education

DEPARTMENT: EDUCATION
MPUMALANGA PROVINCE

NATIONAL SENIOR CERTIFICATE EXAMINATION

MATHEMATICS P1

SEPTEMBER 2017

GRADE 12

MEMORANDUM

MARKS: 150

TIME: 3 HOURS

This MEMORANDUM consists of 15 pages

Errata for Grade 12 Mathematics P1 Preparatory Exam Marking Guidelines

QUESTION 2

2.4 Exclude from marking (Since the k in the formula should have been n or the n should have been k) **(6 marks)**

QUESTION 3

3.2 If learners considered the given $g(x) = -\frac{2}{x-2}$, and used $B(0;1)$; then the equation can be calculated as follows: $B(0;1)$ and $A(2;3)$

$$y = a(x-p)^2 + q$$
$$1 = a(0-2)^2 + 3$$
$$-2 = 4a$$
$$a = -\frac{1}{2}$$
$$\therefore y = -\frac{1}{2}(x-2)^2 + 3$$

OR

$$\therefore y = -\frac{1}{2}(x^2 - 4x + 4) + 3$$
$$y = -\frac{1}{2}x^2 + 2x - 2 + 3$$
$$y = -\frac{1}{2}x^2 + 2x + 1$$

3.3 Exclude from marking (Since learners will refer to the only k that is the x-value at point A while the question wanted a shifting in the y-values). **(2 marks)**

QUESTION 4

$g(x)$ is supposed to be the inverse of f, but

4.1.2 Exclude from marking (2 Marks)

4.3.2 Exclude from marking (2 Marks)

4.4 Exclude from marking (2 Marks)

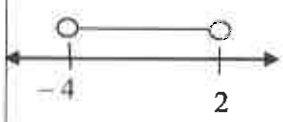
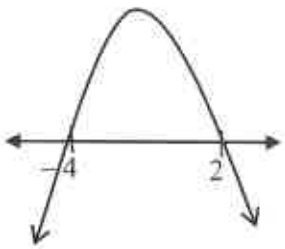
QUESTION 9.2 (ONLY English paper)

In the question the words "if the repeated letters are identical" is left out.

Suggestion: Mark the question correct for both cases – if the learners use the repeated letters as identical or not.

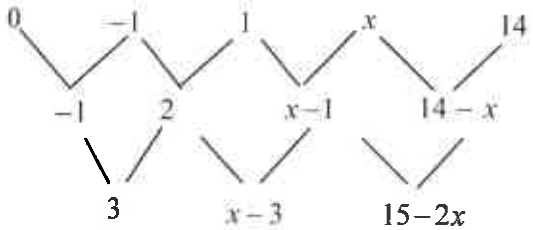
NB: The paper should be marked out of 136 then multiply by 150 to retain the total of out of 150 marks.

QUESTION 1		[26]
1.1.1	$9x^2 - 25 = 0$ $(3x+5)(3x-5) = 0$ $x = -\frac{5}{3}$ *or* $= \frac{5}{3}$	✓ Factors ✓ Answers (2)
1.1.2	$(2x-1)(x-2) = 4$ $2x^2 - 5x - 2 = 0$ $x = \frac{5 \pm \sqrt{(-5)^2 - 4(2)(-2)}}{2(2)}$ $x = \frac{5 \pm \sqrt{41}}{4}$ $x = 2{,}9$ *or* $x = -0{,}4$	✓ Standard form ✓ Substitution into correct formula ✓ $\sqrt{41}$ ✓ Answers (4)
1.1.3	$2x - 3\sqrt{x} - 2 = 0$ $2x - 3x^{\frac{1}{2}} - 2 = 0$ $\left(x^{\frac{1}{2}} - 2\right)\left(2x^{\frac{1}{2}} + 1\right) = 0$ $x^{\frac{1}{2}} = 2$ or $2x^{\frac{1}{2}} = -1$ $x = 4$ (The only real solution) **OR** $2x - 3\sqrt{x} - 2 = 0$ Let $\sqrt{x} = x^{\frac{1}{2}} = k$ $2k^2 - 3k - 2 = 0$ $(k-2)(2k+1) = 0$ $x^{\frac{1}{2}} = 2$ or $2x^{\frac{1}{2}} = -1$ $x = 4$ The only real solution	✓Standard form ✓ Factors ✓ Answers ✓ Conclusion (4) ✓standard form ✓ factors ✓ Answers ✓ Conclusion

	OR $2x - 3\sqrt{x} - 2 = 0$ $2x - 2 = 3\sqrt{x}$ $(2x - 2)^2 = (3\sqrt{x})^2$ $4x^2 - 8x + 4 = 9x$ $4x^2 - 17x + 4 = 0$ $(4x - 1)(x - 4) = 0$ $x = \frac{1}{4}$ *or* $x = 4$ *NA*	✓Standard form ✓ Factors ✓ Answers ✓ Conclusion (4)
1.1.4	$-3(x - 2)(x + 4) > 0$ $(x - 2)(x + 4) < 0$  OR  $-4 < x < 2$ OR $x \in (-4 ; 2)$	✓Inequality ✓ Critical Values ✓✓ Notation (4)
1.2.1	$27^{\frac{x}{3}} = 3^{y-1}$ $\left(3^3\right)^{\frac{x}{3}} = 3^{y-1}$ $3^x = 3^{y-1}$ $x = y - 1$	✓ Exponential Law ✓ Exponential Law (2)

1.2.2	$x = y-1$ $2x^2 - y = 5$ Substitute $x = y-1$ in $2x^2 - y = 5$ $2(y-1)^2 - y = 5$ $2(y^2-2y+1) - y = 5$ $2y^2-4y+2-y = 5$ $2y^2-5y-3 = 0$ $(2y+1)(y-3) = 0$ $y = -\frac{1}{2}$ *or* $y = 3$ Substitute $y = -\frac{1}{2}$ in $x = y-1$ $x = -\frac{1}{2} - 1 = -\frac{3}{2}$ Substitute $y = 3$ in $x = y-1$ $x = 3-1 = 2$ OR $x = y-1$ $2x^2 - y = 5$ Substitute $y = x+1$ in $2x^2 - y = 5$ $2x^2 - (x+1) = 5$ $2x^2 - x - 1 = 5$ $2x^2 - x - 6 = 0$ $(2x+3)(x-2) = 0$ $x = -\frac{3}{2}$ *or* $x = 2$ Substitute $x = -\frac{3}{2}$ in $y = x+1$ $y = -\frac{3}{2}+1 = -\frac{1}{2}$ Substitute $x = 2$ in $y = x+1$ $y = 2+1 = 3$	✓ Substitution ✓Standard form ✓Factors ✓ y-values ✓ x-values (5) ✓ Substitution ✓Standard form ✓Factors ✓ x-values ✓ y - values

1.3	$mx^2 - 3x + 2 = x^2$ $mx^2 - x^2 - 3x + 2 = 0$ $\Delta = (-3)^2 - 4(m+1)(2)$ $\Delta = 9 - 8m - 8$ $\Delta = -8m + 1$ For real and unequal roots $\Delta > 0$ $-8m + 1 > 0$ $-8m > -1$ $m < \frac{1}{8}$	✓Standard form ✓ substitution in Δ ✓ Simplification ✓ $\Delta > 0$ ✓ answer (5)
QUESTION 2		**[25]**
2.1	$6 + 4 + 3 + 2 + \frac{3}{2} + 0 + \frac{3}{4} + ...$	
2.1.1	$-2 ; \frac{3}{8}$	✓✓ Answers (2)
2.1.2	$S_n = \frac{a(r^n - 1)}{(r^n - 1)}$ $S_{57} = \frac{6\left(\left(\frac{1}{2}\right)^{57} - 1\right)}{\frac{1}{2} - 1}$ $S_{57} = 12$ $S_n = \frac{n}{2}[2a + (n-1)d]$ $S_{56} = \frac{56}{2}[2(4) + (56-1)(-2)]$ $S_{56} = -2\,856$ $S_{113} = -2\,844$	✓ Substitution into the correct formula ✓Answer ✓ Substitution into the correct formula ✓ Answer ✓ Addition (5)

2.1.3	$-1 < r < 1$ The ratio in this case is lying between $-1 < \frac{1}{2} < 1$	✓ Condition (1)
2.2	$T_3 = a+6d$ $x + 6 - 5x^2 = x^2 + 6x$ $6x^2 + 5x - 6 = 0$ $(2x+3)(3x-2) = 0$ $x = -\frac{3}{2}$ *or* $x = \frac{2}{3}$	✓ Substitution ✓ Standard Form ✓ Factors ✓ Correct x values (4)
2.3.1	0 , −1 , 1 , x , 14  $x-3-3 = 15-2x-x+3$ $x-6 = 18-3x$ $4x = 24$ $x = 6$ OR $x - 3 = 3$ $x = 6$	✓ Differences ✓ Method ✓ Answer (3)

2.3.2	$0\ ,\ -1\ ,1\ ,\ 6\ ,\ 14$ $-1, 2, 5,$ $3\ ,\ 3$ $2a = 3$ $a = \frac{3}{2}$ $3a + b = -1$ $3\left(\frac{3}{2}\right) + b = -1$ $b = -1 - \frac{9}{2}$ $b = -\frac{11}{2}$ $\frac{3}{2} - \frac{11}{2} + c = 0$ $-4 + c = 0$ $c = 4$ $\therefore T_n = \frac{3}{2}n^2 - \frac{11}{2}n + 4$	✓ Value of a ✓ Value of b ✓ Value of c ✓ General term (4)
2.4	$\sum_{n=1}^{\infty} 27p^k = \sum_{t=2}^{5}\left(1 - t^2\right)$ $\sum_{n=1}^{\infty} 27p^k$ $27p\ ;\ 27p^2\ ,$ $\sum_{t=2}^{5}\left(1 - t^2\right)$ $-3\ ;\ -8\ ,\ -15\ ;\ -24$ $S_4 = -50$ $S_\infty = \frac{27p}{1-p}$ $\frac{27p}{1-p} = -50$ $27p = -50(1-p)$ $27p = -50 + 50p$ $23p = 50$ $p = \frac{50}{23}$	✓ Substitution into the correct formula ✓Sequence ✓ $S_4 = -50$ ✓ Sum to infinity ✓ Substitution ✓ Answer (6)

QUESTION 3			[15]
3.1	$x = 2$ $y = 0$	✓✓ Answers	(2)
3.2	$y = a(x + p)^2 + q$ $5 = a(0+ 2)^2 + 3$ $4a = 2$ $a = \frac{2}{4} = \frac{1}{2}$ $y = \frac{1}{2}(x - 2)^2 + 3$ $y = \frac{1}{2}(x^2 - 4x + 4) + 3$ $y = \frac{1}{2}x^2 - 2x + 5$	✓ Substitution ✓ Value of a ✓ Expansion ✓ Equation	(4)
3.3	$3 < k < 5$	✓✓ Answer	(2)
3.4	$(-2 ; -3)$	✓ Value of x ✓ Value of y	(2)
3.5	$x \in \mathrm{R}, x \neq -2$ OR $x \in \mathrm{R}\ (-\infty; \infty)\ , x \neq -2$	✓✓ Answer	(2)
3.6	$f'(x) = x - 2$ $x - 2 = 5$ $x = 7$	✓ Derivative ✓ Gradient ✓ Answer	(3)

QUESTION 4		**[16]**
4.1.1	$f(x) = \log_a x$ $y = \log_a x$ $-1 = \log_a 2$ $2 = a^{-1}$ $2 = \frac{1}{a}$ $a = \frac{1}{2}$	✓ Substitution ✓ Answer (2)
4.1.2	$y = \left(\frac{1}{2}\right)^x$ OR $y = 2^{-x}$	✓✓ Answer (2)
4.2	Reflection about the $x-$axis	✓✓ Answer (2)
4.3.1	$x \geq 1$ OR $x \in [1 ; \infty)$	✓✓ Answer (2)
4.3.2	$y \geq -2$ OR $y \in [-2 ; \infty)$	✓✓ Answer (2)
4.4	$p(x) = \left(\frac{1}{2}\right)^{x+2} - 1$ OR $p(x) = 2^{-x-2} - 1$	✓✓ Answer (2)
4.5	$\log_{\frac{1}{2}} x = 2$ $\left(\frac{1}{2}\right)^2 = x$ $x = \frac{1}{4}$ $0 < x < \frac{1}{4}$	✓ Equation ✓ Exponential ✓ Value of x ✓Inequality (4)

QUESTION 5		**[14]**
5.1	$A = P(1-i)^n$ $7500 = 12000(1-i)^3$ $\frac{7500}{12000} = (1-i)^3$ $\sqrt[3]{\frac{7500}{12000}} - 1 = -i$ $1 - \sqrt[3]{\frac{7500}{12000}} = i$ $0{,}1450120267 = i$ Rate = 14,5%	✓ Substitution into correct formula ✓ Interests ✓ Rate (3)
5.2.1	$\frac{15}{100}(1200000) = R180000$ Borrowed: R1 200000 – R180 000 = R1 020 000 OR $0{,}85 \times 1\,200\,000 = R1\,020\,000$	✓ Deposit ✓ Loan (2)
5.2.2	$F = \frac{x[(1+i)^n - 1]}{i}$ $1020000\left(1+\frac{0{,}092}{12}\right)^{240} = \frac{x\left[\left(1+\frac{0{,}092}{12}\right)^{240} - 1\right]}{\frac{0{,}092}{12}}$ $x = R9308{,}81$ OR $P = \frac{x\left[1-(1+i)^{-n}\right]}{i}$ $1020000 = \frac{x\left[1-\left(1+\frac{0{,}092}{12}\right)^{-240}\right]}{\frac{0{,}092}{12}}$ $x = R9308{,}81$	✓ Substitution in correct Formula ✓ Correct interest ✓ Compounding ✓ answer (4) ✓ Substitution in correct Formula ✓ Correct interest ✓ Compounding ✓ Answer

5.2.3

$$P = \frac{x\left[1-(1+i)^{-n}\right]}{i}$$

$$1020\,000 = \frac{12\,000\left[1-\left(1+\frac{0,092}{12}\right)^{-n}\right]}{\frac{0,092}{12}}$$

✓ Substitution in correct Formula

$$\frac{1020\,000\left(\frac{0,092}{12}\right)}{12\,000} - 1 = -\left(1+\frac{0,092}{12}\right)^{-n}$$

$$\frac{1020\left(\frac{0,092}{12}\right)}{12} - 1 = -\left(1+\frac{0,092}{12}\right)^{-n}$$

✓Simplification

$$\log\left(\frac{209}{600}\right) = \log\left(1+\frac{0,092}{12}\right)^{-n}$$

$$\log\left(\frac{209}{600}\right) = -n\log\left(1+\frac{0,092}{12}\right)$$

$$\frac{\log\left(\frac{209}{600}\right)}{\log\left(1+\frac{0,092}{12}\right)} = -n \quad OR \quad -n = \log_{\left(1+\frac{0,092}{2}\right)}\left(\frac{209}{600}\right)$$

✓ logs

$$-138,0825487 = -n$$

$$n = 138,0825487$$

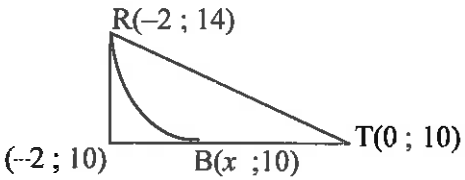
$$\therefore\ n = 12\ years$$

✓ Instalments
✓ Answer in years

(5)

QUESTION 6	Penalty of –1 for notation in Question 6	**[12]**
6.1	$f(x)=\frac{-x^2}{2}-3$ $f(x)=-\frac{1}{2}x^2-3$ $f(x+h)=-\frac{1}{2}(x+h)^2-3$ $f(x+h)=-\frac{1}{2}x^2-xh--\frac{1}{2}h^2-3$ $f'(x)=\lim_{h\to 0}\frac{f(x+h)^2-f(x)}{h}$ $f'(x)=\lim_{h\to 0}\frac{-\frac{1}{2}x^2-xh-\frac{1}{2}h^2-3-\left(-\frac{1}{2}x^2-3\right)}{h}$ $f'(x)=\lim_{h\to 0}\frac{-\frac{1}{2}x^2-xh-\frac{1}{2}h^2-3+\frac{1}{2}x^2+3}{h}$ $f'(x)=\lim_{h\to 0}\frac{-xh-\frac{1}{2}h^2}{h}$ $f'(x)=\lim_{h\to 0}\frac{h\left(-x-\frac{1}{2}h\right)}{h}$ $=-x$	✓ Finding $f(x+h)$ ✓ Simplification ✓ Correct substitution into Formula and notation ✓ Simplification ✓ Answer (5)
6.2.1	$D_x\left[\left(x^2-2\right)\left(\frac{1}{x^2}+3\right)\right]$ $D_x\left[1+3x^2-\frac{2}{x^2}-6\right]$ $D_x\left[3x^2-2x^{-2}-5\right]$ $\frac{dy}{dx}=6x+4x^{-3}\quad=6x+\frac{4}{x^3}$	✓ Removing the brackets ✓Simplified Equation ✓ ✓ Derivative (4)

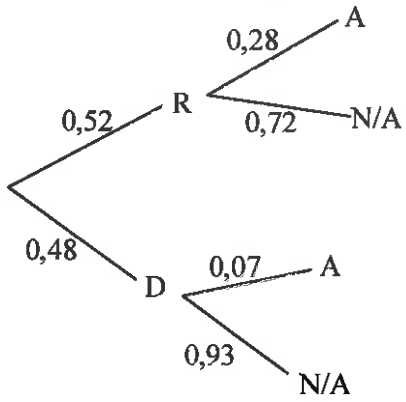
6.2.2	$y = 4\sqrt{x} - \frac{8}{\sqrt{8}} + \pi x^3$ $y = 4x^{\frac{1}{2}} - \frac{8}{\sqrt{8}} + \pi x^3$ $\frac{dy}{dx} = 2x^{-\frac{1}{2}} + 3\pi x^2 = \frac{2}{\sqrt{x}} + 3\pi x^2$	✓ Simplification ✓✓ Derivative (3)
QUESTION 7		**[19]**
7.1	$g(x) = -2x^3 + 6x^2 + 18x + 10$ $g'(x) = -6x^2 + 12x + 18 = 0$ $6x^2 - 12x - 18 = 0$ $x^2 - 2x - 3 = 0$ $(x-3)(x+1) = 0$ $x = 3 \quad or \quad x = -1$ $g(3) = -2(3)^3 + 6(3)^2 + 18(3) + 10$ $g(3) = 64$ $A(3\,;\,64)$	✓ $g'(x)$ ✓ $g'(x) = 0$ ✓ Values of x ✓ Substitution ✓ Values of y (5)
7.2	$f(x) = -2x^3 + 6x^2 + 18x + 10$ $f(2) = -2(2)^3 + 6(2)^2 + 18(2) + 10$ $f(2) = 54$ $(2; 54)$ $f'(2) = -6(2)^2 + 12(2) + 18$ $f'(2) = 18$ The requested equation $y - 54 = 18(x - 2)$ $y - 54 = 18x - 36$ $y = 18x + 18$	✓ Finding the corresponding y Value ✓ $f'(2)$ ✓ $f'(2) = 18$ ✓ Correct substitution into Formula ✓ Answer (5)

7.3.1	$f''(x) = -12x + 12$ $-12x + 12 < 0$ $-12x < -12$ $x > 1$ OR $f''(x) = -12x + 12$ $0 = -12x + 12$ $12x = 12$ $x = 1$ $x \in (1 ; \infty)$	✓ For inflection ✓ Inequality ✓ Answer (3)
7.3.2	$x.f'(x) \geq 0$ $0 < x < 3$ $x < -1$ OR $x \in (-\infty; -1)$ or $(0,3)$	✓✓ Answers (2)
7.4	 $R(-2 ; 14)$ $Q(0 ; 10)$ $B(x ; 10)$ Area of $\Delta RBT = \frac{1}{2} b.h$ $\Delta RBQ = \frac{1}{2}(2)(4)$ $\Delta RBQ = 4$ *units*^{2} $\therefore$ Area of $\Delta RBT < 4$	✓ Formula ✓ Substitution ✓ Answer ✓ Conclusion (4)

QUESTION 8 [8]

8.1	$P = -x^3 + 75x$ $P = -(7)^3 + 75(7)$ $P = R182$	✓ Substitution ✓ Answer (2)
8.2	$P'(x) = -3x^2 + 75 = 0$ $x^2 - 25 = 0$ $(x-5)(x+5) = 0$ $x = 5 \quad or \quad x = -5 \quad N/A$	✓ Derivative ✓ $P'(x) = 0$ ✓ Factors ✓ Answers (4)
8.3	$P = -x^3 + 75x$ $P(5) = -(5)^3 + 75(5)$ $P(5) = R250$	✓ Substitution ✓ Answer (2)

QUESTION 9 [15]

9.1	 $P(A) = [(0,52 \times 0,28) + (0,48 \times 0,07)]$ $P(A) = 0,1792$	✓ 0,28 ✓ 0,48 ✓ ✓Calculations and sum ✓ Answer (5)
9.2	$\frac{6!}{2!} = 360$	✓✓ $\frac{6!}{2!}$ ✓ Answer (3)
9.3.1	$7!4!2! = = 241920$	✓✓ $7!4!2!$ ✓ Answer (3)
9.3.2	$\frac{9! \times 4 \times 7}{11!} = \frac{14}{55}$	✓✓ $9! \times 4 \times 7$ ✓ $11!$ ✓ Answer (4)

TOTAL: 150