



education

Department:
Education
North West Provincial Government
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

**MATHEMATICS P1
SEPTEMBER 2023
MARKING GUIDELINES**

MARKS: 150

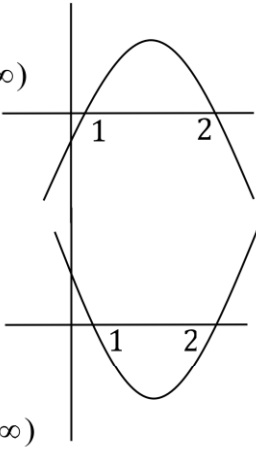

Stanmorephysics

These marking guidelines consists of 16 pages.

NOTE:

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

QUESTION 1

1.1.1	$x^2 = 5x$ $x^2 - 5x = 0$ $x(x-5) = 0$ $x = 0$ or $x = 5$	✓ standard form ✓ factors ✓ x-values (3)
1.1.2	$x^2 - 2x - 13 = 0$ $x = \frac{-(-2) \pm \sqrt{(-2)^2 - 4(1)(-13)}}{2(1)}$ $x = 4,74$ or $x = -2,74$	✓ substitution into the correct formula ✓ $x = 4,74$ ✓ $x = -2,74$ (3)
1.1.3	$(x-2)(1-x) \leq 0$ $x \leq 1$ or $x \geq 2$ / $x \in (-\infty; 1] \text{ or } [2; \infty)$ OR $(x-2)(x-1) \geq 0$ $x \leq 1$ or $x \geq 2$ / $x \in (-\infty; 1] \text{ or } [2; \infty)$	 ✓ critical values ✓ $x \leq 1$ ✓ $x \geq 2$ (3)
1.1.4	$2\sqrt{2x-1} = x-11$ $4(2x-1) = x^2 - 22x + 121$ $8x - 4 = x^2 - 22x + 121$ $x^2 - 30x + 125 = 0$ $(x-25)(x-5) = 0$ $x = 25$ or $x \neq 5$ OR $2\sqrt{2x-1} = x-11$ $\sqrt{2x-1} = \frac{x-11}{2}$ $2x-1 = \frac{x^2 - 22x + 121}{4}$ $8x - 4 = x^2 - 22x + 121$ $x^2 - 30x + 125 = 0$ $(x-25)(x-5) = 0$ $x = 25$ or $x \neq 5$	✓ square on both sides ✓ standard form ✓ factors/formula ✓ both answers ✓ reject $x = 5$ (5)  ✓ square on both sides ✓ standard form ✓ factors/formula ✓ both answers ✓ reject $x = 5$ (5)

1.2	$3x - y = 4$ $y = 3x - 4$ $x^2 + xy = 24$ $x^2 + x(3x - 4) = 24$ $x^2 + 3x^2 - 4x = 24$ $4x^2 - 4x - 24 = 0$ $x^2 - x - 6 = 0$ $(x - 3)(x + 2) = 0$ $x = 3$ or $x = -2$ $y = 3(3) - 4$ or $y = 3(-2) - 4$ $y = 5$ $y = -10$ OR $3x = y + 4$ $x = \frac{y + 4}{3}$ $x^2 + xy = 24$ $\left(\frac{y + 4}{3}\right)^2 + y\left(\frac{y + 4}{3}\right) = 24$ $\frac{y^2 + 8y + 16}{9} + \frac{y^2 + 4y}{3} = 24$ $y^2 + 8y + 16 + 3y^2 + 12y = 216$ $4y^2 + 20y - 200 = 0$ $y^2 + 5y - 50 = 0$ $(y + 10)(y - 5) = 0$ $y = -10$ or $y = 5$ $x = \frac{(-10) + 4}{3}$ or $x = \frac{(5) + 4}{3}$ $x = -2$ $x = 3$	$\checkmark y = 3x - 4$ \checkmark substitution \checkmark standard form \checkmark factors/formula \checkmark both x -values \checkmark both y -values (6)
1.3	$S = \left(1 + \frac{1}{7}\right)\left(1 + \frac{1}{8}\right)\left(1 + \frac{1}{9}\right) \dots \left(1 + \frac{1}{m}\right)$ $S = \left(\frac{8}{7}\right)\left(\frac{9}{8}\right)\left(\frac{10}{9}\right) \dots \left(\frac{m+1}{m}\right)$ $S = \frac{m+1}{7}$ For S to be a natural number, $m+1$ must be a multiple of 7 $m+1 = 14$ or $m+1 = 21$ or $m+1 = 28$ $m = 13$ $m = 20$ $m = 27$	$\checkmark \left(\frac{8}{7}\right)\left(\frac{9}{8}\right)\left(\frac{10}{9}\right) \dots$ $\checkmark \frac{m+1}{m}$ $\checkmark S = \frac{m+1}{7}$ \checkmark multiples 14, 21, 28 \checkmark answer (5)
		[25]


QUESTION 2

2.1.1	$ \begin{array}{cccc} -120 & -99 & -80 & -63 \\ \swarrow & \swarrow & \swarrow & \swarrow \\ 21 & 19 & 17 & \\ \swarrow & \swarrow & \swarrow & \\ 2 & -2 & -2 & \end{array} $ <p>The next TWO terms: -48 ; -35</p>	<p>✓ -48 ✓ -35</p> <p>(2)</p>
2.1.2	$ \begin{array}{lll} 2a = -2 & 3a + b = 21 & a + b + c = -120 \\ a = -1 & 3(-1) + b = 21 & (-1) + (24) + c = -120 \\ & b = 24 & c = -143 \\ T_n = -n^2 + 24n - 143 \end{array} $	<p>✓ 2^{nd} diff = -2 ✓ $a = -1$ ✓ $b = 24$ ✓ $c = -143$</p> <p>(4)</p>
2.1.3	$ \begin{array}{l} T'_n = -2n + 24 = 0 \\ n = 12 \\ T_n = -(12)^2 + 24(12) - 143 \\ T_n = 1 \\ \text{A maximum of 1} \\ \text{Add } -1 \text{ to } T_n \\ \text{OR} \\ n = \frac{-(24)}{2(-1)} = 12 \\ T_n = -(12)^2 + 24(12) - 143 \\ T_n = 1 \\ \text{A maximum of 1} \\ \text{Add } -1 \text{ to } T_n \\ \text{OR} \\ T_n = -n^2 + 24n - 143 + k \\ \Delta = (24)^2 - 4(-1)(k - 143) \\ = 576 + 4k - 572 \\ = 4k + 4 \\ \text{but } \Delta = 0 \\ 4k + 4 = 0 \\ k = -1 \end{array} $	<p>✓ method ✓ $n = 12$</p> <p>✓ maximum 1 ✓ -1</p> <p>(4)</p> <p>✓ method ✓ $n = 12$</p> <p>✓ maximum 1 ✓ -1</p> <p>(4)</p> <p>✓ method</p> <p>✓ $\Delta = 4k + 4$ ✓ $\Delta = 0$</p> <p>✓ -1</p> <p>(4)</p>
2.2.1	$9 + 14 + 19 + \dots + 124$ <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p>Answer only: full marks</p> </div> $ \begin{array}{l} T_n = (9) + (n-1)(5) \\ T_n = 5n + 4 \end{array} $	<p>✓ substitution into the correct formula ✓ $T_n = 5n + 4$</p> <p>(2)</p>

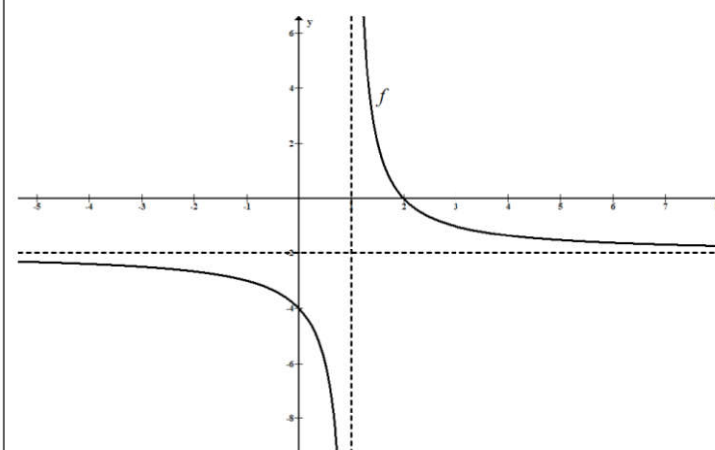
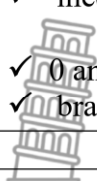
2.2.2	$T_n = 5n + 4 = 124$ $5n = 120$ $n = 24$ $\sum_{n=1}^{24} (5n + 4)$	$\checkmark = 124$ $\checkmark n = 24$ \checkmark answer (3)
2.3	$2^x + 2 \cdot 2^x + 3 \cdot 2^x + 4 \cdot 2^x \dots$ $a = 2^x$ $d = 2^x$ $S_{30} = \frac{30}{2} [2(2^x) + 29(2^x)]$ $3720 = 15(31 \cdot 2^x)$ $248 = 31 \cdot 2^x$ $8 = 2^x$ $2^3 = 2^x$ $x = 3$	$\checkmark a = 2^x$ and $d = 2^x$ \checkmark substitution into the correct formula $\checkmark 2^x = 8$ $\checkmark x = 3$ (4)
		[19]

QUESTION 3

3.1.1	$5; 10; 20; \dots$ $T_n = a \cdot r^{n-1}$ $T_n = (5)(2)^{n-1}$	\checkmark answer (1)
3.1.2	$S_n = \frac{a(r^n - 1)}{r - 1}$ $S_{18} = \frac{5[(2)^{18} - 1]}{2 - 1}$ $S_{18} = 1310715$	\checkmark substitution into the correct formula \checkmark answer (2)
3.2	$r = \frac{(2x+4)(2x-4)}{2x-4} = 2x+4$ Converge: $-1 < r < 1$ $-1 < 2x+4 < 1$ $-5 < 2x < -3$ $-\frac{5}{2} < x < -\frac{3}{2}$	$\checkmark r = 2x+4$ $\checkmark -1 < r < 1$ \checkmark substitution \checkmark answer (4)

3.3	$\frac{S_{\infty}}{S_2} = \frac{\frac{2}{1 - \frac{1}{\sqrt{2}}}}{2 \left(1 - \left(\frac{1}{\sqrt{2}} \right)^2 \right)}$  $= \frac{1}{1 - \frac{1}{2}}$ $= 2$	✓ S_{∞} ✓ S_2 ✓ dividing ✓ answer (3)
		[10]

QUESTION 4

4.1	$x = 1$ $y = -2$	✓ $x = 1$ ✓ $y = -2$ (2)
4.2		✓ x-asymptote and y-asymptote ✓ x-intercept ✓ y-intercept ✓ form-decreasing (4)
4.3	$y = -x + c$ $-2 = -(1) + c$ $-1 = c$ $y = -x - 1$ <div style="border: 1px solid black; padding: 5px; display: inline-block; margin-top: 10px;"> Answer only: full marks </div> OR $y - y_1 = -1(x - x_1)$ $y = -x + 1 - 2$ $y = -x - 1$	✓ method ✓ answer (2)
4.4	$0 \leq x < 1$ OR $x \in [0 ; 1)$	✓ 0 and 1 ✓ inequalities (2)  ✓ 0 and 1 ✓ brackets (2)
		[10]

QUESTION 5

5.1	$y = a\left(\frac{1}{5}\right)^x - 5$ $-4 = a\left(\frac{1}{5}\right)^{-2} - 5$ $1 = a(25)$ $\frac{1}{25} = a$	✓ substitution ✓ simplification (2)
5.2	$0 = \frac{1}{25}\left(\frac{1}{5}\right)^x - 5$ $5 = \frac{1}{25}\left(\frac{1}{5}\right)^x$ $125 = \left(\frac{1}{5}\right)^x$ $5^3 = 5^{-x}$ $x = -3 \quad (-3; 0)$	✓ $y = 0$ ✓ simplifying ✓ answer (3)
5.3.1	$h: y = \left(\frac{1}{5}\right)^x$ $x = \left(\frac{1}{5}\right)^y$ $y = \log_{\frac{1}{5}} x$ or $y = -\log_5 x$	<div style="border: 1px solid black; padding: 5px; display: inline-block;"> Answer only: full marks </div> ✓ swop x and y ✓ answer (2)
5.3.2	$g: y = \left(\frac{1}{5}\right)^2 \cdot \left(\frac{1}{5}\right)^x - 5$ $g(x) = \left(\frac{1}{5}\right)^{x+2} - 5$ 2 units right and 5 units up	✓ rewriting g ✓ 2 units right and 5 units up (2)
		[9]



QUESTION 6

6.1	$y = \frac{1}{2}x + 2$ $0 = \frac{1}{2}x + 2$ $x = -4$ $B(-4;0)$	✓ $y = 0$ ✓ answer (2)
6.2	$y = a(x - x_1)(x - x_2)$ $y = a(x + 2)(x + 6)$ $-12 = a(0 + 2)(0 + 6)$ $-12 = 12a$ $a = -1$ $y = -(x^2 + 8x + 12)$ $y = -x^2 - 8x - 12$ OR $(-2;0): 0 = a(-2)^2 + b(-2) - 12$ $12 = 4a - 2b$ $6 = 2a - b \dots\dots\dots(1)$ and $\frac{-b}{2a} = -4$ $-b = -8a$ $b = 8a \dots\dots(2)$ $6 = 2a - 8a$ $6 = -6a$ $a = -1$ $b = 8(-1) = -8$ $y = -x^2 - 8x - 12$	✓ coordinates of $A(-6;0)$ ✓ substitution ✓ $a = -1$ ✓ answer (4) ✓ substitution ✓ substitution ✓ $a = -1$ ✓ answer (4)



6.3	$FH = -x^2 - 8x - 12 - \left(\frac{1}{2}x + 2\right)$ $= -x^2 - 8x - 12 - \frac{1}{2}x - 2$ $= -x^2 - \frac{17}{2}x - 14$ $\frac{dFH}{dx} = -2x - \frac{17}{2} = 0 \quad \text{or} \quad x = -\frac{b}{2a}$ $-2x = \frac{17}{2} \quad x = -\frac{(-8,5)}{2(-1)}$ $x = -\frac{17}{4} \quad x = -\frac{17}{4}$ $G\left(-\frac{17}{4}; 0\right)$	<p>✓ $f(x) - g(x)$</p> <p>✓ FH ito x</p> <p>✓ method</p> <p>✓ answer (4)</p>
6.4	$-4 < x < 0$ <p>OR</p> $x \in (-4; 0)$	<p>✓ answer</p> <p>✓ inequality (2)</p> <p>✓ -4 and 0</p> <p>✓ inequality (2)</p>
		[12]


QUESTION 7

7.1	$1 + i_{eff} = \left(1 + \frac{i^m}{m}\right)^m$ $1 + 0,113 = \left(1 + \frac{i^4}{4}\right)^4$ $1,027... = 1 + \frac{i^4}{4}$ $0,027... = \frac{i^4}{4}$ $0,1085.. = i^4$ $r = 10,85\%$	<p>✓ substitution</p> <p>✓ 4th root</p> <p>✓ answer (3)</p>
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7.2	$A = 10\,000 \left(1 + \frac{0,053}{12} \right)^{60}$ $A = 13\,026,71$ $F = \frac{500 \left[\left(1 + \frac{0,053}{12} \right)^{58} - 1 \right]}{\frac{0,053}{12}}$ $F = R32\,970,51$ <p>Total = 13 026,71 + 32 970,51 = R45 997,22</p> <p>OR</p> $= 10\,000 \left(1 + \frac{0,053}{12} \right)^{60} + \frac{500 \left[\left(1 + \frac{0,053}{12} \right)^{58} - 1 \right]}{\frac{0,053}{12}}$ $= R45\,997,22$	<p>✓ substitution into the correct formula ✓ $n = 60$ and $i = \frac{0,053}{12}$ ✓ substitution into the F formula ✓ $n = 58$</p> <p>✓ answer (5)</p> <p>✓ substitution into the correct formula ✓ $n = 60$ and $i = \frac{0,053}{12}$ ✓ substitution into the F formula ✓ $n = 58$ ✓ answer (5)</p>
7.3.1	$860\,000 = \frac{7\,200 \left[1 - \left(1 + \frac{0,095}{12} \right)^{-n} \right]}{\frac{0,095}{12}}$ $0,945... = 1 - \left(1 + \frac{0,095}{12} \right)^{-n}$ $-0,054... = - \left(1 + \frac{0,095}{12} \right)^{-n}$ $0,054... = \left(1 + \frac{0,095}{12} \right)^{-n}$ $-n = \log_{(1,007...)} 0,054...$ $-n = -369,212...$ <p>Sam will have 370 installments</p>	<p>✓ substitution into the correct formula ✓ $i = \frac{0,095}{12}$</p> <p>✓ correct use of log</p> <p>✓ answer (4)</p>



7.3.2	<p> $A = 860\,000 \left(1 + \frac{0,095}{12} \right)^{369}$ $A = R15\,782\,859,31$ </p> <p>  $F = \frac{7\,200 \left[\left(1 + \frac{0,095}{12} \right)^{369} - 1 \right]}{\frac{0,095}{12}}$ $F = R15\,781\,334,69$ Balance = R1524,62 (after 369 installments) </p> <p> Last installment = $1524,62 \left(1 + \frac{0,095}{12} \right)^1$ $= R1536,69$ </p> <p>OR</p> <p> $P = \frac{7\,200 \left(1 - \left(1 + \frac{0,095}{12} \right)^{-0,2127679\dots} \right)}{\frac{0,095}{12}}$ $P = R1524,62$ (after 369 installments) </p> <p> Last installment = $1524,62 \left(1 + \frac{0,095}{12} \right)^1$ $= R1536,69$ </p>	<p>✓ loan and interest ✓ $n = 369$</p> <p>✓ payment and interest</p> <p>✓ method</p> <p>✓ answer (5)</p> <p>✓ method ✓ $n = -0,2127679\dots$</p> <p>✓ balance</p> <p>✓ method ✓ answer (5)</p> <p>[17]</p>
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QUESTION 8


8.1	$f(x) = 1 - x^2$ $f(x+h) = 1 - (x+h)^2$ $= 1 - (x^2 + 2xh + h^2)$ $= 1 - x^2 - 2xh - h^2$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{1 - x^2 - 2xh - h^2 - (1 - x^2)}{h}$ $= \lim_{h \rightarrow 0} \frac{-2xh - h^2}{h}$ $= \lim_{h \rightarrow 0} \frac{h(-2x - h)}{h}$ $= \lim_{h \rightarrow 0} (-2x - h)$ $f'(x) = -2x$	$\checkmark = 1 - x^2 - 2xh - h^2$ \checkmark substitution $\checkmark \frac{-2xh - h^2}{h}$ $\checkmark -2x - h$ $\checkmark -2x$ (5)
8.2.1	$D_x \left[3x^2 - \frac{2}{x} \right]$ $D_x [3x^2 - 2x^{-1}]$ $= 6x + 2x^{-2}$	$\checkmark -2x^{-1}$ $\checkmark 6x$ $\checkmark 2x^{-2}$ (3)
8.2.2	$y = \sqrt{x} (\sqrt[3]{x} - 5x)$ $y = x^{\frac{1}{2}} \left(x^{\frac{1}{3}} - 5x \right)$ $y = x^{\frac{5}{6}} - 5x^{\frac{7}{2}}$ $\frac{dy}{dx} = \frac{5}{6} x^{-\frac{1}{6}} - \frac{15}{2} x^{\frac{1}{2}}$	\checkmark change from surd to exponential form $\checkmark x^{\frac{5}{6}}$ and $-5x^{\frac{7}{2}}$ $\checkmark \frac{5}{6} x^{-\frac{1}{6}}$ $\checkmark -\frac{15}{2} x^{\frac{1}{2}}$ (4)
		[12]



QUESTION 9

9.1	$f(x) = ax^3 + bx^2$ $-\frac{1}{3} = a(2)^3 + b(2)^2$ $-\frac{1}{3} = 8a + 4b \dots (1)$  $f'(x) = 3ax^2 + 2bx$ $f'(2) = 3a(2)^2 + 2b(2) = 0$ $12a + 4b = 0$ $4b = -12a$ $b = -3a \dots (2)$ $-\frac{1}{3} = 8a + 4(-3a)$ $-\frac{1}{3} = 8a - 12a$ $-\frac{1}{3} = -4a$ $a = \frac{1}{12}$ $b = -\frac{1}{4}$	<p>✓ substitution $\left(2; -\frac{1}{3}\right)$</p> <p>✓ $f'(x) = 0$</p> <p>✓ substitution $x = 2$</p> <p>✓ solve simultaneously</p> <p>(4)</p>
9.2	$f''(x) = \frac{1}{2}x - \frac{1}{2}$ $\frac{1}{2}x - \frac{1}{2} < 0$ $x < 1 \quad / \quad x \in (-\infty; 1)$	<p>✓ $f''(x)$</p> <p>✓ $f''(x) < 0$</p> <p>✓ answer (3)</p>




9.3	$f(x) = \frac{1}{12}x^3 - \frac{1}{4}x^2$ $f(-2) = \frac{1}{12}(-2)^3 - \frac{1}{4}(-2)^2 = -\frac{5}{3}$  $\left(-2; -\frac{5}{3}\right)$ $m = f'(x) = \frac{1}{4}x^2 - \frac{1}{2}x$ $f'(-2) = \frac{1}{4}(-2)^2 - \frac{1}{2}(-2)$ $m = 2$ $y = 2x + c$ $-\frac{5}{3} = 2(-2) + c$ $c = \frac{7}{3}$ $y = 2x + \frac{7}{3}$	<p>✓ $y = -\frac{5}{3}$</p> <p>✓ gradient</p> <p>✓ substitution of x, y and m</p> <p>✓ answer (4)</p>
9.4	$-\frac{1}{3} < k < 0 \quad / \quad k \in \left(-\frac{1}{3}; 0\right)$	<p>✓✓ answer (2)</p>
[13]		

QUESTION 10

10.1	$\tan 60^\circ = \frac{DF}{x} = \sqrt{3}$ $DF = \sqrt{3}x$ $\therefore \text{Area rectangle} = DF \times DE$ $= \sqrt{3}x(m - 2x)$	<p>✓ $\tan 60^\circ = \sqrt{3}$</p> <p>✓ $DF = \sqrt{3}x$</p> <p>✓ $DE = (m - 2x)$</p> <p>(3)</p>
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10.2	<p>Area = $\sqrt{3}mx - 2\sqrt{3}x^2$</p> <p>$\frac{dA}{dx} = \sqrt{3}m - 4\sqrt{3}x = 0$</p> <p>$x = \frac{m}{4}$</p> <p>Max Area = $\sqrt{3}x(m - 2x)$</p> <p> $= \sqrt{3}\left(\frac{m}{4}\right)\left(m - 2\left(\frac{m}{4}\right)\right)$</p> <p>$= \frac{\sqrt{3}}{8}m^2$</p> <p>OR</p> <p>$\frac{dA}{dx} = \sqrt{3}m - 4\sqrt{3}x = 0$</p> <p>$x = \frac{m}{4}$</p> <p>$\sqrt{3}mx - 2\sqrt{3}(x^2)$</p> <p>$= \sqrt{3}m\left(\frac{m}{4}\right) - 2\sqrt{3}\left(\frac{m}{4}\right)^2$</p> <p>$= \frac{\sqrt{3}m^2}{4} - \frac{\sqrt{3}m^2}{8}$</p> <p>$= \frac{2\sqrt{3}m^2 - \sqrt{3}m^2}{8}$</p> <p>$= \frac{\sqrt{3}m^2}{8}$</p>	<p>✓ $f'(x) = 0$</p> <p>✓ $x = \frac{m}{4}$</p> <p>✓ substitution</p> <p>✓ $\frac{\sqrt{3}}{8}m^2$ (4)</p> <p>✓ $f'(x) = 0$</p> <p>✓ $x = \frac{m}{4}$</p> <p>✓ substitution</p> <p>✓ $\frac{\sqrt{3}}{8}m^2$ (4)</p>
		[7]



QUESTION 11

11.1.1	$P(A \text{ and } C) = 0$	✓ answer (1)
11.1.2	$P(A \text{ and } B) = P(A) \times P(B)$ $P(A \text{ and } B) = 0,3 \times 0,43$ $P(A \text{ and } B) = 0,129$ $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$ $P(A \text{ or } B) = 0,3 + 0,43 - 0,129$ $P(A \text{ or } B) = 0,6$	✓ $P(A \text{ and } B) = 0,129$ ✓ substitution ✓ answer (3)
11.2.1	$P(G \text{ and } T) = \frac{105}{250} = \frac{21}{50} = 42\%$	✓ answer (1)
11.2.2	Independent: $P(T \text{ and } G) = P(T) \times P(G)$ $P(T) \times P(G)$ $P(G \text{ and } T)$ $= \frac{173}{250} \times \frac{130}{250}$ $= \frac{105}{250}$ $= 0,36$ $= 0,42$ $P(G \text{ and } T) \neq P(G) \times P(T)$ Events are not independent.	✓ $P(T) = \frac{173}{250}$ ✓ $P(G) = \frac{130}{250}$ ✓ $P(T) \times P(G) = 0,36$ ✓ answer (4)
11.3.1	12!	✓ answer (1)
11.3.2	Pieter and John next to one another = 10!2! $11! - 10!2!$ $= 32\,659\,200$	✓ 10!2! ✓ $11! - 10!2!$ ✓ answer (3)
11.3.3	$\frac{11!2!}{12!}$ $= \frac{1}{6}$	✓ 11! 2! ✓ 12! ✓ answer (3)
		[16]
	TOTAL:	150

