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**GRADE 12**

**MATHEMATICS PAPER 1**

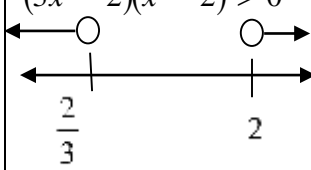
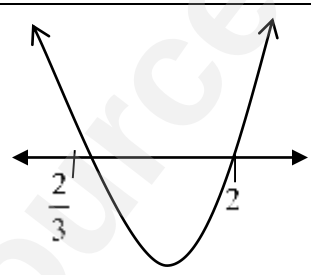
**SEPTEMBER 2018**

**MARKING GUIDELINES**

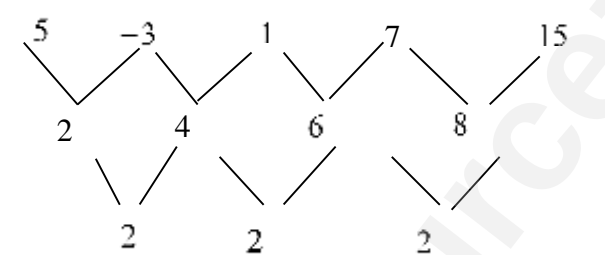
**MARKS: 150**

**TIME: 3 hours**

**These marking guidelines consist of 12 pages**

| QUESTION 1 |                                                                                                                                                                                                                                                                                                                                        | [26]                                                                                          |
|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|
| 1.1.1      | $x^2 + 5x + 6 = 0$<br>$(x+2)(x+3) = 0$<br>$x = -2 \text{ or } x = -3$                                                                                                                                                                                                                                                                  | ✓ Factors<br>✓ Answers<br>(2)                                                                 |
| 1.1.2      | $x(2x - 5) + 1 = 0$<br>$2x^2 - 5x + 1 = 0$<br>$x = \frac{-(-5) \pm \sqrt{(-5)^2 - 4(2)(1)}}{2(2)}$<br>$x = \frac{5 \pm \sqrt{17}}{6}$<br>$x = 1,52 \text{ or } x = 0,15$                                                                                                                                                               | ✓ Standard form<br>✓ Substitution into correct formula<br>✓ $\sqrt{17}$<br>✓ ✓ Answers<br>(5) |
| 1.1.3      | $3x^2 - 8x + 4 > 0$<br>$(3x - 2)(x - 2) > 0$<br> OR<br><br>$x < \frac{2}{3} \text{ or } x > 2$<br>OR<br>$x \in \left(-\infty; \frac{2}{3}\right) \cup (2; \infty)$ | ✓ Critical Values<br>✓ Method<br>✓ Notation<br>(3)                                            |
| 1.1.4      | $3^x - 3^{x-2} = 24$<br>$3^x(1 - 3^{-2}) = 24$<br>$3^x\left(\frac{8}{9}\right) = 24$<br>$3^x = 27$<br>$3^x = 3^3$<br>$x = 3$                                                                                                                                                                                                           | ✓ Common factor<br>✓ Simplification<br>✓ Exponential Law<br><br>✓ Answer<br>(4)               |
| 1.2        | $y + \frac{1}{2}x = 2$<br>$x^2 + y^2 + 6x = 4y - 4$                                                                                                                                                                                                                                                                                    |                                                                                               |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                  |
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| $y = -\frac{1}{2}x + 2$<br>Substitute $y = -\frac{1}{2}x + 2$ in $x^2 + y^2 + 6x = 4y - 4$<br>$x^2 + \left(-\frac{1}{2}x + 2\right)^2 + 6x = 4\left(-\frac{1}{2}x + 2\right) - 4$<br>$x^2 + 4 - 2x + \frac{1}{4}x^2 + 6x = 8 - 2x - 4$<br>$\frac{5}{4}x^2 + 6x = 0$<br>$x\left(\frac{5}{4}x + 6\right) = 0$<br>$x = 0 \quad \text{or} \quad \frac{5}{4}x = -6$<br>$x = -\frac{24}{5}$<br>Substitute $x = 0$ in $y = -\frac{1}{2}x + 2$<br>$y = -\frac{1}{2}(0) + 2 = 2$<br>Substitute $x = -\frac{24}{5}$ in $y = -\frac{1}{2}x + 2$<br>$y = -\frac{1}{2}\left(-\frac{24}{5}\right) + 2 = \frac{22}{5}$<br>OR<br>$y + \frac{1}{2}x = 2$<br>$x^2 + y^2 + 6x = 4y - 4$<br>$2y = -x + 4$<br>$x = -2y + 4$<br>Substitute $x = -2y + 4$ in $x^2 + y^2 + 6x = 4y - 4$<br>$(4 - 2y)^2 + y^2 + 6(4 - 2y) = 4y - 4$<br>$16 - 16y + 4y^2 + y^2 + 24 - 12y = 4y - 4$<br>$5y^2 - 32y + 44 = 0$<br>$(5y - 22)(y - 2) = 0$<br>$y = \frac{22}{5} \quad \text{or} \quad y = 2$<br>$x = -2\left(\frac{22}{5}\right) + 4 = -\frac{24}{5}$<br>$x = -2(2) + 4 = 0$ | ✓ y the subject<br><br>✓ Substitution<br><br>✓ Standard form<br>✓ Factors<br><br>✓ x-values<br><br>✓ Substitution<br><br>✓ y-values (7)<br><br>✓ x the subject<br><br>✓ Substitution<br><br>✓ Standard form<br>✓ Factors<br><br>✓ y - values<br><br>✓ Substitution<br>✓ y-values |
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|                        |                                                                                                                                                                           |                                                                                               |
| 1.3                    | $px^2 + x(p-2) + p = 0$ $0 = (p-2)^2 - 4(p)(p)$ $0 = p^2 - 4p + 4 - 4p^2$ $-3p^2 - 4p + 4 = 0$ $3p^2 + 4p - 4 = 0$ $(3p-2)(p+2) = 0$ $p = \frac{2}{3} \text{ or } p = -2$ | ✓ $\Delta = 0$<br>✓ substitution in $\Delta$<br>✓ Simplification<br>✓ Factors<br>✓ answer (5) |
| <b>QUESTION 2</b> [26] |                                                                                                                                                                           |                                                                                               |
| 2.1                    | ....; ....; 1 ; 7 ; 15 ; 25; ... ..                                                                                                                                       |                                                                                               |
| 2.1.1                  |  <p><math>\therefore T_1 = -5</math></p>                                                | ✓ Differences<br><br>✓ Answer (2)                                                             |
| 2.1.2                  | $2a = 2$ $a = 1$<br>$3a + b = 2$ $3(1) + b = 2$ $b = -1$<br>$1 - 1 + c = -5$ $c = -5$<br>$\therefore T_n = n^2 - n - 5$                                                   | ✓ Value of $a$<br><br>✓ Value of $b$<br><br>✓ Value of $c$<br><br>✓ General term (4)          |
| 2.1.3                  | $T_n = n^2 - n - 5$ $415 = n^2 - n - 5$ $n^2 - n - 420 = 0$ $(n-21)(n+20) = 0$ $\therefore n = 21$                                                                        | ✓ Standard Form<br>✓ Factors<br>✓ Correct $n$ value (3)                                       |
|                        |                                                                                                                                                                           |                                                                                               |

|       |                                                                                                                                                                                                          |                                                                                                                                   |
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| 2.2   | $x ; x + 3 ; 3x - 1$                                                                                                                                                                                     |                                                                                                                                   |
| 2.2.1 | $\frac{x+3}{x} = \frac{3x-1}{x+3}$ $3x^2 - x = x^2 + 6x + 9$ $2x^2 - 7x - 9 = 0$ $(2x-9)(x+1) = 0$ $x = \frac{9}{2} \text{ or } x = -1$                                                                  | ✓ Ratio<br><br>✓ Standard Form<br>✓ Factors<br><br>✓ Correct $x$ values (4)                                                       |
| 2.2.2 | $-1 ; 2 ; -4$<br>$S_n = \frac{a(r^n - 1)}{(r - 1)}$ $S_{20} = \frac{-1((-2)^{20} - 1)}{-2 - 1}$ $S_{20} = 349525$                                                                                        | ✓ Sequence<br><br>✓ Substitution into the correct formula<br><br>✓ Answer (3)                                                     |
| 2.2.3 | $\frac{9}{2} ; \frac{15}{2} ; \frac{25}{2}$<br>$r = \frac{5}{3}$ <p>Will not converge<br/> <math>r</math> is not between -1 and 1</p>                                                                    | ✓ value of $r$<br><br>✓ Reason (2)                                                                                                |
| 2.3   | $T_n = a + (n-1)d$ $T_k = a + (k-1)d = m$ $a = m - (k-1)d$ $T_m = a + (m-1)d = k$ $a = k - (m-1)d$ $m - d(k-1) = k - d(m-1)$ $-d(k-1) + d(m-1) = k - m$ $d[(m-1) - (k-1)] = k - m$ $d = \frac{k-m}{m-k}$ | ✓ Substitution into correct formula<br>✓ Substitution into correct formula<br><br>✓ Equating<br><br>✓ Factors<br><br>✓ Answer (5) |
| 2.4   | $1 + q + 2 + q + 3 + q + 4 + q + 5 + q = 15k$ $5q + 15 = 15k$ $5q = 15k - 15$ $q = 3k - 3$                                                                                                               | ✓ Equation<br>✓ Simplification<br>✓ Answer (3)                                                                                    |

| QUESTION 3 [21] |                                                                                                                                                                            |                                                                                                                                                                       |
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| 3.1             | $y = -x^2 + 2x + 3$<br>$y = -(x^2 - 2x + 1 - 1) + 3$<br>$y = -(x - 1)^2 + 4$<br>TP (1 ; 4)<br>OR<br>$x = \frac{-b}{2a}$<br>$x = \frac{-2}{2(-1)}$<br>$x = 1$<br>TP (1 ; 4) | ✓ Completing of the square<br>✓ Value of $x$<br>✓ Value of $y$<br>✓ Turning point (4)<br><br>✓ Formula for $x$<br>✓ Value of $x$<br>✓ Value of $y$<br>✓ Turning point |
| 3.2             | $-x^2 + 2x + 3 = 0$<br>$x^2 - 2x - 3 = 0$<br>$(x - 3)(x + 1) = 0$<br>$x = 3$ or $x = -1$<br>AB = 4units                                                                    | ✓ Factors<br><br>✓ Correct $x$ values<br>✓ Answer (3)                                                                                                                 |
| 3.3             | $EF = -x^2 + 2x + 3 - (-x + 3)$<br>$= -x^2 + 3x$<br>Max: $-2x + 3 = 0$ OR $x = \frac{-b}{2a}$<br>$x = \frac{3}{2}$ $x = \frac{-3}{2(-1)} = \frac{3}{2}$                    | ✓ $f(x) - g(x)$<br><br>✓ Derivative OR formula<br><br>✓ Value of $x$ (3)                                                                                              |
| 3.4             | $p(x) = -(x - 1)^2 + 4 - 2$<br>$p(x) = -(x - 1)^2 + 2$<br>$y \leq 2; y \in R$<br>OR $(-\infty ; 2]$                                                                        | ✓✓ Answer (2)                                                                                                                                                         |
| 3.5.1           | Four units down<br>One unit to the left<br>Reflection over the $x$ -axis                                                                                                   | ✓ Translation<br>✓ Translation<br>✓ Reflection (3)                                                                                                                    |

|                        |                                                                                                                                                                          |                                                                                                                                  |
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| 3.5.2                  | $x \geq 0$ or $x \leq 0$                                                                                                                                                 | ✓✓ Answers (2)                                                                                                                   |
| 3.6.1                  | $B(3; 0)$<br>$0 < x < 3$                                                                                                                                                 | ✓ Critical values<br>✓ Notation (2)                                                                                              |
| 3.6.2                  | $x > 1$                                                                                                                                                                  | ✓✓ Answer (2)                                                                                                                    |
| <b>QUESTION 4</b> [12] |                                                                                                                                                                          |                                                                                                                                  |
| 4.1.1                  | $y = a^x$ OR<br>$\frac{1}{3} = a^1$ $9 = a^{-2}$<br>$a = \frac{1}{3}$ $a = \frac{1}{3}$                                                                                  | ✓ Substitution<br><br>✓ Answer (2)                                                                                               |
| 4.1.2                  | $g(x) = \frac{k}{x+p} + q$<br>$g(x) = \frac{k}{x+2} + 1$<br>$\frac{1}{3} = \frac{k}{1+2} + 1$<br>$\frac{-2}{3} = \frac{k}{3}$<br>$k = -2$<br>$g(x) = \frac{-2}{x+2} + 1$ | ✓ Substitution of $p$ and $q$<br><br>✓ Substitution of $\left(1; \frac{1}{3}\right)$<br><br>✓ Value of $k$<br><br>✓ Equation (4) |
| 4.2                    | $y = \log_{\frac{1}{3}} x$                                                                                                                                               | ✓ Answer (1)                                                                                                                     |
| 4.3                    | $h(x) = x + c$<br>$9 = -2 + c$<br>$c = 11$                                                                                                                               | ✓ Substitution of $(-2; 9)$<br>✓ Answer (2)                                                                                      |
| 4.4                    | $0 < x \leq 1$<br>OR<br>$x \in (0; 1]$                                                                                                                                   | ✓✓ Answer (2)                                                                                                                    |

| QUESTION 5 |                                                                                                                                                                                                                                                                      | [15]                                                                                                                     |
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| 5.1        | $A = P(1 - i)^n$ $x = 2x(1 - 0,075)^n$ $\frac{1}{2} = (1 - 0,075)^n$ $\log \frac{1}{2} = n \log 0,925$ $n = \frac{\log \frac{1}{2}}{\log 0,925}$ $n = 8,89$ $n = 8 \text{ years } 11 \text{ months}$                                                                 | ✓ Substitution into correct formula<br>✓ Substitute A & P<br>✓ Use of logs<br>✓ Answer<br>✓ Rounding to months (5)       |
| 5.2.1      | $\frac{30}{100}(18\,480)$ $= R5\,544$                                                                                                                                                                                                                                | ✓ Answer (1)                                                                                                             |
| 5.2.2      | $P = \frac{x[1 - (1 + i)^{-n}]}{i}$ $P = \frac{5544 \left[ 1 - \left( 1 + \frac{0,08}{12} \right)^{-300} \right]}{\frac{0,08}{12}}$ $P = R718\,305,71$                                                                                                               | ✓ Substitution in correct Formula<br>✓ value of $n$<br>✓ value of $i$<br>✓ Answer (4)                                    |
| 5.3        | $A = P(1 + i)^n$ $A = 1000 \left( 1 + \frac{0,15}{12} \right)^{18}$ $A = R\,1\,250,58$ $F = \frac{x[(1 + i)^n - 1]}{i}$ $= \frac{700 \left[ \left( 1 + \frac{0,15}{12} \right)^{18} - 1 \right]}{\frac{0,15}{12}}$ $x = R\,14\,032,33$ $\text{Total: R } 15\,282,91$ | ✓ Substitution in correct Formula<br>✓ Value of A<br>✓ Substitution into correct formula<br>✓ Value of F<br>✓ answer (5) |

| QUESTION 6 | Penalty of -1 for notation in Question 6                                                                                                                                                                                                                                                                                                                                                                                    | [13]                                                                                                                                                            |
|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 6.1        | $f(x) = -2x^2 + 5$ $f(x+h) = -2(x+h)^2 + 5$ $f(x+h) = -2x^2 - 4xh - 2h^2 + 5$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h)^2 - f(x)}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{-2x^2 - 4xh - 2h^2 + 5 - (-2x^2 + 5)}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{-2x^2 - 4xh - 2h^2 + 5 + 2x^2 - 5}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{-4xh - 2h^2}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{h(-4x - 2h)}{h}$ $= -4x$ | <p>✓ Finding <math>f(x+h)</math></p> <p>✓ Simplification</p> <p>✓ Correct substitution into Formula and notation</p> <p>✓ Common factor</p> <p>✓ Answer (5)</p> |
| 6.2        | $y = 5x + \frac{6}{\sqrt{x}}$ $y = 5x + \frac{6}{x^{\frac{1}{2}}}$ $y = 5x + 6x^{-\frac{1}{2}}$ $\frac{dy}{dx} = 5 - 3x^{-\frac{3}{2}}$                                                                                                                                                                                                                                                                                     | <p>✓ <math>x^{\frac{1}{2}}</math></p> <p>✓ Exponent Law</p> <p>✓ ✓ Derivative (4)</p>                                                                           |
| 6.3.1      | $g(x) = \frac{2x^3 + x^2 - 3x}{x-1}$ $= \frac{x(2x+3)(x-1)}{x-1}$ $= x(2x+3) = 2x^2 + 3x$ $g'(x) = 4x + 3$ $g'(2) = 11$                                                                                                                                                                                                                                                                                                     | <p>✓ Factorise</p> <p>✓ Simplify</p> <p>✓ Derivative</p> <p>✓ Answer (4)</p>                                                                                    |

**QUESTION 7****[16]**

|     |                                                                                                                                                                                                                                                                                                     |                                                                                                                                                               |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7.1 | $y = a(x - x_1)(x - x_2)(x - x_3)$ $y = 2(x + 1)\left(x - \frac{1}{2}\right)(x - 3)$ $y = 2(x^2 - 2x - 3)\left(x - \frac{1}{2}\right)$ $y = 2\left(x^3 - \frac{5}{2}x^2 - 2x + \frac{3}{2}\right)$ $y = 2x^3 - 5x^2 - 4x + 3$                                                                       | <p>✓ Substitution of <math>x</math> values into correct formula</p> <p>✓ Simplification</p> <p>✓ Simplification</p> <p>✓ Answer (4)</p>                       |
| 7.2 | $y = 2x^3 - 5x^2 - 4x + 3$ $6x^2 - 10x - 4 = 0$ $3x^2 - 5x - 2 = 0$ $(x - 2)(3x + 1) = 0$ $x = 2 \text{ or } x = -\frac{1}{3}$ $y = 2\left(-\frac{1}{3}\right)^3 - 5\left(-\frac{1}{3}\right)^2 - 4\left(-\frac{1}{3}\right) + 3$ $y = \frac{100}{27}$ $A\left(-\frac{1}{3}; \frac{100}{27}\right)$ | <p>✓ Derivative</p> <p>✓ <math>= 0</math></p> <p>✓ Factors</p> <p>✓ <math>x</math> - values</p> <p>✓ select one value</p> <p>✓ <math>y</math> - value (6)</p> |
| 7.3 | $f(x) = 2x^3 - 5x^2 - 4x + 3$ $f(x) = 2(-2)^3 - 5(-2)^2 - 4(-2) + 3 = -25 \quad \therefore D(-2; -25)$ $f'(x) = 6x^2 - 10x - 4$ $f'(x) = 6(-2)^2 - 10(-2) - 4 = 40$ $y - y_1 = m(x - x_1)$ $y + 25 = 40(x + 2)$ $y = 40x + 55$                                                                      | <p>✓ Value of <math>f(-2)</math></p> <p>✓ Value of <math>f'(-2)</math></p> <p>✓ Substitution into correct formula</p> <p>✓ Answer (4)</p>                     |

|                       |                                                                                                                                                                                                            |                                                               |
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|                       |                                                                                                                                                                                                            |                                                               |
| 7.4                   | $12x - 10 > 0$<br>$x > \frac{5}{6}$                                                                                                                                                                        | ✓ Inequality<br>✓ Answer (2)                                  |
| <b>QUESTION 8</b> [7] |                                                                                                                                                                                                            |                                                               |
| 8.1                   | Area = $2(\frac{1}{2}b \times H) + Lx B + Lx B + Lx B$<br>$600 = 5x \cdot 12x + 5xy + 12xy + 13xy$<br>$= 60x^2 + 30xy$<br>$\therefore y = \frac{600 - 60x^2}{30x}$<br>$= \frac{20 - 2x^2}{x}$              | ✓ area<br>✓ method<br>✓ Answer (3)                            |
| 8.2                   | Volume = area of base $\times h$<br>$= \frac{1}{2} 5x \cdot 12x \cdot \frac{20 - 2x^2}{x}$<br>$= 600x - 60x^3$<br>Max : $600 - 180x^2 = 0$<br>$x^2 = \frac{10}{3}$<br>$\therefore x = \sqrt{\frac{10}{3}}$ | ✓ Volume<br>✓ simplification<br>✓ $f'(x) = 0$<br>✓ answer (4) |

| QUESTION 9 |                                                                                                                                                                                                                                              | [15]                                                                                   |
|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|
| 9.1.1      | Event A : 1,2<br>B: 2,4,6<br>C : 6<br>$P(A) = \frac{2}{6} = \frac{1}{3}$<br>$P(B) = \frac{3}{6} = \frac{1}{2}$<br>$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$<br>$= \frac{2}{6} + \frac{1}{2} - \frac{1}{6}$<br>$= \frac{2}{3}$ | ✓ P(A)<br><br>✓ P(B)<br><br>✓ Substitution into correct formula<br><br>✓ Answer<br>(4) |
| 9.1.2      | A and C are mutually exclusive<br>$P(A \text{ and } C) = 0$                                                                                                                                                                                  | ✓ Events<br>✓ Reason<br>(2)                                                            |
| 9.1.3      | $P(B) \times P(C) = \frac{1}{2} \times \frac{1}{6} = \frac{1}{12}$<br>$P(B \cap C) = \frac{1}{6}$<br>$P(B) \times P(C) \neq P(B \cap C)$<br>B and C are not independent events                                                               | ✓ $P(B) \times P(C)$<br><br>✓ $P(B \cap C)$<br><br>✓ Conclusion<br>(3)                 |
| 9.2.1      | $6! = 720$                                                                                                                                                                                                                                   | ✓ $6!$<br>✓ Answer<br>(2)                                                              |
| 9.2.2      | $1!4!1! = 24$                                                                                                                                                                                                                                | ✓ $1!4!1!$<br>✓ Answer<br>(2)                                                          |
| 9.2.3      | $2! \times 4! \times 5 = 240$<br>$P(\text{Visits}) = \frac{240}{720} = \frac{1}{3}$                                                                                                                                                          | ✓ $2! \times 4! \times 5$<br>✓ Answer<br>(2)                                           |

**TOTAL: 150**