education

Department of
Education
FREE STATE PROVINCE

PREPARATORY EXAMINATION
VOORBEREIDENDE EKSAMEN

GRADE/*GRAAD* 12

MATHEMATICS P1
WISKUNDE V1

SEPTEMBER 2021

MARKS/*PUNTE*: 150

MARKING GUIDELINES
NASIENRIGLYNE

These marking guidelines consists of 19 pages.
Hierdie nasienriglyne bestaan uit 19 bladsye.

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Please turn over/*Blaai om asseblief*

NOTE:

- If a candidate answered a question TWICE, mark only the FIRST attempt.
- If a candidate has crossed out an attempt to answer a question and did not redo it, mark the crossed-out version.
- Consistent accuracy applies in ALL aspects of the marking memorandum. Stop marking at the second calculation error.
- Assuming answers/values in order to solve a problem is NOT acceptable.

NOTA:

- *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. Hou op nasien by die tweede berekeningsfout.*
- *Om antwoorde/waardes te aanvaar om 'n probleem op te los, word NIE toegelaat NIE.*

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QUESTION/*VRAAG* 1

1.1.1	$x^2-4x-21=0$ $(x-7)(x+3)=0$ $x=7$ *or/of* $x=-3$	✓ factors ✓ $x=7$ ✓ $x=-3$ (3)
1.1.2	$x(5x-1)=3$ $5x^2-x-3=0$ $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$ $x=\frac{-(-1)\pm\sqrt{(-1)^2-4(5)(-3)}}{2(5)}$ $=\frac{1\pm\sqrt{61}}{10}$ $x=0{,}88$ or/*of* $x=-0.68$ **OR/*OF*** $5x^2-x-3=0$ $x^2-\frac{1}{5}x+\frac{1}{100}=\frac{3}{5}+\frac{1}{100}$ $\left(x-\frac{1}{10}\right)^2=\frac{61}{100}$ $x-\frac{1}{10}=\frac{\pm\sqrt{61}}{10}$ $x=\frac{1\pm\sqrt{61}}{10}$ $x=0{,}88$ *or/of* $x=-0{,}638$	✓ standard form ✓ substitution into correct formula ✓ $x=0{,}88$ ✓ $x=-0.68$ (4) **OR/*OF*** ✓ standard form ✓ $x^2-\frac{1}{5}x+\frac{1}{100}=\frac{3}{5}+\frac{1}{100}$ ✓ $x=0{,}88$ ✓ $x=-0.68$ (4)
1.1.3	$2x^2-9x+4\geq 0$ $(2x-1)(x-4)\geq 0$ $x\leq\frac{1}{2}$ *or/of* $x\geq 4$	✓ factors ✓✓ answers (**combo marks**) (3)
1.1.4	$3^{x+1}-3^{x-1}-24=0$ $3^x(3-3^{-1})=24$ $3^x\left(\frac{8}{3}\right)=24$ $3^x=3^2$ $\therefore\ x=2$	✓ $3^x(3-3^{-1})=24$ ✓ $3^x\left(\frac{8}{3}\right)=24$ ✓ $3^x=3^2$ ✓ answer (4)

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1.2	$y + 2x = 2$ and/en $y^2 - 3yx = -2x^2$ $y = 2 - 2x$ $y^2 - 3yx = -2x^2$ $(2-2x)^2 - 3x(2-2x) = -2x^2$ $4 - 8x + 4x^2 - 6x + 6x^2 = -2x^2$ $12x^2 - 14x + 4 = 0$ $6x^2 - 7x + 2 = 0$ $(3x-2)(2x-1) = 0$ $\therefore\ x = \frac{2}{3}$ *or/of* $x = \frac{1}{2}$ $\therefore\ y = 2 - 2\left(\frac{2}{3}\right)$ *or/of* $y = 2 - 2\left(\frac{1}{2}\right)$ $y = \frac{2}{3}$ $y = 1$	✓ $y = 2 - 2x$ ✓ substitution ✓ standard form ✓ both x values ✓ both y values (5)
1.3	$\left(\sqrt[4]{\sqrt{20} - \sqrt{D_x(4x)}}\right)\left(\sqrt[4]{\sqrt{20} + \sqrt{D_x(4x)}}\right)$ $= \left(\sqrt[4]{\sqrt{20} - \sqrt{4}}\right)\left(\sqrt[4]{\sqrt{20} + \sqrt{4}}\right)$ $= \left(\sqrt[4]{\sqrt{20} - 2}\right)\left(\sqrt[4]{\sqrt{20} + 2}\right)$ $= \sqrt[4]{20 - 4}$ $= \sqrt[4]{16}$ $= 2$	✓ $\left(\sqrt[4]{\sqrt{20} - \sqrt{4}}\right)\left(\sqrt[4]{\sqrt{20} + \sqrt{4}}\right)$ ✓ $\left(\sqrt[4]{\sqrt{20} - 2}\right)\left(\sqrt[4]{\sqrt{20} + 2}\right)$ ✓ $\sqrt[4]{20 - 4}$ ✓ answer (4)
		[23]

QUESTION/*VRAAG* 2

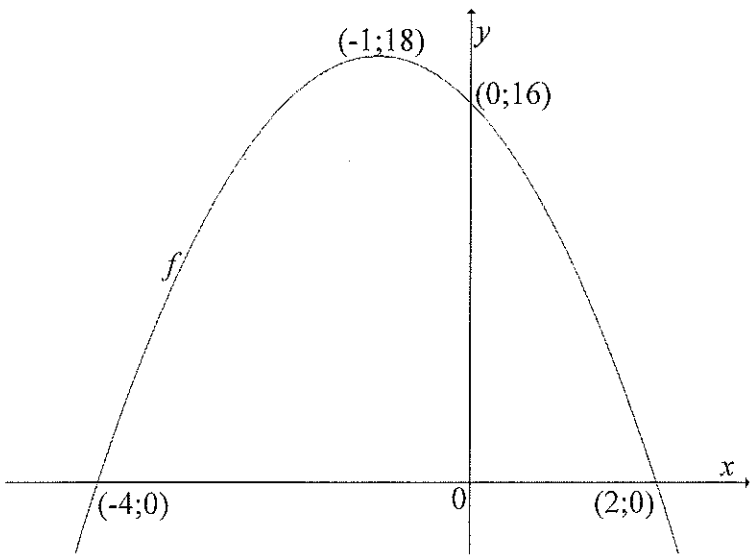
2.1.1	-22; -12; -6; -4; ... 10 6 2 -2 - 4 - 4 - 4 The next two terms are/*die volgende twee terme is* -6 and/*en* -12	✓ -6 ✓ -10 (2)
2.1.2	$2a=-4 \quad 3(-2)+b=10 \quad -2+16+c=-22$ $\therefore a=-2 \quad \therefore \ b=16 \quad \therefore \ c=-36$ $\therefore \ T_n=-2n^2+16n-36$ Answer only: Full marks/ *Slegs antwoord: Volpunte*	✓ $a=-2$ ✓ $b=16$ ✓ $c=-36$ ✓ $T_n=-2n^2+16n-36$ (4)
2.1.3	$\therefore \ T_n=-2n^2+16n-36$ $n=-\frac{b}{2a}$ $=-\frac{16}{2(-2)}$ $n=4$ Answer only: Full marks/ *Slegs antwoord: Volpunte* **OR/*OF*** $T'_n=-4n+16$ $0=-4n+16$ $\therefore \ n=4$	✓ substitution ✓ answer (2) **OR/*OF*** ✓ $0=-4n+16$ ✓ answer (2)
2.2.1	$d=-6$	✓ answer (1)
2.2.2	$T_n=27-6(n+1)$ $-117=27-6(n+1)$ $6n=138$ $\therefore \ n=23$	✓ $-117=27-6(n+1)$ ✓ answer (2)
2.3.1	$5+9+13+....$ $S_n=\frac{n}{2}[2a+(n-1)d]$ $S_n=\frac{n}{2}[2(5)+(n-1)4]$ $=\frac{n}{2}[10+4n-4]$ $S_n=2n^2+3n$	✓Substitution into the correct formula ✓ answer (2)

2.3.2	$S_n = 2n^2 + 3n$ $\therefore S_{n-6} = 2(n-6)^2 + 3(n-6)$ $= 2n^2 - 24n + 72 + 3n - 18$ $= 2n^2 - 21n + 54$ **OR/OF** $S_{n-6} = S_n - 906$ $= 2n^2 + 3n - 906$	✓ $S_{n-6} = 2(n-6)^2 + 3(n-6)$ ✓ $S_{n-6} = 2n^2 - 21n + 54$ (2) **OR/OF** ✓ $S_{n-6} = S_n - 906$ ✓ $S_{n-6} = 2n^2 + 3n - 906$ (2)
2.3.3	$906 = S_n - S_{n-6}$ $906 = 2n^2 + 3n - (2n^2 - 21n + 54)$ $906 = 24n - 54$ $960 = 24n$ $\therefore n = 40$	✓ setting up the equation ✓ substitution ✓ simplification ($960 = 24n$) ✓ answer (4)
		[19]

QUESTION/*VRAAG* 3

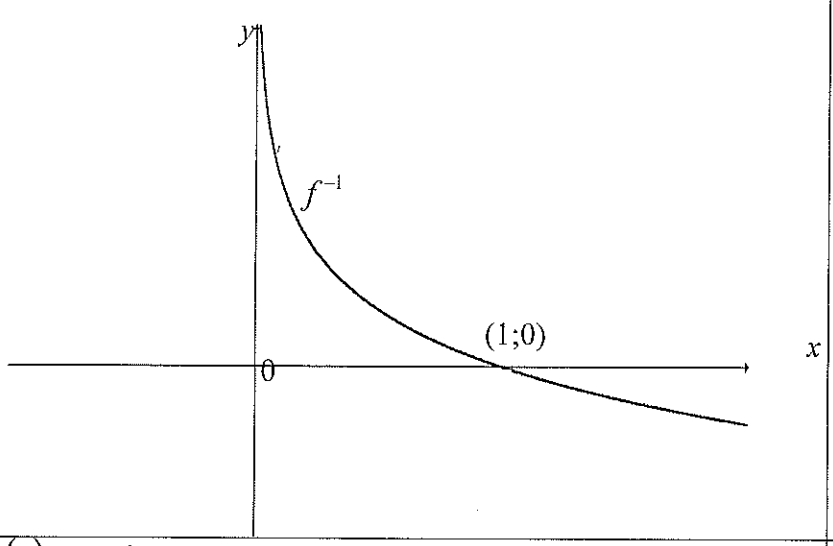
3.1	$T_n > \frac{3}{16384}$ $ar^{n-1} > \frac{3}{16384}$ $3\left(\frac{1}{2}\right)^{n-1} > \frac{3}{16384}$ $\left(\frac{1}{2}\right)^{n-1} > \left(\frac{1}{2}\right)^{14}$ or/of $2^{-n+1} > 2^{-14}$ $\therefore n-1<14$ $\therefore -n+1>-14$ $n<15$ $n<15$ $\therefore n=14$ $\therefore n=14$ **OR/*OF*** 1; 2; 4; … $ar^{n-1}<16384$ $1.2^{n-1}<16384$ $2^{n-1}<2^{14}$ $\therefore n-1<14$ $n<15$ $\therefore n=14$	✓ substituting into the correct formula ✓ method/same base ✓ calculating n ✓ answer (4) ✓ substituting into the correct formula ✓ method/$2^{n-1}<2^{14}$ ✓ calculating n ✓ answer (4)
3.2	$\sum_{n=1}^{30} 3\left(\frac{1}{2}\right)^{n-1} = 3+\frac{3}{2}+\frac{3}{4}+\ldots$ $\sum_{k=1}^{\infty} 27p^k = 27p+27p^2+27p^3+\ldots$ $\frac{a}{1-r} = \frac{a(1-r^n)}{1-r}$ $\frac{27p}{1-p} = \frac{3\left(1-\left(\frac{1}{2}\right)^{30}\right)}{1-\frac{1}{2}}$ $\frac{27p}{1-p} = 6$ $27p = 6-6p$ $\therefore p = \frac{2}{11}$	✓ Both expansions ✓ Substitution into S_∞ formula ✓ Substitution into S_n formula ✓ simplification: $\frac{27p}{1-p}=6$ ✓ answer (5)
		[9]

QUESTION/*VRAAG* 4

4.1	Y-intercept/*-snypunt*: $(0;16)$	✓ y intercept: $(0;16)$ (1)
4.2	X-intercept/*-snypunt*: $0 = -2x^2 - 4x + 16$ $0 = x^2 + 2x - 8$ $0 = (x+4)(x-2)$ $\therefore \quad x = -4 \quad or/of \quad x = 2$	✓ $y = 0$ ✓ both x values (2)
4.3	$x = -\frac{b}{2a}$ $x = -\frac{(-4)}{2(-2)} = -1$ $f(-1) = -2(-1)^2 - 4(-1) + 16$ $f(-1) = 18$ Turning point/*draaipunt*:$(-1;18)$ **OR/OF** $f'(x) = 2x + 2$ $0 = 2x + 2$ $\therefore \quad x = -1$ $f(-1) = -2(-1)^2 - 4(-1) + 16$ $f(-1) = 18$ Turning point/*draaipunt*:$(-1;18)$	✓ method ✓ $x = -1$ ✓ Turning point $:(-1;18)$ (3) **OR/OF** ✓ method ✓ $x = -1$ ✓ Turning point $:(-1;18)$ (3)
4.4		✓ shape ✓ x and y intercepts ✓ turning point (3)

4.5	Range/*waardeversameling*: $y \in (-\infty;18]$ **OR/OF** $y \leq 18$	✓✓ answer (2) **OR/OF** ✓✓ answer (2)
		[11]

QUESTION/*VRAAG* 5

5.1	$f(x)=\left(\frac{1}{2}\right)^x$ $x=\left(\frac{1}{2}\right)^y$ $\therefore\ y=\log_{\frac{1}{2}} x$	✓ $x=\left(\frac{1}{2}\right)^y$ ✓ answer (2)
5.2	$x \in R, x>0$ or/of $x \in (0;\infty)$	✓ answer (1)
5.3		✓ shape and asymptote $x=0$ ✓ x intercept (2)
5.4	$h(x)=x+3$ $1=x+3$ $\therefore\ x=-2$ $B(-2;1)$	✓ Substitution: $1=x+3$ ✓ answer: $B(-2;1)$ (2)
5.5	$g(x)=\frac{a}{x+2}+1$ $0=\frac{a}{0+2}+1$ $-1=\frac{a}{2}$ $\therefore\ a=-2$ $g(x)=\frac{-2}{x+2}+1$	✓ substitute $p=2$ and $q=1$ ✓ substitute $(0;0)$ ✓ $a=-2$ ✓ answer: $g(x)=\frac{-2}{x+2}+1$ (4)
5.6	$k(x)=\frac{-2}{x-1}+2$	✓ $+2$ ✓ -1 (2)
5.7.1	$-2<x\leq 0$	✓ critical values ✓ notation (2)

5.7.2	$x \in R; x \neq -2$	✓ ✓ answer (2)
		[17]

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QUESTION/*VRAAG* 6

6.1	One x value is associated with two y values/*Een x-waarde word met twee y-waardes geassosieer.* **OR/OF** Vertical line test cuts the graph twice/*Vertikale lyntoets sny die grafiek twee keer.*	✓✓ answer **OR/OF** ✓✓ answer (2)
6.2	$x \leq 0 \quad or/of \quad x \geq 0$	✓ $x \leq 0$ ✓ $x \geq 0$ (2)
6.3	$y = \sqrt{\frac{x}{2}}$ $x = \sqrt{\frac{y}{2}}$ $x^2 = \frac{y}{2}$ $y = 2x^2$ $\therefore \quad \frac{dy}{dx} = 4x$	✓ $x = \sqrt{\frac{y}{2}}$ ✓ $y = 2x^2$ ✓ $\frac{dy}{dx} = 4x$ (3)
		[7]

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QUESTION/*VRAAG* 7

7.1	$1+i_{eff}=\left(1+\frac{i_{nom}}{n}\right)^n$ $1+i_{eff}=\left(1+\frac{0,12}{2}\right)^2$ $\therefore \quad i_{eff}=12,36\%$	✓ substitution into the correct formula ✓ answer (2)
7.2	$A=P(1-i)^n$ $\frac{P}{2}=P(1-0,07)^n$ $\frac{1}{2}=(0,93)^n$ $n=log_{0,93}\frac{1}{2}$ $\therefore \ n=9,55$ years/*jare*	✓ substitution into the correct formula ✓ correct use of logs ✓ answer (3)
7.3.1	$A=P(1+i)^n$ $A=R250\ 000\left(1+\frac{0,095}{4}\right)^{48}$ $A=R771\ 343,67$	✓ $i=\frac{0,095}{4}$ and $n=48$ ✓ substitution into the correct formula ✓ answer (3)
7.3.2	Home loan/*Huislening* $=R2\ 920\ 000-R771\ 343,67$ $=R2\ 148\ 656,33$	✓ answer (1)
7.3.3	$i=\frac{0,103}{12}$ and/en $n=240$ $P=\frac{x\left[1-(1+i)^{-n}\right]}{i}$ $R2\ 148\ 656,33=\frac{x\left[1-\left(1+\frac{0,103}{12}\right)^{-240}\right]}{\frac{0,103}{12}}$ $\therefore \quad x=R21\ 163,87$ **OR/*OF*** $F=\frac{x\left[(1+i)^n-1\right]}{i}$ $R2\ 148\ 656,33\left(1+\frac{0,103}{12}\right)^{240}=\frac{x\left[\left(1+\frac{0,103}{12}\right)^{240}-1\right]}{\frac{0,103}{12}}$ $\therefore \quad x=R21\ 163,87$	✓ $i=\frac{0,103}{12}$ and $n=240$ ✓ substitution into the correct formula ✓ answer (3) **OR/*OF*** ✓ $i=\frac{0,103}{12}$ and $n=240$ ✓ substitution into the correct formula ✓ answer (3)

7.3.4	Interest/*Rente* = R21 163,87 × 240 −R2 148 656,33 = R2 930 672,47	✓ method ✓ answer (2)
		[14]

QUESTION/*VRAAG* 8

8.1	$f(x) = -\frac{3}{x}$ $f'(x) = \lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$ $= \lim_{h\to 0}\frac{-\frac{3}{x+h}-\left(-\frac{3}{x}\right)}{h}$ $= \lim_{h\to 0}\frac{-3x+3(x+h)}{x(x+h)}\div h$ $= \lim_{h\to 0}\frac{3h}{x^2+xh}\times\frac{1}{h}$ $= \frac{3}{x^2}$	✓ substitution: $\frac{-\frac{3}{x+h}-\left(-\frac{3}{x}\right)}{h}$ ✓ expression with LCD: $\lim_{h\to 0}\frac{-3x+3(x+h)}{x(x+h)}\div h$ ✓ simplify: $\lim_{h\to 0}\frac{3h}{x^2+xh}\times\frac{1}{h}$ ✓ answer (4)
8.2.1	$D_x\left[(3x^3-2)^2\right]$ $= D_x\left[9x^6-12x^3+4\right]$ $= 54x^5-36x^2$	✓ expansion ✓ $54x^5$ ✓ $-36x^2$ (3)
8.2.2	$y = 2x^3-\frac{4}{x}+4\sqrt[3]{x}$ $y = 2x^3-4x^{-1}+4x^{\frac{1}{3}}$ $\frac{dy}{dx} = 6x^2+4x^{-2}+\frac{4}{3}x^{-\frac{2}{3}}$	✓ $4x^{\frac{1}{3}}$ ✓ $6x^2$ ✓ $+4x^{-2}$ ✓ $+\frac{4}{3}x^{-\frac{2}{3}}$ (4)

8.3	$y=-2x+\frac{4}{3}$ $\therefore \quad m=-2$ Gradient of tangent/*Gradiënt van raaklyn*: $f'(x)=\frac{1}{2}$ $y=2(1-x)^2=2x^2-4x+2$ $4x-4=\frac{1}{2}$ $\therefore \quad x=\frac{9}{8}$ $\therefore \quad y=\frac{1}{32}$ Coordinates/*Koördinate*: $\left(\frac{9}{8};\frac{1}{32}\right)$	✓ gradient of tangent: $f'(x)=\frac{1}{2}$ ✓ $4x-4=\frac{1}{2}$ ✓ x value ✓ coordinates: $\left(\frac{9}{8};\frac{1}{32}\right)$ (4)
		[15]

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QUESTION/*VRAAG* 9

9.1	$y = a(x-1)^2(x-3)$ $6 = a(0-1)^2(0-3)$ $6 = -3a$ $\therefore\ a = -2$ $y = -2(x-1)^2(x-3)$ $y = -2(x^2-2x+1)(x-3)$ $y = -2(x^3-5x^2+7x-3)$ $y = -2x^3+10x^2-14x+6$ $\therefore\ a=-2;\ b=10;\ c=-14$ and/*en* $d=6$	✓ subst. $x_1 = 1$ and/en $x_2 = 3$ ✓ subst. $A(0;6)$ ✓ $-3a = 6$ ✓ $y=-2(x-1)^2(x-3)$ ✓ $y=-2(x^3-5x^2+7x-3)$ (5)
9.2	$y = -2x^3+10x^2-14x+6$ $f'(x)=-6x^2+20x-14$ $f''(x)=-12x+20$ $0=-12x+20$ $\therefore\ x=\frac{20}{12}=\frac{5}{3}$	✓ $f'(x) = -6x^2+20x-14$ ✓ $f''(x)=0$ ✓ answer (3)
9.3.1	$f'(x)=-6x^2+20x-14$ $0=-6x^2+20x-14$ $0=3x^2-10x+7$ $0=(x-1)(3x-7)$ $x=1$ or $x=\frac{7}{3}$ $1<x<\frac{7}{3}$ Accept/*Aanvaar*: $1\le x\le\frac{7}{3}$	✓ $f'(x)=0$ ✓ factors ✓ both x values ✓✓ answer (**combo mark**) (5)
9.3.2	Turning point/*Draaipunt* $C\left(\frac{7}{3};\frac{64}{27}\right)$ $\therefore\ 0<k<\frac{64}{27}$	✓ $C\left(\frac{7}{3};\frac{64}{27}\right)$ ✓✓ answer (**combo mark**) (3)
		[16]

QUESTION/*VRAAG* 10

10.1	Length/*Lengte* 2BC = 100-3x Length/*Lengte* BC $= \dfrac{100-3x}{2}$ $= 50-\dfrac{3}{2}x$ Area/*Oppervlakte* = AB.BC $A(x) = x\left(50-\dfrac{3}{2}x\right)$ $= 50x-\dfrac{3}{2}x^2$	✓ $2BC = 100-3x$ ✓ Substitution in the area formula. (2)
10.2	$A'(x) = 50-3x$ $0 = 50-3x$ $\therefore \quad x = \dfrac{50}{3}m$ $AB = \dfrac{50}{3}m$	✓ $A'(x) = 50-3x$ ✓ $A'(x) = 0$ ✓ $x = \dfrac{50}{3}$ (3)
		[5]

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QUESTION/*VRAAG* 11

11.1.1	P(female and green eyes)/*vrou met groen oë* $= \frac{147}{540} = \frac{49}{180} = 0,27$	✓ answer (1)
11.1.2	For independent events/*Vir onafhanklike gebeure*: P(female and green eyes/*vroulik en groen oë*) = P(female/*vroulik*) x P(green eyes/*groen oë*) P(female and green eyes/*vroulik en groen oë*) = 0,27 P(female/*vrou/lik*) x P(green eyes/*groen oë*) = $\frac{240}{540} \times \frac{330}{540} = \frac{22}{81} = 0,27$ ∴ The events are independent, and the learner is correct/*Die gebeure is onafhanklik, en die leerder is reg.* **OR/*OF*** For independent events/*Vir onafhanklike gebeure*: P(male and green eyes/*manlik en groen oë*) = P(male/*manlik*) x P(green eyes/*groen oë*) P(male and green eyes/*manlik en groen oë*)) $= \frac{183}{540} = \frac{61}{180} = 0,34$ P(male/*manlik*)) x P(green eyes/*groen oë*) $= \frac{300}{540} \times \frac{330}{540} = \frac{55}{162} = 0,34$ ∴ The events are independent, and the learner is correct/*Die gebeure is onafhanklik, en die leerder is reg.*	✓ rule for independent events ✓ P(female and green eyes) = 0,27 ✓ $\frac{240}{540} \times \frac{330}{540} = \frac{22}{81} = 0,27$ ✓ conclusion (4) **OR/*OF*** ✓ rule for independent events ✓ P(male and green eyes) = 0,34 ✓ $= \frac{300}{540} \times \frac{330}{540} = \frac{55}{162} = 0,34$ ✓ conclusion (4)
11.2	$P(E \text{ and / en } F) = P(E) \times P(F)$ $\frac{1}{3} = x \times y$ $xy = \frac{1}{3}$ $P(E \text{ or / of } F) = P(E) + P(F) - P(E \text{ and / en } F)$ $\frac{9}{10} = x + y - \frac{1}{3}$ $\frac{9}{10} = \frac{1}{3y} + y - \frac{1}{3}$ $27y = 10 + 30y^2 - 10y$ $37y = 30y^2 + 10$	✓ $xy = \frac{1}{3}$ ✓ $\frac{9}{10} = x + y - \frac{1}{3}$ ✓ $\frac{9}{10} = \frac{1}{3y} + y - \frac{1}{3}$ (3)
11.3.1	13! = 6227020800	✓✓ answer (2)
11.3.2	7! × 5! × 1! = 604 800	✓ 7! ✓ 5!

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		✓ 1! ✓ 604 800 (4)
		[14]

TOTAL/*TOTAAL*: 150

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