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SENIOR CERTIFICATE/*SENIOR SERTIFIKAAT*
NATIONAL SENIOR CERTIFICATE/*NASIONALE SENIOR SERTIFIKAAT*

GRADE 12/*GRAAD 12*

MATHEMATICS P1/*WISKUNDE V1*

NOVEMBER 2020

MARKING GUIDELINES/*NASIENRIGLYNE*

MARKS/*PUNTE*: 150

These guidelines consist of 18 pages.
Hierdie nasienriglyne bestaan uit 18 bladsye.

NOTE:

- If a candidate answers a question TWICE, only mark the FIRST attempt.
- Consistent accuracy applies in all aspects of the marking memorandum.

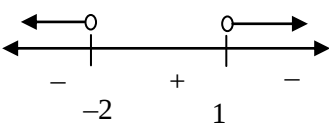
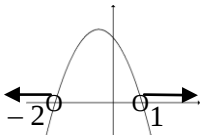
LET WEL:

- Indien 'n kandidaat 'n vraag TWEE keer beantwoord, sien slegs die EERSTE poging na.
- Volgehoue akkuraatheid is op ALLE aspekte van die nasienriglyne van toepassing.

REMEMBER: (A) next to the description of a tick implies accuracy mark

ONTHOU: (A) langs die beskrywing van 'n regmerk impliseer akkuraatheids-punt

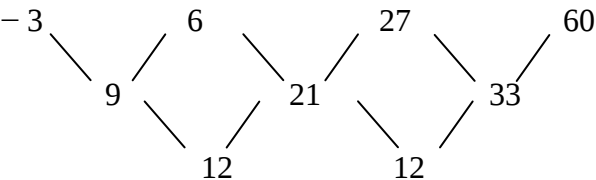
QUESTION/VRAAG 1

1.1.1	$x^2 - 6x = 0$ $x(x - 6) = 0$ $x = 0 \text{ or } x = 6$	✓ common factor ✓ both answers (2)
1.1.2	$x^2 + 10x + 8 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $= \frac{-10 \pm \sqrt{10^2 - 4(1)(8)}}{2(1)}$ $= \frac{-10 \pm \sqrt{68}}{2}$ $x = -0,88 \text{ or } x = -9,12$	✓ substitution into the correct formula ✓ -0,88 ✓ -9,12 (3)
1.1.3	$(1 - x)(x + 2) < 0$ Critical values: $x = 1 \text{ or } x = -2$  or  $x < -2 \text{ or } x > 1$	✓ critical values ✓ correct method ✓ answer (3)
1.1.4	$\sqrt{x+18} = x - 2$ $x + 18 = x^2 - 4x + 4$ $0 = x^2 - 5x - 14$ $(x - 7)(x + 2) = 0$ $x = 7 \text{ or } x = -2$	✓ squaring both sides (m) ✓ standard form ✓ factors ✓ both answers ✓ rejection of $x = -2$ (5)

1.2	$x + y = 3$ $y = 3 - x \dots\dots\dots (1)$ $2x^2 + 4xy - y = 15 \dots\dots\dots (2)$ Substitute (1) into (2): $2x^2 + 4x(3 - x) - (3 - x) = 15$ $2x^2 + 12x - 4x^2 - 3 + x - 15 = 0$ $-2x^2 + 13x - 18 = 0$ $2x^2 - 13x + 18 = 0$ $(2x - 9)(x - 2) = 0$ $x = \frac{9}{2} \quad \text{or} \quad x = 2$ $y = -\frac{3}{2} \quad \text{or} \quad y = 1$ OR $x + y = 3$ $x = 3 - y \dots\dots\dots (1)$ $2x^2 + 4xy - y = 15 \dots\dots\dots (2)$ Substitute (1) into (2): $2(3 - y)^2 + 4(3 - y)y - y = 15$ $2y^2 - 12y + 18 - 4y^2 + 12y - y - 15 = 0$ $-2y^2 - y + 3 = 0$ $2y^2 + y - 3 = 0$ $(2y + 3)(y - 1) = 0$ $y = -\frac{3}{2} \quad \text{or} \quad y = 1$ $x = \frac{9}{2} \quad \text{or} \quad x = 2$	✓ y subject of the formula ✓ substitution ✓ standard form ✓ factors ✓ x-values ✓ y-values (6) OR ✓ x subject of the formula ✓ substitution ✓ standard form ✓ factors ✓ y-values ✓ x-values (6)
1.3	$n^{200} < 5^{300}$ $(n^2)^{100} < (5^3)^{100}$ $(n^2)^{100} < (125)^{100}$ $n^2 < 125$ Maximum value of n is 11. OR $200 \log n < 300 \log 5$ $n < 10^{\frac{3}{2} \log 5}$ $n < 11,18$ $\therefore n = 11$ OR	✓ $(n^2)^{100} < (5^3)^{100}$ ✓ $n^2 < 125$ ✓ 11 (3) OR ✓ use of logs ✓ $n < 11,18$ ✓ 11 (3) OR

$n^{200} < 5^{300}$ $(n^2)^{100} < (5^3)^{100}$ $\sqrt{n^2} < \sqrt{5^3}$ $n < 5^{\frac{3}{2}}$ $n < 11,18$ $\therefore n = 11$ OR $n^{200} < 5^{\frac{300}{2}}$ $n < 5^{\frac{300}{200}}$ $n < 11,18$ $\therefore n = 11$	$\checkmark (n^2)^{100} < (5^3)^{100}$ $\checkmark n < 11,18$ $\checkmark 11$ (3) OR $\checkmark n < 5^{\frac{300}{200}}$ $\checkmark n < 11,18$ $\checkmark n = 11$ (3)
	[22]

QUESTION/VRAAG 2

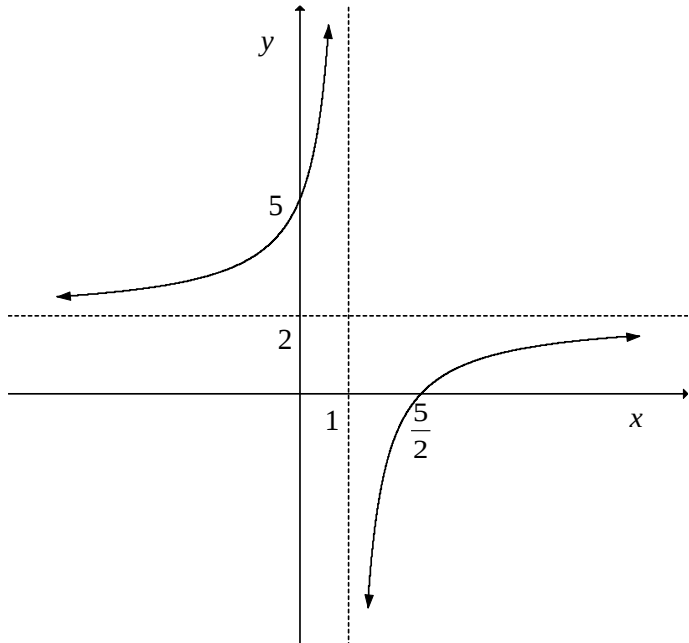
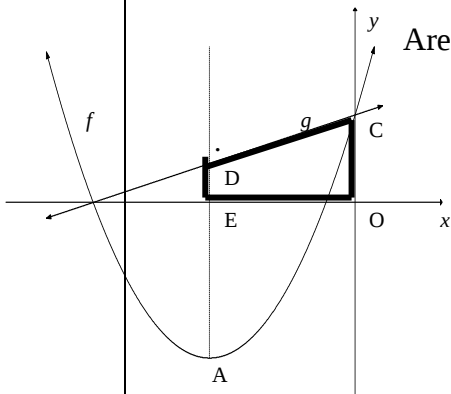
2.1	$7 ; x ; y ; -11 ; \dots$ $a = 7$ $a + 3d = -11$ $7 + 3d = -11$ $d = -6$ $x = a + d = 7 + (-6) = 1$ $y = a + 2d = 7 + 2(-6) = -5$ OR $a + 3d = -11$ $3d = -11 - 7$ $3d = -18$ $d = -6$ $x = 1$ $y = -5$ OR $x - 7 = y - x$ and $y - x = -11 - y$ $2x - 7 = y \dots(1)$ $2y = -11 + x \dots(2)$ (1) into (2) $2(2x - 7) = -11 + x$ $4x - 14 = -11 + x$ $3x = 3$ $x = 1$ $y = 2(1) - 7 = -5$	$\checkmark 7 + 3d = -11$ $\checkmark d = -6$ $\checkmark$ value of x $\checkmark$ value of y (4) OR $\checkmark 3d = -11 - 7$ $\checkmark d = -6$ $\checkmark x = 1$ $\checkmark y = -5$ (4) OR $\checkmark$ 2 equations $\checkmark$ substitution $\checkmark$ value of x $\checkmark$ value of y (4)
2.2.1	$-3 ; 6 ; 27 ; 60 ; \dots$  $2a = 12$ $a = 6$ $3a + b = 9$ $3(6) + b = 9$ $b = -9$ $a + b + c = -3$ $6 - 9 + c = -3$ $c = 0$ $T_n = 6n^2 - 9n$	$\checkmark$ second difference $\checkmark a = 6$ $\checkmark b = -9$ $\checkmark c = 0$ (4)

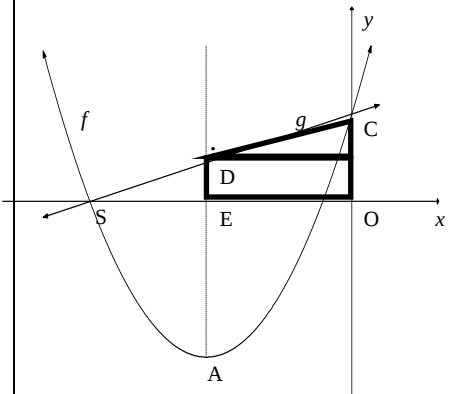
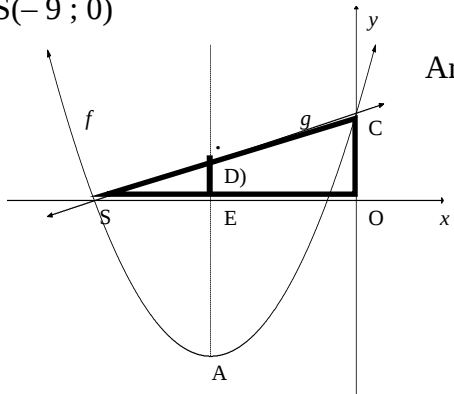
2.2.2	$T_{50} = 6(50)^2 - 9(50)$ $= 14\ 550$	Answer Only: Full Marks	✓ substitute 50 ✓ answer (2)
2.2.3	$9 ; 21 ; 33 ; \dots$ $a = 9$ $d = 12$ $S_n = \frac{n}{2}[2a + (n-1)d]$ $S_n = \frac{n}{2}[2(9) + (n-1)(12)]$ $= \frac{n}{2}[18 + 12n - 12]$ $= \frac{n}{2}[12n + 6]$ $= 6n^2 + 3n$		✓ a and d ✓ substitution into the correct formula ✓ $\frac{n}{2}[12n + 6]$ (3)
2.2.4	$-3 + S_n = 21060$ $S_n = 21063$ $6n^2 + 3n = 21063$ $6n^2 + 3n - 21063 = 0$ $2n^2 + n - 7021 = 0$ $n = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $n = \frac{-1 \pm \sqrt{(1)^2 - 4(1)(-7021)}}{2(2)}$ $n = 59 \text{ or } n \neq \frac{-119}{2}$ $\therefore n = 59$ OR $T_n = 21060$ $6n^2 - 9n - 21060 = 0$ $2n^2 - 3n - 7020 = 0$ $n = 60$ $\therefore 59 \text{ first differences must be added.}$		✓ $-3 + S_n = 21060$ ✓ equation ✓ standard form ✓ answer (4)
			✓ equation ✓ standard form ✓✓ answer (4)
			[17]

QUESTION/VRAAG 3

3.1	$\sum_{k=1}^{\infty} 4 \cdot 3^{2-k} = 12 + 4 + \frac{4}{3} + \dots$ $r = \frac{4}{12} = \frac{1}{3}$ $-1 < \frac{1}{3} < 1$ $\therefore \text{series is convergent } (-1 < r < 1)$	$\checkmark 12 + 4 + \frac{4}{3} + \dots \text{ or } 36 \left(\frac{1}{3} \right)^k$ $\checkmark \text{ value of } r$ $\checkmark -1 < r < 1$ (3)
3.2	$\sum_{k=p}^{\infty} 4 \cdot 3^{2-k} = 4 \cdot 3^{2-p} + 4 \cdot 3^{1-p} + 4 \cdot 3^{-p} + \dots$ $a = 4 \cdot 3^{2-p}$ $r = \frac{1}{3}$ $S_{\infty} = \frac{a}{1-r}$ $\frac{2}{9} = \frac{4 \cdot 3^{2-p}}{1 - \frac{1}{3}}$ $4 \cdot 3^{2-p} = \frac{4}{27}$ $3^{2-p} = 3^{-3}$ $2 - p = -3$ $p = 5$	$\checkmark \text{ expression for } a$ $\checkmark \text{ substitution of } a, r \text{ and } S_{\infty}$ $\checkmark \text{ simplification } \left(4 \cdot 3^{2-p} = \frac{4}{27} \right)$ $\checkmark 3^{2-p} = 3^{-3}$ $\checkmark \text{ answer}$ (5)
		[8]

QUESTION/VRAAG 4

4.1.1	$x = 1$ $y = 2$	✓ $x = 1$ ✓ $y = 2$ (2)
4.1.2	$y = mx + c$ $2 = -1 + c$ or $y - y_1 = m(x - x_1)$ or $y = -(x - p) + q$ $c = 3$ or $y - 2 = -1(x - 1)$ or $= -(x - 1) + 2$ $y = -x + 3$ or $y - 2 = -x + 1$ or $y = -x + 3$	✓ substitution of $m = -1$ and $(1; 2)$ ✓ answer (2)
4.1.3		✓ vertical asymptote: $x = 1$ and horizontal asymptote: $y = 2$ ✓ x-intercept: $\frac{5}{2}$ ✓ y-intercept: 5 ✓ shape (A) (4)
4.2.1	$(-5; -8)$	✓ $x = -5$ ✓ $y = -8$ (2)
4.2.2	$y \geq -8$ or $[-8; \infty)$	✓ answer (1)
4.2.3	$m = -5$ $n = g(-5)$ $= \frac{1}{2}(-5) + \frac{9}{2}$ $= 2$	✓ $m = -5$ ✓ substitution ✓ $n = 2$ (3)
4.2.4	 Area trapezium = $\frac{1}{2}(DE + OC) \times OE$ $= \frac{1}{2}(2 + 4,5) \times 5$ $= \frac{65}{4}$ or 16,25 OR	✓ method ✓ correct substitution ✓ answer (3)

	 $\text{Area } \Delta = \frac{1}{2} b.h$ $= \frac{1}{2} (5) \left(\frac{5}{2} \right)$ $= \frac{25}{4}$ $\text{Area rect} = b.h$ $= (5)(2)$ $= 10$ $\text{Area trapezium} = \frac{25}{4} + 10 = \frac{65}{4} \text{ or } 16,25$ OR S(-9 ; 0)  $\text{Area } \Delta \text{ SOC} = \frac{1}{2} b.h$ $= \frac{1}{2} (9) \left(\frac{9}{2} \right)$ $= \frac{81}{4}$ $\text{Area } \Delta \text{ SED} = \frac{1}{2} b.h = \frac{1}{2} (4)(2) = 4$ $\text{Area trapezium} = \text{area } \Delta \text{ SOC} - \text{Area } \Delta \text{ SED}$ $= \frac{81}{4} - 4$ $= \frac{65}{4} \text{ or } 16,25$	✓ method ✓ correct substitution ✓ answer (3) OR ✓ method ✓ correct substitution ✓ answer (3)
4.2.5	$g^{-1}: x = \frac{1}{2}y + \frac{9}{2}$ $g^{-1}: y = 2x - 9$	✓ changing x and y ✓ answer (2)

QUESTION/VRAAG 5

5.1	A(0 ; 1)	✓ answer (1)
5.2	$9 = 3^{-x}$ $3^2 = 3^{-x}$ $x = -2$ B(-2 ; 9)	✓ equating ✓ $3^2 = 3^{-x}$ ✓ $x = -2$ (3)
5.3	$x \in (0; \infty)$ or $x > 0$	✓✓ answer (2)
5.4	$h(x) = 27 \cdot 3^{-x}$ $h(x) = 3^{-(x-3)}$ f shifted 3 units to the right	✓ $h(x) = 3^{-(x-3)}$ ✓ 3 units ✓ right (3)
5.5	$\frac{27}{3^x} < 1$ $3^{-x+3} < 1$ $3^x > 27$ or $3^{-x+3} < 3^0$ $3^x > 3^3$ $-x + 3 < 0$ $x > 3$ $x > 3$ OR The graph shifts 3 units to the right Thus the y-intercept shift 3 units to the right (3 ; 1) $\therefore x > 3$	✓ $3^x > 27$ or $3^{-x+3} < 3^0$ ✓ $3^x > 3^3$ or $-x + 3 < 0$ ✓ $x > 3$ (3) OR ✓ translation ✓ y-intercept ✓ answer (3)
		[12]

QUESTION/VRAAG 6

6.1.1	$F = \frac{x[(1+i)^n - 1]}{i}$ $= \frac{1\,000 \left[\left(1 + \frac{0,075}{12} \right)^{145} - 1 \right]}{\frac{0,075}{12}}$ $= R234\,888,53$	✓ $n = 145$ ✓ $i = \frac{0,075}{12}$ ✓ substitution into the correct formula ✓ answer (4)
6.1.2	$A = P(1+i)^n$ $= 234\,888,53 \left(1 + \frac{0,075}{12} \right)^{12}$ $= R253\,123,54$	✓ substitution into the correct formula ✓ answer (2)
6.2	$A = P(1-i)^n$ $92\,537,64 = 250\,000(1-0,22)^n$ $0,37015056 = (0,78)^n$ $n = \frac{\log 0,37015056}{\log 0,78}$ $n = 4 \text{ years}$	✓ substitution into the correct formula ✓ correct use of logs ✓ answer (3)
6.3.1	Loan amount: $= \frac{x[1 - (1+i)^{-n}]}{i}$ $= \frac{1500 \left[1 - \left(1 + \frac{0,113}{12} \right)^{-72} \right]}{\frac{0,113}{12}}$ $= R78\,173,49323$	✓ 72 ✓ substitution into the correct formula ✓ answer (3)
6.3.2	Balance after 5 years: $P = \frac{x[1 - (1+i)^{-n}]}{i}$ $= \frac{1\,500 \left[1 - \left(1 + \frac{0,113}{12} \right)^{-12} \right]}{\frac{0,113}{12}}$ $= R16\,945,00629$ Amount paid: $R1\,500 \times 60 = R90\,000$ Interest $= \text{Amount paid} - [\text{Loan} - \text{Balance}]$ $= R90\,000 - [R78\,173,49323 - R16\,945,00629]$ $= R28\,771,51$	✓ substitution (A) ✓ R16 945,00629 (A) ✓ R90 000 – [Loan – Balance] ✓ answer (4)

	OR Balance $= 78\,173,49 \left(1 + \frac{0,133}{12}\right)^{60} - \frac{1\,500 \left(\left(1 + \frac{0,113}{12}\right)^{60} - 1 \right)}{\frac{0,113}{12}}$ Balance = R16 945.00 Amount paid: R1 500 × 60 = R90 000 Interest = Amount paid – [Loan – Balance] = R90 000 – [R78 173,49323 – R16 945,00629] = R28 771,51	OR ✓ substitution ✓ R16 945,00629 ✓ R90 000 – [Loan – Balance] ✓ answer (4)
		[16]

QUESTION/VRAAG 7**Penalty of – 1 for notation only in 7.1**

7.1	$f(x) = 2x^2 - 1$ $f(x+h) = 2(x+h)^2 - 1$ $= 2(x^2 + 2xh + h^2) - 1$ $= 2x^2 + 4xh + 2h^2 - 1$ $f(x+h) - f(x) = 2x^2 + 4xh + 2h^2 - 1 - (2x^2 - 1)$ $= 2x^2 + 4xh + 2h^2 - 1 - 2x^2 + 1$ $= 4xh + 2h^2$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{4xh + 2h^2}{h}$ $= \lim_{h \rightarrow 0} \frac{h(4x + 2h)}{h}$ $= \lim_{h \rightarrow 0} (4x + 2h)$ $= 4x$	✓ $2x^2 + 4xh + 2h^2 - 1$ ✓ $4xh + 2h^2$ ✓ substitution ✓ simplification ✓ answer (5)
7.2.1	$\frac{d}{dx} \left(\sqrt[5]{x^2} + x^3 \right)$ $= \frac{d}{dx} \left(x^{\frac{2}{5}} + x^3 \right)$ $\frac{dy}{dx} = \frac{2}{5} x^{-\frac{3}{5}} + 3x^2$	✓ $x^{\frac{2}{5}}$ ✓ $\frac{2}{5} x^{-\frac{3}{5}}$ ✓ $3x^2$ (3)
7.2.2	$f(x) = \frac{4x^2 - 9}{4x + 6}$ $= \frac{(2x-3)(2x+3)}{2(2x+3)}$ $= \frac{2x-3}{2}$ $= x - \frac{3}{2}$ $f'(x) = 1$	✓ $(2x-3)(2x+3)$ ✓ $2(2x+3)$ ✓ simplification to two separate terms ✓ answer (4)
		[12]

QUESTION/VRAAG 8

8.1	$-1 < x < 2$	✓✓ answer (2)
8.2	$x = \frac{-1+2}{2}$ $x = \frac{1}{2}$ Answer Only: Full Marks	✓ method ✓ answer (2)
8.3	From the graph $x > \frac{1}{2}$ Answer Only: Full Marks	✓✓ answer (2)
8.4	$g(x) = ax^3 + bx^2 + cx$ $g'(x) = 3ax^2 + 2bx + c = -6x^2 + 6x + 12$ $3a = -6, \quad 2b = 6 \quad c = 12$ $a = -2 \quad b = 3$ $g(x) = -2x^3 + 3x^2 + 12x$	✓ $g'(x) = 3ax^2 + 2bx + c$ ✓ $a = -2$ ✓ $b = 3$ ✓ $g(x) = -2x^3 + 3x^2 + 12x$ (4)
8.5	$g'\left(\frac{1}{2}\right) = -6\left(\frac{1}{2}\right)^2 + 6\left(\frac{1}{2}\right) + 12$ $m = \frac{27}{2} \quad \text{or} \quad 13,5$ $y = -2\left(\frac{1}{2}\right)^3 + 3\left(\frac{1}{2}\right)^2 + 12\left(\frac{1}{2}\right)$ $y = \frac{13}{2} \quad \text{or} \quad 6,5$ $y - y_1 = m(x - x_1)$ $y - 6,5 = 13,5(x - 0,5)$ $y = 13,5x - 0,25$	✓ max gradient at $x = \frac{1}{2}$ ✓ answer ✓ y value ✓ substitution ✓ answer (5)
		[15]

QUESTION/VRAAG 9

9.1	Total surface area = $2\ell w + 2wh + 2\ell h$ but: $\ell = 3w$ Total surface area = $6w^2 + 2wh + 6wh$ $C = 15(6w^2) + 6(2wh + 6wh)$ $= 15(6w^2) + 6(8wh)$ $= 90w^2 + 48wh$	✓ $2\ell w + 2wh + 2\ell h$ ✓ $\ell = 3w$ ✓ $15(6w^2)$ ✓ $6(2wh + 6wh)$ (4)
9.2	$5 = 3w^2 h$ $h = \frac{5}{3w^2}$ $C = 90w^2 + 48wh$ $C(w) = 90w^2 + 48w\left(\frac{5}{3w^2}\right)$ $= 90w^2 + 80w^{-1}$ $C'(w) = 180w - 80w^{-2}$ $180w - 80w^{-2} = 0$ $180w^3 - 80 = 0$ $w^3 = \frac{80}{180}$ $w = \sqrt[3]{\frac{80}{180}}$ $w = 0,76$	✓ $h = \frac{5}{3w^2}$ ✓ substitution ✓ $C(w) = 90w^2 + 80w^{-1}$ ✓ derivative ✓ equating derivative to zero ✓ value of w (6)
		[10]

QUESTION/VRAAG 10

10.1	10^{10} or 10 000 000 000	✓✓ answer (2)
10.2.1	$\frac{8 \times 10 \times 10}{\text{Area}} \times \frac{8 \times 8 \times 10}{\text{exchange}} \times \frac{2 \times 10 \times 10 \times 10}{\text{number}}$ No. of valid 10-digit numbers $= (8 \times 10 \times 10) \times (8 \times 8 \times 10) \times (2 \times 10 \times 10 \times 10)$ $= 1,024 \times 10^9$	✓ $\frac{8 \times 10 \times 10}{\text{or } 8 \times 8 \times 10}$ ✓ $2 \times 10 \times 10 \times 10$ ✓ $1,024 \times 10^9$ (A) (3)
10.2.2	Probability $= \frac{1,024 \times 10^9}{10^{10}}$ $= \frac{64}{625} = 0,1024 = 10,24\%$	✓ $\frac{1,024 \times 10^9}{10^{10}}$ ✓ answer (2)
		[7]

QUESTION/VRAAG 11

11	First shot Second shot Third shot BBB BBN BNB BNN NBB NBN NNB NNN	
11.1	P (Bull's eye first shot and second shot) $= 0,5 \times 0,5$ $= 0,25$ or $\frac{1}{4}$	✓ two 0,5's ✓ $0,5 \times 0,5$ (2)

11.2	P (Bull's eye at least twice in 3 shots) $= (0,5 \times 0,5 \times 0,5) + (0,5 \times 0,5 \times 0,5) + (0,5 \times 0,5 \times 0,5) + (0,5 \times 0,5 \times 0,5)$ $= 0,125 + 0,125 + 0,125 + 0,125$ $= 0,5 \quad \text{or} \quad \frac{1}{2}$	✓ $0,5 \times 0,5 \times 0,5$ ✓ four events ✓ answer (A) (3)
11.3	Person shoots first: $(0,5) + (0,5)^3 + (0,5)^5 + \dots$ $P = \frac{a}{1-r}$ $P = \frac{0,5}{1-0,25}$ $P = \frac{2}{3} = 0,67$	✓ $(0,5) + (0,5)^3$ ✓ $\dots + (0,5)^5 + \dots$ ✓ $P = \frac{0,5}{1-0,25}$ (3)
		[8]

TOTAL/TOTAAL: 150