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**SENIOR CERTIFICATE EXAMINATIONS/
SENIORSERTIFIKAAT-EKSAMEN
NATIONAL SENIOR CERTIFICATE EXAMINATIONS/
NASIONALE SENIORSERTIFIKAAT-EKSAMEN**

MATHEMATICS P1/WISKUNDE V1

MARKING GUIDELINES/NASIENRIGLYNE

MAY/JUNE/MEI/JUNIE 2024

**MARKS: 150
PUNTE: 150**

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

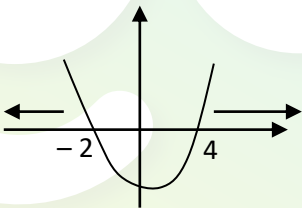
NOTE:

- 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, merk slegs die EERSTE poging.
- Volgehoue akkuraatheid is DEURGAANS op ALLE aspekte van die nasienriglyne van toepassing.

QUESTION 1/VRAAG 1

1.1.1	$3x^2 + 5x = 0$ $x(3x + 5) = 0$ $x = 0$ or $x = -\frac{5}{3}$	$\checkmark x = 0$ $\checkmark x = -\frac{5}{3}$ (2)
1.1.2	$4x^2 + 3x - 5 = 0$ $x = \frac{-(3) \pm \sqrt{(3)^2 - 4(4)(-5)}}{2(4)}$ $x = 0,80$ or $x = -1,55$	\checkmark correct substitution into correct formula \checkmark answer \checkmark answer (3)
1.1.3	$(x-1)^2 - 9 \geq 0$ $x^2 - 2x - 8 \geq 0$ $(x-4)(x+2) \geq 0$ $x = 4$ or $x = -2$ $x \leq -2$ or $x \geq 4$	 \checkmark standard form \checkmark critical values $\checkmark \checkmark x \leq -2$ or $x \geq 4$ (4)
1.1.4	$5^{2x} - 5^x = 0$ $5^x(5^x - 1) = 0$ $5^x \neq 0$ or $5^x = 1$ $x = 0$ OR/OF $5^{2x} = 5^x$ $2x = x$ $2x - x = 0$ $x = 0$	\checkmark common factor $\checkmark 5^x \neq 0$ $\checkmark 5^x = 1$ $\checkmark x = 0$ (4) OR/OF $\checkmark 5^{2x} = 5^x$ $\checkmark 2x = x$ $\checkmark 2x - x = 0$ $\checkmark x = 0$ (4)

1.1.5	$\frac{x}{\sqrt{20-x}} = 1$ $x = \sqrt{20-x}$ $x^2 = 20-x$ $x^2 + x - 20 = 0$ $(x+5)(x-4) = 0$ $x = 4 \text{ or } x \neq -5$	<ul style="list-style-type: none"> ✓ isolating the surd ✓ squaring both sides ✓ standard form ✓ answers ✓ selection <p>(5)</p>
1.2	$2x^2 - y^2 = 7 \quad \dots (1)$ $x + y = 9 \quad \dots (2)$ $y = 9 - x$ $2x^2 - (9 - x)^2 = 7$ $2x^2 - 81 + 18x - x^2 = 7$ $x^2 + 18x - 88 = 0$ $(x+22)(x-4) = 0$ $x = -22 \text{ or } x = 4$ $y = 31 \text{ or } y = 5$ <p>OR/OF</p> $2x^2 - y^2 = 7 \quad \dots (1)$ $x + y = 9 \quad \dots (2)$ $x = 9 - y$ $2(9 - y)^2 - y^2 = 7$ $2(81 - 18y + y^2) - y^2 - 7 = 0$ $162 - 36y + 2y^2 - y^2 - 7 = 0$ $y^2 - 36y + 155 = 0$ $(y - 31)(y - 5) = 0$ $y = 31 \text{ or } y = 5$ $x = -22 \text{ or } x = 4$	<ul style="list-style-type: none"> ✓ $y = 9 - x$ ✓ substitution ✓ standard form ✓ x-values ✓ y-values <p>(5)</p> <p>OR/OF</p> <ul style="list-style-type: none"> ✓ $x = 9 - y$ ✓ substitution ✓ standard form ✓ y-values ✓ x-values <p>(5)</p>
1.3	$P \times T = (1-a)(1+a)(1+a^2)(1+a^4) \dots (1+a^{512})$ $P \times T = (1-a^2)(1+a^2)(1+a^4) \dots (1+a^{512})$ $P \times T = (1-a^4)(1+a^4) \dots (1+a^{512})$ $P \times T = (1-a^8) \dots (1+a^{512})$ $P \times T = (1-a^{512})(1+a^{512})$ $= 1 - a^{1024}$	<ul style="list-style-type: none"> ✓ $(1-a^4)$ ✓ $(1-a^{512})$ ✓ $1 - a^{1024}$ <p>(3)</p>
		[26]

QUESTION 2/VRAAG 2

2.1.1	$r = \frac{1}{2}$ Yes, because $-1 < \frac{1}{2} < 1$	$\checkmark r = \frac{1}{2}$ \checkmark answer with reason (2)
2.1.2	$S_{\infty} = \frac{a}{1-r}$ $S_{\infty} = \frac{4}{1-\frac{1}{2}}$ $\therefore S_{\infty} = 8$	\checkmark substitution \checkmark answer (2)
2.2	$\sum_{p=k}^{10} 3^{p-1} = 3^{k-1} + 3^{k+1-1} + 3^{k+2-1} + \dots + 3^9$ $= 3^{k-1} + 3^k + 3^{k+1} + \dots + 3^9$ $S_n = \frac{a(r^n - 1)}{r - 1}$ $29\,520 = \frac{3^{k-1}(3^{11-k} - 1)}{3 - 1}$ $3^{10} - 3^{k-1} = 59\,040$ $3^{k-1} = 9$ $k - 1 = 2$ $\therefore k = 3$	$\checkmark a = 3^{k-1}$ $\checkmark r = 3$ $\checkmark n = 11 - k$ \checkmark substitution \checkmark answer (5)
		[9]

QUESTION 3/VRAAG 3

<p>3.1.1</p>	$\begin{array}{ccccccc} & & 3 & ; & 7 & ; & 12 & ; & 18 \\ & & \vee & & \vee & & \vee & & \\ \text{First diff:} & & 4 & ; & 5 & ; & 6 \\ & & \vee & & \vee & & \\ \text{Second diff:} & & 1 & ; & 1 \end{array}$ $2a=1$ $a = \frac{1}{2}$ $3a+b=4$ $3\left(\frac{1}{2}\right)+b=4$ $b = \frac{5}{2}$ $a+b+c=3$ $\frac{1}{2} + \frac{5}{2} + c = 3$ $c=0$ $T_n = \frac{1}{2}n^2 + \frac{5}{2}n$	$\checkmark 2a=1$ $\checkmark 3\left(\frac{1}{2}\right)+b=4$ $\checkmark \frac{1}{2} + \frac{5}{2} + c = 3$ <p style="text-align: right;">(3)</p>
<p>3.1.2</p>	$13\,527 = \frac{1}{2}n^2 + \frac{5}{2}n$ $n^2 + 5n - 27\,054 = 0$ $(n-162)(n+167) = 0$ $n = 162 \text{ or } n = -167$ $T_{161} = 13\,363$ $\therefore T_{161} + 164 = 13\,527$ <p>164 must be added.</p> <p>OR/OF</p> $T_n = 3 + \text{sum of 1}^{\text{st}} \text{ differences}$ $13\,527 = 3 + 4 + 5 + \dots + n$ $\frac{n-3+1}{2}[3+n] = 13\,527$ $n^2 + n - 27\,060 = 0$ $(n+165)(n-167) = 0$ $n = 164$	$\checkmark 13\,527 = \frac{1}{2}n^2 + \frac{5}{2}n$ $\checkmark \text{standard form}$ $\checkmark \text{answers for } n$ $\checkmark 164$ <p>OR/OF</p> $\checkmark 13\,527 = 3 + 4 + 5 + \dots + n$ $\checkmark n^2 + n - 27\,060 = 0$ $\checkmark \text{answers for } n$ $\checkmark 164$ <p style="text-align: right;">(4)</p>

3.2.1	$T_n = 8 + (n-1)(3)$ $T_n = 3n + 5$ $41 = 3n + 5$ $36 = 3n$ $n = 12$	$\checkmark T_n = 3n + 5$ $\checkmark T_n = 41$ \checkmark answer (3)
3.2.2a	$P_{41} = 12$	\checkmark answer (1)
3.2.2b	$P_8 = a + 7d = 1$ $P_{11} = a + 10d = 2$ $3d = 1$ $d = \frac{1}{3}$ $a + 7\left(\frac{1}{3}\right) = 1$ $a = -\frac{4}{3}$	$\checkmark a + 7d = 1$ $\checkmark a + 10d = 2$ \checkmark value of d \checkmark value of a (4)
		[15]

QUESTION 4/VRAAG 4

4.1	$x = 1$ $y = 2$	✓ $x = 1$ ✓ $y = 2$ (2)
4.2		✓ x-intercept ✓ y-intercept ✓ asymptotes ✓ shape (4)
4.3	$x < \frac{1}{2}$ or $x > 1$	✓ $x < \frac{1}{2}$ ✓ $x > 1$ (2)
4.4	$y = -(x-1) + 2$ $y = -x + 3$ OR/OF $y - 2 = -(x - 1)$ $y = -x + 3$ OR/OF $y = -x + c$ $2 = -(1) + c$ $c = 3$ $\therefore y = -x + 3$	✓ substitution of (1 ; 2) ✓ answer (2) OR/OF ✓ substitution of (1 ; 2) ✓ answer (2) OR/OF ✓ substitution of (1 ; 2) ✓ answer (2)
		[10]

QUESTION5/VRAAG 5

5.1	$P'(2; 4)$	$\checkmark x = 2$ $\checkmark y = 4$ (2)
5.2	$f(x) = \log_a x$ $2 = \log_a 4$ $a^2 = 4$ $a = 2$	\checkmark substitute (4 ; 2) $\checkmark a^2 = 4$ (2)
5.3	$y = 2^x$	$\checkmark y = 2^x$ (1)
5.4	$1 = \log_2 x$ $\therefore x = 2$ T(2 ; 1) RT = 2 units P'T = 3 units $\text{Area of } \Delta RTP' = \frac{1}{2} \cdot RT \cdot TP'$ $= \frac{1}{2} \times 2 \times 3 = 3 \text{ units}^2$	$\checkmark x = 2$ $\checkmark RT = 2 \text{ units}$ $\checkmark P'T = 3 \text{ units}$ \checkmark answer (4)
		[9]

QUESTION 6/VRAAG 6

6.1	$y \geq -4$ or $y \in [-4; \infty)$	✓ answer (1)
6.2	$x^2 - 2x - 3 = 0$ $(x - 3)(x + 1) = 0$ $x = 3$ or $x = -1$ $\therefore E(3; 0)$ and $D(-1; 0)$	✓ = 0 ✓ both x -values ✓ correct identification of coordinates (3)
6.3	$P(0; -3)$ $\therefore m_{PE} = 1$ $\therefore g(x) = x - 3$	✓ $m_{PE} = 1$ ✓ $g(x) = x - 3$ (2)
6.4	$f(x) > g(x)$ $x < 0$ or $x > 3$	✓ $x < 0$ ✓ $x > 3$ (2)
6.5	$\text{Distance} = -x^2 + 2x + 3 - x + 3 = -x^2 + x + 6$ $D' = -2x + 1 = 0$ or/of $x = -\frac{b}{2a}$ $\therefore x = \frac{1}{2}$ $\therefore x = \frac{1}{2}$ $D\left(\frac{1}{2}\right) = -\left(\frac{1}{2}\right)^2 + \frac{1}{2} + 6$ $= \frac{25}{4} = 6,25$	✓ $D = -x^2 + x + 6$ ✓ method ✓ $x = \frac{1}{2}$ ✓ substitution ✓ answer (5)
6.6	$f'(x) = m$ $1 = 2x - 2$ $x = \frac{3}{2}$ Point on $f: \left(\frac{3}{2}; \frac{-15}{4}\right)$ $-\frac{15}{4} = \left(\frac{3}{2} - 3\right) - n$ $\therefore n = 2\frac{1}{4} = \frac{9}{4} = 2,25$ OR/OF $f(x) = k(x)$ $x^2 - 2x - 3 = x - 3 - n$ $x^2 - 3x + n = 0$ $\Delta = b^2 - 4ac$ $= (-3)^2 - 4(1)(n)$ To touch: $\Delta = 0$ $0 = 9 - 4n$ $4n = 9$ $n = \frac{9}{4}$	✓ $1 = 2x - 2$ ✓ $x = \frac{3}{2}$ ✓ $-\frac{15}{4}$ ✓ $-\frac{15}{4} = \left(\frac{3}{2} - 3\right) - n$ ✓ answer (5) OR/OF ✓ equating ✓ standard form ✓ substitution into Δ ✓ $\Delta = 0$ ✓ answer (5)
		[18]

QUESTION 7/VRAAG 7

7.1	$A = P(1-i)^n$ $8\,337,75 = 13\,000(1-i)^6$ $i = 7,14\%$	✓ substitution in correct formula ✓✓ answer (3)
7.2	$F = \frac{x[(1+i)^n - 1]}{i}$ $80\,000 = \frac{x\left[\left(1 + \frac{8,6}{1200}\right)^{36} - 1\right]}{\frac{8,6}{1200}}$ $x = R1\,955,78$ Thandi's total = $1955,78 \times 36 = R\,70\,408,08$ Eric's total = $1402,31 \times 48 = R\,67\,310,88$ Difference = $70\,408,08 - 67\,310,88$ = $R3\,097,20$	✓ i ✓ substitution into correct formula ✓ answer ✓ answer (4)
7.3	$A = P(1+i)^n$ $A = 225\,000\left(1 + \frac{0,09}{12}\right)^3$ $A = R\,230\,100,5637\dots$ $225\,000\left(1 + \frac{0,09}{12}\right)^3 = \frac{5\,500\left[1 - \left(1 + \frac{0,09}{12}\right)^{-n}\right]}{\frac{0,09}{12}}$ $0,3137734959\dots = 1 - \left(1 + \frac{0,09}{12}\right)^{-n}$ $\left(1 + \frac{0,09}{12}\right)^{-n} = 0,6862265041\dots$ $-n = \log_{\left(1 + \frac{0,09}{12}\right)} 0,6862265041\dots$ $n = 50,394375\dots$ $n = 51$	✓ substitution in correct formula ✓ answer ✓ substitution ✓ simplification ✓ use of logs ✓ answer (6)
		[13]

QUESTION8/VRAAG 8

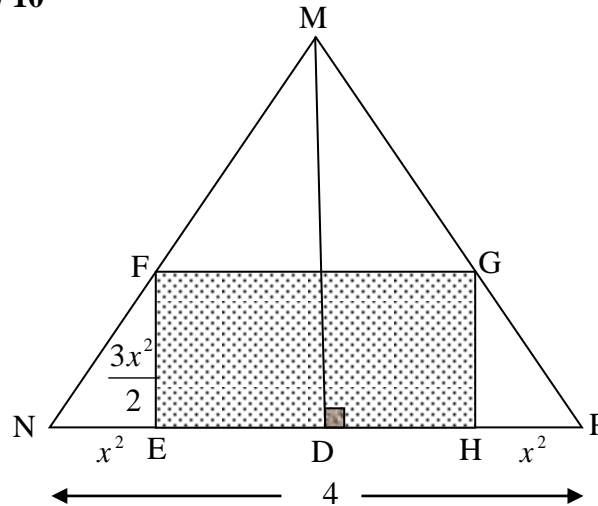
<p>8.1</p>	$f(x) = \frac{1}{x}$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{\frac{1}{(x+h)} - \frac{1}{x}}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{x - (x+h)}{x(x+h)} \times \frac{1}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{-h}{x(x+h)} \times \frac{1}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{-1}{x(x+h)}$ $f'(x) = -\frac{1}{x^2}$ <p>OR/OF</p> $f(x) = \frac{1}{x}$ $f(x+h) = \frac{1}{x+h}$ $f(x+h) - f(x) = -\frac{h}{x(x+h)}$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{-h}{x(x+h)} \times \frac{1}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{-1}{x(x+h)}$ $f'(x) = -\frac{1}{x^2}$	$\checkmark f(x+h) = \frac{1}{x+h}$ $\checkmark \frac{x - (x+h)}{x(x+h)} \times \frac{1}{h}$ $\checkmark \frac{-h}{x(x+h)} \times \frac{1}{h}$ $\checkmark \frac{-1}{x(x+h)}$ <p>✓ answer</p> <p style="text-align: right;">(5)</p> <p>OR/OF</p> $\checkmark f(x+h) = \frac{1}{x+h}$ $\checkmark f(x+h) - f(x) = -\frac{h}{x(x+h)}$ $\checkmark \frac{-h}{x(x+h)} \times \frac{1}{h}$ $\checkmark \frac{-1}{x(x+h)}$ <p>✓ answer</p> <p style="text-align: right;">(5)</p>
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8.2.1	$\frac{d}{dx}(\sqrt{4x^6} + \sqrt{2} \cdot x^2)$ $= \frac{d}{dx}(2x^3 + \sqrt{2} \cdot x^2)$ $= 6x^2 + 2\sqrt{2}x$	$\checkmark 2x^3$ $\checkmark 6x^2$ $\checkmark 2\sqrt{2}x$ (3)
8.2.2	$g(x) = \frac{3x^4 - 4x^2 + 6}{x^2}$ $g(x) = 3x^2 - 4 + 6x^{-2}$ $g'(x) = 6x - 12x^{-3}$	$\checkmark 3x^2 - 4 + 6x^{-2}$ $\checkmark 6x$ $\checkmark -12x^{-3}$ (3)
8.3	$f(x) = 3x^2 + bx + c$ $f'(x) = 6x + b$ $f'(1) = 6 + b = 9$ $\therefore b = 3$ $f(1) = 3 + 3 + c = 0$ $c = -6$ $\therefore f(x) = 3x^2 + 3x - 6$	$\checkmark f'(1) = 6 + b = 9$ $\checkmark b = 3$ $\checkmark f(1) = 3 + 3 + c = 0$ $\checkmark c = -6$ (4)
		[15]

QUESTION9/VRAAG 9

9.1	$f(x) = ax^3 + bx^2 + cx - 5$ $-5 = a(0+1)^2(0-5)$ $-5 = -5a$ $a = 1$ $f(x) = (x+1)(x+1)(x-5)$ $f(x) = (x^2 + 2x + 1)(x-5)$ $f(x) = x^3 - 3x^2 - 9x - 5$ $\therefore b = -3$ and $c = -9$	✓ substitution of x -intercepts ✓ simplification ✓ simplification (3)
9.2	$f(x) = x^3 - 3x^2 - 9x - 5$ $f'(x) = 3x^2 - 6x - 9$ $x^2 - 2x - 3 = 0$ $(x-3)(x+1) = 0$ $x = 3$ or $x = -1$ Minimum value at $x = 3$	✓ $f'(x) = 3x^2 - 6x - 9$ ✓ $f'(x) = 0$ ✓ factors ✓ $x = 3$ (4)
9.3	$f''(x) \cdot f(x) > 0$ Point of inflection: $x = 1$ $x < 1$; $x \neq -1$ or $x > 5$	✓ $x = 1$ ✓ $x < 1$; $x \neq -1$ ✓ $x > 5$ (3)
9.4	$-32 < -t < -5$ $5 < t < 32$ OR/OF Shift up more than 5 units and less than 32 units $\therefore 5 < t < 32$	✓ -32 ✓ $-32 < -t < -5$ ✓ $5 < t < 32$ (3) OR/OF ✓ more than 5 units ✓ less than 32 units ✓ $5 < t < 32$ (3)
		[13]

QUESTION 10/VRAAG 10



10.1	$\frac{NE}{EF} = \frac{2}{3} = \frac{x^2}{b}$ $3x^2 = 2b$ $\therefore b = \frac{3x^2}{2}$ $EH = 4 - 2x^2$ $\text{Area EFGH} = (4 - 2x^2) \left(\frac{3x^2}{2} \right)$ $A(x) = 6x^2 - 3x^4$ <p>OR/OF</p> <p>In $\triangle DMP$: $\tan P = \frac{3}{2}$</p> <p>In $\triangle HGP$: $\tan P = \frac{GH}{x^2}$</p> $\frac{GH}{x^2} = \frac{3}{2}$ $\therefore b = \frac{3x^2}{2}$ $EH = 4 - 2x^2$ $\text{Area EFGH} = (4 - 2x^2) \left(\frac{3x^2}{2} \right)$ $A(x) = 6x^2 - 3x^4$	$\checkmark \frac{NE}{EF} = \frac{2}{3} = \frac{x^2}{b}$ $\checkmark \therefore b = \frac{3x^2}{2}$ $\checkmark EH = 4 - 2x^2$ $\checkmark (4 - 2x^2) \left(\frac{3x^2}{2} \right)$ <p style="text-align: right;">(4)</p> <p>OR/OF</p> $\checkmark \frac{GH}{x^2} = \frac{3}{2}$ $\checkmark \therefore b = \frac{3x^2}{2}$ $\checkmark EH = 4 - 2x^2$ $\checkmark (4 - 2x^2) \left(\frac{3x^2}{2} \right)$ <p style="text-align: right;">(4)</p>
10.2	$A(x) = 6x^2 - 3x^4$ $A'(x) = 12x - 12x^3 = 0$ $12x(1 - x^2) = 0$ $\therefore x \neq 0 \text{ or } x = -1 \text{ or } x = 1$ $\therefore \text{max area: } A(1) = 6(1)^2 - 3(1)^4 = 3 \text{ cm}^2$	$\checkmark 12x - 12x^3 = 0$ $\checkmark \text{values of } x$ $\checkmark \text{correct substitution}$ $\checkmark \text{answer}$ <p style="text-align: right;">(4)</p>
		[8]

QUESTION 11/VRAAG 11

11.1	$P(A) + P(B) = 0,52$ $0,4 + P(B) = 0,52$ $P(B) = 0,12$	✓ substitution ✓ answer (2)
11.2.1	$P(\text{sandwich}) = \frac{4}{25}$ OR/OF $0,02 + 0,01 + 0,04 + 0,09 = \frac{4}{25} = 0,16$	✓ answer (1) OR/OF ✓ answer (1)
11.2.2	$P(\text{at least two events}) = 0,02 + 0,01 + 0,03 + 0,04$ $= 0,1$	✓ $0,02 + 0,01 + 0,03 + 0,04$ ✓ answer (2)
11.2.3	$P(\text{not any}) = 1 - (0,1 + 0,04 + 0,09 + 0,2)$ $= 0,57$	✓ $1 - (0,1 + 0,04 + 0,09 + 0,2)$ ✓ answer (2)
11.3.1	$7! = 5040$	✓ $7!$ (1)
11.3.2	$P(4 \text{ players alphabetically}) = \frac{1}{7 \times 6 \times 5 \times 4} = \frac{1}{840}$	✓ 1 ✓ 840 ✓ $\frac{1}{840}$ (3)

11.3.3	<table><tr><td></td><td>F</td><td></td><td>F</td><td></td><td>F</td><td></td><td>F</td><td></td></tr></table> <p>F arrangements: 4!</p> <p>M arrangements: 5 options with 3 males = $5 \times 4 \times 3$</p> <p>$4! \times 5 \times 4 \times 3$ = 1 440</p> <p>OR/OF</p> <p>10 Options:</p> <p>F M F M F M F M F M F M F F F F M F M F M F M F M F F M M F M F F M F M F M F F F M F M F F M F M M F F M F F M M F F M F M F M F F F M F M</p> <p>Hence $10 \times 4! \times 3! = 1440$</p>		F		F		F		F		<p>✓4!</p> <p>✓$5 \times 4 \times 3$</p> <p>✓1 440</p> <p>(3)</p> <p>OR/OF</p> <p>✓$4! \times 3!$</p> <p>✓$\times 10$</p> <p>✓1 440</p> <p>(3)</p>
	F		F		F		F				
		[14]									
	TOTAL/TOTAAL: 150										