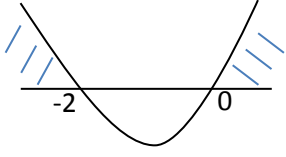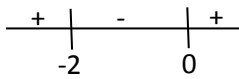## SEPTEMBER 2015 MATHEMATICS P1 MEMORANDUM

GENERAL GUIDELINES FOR MARKING
- If a learner makes more than one attempt at answering a question and does not cancel any of them out, only the first attempt will be marked irrespective of which of the attempt(s) may be the correct answer.
- Consistent Accuracy(CA) marking regarding calculations will be followed in the following cases:
  - Sub-question to sub-question: When a certain variable is incorrectly calculated in one sub-question and needs to be substituted into another sub-question full marks can be awarded for the subsequent sub-questions provided the methods used are correct and the calculations are correct.
- Assuming values/answers in order to solve a problem is unacceptable.

QUESTION/*VRAAG* 1

Q#	SUGGESTED ANSWER(S)	DESCRIPTOR(S)	
1.1.1	$x(x + 2) = 0$ $x = 0$ OR/OF $x = -2$	✓ $x = 0$ ✓ x $= -2$	(2)
1.1.2	$x^2 + 2x \geq 0$ $x(x + 2) \geq 0$ OR/OF $\therefore x > 0$	✓ $x^2 + 2x \geq 0$ ✓ graph/grafiek/ critical pts ✓ $x > 0$ If $x \geq 0$ only 1 mark Indien $x \geq 0$ slegs 1 punt	(3)
1.2	$x = \dfrac{-(-3) \pm \sqrt{(-3)^2 - 4(2)(-7)}}{2(2)}$ $= \dfrac{3 \pm \sqrt{65}}{4}$ $x = 2,77 \quad OR/OF \quad x = -1,27$	✓ substitution into correct formula/ *substitusie in korrekte formule* ✓ simplify ✓ 2,77 ✓ -1,27 If left in surd form only 2 marks. Indien in wortelvorm, slegs 2 punte.	(4)
1.3.1	$k^2 + 5k - 14 = 0$ $(k - 2)(k + 7) = 0$ $k = 2$ or $k = -7$	✓ multiplying ✓ factorising ✓ both solutions	(3)
1.3.2	$\sqrt{x+5} = 2$ or $\sqrt{x+5} = -7$ $x + 5 = 4$ or invalid/ no solution $x = -1$	✓ substitution ✓ identifying invalid ✓ value of x	(3)

1.4	$x - 2y - 3 = 0$ .... (1)		
	$4x^2 - 5xy + y^2 = 0$ ..... (2)		
	From eq (1): $x = 2y + 3$ ...(3)	✓ equation (3)	
	Subst. (3) into (2):		
	$\therefore 4(2y + 3)^2 - 5y(2y + 3) + y^2 = 0$	✓ substitution	
	$\therefore 4(4y^2 + 12y + 9) - 5y(2y + 3) + y^2 = 0$	✓ simplification	
	$\therefore 16y^2 + 48y + 36 - 10y^2 - 15y + y^2 = 0$		
	$\therefore 7y^2 + 33y + 36 = 0$	✓ standard form	
	$\therefore (7y + 12)(y + 3) = 0$	✓ factors	
	$\therefore y = \dfrac{-12}{7}$ or $y = -3$	✓ both y values	
	$\therefore x = \dfrac{-3}{7}$ or $x = -3$	✓ both x-values	(7)
1.5	For real roots :		
	$4 - 20k \geq 0$	✓ $4 - 20k \geq 0$	
	$\therefore -20k \geq -4$		
	$\therefore k \leq \dfrac{1}{5}$	✓ Answer	(2)
			[24]

QUESTION/ VRAAG 2

2.1.1	$3 + (n - 1)(2) = 71$	✓ $a = 3$ en/and $d = 2$	
	$2n - 2 = 68$	✓ 35	
	$2n = 70$		
	$n = 35$		
	The 35th term is equal to 71/Die 35ste term is gelyk aan 71		(2)
2.1.2	$S_{40} = \dfrac{40}{2}[2(3) + 39(2)] = 1680$	✓ substitusie/ substitution	
		✓ 1680	(2)
2.2	$\dfrac{1}{2} + \dfrac{1}{4} + \dfrac{1}{8} + \cdots. 19$ terme/terms	✓ vorming van reeks/generating series	
	MR/GS: $a = \frac{1}{2}$; $r = \frac{1}{2}$; $n = 19$	✓ $a = \frac{1}{2}$; $r = \frac{1}{2}$; $n = 19$	
	$S_{19} = \dfrac{\frac{1}{2}\left(1 - \frac{1}{2}^{19}\right)}{1 - \frac{1}{2}} = \dfrac{\frac{1}{2}\left(1 - \frac{1}{524288}\right)}{\frac{1}{2}} = \dfrac{524287}{524288} < 1$	✓ substitusie/substitution	
		✓ $\dfrac{524287}{524288}$	
	JA/YES all will fit into 1st tank	✓ $\dfrac{524287}{524288} < 1$ JA/YES	(5)

2.3	$2^x + 2.2^x + 3.2^x + 4.2^x \dots + 15.2^x$ $a = 2^x$ en/and $d = 2^x$ $S_n = \dfrac{15}{2}[2^x + 15.2^x]$ $\therefore S_n = \dfrac{15}{2}[16.2^x]$ $\therefore S_n = 15[8.2^x]$ $\therefore S_n = 15[2^3.2^x]$ $\therefore S_n = 15.2^{x+3}$	✓ vorming van reeks/ generating series ✓ $a = 2^x$ en/and $d = 2^x$ ✓ $S_n = \dfrac{15}{2}[2^x + 15.2^x]$ ✓ $S_n = 15.2^{x+3}$	(4)
			[13]

QUESTION/ VRAAG 3

3.1	$-3; 4; x; 30; \dots$ $7; x-4; 30-x$ (Eerste verskil/First difference) $x-11; 34-2x$ (Tweede verskil/Second difference) $x - 11 = 34 - 2x$ $3x = 45$ $x = 15$	✓ Eerste verskil/First difference ✓ Tweede verskil/Second difference ✓ $x - 11 = 34 - 2x$ ✓ $x = 15$	(4)
3.2.1	$r = \dfrac{x-1}{2}$ $-1 < \dfrac{x-1}{2} < 1$ $-2 < x - 1 < 2$ $-1 < x < 3$	✓ $r = \dfrac{x-1}{2}$ ✓ $-1 < \dfrac{x-1}{2} < 1$ ✓ $-1 < x < 3$	(3)
3.2.2	$a = \dfrac{3}{4}; r = \dfrac{x-1}{2} \therefore r = \dfrac{\frac{3}{4}-1}{2} \therefore r = -\dfrac{1}{8}$ $S_\infty = \dfrac{\frac{3}{4}}{1-\left(-\frac{1}{8}\right)} = \dfrac{2}{3}$	✓ $a = \dfrac{3}{4}$ ✓ $r = -\dfrac{1}{8}$ ✓ $S_\infty = \dfrac{\frac{3}{4}}{1-\left(-\frac{1}{8}\right)}$ ✓ $S_\infty = \dfrac{2}{3}$	(4)
			[11]

QUESTION/ VRAAG 4

4.1	R(-2; 4)	✓ -2 ✓ 4	(2)
4.2	B(-4; 0) through symmetry ∴ AB = 4 units OR roots: $(x+2)^2 = 4$ OR $-x^2 - 4x = 0$ ∴ $x + 2 = \pm 2$ $x(x+ 4) = 0$ ∴ $x = 0$ or -4 ∴ AB = 4 units	✓ -4 ✓ 4 units	(2)
4.3	$m = -2$ eqn: $y = -2x$	✓ $m = -2$ ✓ eqn	(2)
4.4	$x < -2$ OR $x > 0$	✓ $x < -2$ ✓ $x > 0$	(2)
4.5	$h(x) = f(-x) = -(-x + 2)^2 + 4$ sym- axis: $x = 2$	✓ h(x) ✓ $x = 2$ Answer Only = FULL marks	(2)
4.6	$p(x) = -f(x) = (x + 2)^2 - 4$ range: $y \geq -4$; $y \in R$ OR $[-4; \infty)$	✓ p(x) ✓ $y \geq -4$ Answer Only = FULL marks	(2)
			[12]

QUESTION/ VRAAG 5

5.1	$x = 2$; $y = 1$	✓ $x = 2$ ✓ $y = 1$	(2)
5.2	y-int: $y = 0$; x-int: $\frac{2}{x-2} = -1$ ∴ $x - 2 = -2$ ∴ $x = 0$	✓ $y = 0$ ✓ $\frac{2}{x-2} = -1$ ✓ $x = 0$	(3)
5.3		✓ asymptotes ✓ x/y intercept ✓ shape	(3)
5.4	$x \in R; x \neq 2$	✓ $x \in R$ ✓ $x \neq 2$	(2)

5.5	Graph shifts(translates) 3 units to the left	✓ 3 units to the left	(2)
5.6	$y = -x + c$ $subst.\,(2;1): 1 = -2 + c \Rightarrow c = 3$ $\therefore y = -x + 3$	✓ $m = -1$ ✓ $c = 3$	(2)
			[14]

QUESTION/ VRAAG 6

6.1.1	A(0; 1)	✓ Answer	(1)
6.1.2	$f^{1}: y = \log_3 x$	✓ $y = \log_3 x$	(1)
6.1.3	$0 < x \le 1$	✓ endpoints ✓ notation	(2)
6.1.4	$y = 0$	✓ $y = 0$	(1)

6.2.1	$f(x) = \sqrt{\dfrac{x}{a}}$ OR $f^{-1}(x) = ax^2$
	
	 $(8;2):\ 2 = \sqrt{\dfrac{8}{a}} \Rightarrow a = 2$ $(2;8):\ 8 = a(2)^2 \Rightarrow a = 2$
	
	 $\therefore f(x) = \sqrt{\dfrac{x}{2}}$ $\therefore f^{-1}(x) = 2x^2$
	          $f(x):\ x = 2y^2$
	          $y = \sqrt{\dfrac{x}{2}}$
		✓ $a = 2$
		
		 ✓ eqn
			(2)

6.2.2	$f^{-1}(x) = ax^2$ $(2;8):\ 8 = a(2)^2 \Rightarrow a = 2$ $\therefore f^{-1}(x) = 2x^2$	✓ eqn	(1)
6.2.3	$(-3; -1)$	✓ each value	(2)
			[10]

QUESTION/*VRAAG* 7
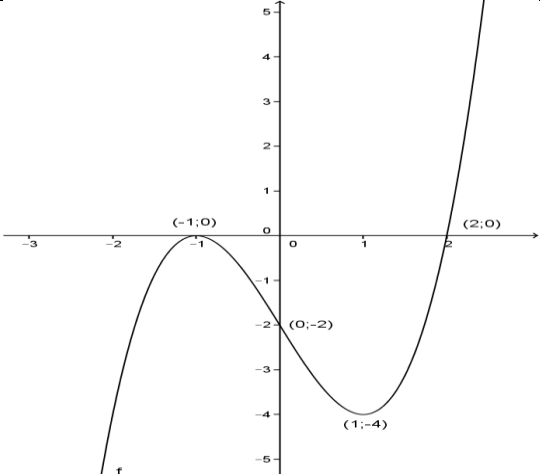
7.1	$A = P(1 + i)^n$ $30\,440 = 12\,500\left(1 + \dfrac{0{,}09}{4}\right)^{4k}$ $\dfrac{1522}{625} = \left(\dfrac{409}{400}\right)^{4k}$ OR $2{,}4352 = (1{,}0225)^{4k}$ $\therefore 4k = \log_{1,0225} 2{,}4352$ $\therefore 4k = 40{,}0002\ ...$ $\therefore k = 10$ years	✓ substitution into correct formula/*substitusie in korrekte formule(A and/en P)* ✓ $i = \dfrac{0{,}09}{4}$ OR $\dfrac{9}{400}$ ✓ $\therefore 4k = \log_{1,0225} 2{,}4352$ ✓ answer/*antwoord*	(4)

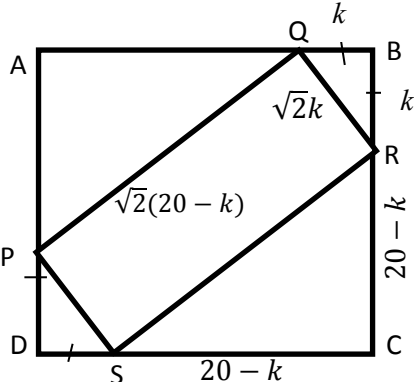| 7.2.1	$1 + i^{eff} = (1 + \dfrac{i^n}{n})^n$ $i^{eff} = (1 + \dfrac{0,18}{12})^{12} - 1$ $i^{eff} = 1,195618.... - 1$ $= 0,195618...$ $i^{eff} = 19,56\%$	✓substitution into correct formula/*substitusie in korrekte formule* ✓$i = \dfrac{0,18}{12}$ ✓answer/*antwoord*	(3)
7.2.2	$P = \dfrac{x\left[1 - (1+i)^{-n}\right]}{i}$ $500\,000 = \dfrac{x\left[1 - \left(1 + \dfrac{0,18}{12}\right)^{-60}\right]}{\dfrac{0,18}{12}}$ $x = R12\,696,71$	✓ substitution into correct formula/*substitusie in korrekte formule* ✓P = 500 000 ✓ -n = – 60 ✓answer/*antwoord*	(4)
7.2.3	$\text{balance/}saldo = 500\,000(1 + \dfrac{0,18}{12})^{24} - \dfrac{12700[(1+\dfrac{0,18}{12})^{24} - 1]}{\dfrac{0,18}{12}}$ $= 714\,751,406 - 363\,645,7142$ $= R351\,105,69$ **OR/OF** $P = \dfrac{x\left[1 - (1+i)^{-n}\right]}{i}$ $= \dfrac{12700\left[1 - \left(1 + \dfrac{0,18}{12}\right)^{-36}\right]}{\dfrac{0,18}{12}}$ $= R351\,290,69$	✓substitute into correct formula/*substitusie in korrekte formule* ✓n = 24 or/of n = -36 ✓ $\dfrac{0,18}{12}$ ✓answer/*antwoord*	(4)
7.2.4	$500\,000(1 - i)^2 = 304\,200$ $(1 - i)^2 = 0,6094$ $i = 22\%$	✓substitute into correct formula/*substitusie in korrekte formule* ✓answer/*antwoord*	(2)
			[17]

QUESTION/ VRAAG 8

8.1	$f(x) = -2x^2$		
	$f(x + h) = -2(x + h)^2$		
	$f(x + h) - f(x) = -2(x + h)^2 - (-2x^2)$	✓ substitution $(x + h)$	
	$\qquad\qquad = -4xh - 2h^2$	✓ simplification	
	$f'(x) = \lim_{h \to 0} \dfrac{-4xh - 2h^2}{h}$	✓subst into formula	
	$f'(x) = \lim_{h \to 0} \dfrac{-2h(2x - h)}{h}$	✓ simplification	
		✓ answer	
	$f'(x) = \lim_{h \to 0} -4x + 2h$		
	$f'(x) = -4x$		
	OR	✓ substitution $(x + h)$	
	$f'(x) = \lim_{h \to 0} \dfrac{f(x + h) - f(x)}{h}$	✓subst into formula	
	$f'(x) = \lim_{h \to 0} \dfrac{-2(x + h)^2 - (-2x^2)}{h}$	✓ simplification	
	$f'(x) = \lim_{h \to 0} \dfrac{-4xh - 2h^2}{h}$	✓ simplification	
	$f'(x) = \lim_{h \to 0} -4x + 2h$	✓ answer	
	$f'(x) = -4x$		(5)
8.2.1	$y = \dfrac{2x^2}{x^{\frac{1}{2}}} - \dfrac{1}{x^{\frac{1}{2}}}$	note: notation error penalise 1 mark	✓ $y = 2x^{\frac{3}{2}} - x^{\frac{-1}{2}}$	
	$y = 2x^{\frac{3}{2}} - x^{\frac{-1}{2}}$	candidates do NOT have to give their answers with positive exponents	✓$3x^{\frac{1}{2}}$	
	$\dfrac{dy}{dx} = 3x^{\frac{1}{2}} + \dfrac{1}{2}x^{-\frac{3}{2}}$		✓ $+ \dfrac{1}{2}x^{-\frac{3}{2}}$	(3)
8.2.2	$D_x[(3x - 2)^2]$ OR chain rule: $D_x = 2(3x - 2).3$		✓ simplify	
	$= D_x[9x^2 - 12x + 4]$ $= 18x - 12$		✓$18x$	
	$= 18x - 12$		✓$-1\,2$	(3)
8.3	$y = x^{-2}$			
	$\dfrac{dy}{dx} = -2x^{-3}$		✓$-2x^{-3}$	
	$for\ x > 0$		✓ $x^3 > 0$	
	$\therefore\ x^3 > 0$		✓ $\therefore \dfrac{-2}{x^3} < 0$	
	$\dfrac{-2}{x^3} < 0$			
	$\therefore$ gradient of tangent is $< 0\ if\ x > 0$			(3)
				[14]

QUESTION 9

9.1		✔ $(-1; 0)$ ✔ $(2; 0)$ ✔ $(0; -2)$ ✔ $(1; -4)$ ✔ shape	(5)
9.2	$-1 < x < 1$	✔ endpoints ✔ notation	(2)
9.3	Pt. of inflection: "halfway" between turning points(x-values) $\therefore x = \dfrac{-1+1}{2}$ $\therefore x = 0$	✔ $x = \dfrac{-1+1}{2}$ ✔ $x = 0$	(2)
9.4	$f''(x) > 0$ $\therefore x > 0$	✔ $f''(x) > 0$ ✔ $x > 0$	(2)
			[11]

QUESTION/ VRAAG 10

10.1	$QR = \sqrt{2}k \qquad\qquad Pythagoras$ $SR = \sqrt{2}(20 - k) \qquad Pythagoras$ $Area\ PQRS = \sqrt{2}k\left[\sqrt{2}(20 - k)\right]$ $\qquad\qquad = 2k(20 - k) = 40k - 2k^2$	✔ $QR = \sqrt{2}k$ ✔ $SR = \sqrt{2}(20 - k)$ ✔ $Area\ PQRS =$ $\sqrt{2}k\left[\sqrt{2}(20 - k)\right]$	(4)
10.2	$A = -2k^2 + 40k$ $\dfrac{dA}{dk} = -4k + 40 = 0$ $\qquad\qquad k = 10$	✔ $-4k + 40$ ✔ ✔ $= 0$ ✔ 10	(4)
			[8]

QUESTION/ VRAAG 11

11.1.1	$P(A \text{ or } B) = \frac{3}{8} + \frac{1}{4} = \frac{5}{8}$	$\checkmark \frac{5}{8}$	(1)
11.1.2	$P(A \text{ and } B) = \frac{3}{8} \times \frac{1}{4} = \frac{3}{32}$ $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B) = \frac{3}{8} + \frac{1}{4} - \frac{3}{32}$ $\qquad = \frac{17}{32}$	$\checkmark$ $P(A \cap B)$ or $\qquad P(A \text{ and } B) = \frac{3}{32}$ $\checkmark$ $P(A \cup B) = P(A) +$ $P(B) - P(A \cap B)$ $\checkmark \frac{17}{32}$	(3)
11.2.1	 $P(\text{both BMW}) = \frac{18}{32} \times \frac{17}{31} = \frac{153}{496} \approx 0{,}31$	$\checkmark\checkmark$ Boomdiagram/Tree diagram $\checkmark \frac{18}{32} \times \frac{17}{31}$ $\checkmark \frac{153}{496} \approx 0{,}31$	(4)
11.2.1	$P(\text{BMW } \dots \text{ VW}) = \frac{18}{32} \times \frac{14}{31} = \frac{63}{248} \approx 0{,}25$	$\checkmark \frac{18}{32} \times \frac{14}{31}$ $\checkmark \frac{63}{248} \approx 0{,}25$	(2)
11.3.1	$n(E) = 7.13!.6$ $n(S) = 15!$ $P(E) = \dfrac{n(E)}{n(S)} = \dfrac{7.13!.6}{15!} = \dfrac{1}{5}$	$\checkmark$ $n(E) = 7.13!.6$ $\checkmark n(S) = 15!$ $\checkmark \dfrac{1}{5}$	(3)
11.3.2	$n(E) = 8!\,7!$ $n(S) = 15!$ $P(E) = \dfrac{n(E)}{n(S)} = \dfrac{8!\,7!}{15!} = \dfrac{1}{6435}$	$\checkmark$ $n(E) = 8!\,7!$ $\checkmark$ $P(E) = \dfrac{n(E)}{n(S)} = \dfrac{8!7!}{15!}$ $\checkmark \dfrac{1}{6435}$	(3)
			[16]

TOTAL: 150