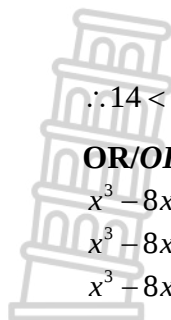
QUESTION/VRAAG 8

8.1	$f(x) = -2x + 3$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{-2(x+h) + 3 - (-2x + 3)}{h}$ $= \lim_{h \rightarrow 0} \frac{-2h}{h}$ $= \lim_{h \rightarrow 0} (-2)$ $= -2$ OR/OF $f(x) = -2x + 3$ $f(x+h) = -2(x+h) + 3$ $f(x+h) - f(x) = -2x - 2h + 3 + 2x - 3 = -2h$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{-2h}{h}$ $= \lim_{h \rightarrow 0} (-2)$ $= -2$	✓ $f(x+h)$ ✓ substitution ✓ simplification ✓ answer (4) OR/OF ✓ $f(x+h)$ ✓ simplification ✓ substitution ✓ answer (4)
8.2.1	$g(x) = -3x^4 + 2x$ $g'(x) = -12x^3 + 2$	✓ $-12x^3$ ✓ 2 (2)
8.2.2	$y = \frac{2x^4 + 1}{x^2}$ $y = 2x^2 + x^{-2}$ $\frac{dy}{dx} = 4x - 2x^{-3}$	✓ $2x^2$ ✓ x^{-2} ✓ derivative first term ✓ derivative second term (4)
		[10]

QUESTION/VRAAG 9



9.1	$f(x) = x^3 - 8x^2 + 5x + 14$ $f'(x) = 3x^2 - 16x + 5 = 0$ $(3x - 1)(x - 5) = 0$ $x = \frac{1}{3}$ or $x = 5$ $E(5; -36)$	$\checkmark f'(x)$ $\checkmark f'(x) = 0$ $\checkmark x\text{-value}$ $\checkmark y\text{-value}$ (4)
9.2	$f''(x) = 6x - 16 < 0$ $x < \frac{8}{3}$ OR/OF $x = \frac{\frac{1}{3} + 5}{2} = \frac{8}{3}$ $x < \frac{8}{3}$	$\checkmark f''(x)$ $\checkmark f''(x) < 0$ $\checkmark \text{answer}$ (3) OR/OF $\checkmark \text{midpoint of TPs}$ $\checkmark f''(x) < 0$ $\checkmark \text{answer}$ (3)
9.3	x-intercepts of f : $(-1; 0)$ and $(7; 0)$ $-1 < x < 2$ or $\frac{8}{3} < x < 7$	$\checkmark\checkmark$ x-intercepts $\checkmark$ first interval $\checkmark$ second interval (4)
9.4	$3x^2 - 16x + 5 = -11$ $3x^2 - 16x + 16 = 0$ $(x - 4)(3x - 4) = 0$ $x = 4$ or $x = \frac{4}{3}$ At $x = 4$: $(4)^3 - 8(4)^2 + 5(4) + 14 = -11(4) + t$ $t = 14$ At $x = \frac{4}{3}$: $\left(\frac{4}{3}\right)^3 - 8\left(\frac{4}{3}\right)^2 + 5\left(\frac{4}{3}\right) + 14 = -11\left(\frac{4}{3}\right) + t$ $t = \frac{634}{27} = 23\frac{13}{27} = 23,48$	$\checkmark$ equating $\checkmark$ x-values $\checkmark$ answer $\checkmark$ answer



$$\therefore 14 < t < \frac{634}{27}$$

OR/OF

$$x^3 - 8x^2 + 5x + 14 = -11x + t$$

$$x^3 - 8x^2 + 5x + 14 + 11x = t$$

$$x^3 - 8x^2 + 16x + 14 = t$$

$$3x^2 - 16x + 16 = 0$$

$$(x - 4)(3x - 4) = 0$$

$$x = 4 \quad \text{or} \quad x = \frac{4}{3}$$

$$\text{At } x = 4: \quad (4)^3 - 8(4)^2 + 5(4) + 14 = -11(4) + t$$

$$t = 14$$

$$\text{At } x = \frac{4}{3}: \quad \left(\frac{4}{3}\right)^3 - 8\left(\frac{4}{3}\right)^2 + 5\left(\frac{4}{3}\right) + 14 = -11\left(\frac{4}{3}\right) + t$$

$$t = \frac{634}{27} = 23\frac{13}{27} = 23,48$$

$$\therefore 14 < t < \frac{634}{27}$$

✓✓ answer

(6)

OR/OF

✓ equating

✓ x-values

✓ answer

✓ answer

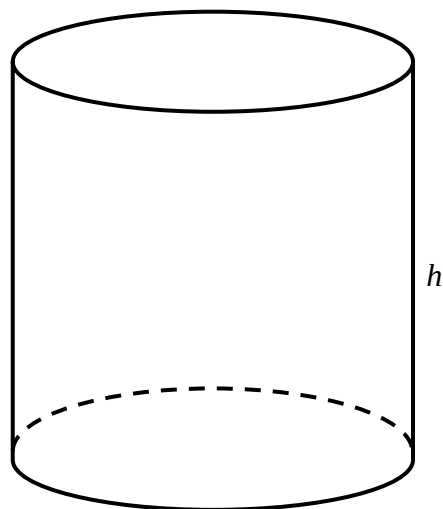
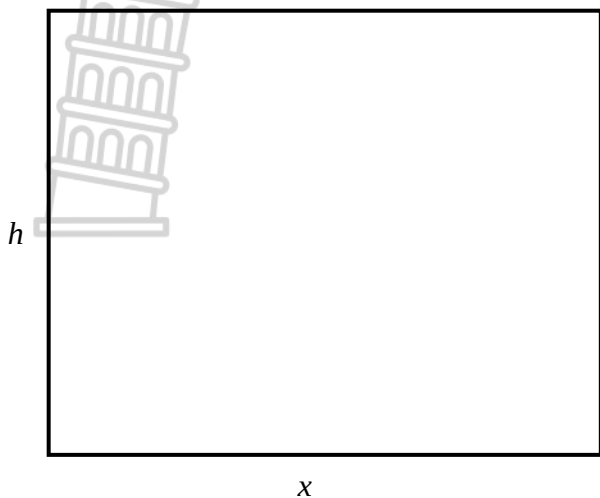
✓✓ answer

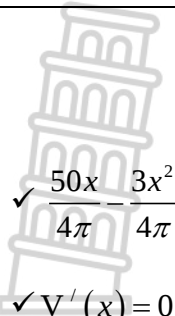
(6)

[17]

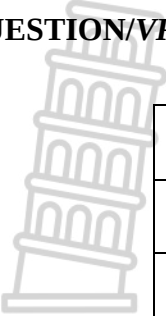


QUESTION/VRAAG 10



10.1	$2x + 2h = 50$ $h = 25 - x$ $2\pi r = x$ $r = \frac{x}{2\pi}$ $V = \pi r^2 h$ $V = \pi \left(\frac{x}{2\pi} \right)^2 (25 - x)$ $V = \frac{\pi x^2}{4\pi^2} (25 - x)$ $V = \frac{25x^2}{4\pi} - \frac{x^3}{4\pi}$	$\checkmark 2x + 2h = 50$ $\checkmark r = \frac{x}{2\pi}$ $\checkmark$ substitution (3)
10.2	$V'(x) = \frac{50x}{4\pi} - \frac{3x^2}{4\pi}$ $V'(x) = \frac{50x}{4\pi} - \frac{3x^2}{4\pi} = 0$ $50x - 3x^2 = 0$ $0 = x(50 - 3x)$ $x \neq 0 \quad \text{or} \quad x = \frac{50}{3}$ $\therefore x = \frac{50}{3} = 16,67$	 $\checkmark \frac{50x}{4\pi} - \frac{3x^2}{4\pi}$ $\checkmark V'(x) = 0$ $\checkmark$ answer with selection (3)
		[6]

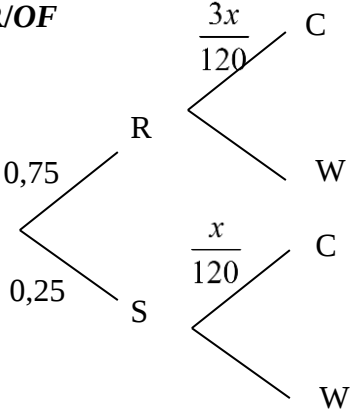
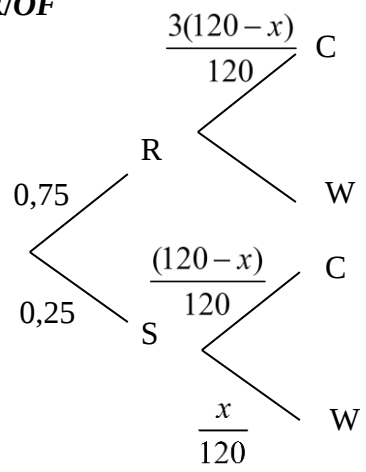
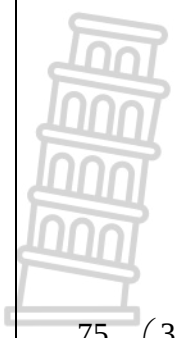
QUESTION/VRAAG 11



	JUICE	ENERGY DRINKS	TOTAL
Females	a	72	120
Males	36	54	90
Total	84	126	210

11.1.1	$P(\text{Male and Prefer juice}) = P(\text{Male}) \times P(\text{Prefer juice})$ $\frac{36}{210} = \frac{90}{210} \times \frac{e}{210}$ $e = 84$	$\checkmark P(M \text{ and } J) = P(M) \times P(J)$ $\checkmark \frac{36}{210}$ $\checkmark P(\text{Male}) = \frac{90}{210}$ (3)
11.1.2	$P(\text{Female and like energy drink}) = \frac{b}{210}$ $d = 210 - 84 = 126$ $b = 126 - 54 = 72$ $P(\text{Female and like energy drink}) = \frac{72}{210} = \frac{12}{35} = 0,34$ OR/OF $c = 120$ $b = 72$ $P(\text{Female and like energy drink}) = \frac{72}{210} = \frac{12}{35} = 0,34$	$\checkmark d\text{-value}$ $\checkmark b\text{-value}$ $\checkmark \text{answer}$ (3) OR/OF $\checkmark c\text{-value}$ $\checkmark b\text{-value}$ $\checkmark \text{answer}$ (3)



11.2 	$\frac{3}{4}(3x) + \frac{1}{4}x = \frac{7}{12}$ $27x + 3x = 7$ $30x = 7$ $x = \frac{7}{30}$ $\therefore 28 \text{ cups}$ OR/OF  $\frac{75}{100} \times \left(\frac{3x}{120} \right) + \frac{25}{100} \left(\frac{x}{120} \right) = \frac{7}{12}$ $\frac{3}{160}x + \frac{1}{480}x = \frac{7}{12}$ $10x = 280$ $x = 28 \text{ cups of coffee}$ OR/OF  $\frac{75}{100} \times \left(\frac{3(120-x)}{120} \right) + \frac{25}{100} \left(\frac{120-x}{120} \right) = \frac{7}{12}$ $270 - \frac{9}{4}x + 30 - \frac{1}{4}x = 70$ $-\frac{5}{2}x = -230$ $\therefore x = 92 \text{ (bottles of water)}$ $\therefore \text{there are 28 cups of coffee}$	$\checkmark \frac{3}{4}(3x)$ $\checkmark \frac{1}{4}x$ $\checkmark = \frac{7}{12}$ $\checkmark \text{answer}$ (4) OR/OF $\checkmark \frac{75}{100} \times \left(\frac{3x}{120} \right)$ $\checkmark \frac{25}{100} \left(\frac{x}{120} \right)$ $\checkmark = \frac{7}{12}$ $\checkmark \text{answer}$ (4) OR/OF  $\checkmark \frac{75}{100} \times \left(\frac{3(120-x)}{120} \right)$ $\checkmark \frac{25}{100} \left(\frac{120-x}{120} \right)$ $\checkmark = \frac{7}{12}$ $\checkmark \text{answer}$ (4)
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11.3.1	$7.6! = 5\,040$ OR/OF $7! = 5\,040$	✓✓ answer (2) OR/OF ✓✓ answer (2)
11.3.2	Possible outcomes: $A \times 6 \times 5 \times B \times 4 \times 3 \times 2 \times 1$ $A \times 6 \times 5 \times 4 \times B \times 3 \times 2 \times 1$ $A \times 6 \times 5 \times 4 \times 3 \times B \times 2 \times 1$ $A \times 6 \times 5 \times 4 \times 3 \times 2 \times B \times 1$ $A \times 6 \times 5 \times 4 \times 3 \times 2 \times 1 \times B$ $5 \times 6! + 4 \times 6! + 3 \times 6! + 2 \times 6! + 1 \times 6!$ $= 6!(5 + 4 + 3 + 2 + 1)$ $= 6!(15)$ $P(\text{two or more runners finishing after Andrew}) = \frac{6!(15)}{8!}$ $= \frac{15}{56}$ $= 0,27$ OR/OF $\frac{8! - (7!.2 + 2.6.6!)}{8!.2}$ $= \frac{15}{56}$	✓✓ $6! (15)$ ✓ $8!$ in denominator ✓ $\frac{6!(15)}{8!}$ or $\frac{15}{56}$ (4) OR/OF ✓ $8!$ in numerator and denominator ✓✓ $(7!.2 + 2.6.6!)$ ✓ $\frac{15}{56}$ (4)
		[16]

TOTAL/TOTAAL: 150