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# **PREPARATORY EXAMINATION 2019 MARKING GUIDELINES**

**MATHEMATICS (PAPER 1) (10611)**

**20 pages**

## GAUTENG DEPARTMENT OF EDUCATION

## PREPARATORY EXAMINATION

MATHEMATICS  
(Paper 1)

## MARKING GUIDELINES

| QUESTION 1 |                                                                                                                                                                                                                                                       |                                                                                                 |
|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|
| 1.1.1      | $2x^2 + 3 = 8x$<br>$2x^2 - 8x + 3 = 0$<br>$x = \frac{-b \pm \sqrt{b^2 - 4(a)(c)}}{2(a)}$ $x = \frac{-(-8) \pm \sqrt{(-8)^2 - 4(2)(3)}}{2(2)}$<br>$x = 3,58 \quad \text{or} \quad x = 0,42$<br><b>Penalise for rounding-off in this question ONLY.</b> | ✓ standard form<br><br>✓ correct substitution into correct formula<br><br>✓✓ answers<br><br>(4) |
| 1.1.2      | $4x - 2x(x - 3) \leq 0$<br>$4x - 2x^2 + 6x \leq 0$<br>$2x^2 - 10x \geq 0$<br>$2x(x - 5) \geq 0$<br>$x \geq 5 \quad \text{or} \quad x \leq 0$<br><b>Both inequalities MUST be correct for allocating the marks.</b>                                    | ✓ standard form<br>✓ factors<br>✓✓ answers<br><br>(4)                                           |

|       |                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                  |
|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.1.3 | $2^x - 5.2^{x+1} = -144$<br>$2^x(1 - 5.2) = -144$<br>$2^x(1 - 10) = -144$<br>$2^x(-9) = -144$<br>$2^x = 16$ <b>OR</b> $x = \log_2 16$<br>$2^x = 2^4$<br>$x = 4$                                                                                                                                                            | ✓ factorise<br><br>✓ simplification ( $-9$ )<br><br>✓ simplification ( $2^4$ )<br><b>OR</b><br>correct use of logs<br><br>✓ answer<br><br>(4)    |
| 1.2   | $f(x) = (x - 2)(x + 6)$<br>$f(x) = x^2 + 4x - 12$                                                                                                                                                                                                                                                                          | ✓ both correct factors<br><br>✓ answer<br><br>(2)                                                                                                |
| 1.3   | $2x + y = 17$ .....(1)<br>$xy = 8$ ..... (2)<br><br>from (1)<br>$2x + y = 17$<br>$y = 17 - 2x$ .....(3)<br><br>substitute (3) into (2)<br>$x(17 - 2x) = 8$<br>$17x - 2x^2 = 8$<br>$-2x^2 + 17x - 8 = 0$<br>$2x^2 - 17x + 8 = 0$<br>$(2x - 1)(x - 8) = 0$<br>$x = \frac{1}{2}$ <b>or</b> $x = 8$<br><br>substitute into (3) | ✓ solve for $y$ in equ. 1<br><br><br><br><br><br>✓ substitute for $y$ in<br>equ. 2<br><br><br>✓ standard form<br>✓ factors<br>✓ both $x$ answers |

|  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                          |
|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | $y = 17 - 2\left(\frac{1}{2}\right)$ $y = 16$ <p style="text-align: center;"><b>or</b></p> $y = 17 - 2(8)$ $y = 1$ <p><b>OR</b></p> $2x + y = 17 \dots\dots\dots(1)$ $xy = 8 \dots\dots\dots(2)$ <p>from (2)</p> $xy = 8$ $y = \frac{8}{x} \dots\dots\dots(3)$ <p>substitute (3) into (1)</p> $2x + \frac{8}{x} = 17$ $2x^2 - 17x + 8 = 0$ $(2x - 1)(x - 8) = 0$ $x = \frac{1}{2} \quad \text{or} \quad x = 8$ <p>substitute into (2)</p> $\frac{1}{2}y = 8 \qquad \qquad \mathbf{OR} \qquad \qquad 8y = 8$ $y = 16 \qquad \qquad \qquad \qquad y = 1$ | <p>✓ both <math>y</math> answers</p> <p><b>OR</b></p> <p>✓ solve for <math>y</math> in equ. 2</p> <p>✓ substitute for <math>y</math> in equation 1</p> <p>✓ standard form</p> <p>✓ factors</p> <p>✓ both <math>x</math> answers</p> <p>✓ both <math>y</math> answers</p> |
|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                              |
|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                             | (6)                                                                                                                                                          |
| 1.4               | $2mx^2 = 3x - 8$ $2mx^2 - 3x + 8 = 0$ $\Delta = (-3)^2 - 4(2m)(8)$ $\Delta = 9 - 64m$ <p>for non-real roots, <math>\Delta &lt; 0</math></p> $9 - 64m < 0$ $9 < 64m \quad \text{OR} \quad -64m < -9$ $\frac{9}{64} < m \quad m > \frac{9}{64}$                                                                                                                                                                                                               | <p>✓ standard form</p> <p>✓ correct substitution into correct formula</p> <p>✓ <math>\Delta &lt; 0</math></p> <p>✓ answer</p> <p>(4)</p>                     |
|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                             | [24]                                                                                                                                                         |
| <b>QUESTION 2</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                              |
| 2.1               | $-\frac{1}{2} ; 2 ; \frac{11}{2} ; 10$ $\begin{array}{ccc} \swarrow & \swarrow & \swarrow \\ \frac{5}{2} & \frac{7}{2} & \frac{9}{2} \\ \swarrow & \swarrow & \\ 1 & 1 & \end{array}$ $2a = 1 \quad 3a + b = \frac{5}{2} \quad a + b + c = -\frac{1}{2}$ $a = \frac{1}{2} \quad 3\left(\frac{1}{2}\right) + b = \frac{5}{2} \quad \frac{1}{2} + 1 + c = -\frac{1}{2}$ $b = 1 \quad c = -2$ $T_n = \frac{1}{2}n^2 + n - 2$ $T_n = \frac{1}{2}(n^2 + 2n - 4)$ | <p>✓ <math>a = \frac{1}{2}</math></p> <p>✓ <math>b = 1</math></p> <p>✓ <math>c = -2</math></p> <p>✓ <math>T_n = \frac{1}{2}n^2 + n - 2</math></p> <p>(4)</p> |
| 2.2               | $T_{75} - T_{74} = \left[\frac{1}{2}\{(75)^2 + 75 - 2\}\right] - \left[\frac{1}{2}\{(74)^2 + 74 - 2\}\right]$ $T_{75} - T_{74} = \frac{151}{2}$                                                                                                                                                                                                                                                                                                             | <p>✓ correct substitution</p> <p>✓ answer</p> <p>(2)</p>                                                                                                     |

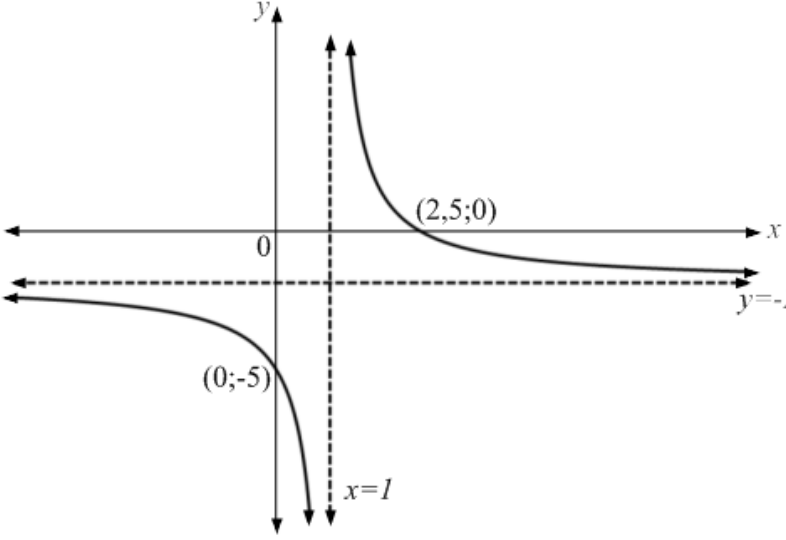
|       |                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                               |
|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2.3.1 | Arithmetic<br>Constant difference between successive terms                                                                                                                                                                                                                                                                                                 | ✓ arithmetic<br>✓ correct reason<br>(2)                                                                                                                                                                       |
| 2.3.2 | 74 <sup>th</sup>                                                                                                                                                                                                                                                                                                                                           | ✓ answer<br>(1)                                                                                                                                                                                               |
| 2.3.3 | $T_n = a + (n-1)d$<br>$T_{30} = \frac{5}{2} + (30-1)(1)$<br>$T_{30} = \frac{63}{2}$                                                                                                                                                                                                                                                                        | ✓ correct substitution of $a$ , $n$ and $d$<br>✓ answer<br>(2)                                                                                                                                                |
| 2.3.4 | $Sn = \frac{n}{2}[2a + (n-1)d]$<br>$2176 = \frac{n}{2}[2(\frac{5}{2}) + (n-1)(1)]$<br>$0 = n^2 + 4n - 4352$<br>$0 = (n-64)(n+68)$<br>$n = 64$<br>$n \neq -68$<br>$64 + 1 = 65$<br><b>OR</b><br>$-\frac{1}{2} + 2176 = \frac{1}{2}(n^2 + 2n - 4)$<br>$-1 + 4352 = n^2 + 2n - 4$<br>$n^2 + 2n - 4355 = 0$<br>$(n+67)(n-65) = 0$<br>$n \neq -67 \quad n = 65$ | ✓ substitute into correct formula<br>✓ standard form<br><br>✓ choice of $n = 64$<br><br>✓ answer<br><b>OR</b><br><br>✓✓ equating correctly<br><br>✓ standard form<br><br>✓ choosing correct $n$ -value<br>(4) |
|       |                                                                                                                                                                                                                                                                                                                                                            | [15]                                                                                                                                                                                                          |

| QUESTION 3 |                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                       |
|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3.1        | $r = \frac{2(3x-1)^2}{2(3x-1)}$ $r = 3x - 1$ $-1 < 3x - 1 < 1$ $0 < 3x < 2$ $0 < x < \frac{2}{3}$                                                                                                                                                                                                                                                     | ✓ value of $r$<br>✓ $-1 < 3x - 1 < 1$<br>✓ correct constraints<br>(3)                                                                                                                                 |
| 3.2        | $T_2 = ar$ $6 = kr$ $r = \frac{6}{k} \quad \dots (1)$ <p>sub. (1) into (2)</p> $25 = \frac{k}{1 - \frac{6}{k}}$ $k = 25 \left( 1 - \frac{6}{k} \right)$ $k = 25 - \frac{150}{k}$ $0 = k^2 - 25k + 150$ $0 = (k - 10)(k - 15)$ $\therefore k = 10 \text{ or } k = 15$                                                                                  | $S_\infty = 25$ $S_\infty = \frac{a}{1 - r}$ $25 = \frac{k}{1 - r} \quad \dots (2)$ ✓ $r = \frac{6}{k}$<br>✓ substitution<br>( $a, r, S_\infty$ )<br>✓ standard form<br>✓ factors<br>✓ answers<br>(5) |
| 3.3        | $(1 \times 2) + (5 \times 6) + (9 \times 10) + (13 \times 14) + \dots + (81 \times 82)$ $(4n - 3) \times (4n - 2)$ $= 16n^2 - 20n + 6$ $4n - 3 = 81 \quad \text{OR} \quad 4n - 2 = 82$ $4n = 84 \quad \quad \quad 4n = 84$ $n = 21 \quad \quad \quad n = 21$ $\sum_{n=1}^{21} 16n^2 - 20n + 6 \quad \text{OR} \quad \sum_{n=1}^{21} (4n - 3)(4n - 2)$ | ✓ $(4n - 3)$<br>✓ $(4n - 2)$<br>✓ $n = 21$<br>✓ answer<br>(4)                                                                                                                                         |
|            |                                                                                                                                                                                                                                                                                                                                                       | [12]                                                                                                                                                                                                  |

| QUESTION 4 |                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                       |
|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4.1        | $4500 = 3000 \left( 1 + \frac{0,08}{12} \right)^n$ $\frac{3}{2} = \left( 1 + \frac{0,08}{12} \right)^n$ $\log_{\left( 1 + \frac{0,08}{12} \right)} \frac{3}{2} = n$ $n = 61,02 \text{ months} \quad / \quad (\text{accept } 62)$ $n = 5,09 \text{ years} \quad / \quad (\text{accept } 5,17)$ <p><b>NOTE: (5,08 is NOT accepted.)</b></p>                              | ✓ correct substitution<br>✓ simplification<br><br>✓ correct use of logs<br>✓ correct answer in years<br><br>(4)                                                                                                                       |
| 4.2.1      | $P_v = \frac{x[1 - (1+i)^{-n}]}{i}$ $40\,000 = \frac{x[1 - (1 + \frac{0,24}{12})^{-240}]}{\frac{0,24}{12}}$ $x = R806,96$                                                                                                                                                                                                                                              | ✓ $n = 240$<br>✓ $i = \frac{0,24}{12}$<br>✓ correct sub. into correct formula<br>✓ correct answer<br>(4)                                                                                                                              |
| 4.2.2      | $P_o = \frac{x[1 - (1+i)^{-n}]}{i}$ $P_o = \frac{806,96 \left[ 1 - \left( 1 + \frac{0,24}{12} \right)^{-180} \right]}{\frac{0,24}{12}}$ $= R39205,67$ <p><b>OR</b></p> $P_o = P(1+i)^n - \frac{x[(1+i)^n - 1]}{i}$ $P_o = 40\,000 \left( 1 + \frac{0,24}{12} \right)^{60} - \frac{806,96 \left[ \left( 1 + \frac{0,24}{12} \right)^{60} - 1 \right]}{\frac{0,24}{12}}$ | ✓ correct substitution into correct formula<br><br>✓ $n = 180$<br>✓ $i = \frac{0,24}{12}$<br>✓ answer<br><p><b>OR</b></p> ✓ correct substitution into correct formula<br><br>✓ $n = 60$<br>✓ $i = \frac{0,24}{12}$<br>✓ answer<br>(4) |

|       |                                                                                                                                                                                                               |                                                                                                                  |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|
|       | = R39 206,20                                                                                                                                                                                                  |                                                                                                                  |
| 4.2.3 | $P_v = \frac{x[1 - (1 + i)^{-n}]}{i}$ $39205,67 = \frac{x[1 - (1 + \frac{0,18}{12})^{-180}]}{\frac{0,18}{12}}$ $x = R631,38$ <p><b>NOTE: If the candidate uses R39 206,20 then the answer is R631,39.</b></p> | ✓ $n = 180$<br>✓ $i = \frac{0,18}{12}$<br>✓ correct substitution into correct formula<br>✓ correct answer<br>(4) |
|       |                                                                                                                                                                                                               | [16]                                                                                                             |

**QUESTION 5**

|     |                                                                                                                                                                                                     |                                                                             |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|
| 5.1 | $f(x) = \frac{3}{x-1} - 2$ $0 = \frac{3}{x-1} - 2$ $2(x-1) = 3$ $2x - 2 = 3$ $2x = 5$ $x = \frac{5}{2}$ $\therefore \left( \frac{5}{2} ; 0 \right)$ <p><b>NOTE: Must be in coordinate form.</b></p> | <p>✓ equate to 0</p> <p>✓ answer (2)</p>                                    |
| 5.2 | $f(0) = \frac{3}{0-1} - 2$ $y = -5$ $\therefore (0 ; -5)$ <p><b>NOTE: Not necessarily in coordinate form.</b></p>                                                                                   | <p>✓ answer (1)</p>                                                         |
| 5.3 |                                                                                                                 | <p>✓ shape</p> <p>✓ x- and y-intercepts</p> <p>✓ correct asymptotes (3)</p> |

|     |                                                                                                                                |                                                                                          |
|-----|--------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|
| 5.4 | $f(x) = \frac{3}{x-1} - 2$ <p>Point of intersection (1 ; -2)</p> $y = -x + q$ $-2 = -(1) + q$ $q = -1$ $\therefore y = -x - 1$ | <p>✓ <math>m = -1</math></p> <p>✓ substitute point (1;-2)</p> <p>✓ answer</p> <p>(3)</p> |
|     |                                                                                                                                | [9]                                                                                      |

**QUESTION 6**

6.1

$$f(x) = -2x^2 - 5x + 3$$

$$x = \frac{-(-5)}{2(-2)}$$

$$x = -\frac{5}{4}$$

$$f\left(-\frac{5}{4}\right) = -2\left(-\frac{5}{4}\right)^2 - 5\left(-\frac{5}{4}\right) + 3$$

$$f\left(-\frac{5}{4}\right) = \frac{49}{8}$$

$$\therefore TP\left(-\frac{5}{4}; \frac{49}{8}\right)$$

**OR**

$$f'(x) = 0$$

$$-4x - 5 = 0$$

$$x = -\frac{5}{4}$$

$$f\left(-\frac{5}{4}\right) = -2\left(-\frac{5}{4}\right)^2 - 5\left(-\frac{5}{4}\right) + 3$$

$$f\left(-\frac{5}{4}\right) = \frac{49}{8}$$

$$\therefore TP\left(-\frac{5}{4}; \frac{49}{8}\right)$$

**OR**

$$f(x) = -2x^2 - 5x + 3$$

$$f(x) = -2\left[x^2 + \frac{5}{2}x - \frac{3}{2}\right]$$

$$f(x) = -2\left[x^2 + \frac{5}{2}x + \left(\frac{5}{4}\right)^2 - \left(\frac{5}{4}\right)^2 - \frac{3}{2}\right]$$

$$f(x) = -2\left[\left(x + \frac{5}{4}\right)^2 - \frac{49}{16}\right]$$

$$f(x) = -2\left(x + \frac{5}{4}\right)^2 + \frac{49}{8}$$

$$\therefore TP\left(-\frac{5}{4}; \frac{49}{8}\right)$$

✓ correct substitution  
into  $x = \frac{-b}{2a}$

✓ x-value

✓ y-value

**OR**

✓ derivative

✓ equate to zero

✓ y-value

**OR**

✓ determine  
 $\frac{25}{16}$  or  $\left(\frac{5}{4}\right)^2$

✓ factorisation  
 $\left(x + \frac{5}{4}\right)^2$

✓ y-value

(3)

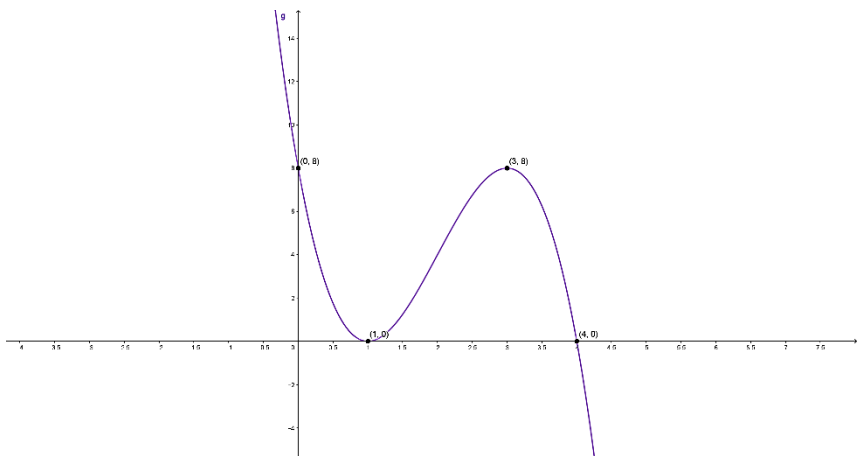
|     |                                                                                                                                                                           |                                                                                    |
|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
| 6.2 | $y \in (-\infty; \frac{49}{8}]$<br><b>OR</b><br>$y \leq \frac{49}{8}$                                                                                                     | ✓ answer<br><br>(1)                                                                |
| 6.3 | $\tan 135^\circ = -1$<br>$m = -1$<br>$f'(x) = -1$<br>$-4x - 5 = -1$<br>$\therefore x = -1$<br><br>$f(-1) = -2(-1)^2 - 5(-1) + 3$<br>$y = 6$<br><br>$\therefore P(-1 ; 6)$ | ✓ $m = -1$<br><br>✓ $f'(x) = -1$<br><br>✓ $x = -1$<br><br><br>✓ $y = 6$<br><br>(4) |
| 6.4 | $k < -\frac{49}{8}$ <b>or</b> $k > -\frac{49}{8}$                                                                                                                         | ✓ answer<br>✓ answer<br>(2)                                                        |
|     |                                                                                                                                                                           | [10]                                                                               |

| QUESTION 7 |                                                                                                                                                                |                                                |
|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|
| 7.1        | $f(x) = a^x$<br>$\frac{1}{4} = a^2$<br>$\sqrt{\frac{1}{4}} = a$<br>$\frac{1}{2} = a$                                                                           | ✓ correct substitution<br>✓ square root<br>(2) |
| 7.2        | $y = \left(\frac{1}{2}\right)^x$<br>$x = \left(\frac{1}{2}\right)^y$<br>$y = \log_{\frac{1}{2}} x$                                                             | ✓ interchange $x$ and $y$<br>✓ answer<br>(2)   |
| 7.3        | $y = \left(\frac{1}{2}\right)^x$<br>$-y = \left(\frac{1}{2}\right)^x$<br>$h(x) = -\left(\frac{1}{2}\right)^x$ <b>OR</b> $h(x) = -a^x$ <b>OR</b> $h(x) = -f(x)$ | ✓ answer    (1)                                |
| 7.4        | $x \leq 0$ <b>OR</b> $x > 0$ <b>OR</b> $x < 0$ <b>OR</b> $x \geq 0$                                                                                            | ✓✓ answer<br>(2)                               |
|            |                                                                                                                                                                | [7]                                            |

| QUESTION 8 |       |                                                                                                                     |                                                          |
|------------|-------|---------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|
| 8.1        | 8.1.1 | $x < 2$                                                                                                             | ✓✓ answer<br>(2)                                         |
|            | 8.1.2 | $0 < x \leq 1$                                                                                                      | ✓ critical values<br>✓ answer in correct notation<br>(2) |
| 8.2        | 8.2.1 | $g(x) = \log_2 x$<br>$y = \log_2 x$<br>$\therefore x = 2^y$<br>$\therefore y = 2^x$<br>$\therefore g^{-1}(x) = 2^x$ | ✓ interchange $x$ and $y$<br>✓ answer<br>(2)             |
|            | 8.2.2 | $\log_2(3-x) = x$<br>$2^x = 3-x$<br>therefore point of intersection of $g^{-1}$ and $f$                             | ✓ $g^{-1}$ (inverse)<br>✓ point of intersection<br>(2)   |
|            | 8.2.3 | $x = 1$                                                                                                             | ✓ answer<br>(1)                                          |
|            |       |                                                                                                                     | [9]                                                      |

| QUESTION 9 |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|------------|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 9.1        | 9.1.1 | $f(x) = 3x - x^2$ $f(x+h) = 3(x+h) - (x+h)^2$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{3(x+h) - (x+h)^2 - (3x - x^2)}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{3x + 3h - x^2 - 2xh + h^2 - 3x + x^2}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{3h - 2xh + h^2}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{h(3 - 2x + h)}{h}$ $f'(x) = 3 - 2x$ <p><b>NOTE: Answer only</b> <math>\left(\frac{0}{5}\right)</math></p> |
|            | 9.1.2 | $f(1) = 2$ $f(3) = 0$ $\frac{f(3) - f(1)}{2}$ $= \frac{0 - 2}{2}$ $= -1$                                                                                                                                                                                                                                                                                                                                                                                                  |
| 9.2        | 9.2.1 | $y = \frac{8 - 3x^6}{8x^5}$ $y = x^{-5} - \frac{3}{8}x$ $\frac{dy}{dx} = -5x^{-6} - \frac{3}{8}$                                                                                                                                                                                                                                                                                                                                                                          |

|  |       |                                                                                                                                                                        |                                                                                                                               |
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|  | 9.2.2 | $D_x \left[ \sqrt[3]{x^2} + \frac{1}{x} + 2x \right]$ $D_x \left[ x^{\frac{2}{3}} + x^{-1} + 2x \right]$ $D_x \left[ \frac{2}{3}x^{-\frac{1}{3}} - x^{-2} + 2 \right]$ | <p>✓ simplification</p> <p>✓ <math>\frac{2}{3}x^{-\frac{1}{3}}</math></p> <p>✓ <math>-x^{-2}</math></p> <p>✓ 2</p> <p>(4)</p> |
|  |       |                                                                                                                                                                        | [15]                                                                                                                          |
|  |       |                                                                                                                                                                        |                                                                                                                               |

| QUESTION 10 |                                                                                                                                                            |                                                                                                                                                                                         |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 10.1        |                                                                          | <ul style="list-style-type: none"> <li>✓ shape</li> <li>✓ x and y-intercepts</li> <li>✓ turning points</li> </ul> <p style="text-align: right;">(3)</p>                                 |
| 10.2        | $f(x) = a(x-1)^2(x-4)$ $8 = a(3-1)^2(3-4)$ $8 = a(-4)$ $a = -2$<br>$f(x) = -2(x-1)^2(x-4)$ $f(x) = -2(x^2 - 2x + 1)(x-4)$ $f(x) = -2x^3 + 12x^2 - 18x + 8$ | <ul style="list-style-type: none"> <li>✓ substitution</li> <li>✓ <math>a = -2</math></li> <li>✓ substitution</li> <li>✓ simplification</li> </ul> <p style="text-align: right;">(4)</p> |
| 10.3        | $f(x) = -2x^3 + 12x^2 - 18x + 8$ $f'(x) = -6x^2 + 24x - 18$ $f''(x) = -12x + 24$ $f''(x) < 0$ $-12x + 24 < 0$ $-x < -2$ $x > 2$                            | <ul style="list-style-type: none"> <li>✓ second derivative</li> <li>✓ <math>f''(x) &lt; 0</math></li> <li>✓ answer</li> </ul> <p style="text-align: right;">(3)</p>                     |
|             |                                                                                                                                                            | <b>[10]</b>                                                                                                                                                                             |

| QUESTION 11 |                                                                                                                                                                                                           |                                                                                                                                                                                                          |  |
|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| 11.1        | $P = \pi r + 4x + 2l$<br>$32 = \pi.2x + 4x + 2l$<br>$16 = \pi x + 2x + l$<br>$l = 16 - \pi x - 2x$                                                                                                        | <div>✓ correct formula</div> <div>✓ correct substitution</div> <div>✓ answer</div> <div>(3)</div>                                                                                                        |  |
| 11.2        | $A = 4x.l + \frac{1}{2}\pi(2x)^2$<br>$A = 4x[16 - \pi x - 2x] + 2\pi x^2$<br>$= -8x^2 - 2\pi x^2 + 64x$                                                                                                   | <div>✓ correct formula</div> <div>✓ correct substitution and simplification</div> <div>(2)</div>                                                                                                         |  |
| 11.3        | $A'(x) = 0$<br>$-16x - 4\pi x + 64 = 0$<br>$4x + \pi x - 16 = 0$<br>$x(4 + \pi) = 16$<br>$x = \frac{16}{4 + \pi}$<br>$x = 2,24m$<br><br><b>OR</b><br><br>$x = \frac{-64}{2(-8 - 2\pi)}$<br><br>$x = 2,24$ | <div>✓ derivative</div> <div>✓ derivative = 0</div> <div>✓ answer</div> <div><b>OR</b></div> <div>✓✓ sub. <math>a</math> and <math>b</math> into A.o.S. formula</div> <div>✓ answer</div> <div>(3)</div> |  |
|             |                                                                                                                                                                                                           | <div>[8]</div>                                                                                                                                                                                           |  |

| QUESTION 12 |        |                                                                                                                              |                                   |
|-------------|--------|------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|
| 12.1        |        | $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$ $0,6 = 0,3 + 0,4 - P(A \text{ and } B)$ $P(A \text{ and } B) = 0,1$ | ✓ substitution<br>✓ answer<br>(2) |
| 12.2        | 12.2.1 | $A = 32$<br>$B = 48$                                                                                                         | ✓ answer<br>✓ answer<br>(2)       |
|             | 12.2.2 | $P(\text{iPhone}) = \frac{101}{166}$ $= 0,61$                                                                                | ✓✓ $\frac{101}{166}$<br>(2)       |
|             | 12.2.3 | $P(\text{iPhone/Gr 12}) = \frac{48}{101}$ $= 0,48$                                                                           | ✓✓ $\frac{48}{101}$<br>(2)        |
|             |        |                                                                                                                              | [8]                               |

| QUESTION 13 |                                                                                                                                  |                                                                                                                  |
|-------------|----------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|
| 13.1        | $9!$<br>$= 362\,880$<br><b>OR</b><br>$9 \times 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1$<br>$= 362\,880$ | ✓✓ $9!$<br><b>OR</b><br>✓✓<br>$9 \times 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1$<br>(2) |
| 13.2        | $4! \times 3! \times 2! \times 3!$<br>$= 1\,728$                                                                                 | ✓✓ $4! \times 3! \times 2! \times 3!$<br>✓ answer<br>(3)                                                         |
| 13.3        | From left to right and from right to left<br>Therefore 2 ways<br><b>NOTE: If answer is 1 way, award 1 mark ONLY</b>              | ✓✓ answer<br>(2)                                                                                                 |
|             |                                                                                                                                  | [7]                                                                                                              |

TOTAL: 150