



**LIMPOPO**

**PROVINCIAL GOVERNMENT**  
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF  
**EDUCATION**

**NATIONAL  
SENIOR CERTIFICATE**

**GRADE 11**

**MATHEMATICS P1**  
**JUNE 2024**

**MARKS: 100**

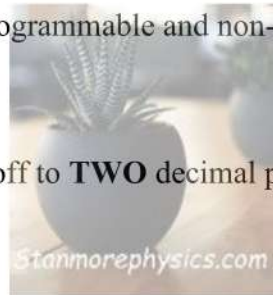
**TIME: 2 Hours**

**This question paper consists of 6 pages**

## INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of 6 Questions.
2. Answer **ALL** the questions.
3. Number your answers correctly according to the numbering system used in this question paper.
4. Clearly show **ALL** calculations, diagrams and graphs that you have used in determining your answers.
5. Answers only will **NOT** necessarily be awarded full marks.
6. An approved scientific calculator (non-programmable and non-graphical) may be used, unless stated otherwise.
7. If necessary, answers should be rounded off to **TWO** decimal places, unless stated otherwise.
8. Diagrams are **NOT** necessarily drawn to scale.
9. Information sheet with formulae is included at the end of the question paper.
10. Write neatly and legibly.



**QUESTION 1**

1.1 Solve for  $x$  if:

1.1.1  $x^2 + x - 12 = 0$  (3)

1.1.2  $\sqrt{x-1} + 3 = x - 4$  (6)

1.1.3  $x^2 > 3(x + 6)$  (4)

1.1.4  $2^{3x+1} + 2^{3x} = 12$  (4)

1.2 Given :  $f(x) = 5x^2 + 6x - 7$

1.2.1 Solve for  $x$  if  $f(x) = 0$  (correct to TWO decimal places) (4)

1.2.2 Hence or, otherwise, calculate the value of  $d$  for which  $5x^2 + 6x - d = 0$  has equal roots. (3)

1.3 Solve for  $x$  and  $y$  simultaneously:

$y + x = 2$  and  $x^2 + 3xy + 8 = 0$  (6)

**[30]**

**QUESTION 2**

2.1 Simplify WITHOUT using a calculator:

2.1.1  $\frac{3^{m+4} - 6 \cdot 3^{m+1}}{7 \cdot 3^{m+2}}$  (4)

2.1.2  $\frac{2^{n+2} \cdot 4^{n+1}}{8^{n-1}}$  (3)

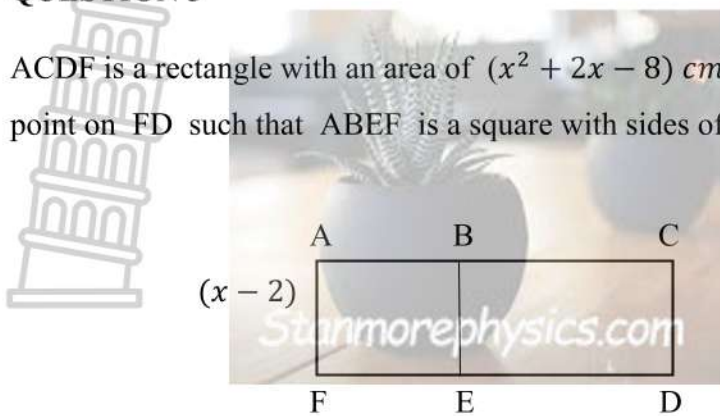
2.1.3  $\sqrt{x + \sqrt{2x - 1}} \cdot \sqrt{x - \sqrt{2x - 1}}$  (4)

2.2 Calculate the sum of the digits of  $2^{2021} \times 5^{2024}$  (4)

**[15]**

**QUESTION 3**

ACDF is a rectangle with an area of  $(x^2 + 2x - 8) \text{ cm}^2$ . B is a point on AC and E is a point on FD such that ABEF is a square with sides of length  $(x - 2) \text{ cm}$  each.



Calculate the length of ED.

(5)

[5]

**QUESTION 4**

Given:  $f(x) = \frac{8}{x - 2} + 3$



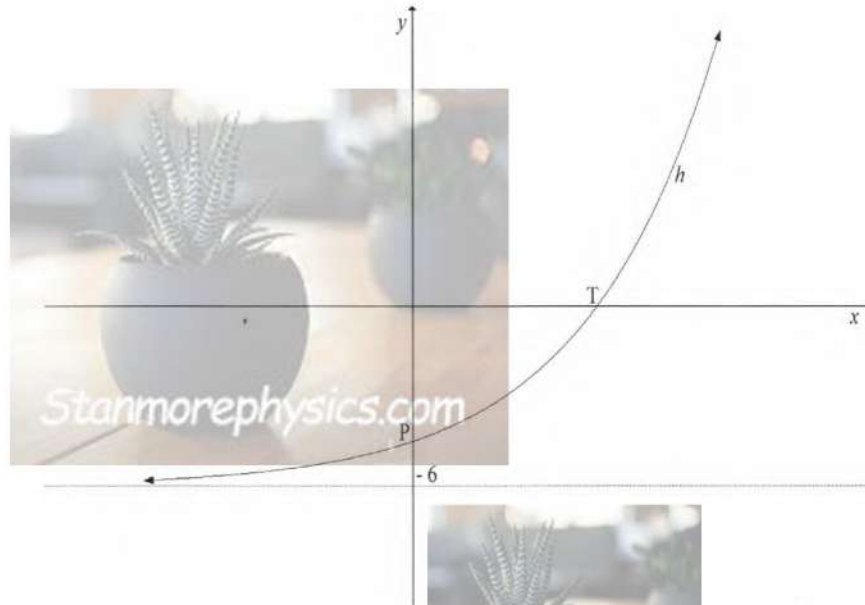
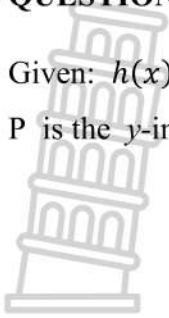
- 4.1 Write down the equations of the asymptotes of  $f$ . (2)
- 4.2 Calculate the  $x$ - and  $y$ - intercepts of  $f$ . (3)
- 4.3 Sketch the graph of  $f$ . Show clearly the intercepts with the axes and the asymptotes. (3)
- 4.4 If  $y = x + k$  is an equation of the line of symmetry of  $f$ , calculate the value of  $k$ . (2)
- 4.5 The graph of  $f$  is reflected about the  $x$ -axis to obtain the graph of  $g$ . (2)  
Write down the equation of  $g$ .
- 4.6 Write down the domain of  $f$ . (2)

[14]

**QUESTION 5**

Given:  $h(x) = a \cdot 2^{x-1} + q$ . The line  $y = -6$  is an asymptote to the graph of  $h$ .

P is the  $y$ -intercept of  $h$  and T is the  $x$ -intercept of  $h$ .

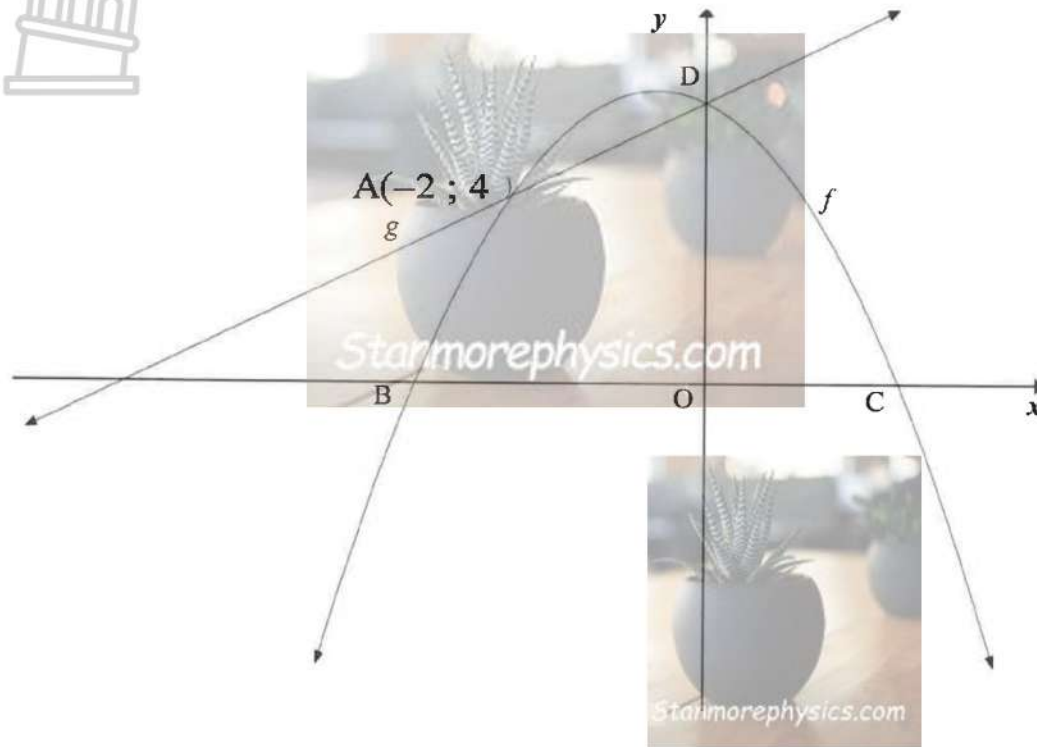


- 5.1 Write down the value of  $q$ . (1)
- 5.2 If the graph of  $h$  passes through the point  $(-1; -5\frac{1}{4})$ , calculate the value of  $a$ . (4)
- 5.3 Calculate the average gradient between the  $x$ -intercept and the  $y$ -intercept of  $h$ . (5)
- 5.4 Determine the equation of  $g$  if  $g(x) = h(x - 2)$  in the form  $g(x) = a \cdot 2^{x-1} + q$  (2)
- 5.5 Write down the range of  $h$ . (2)

**[14]**

**QUESTION 6**

The diagram below shows the graphs of  $f(x) = -x^2 - x + 6$  and  $g(x) = mx + c$ .  
 $A(-2; 4)$  is the point of intersection of the graphs.



- 6.1 Determine the coordinates of B and C. (4)
- 6.2 Write down the equation of the axis of symmetry of  $f$ . (2)
- 6.3 Determine the range of  $f$ . (3)
- 6.4 Write down the equation of  $g$  in the form  $g(x) = mx + c$ . (3)
- 6.5 Calculate the average gradient between point A and D. (1)
- 6.6 Determine the equation of  $h$ , if  $h$  is the reflection of  $f$  about the  $x$ -axis and then translated 3 units to the right. Leave your answer in the form  $f(x) = a(x + p)^2 + q$ . (3)
- 6.7 Write down the values of  $x$  for which:
  - 6.7.1  $f(x) < 0$  (2)
  - 6.7.2  $f(x) \geq g(x)$  (2)
- 6.8 If  $f(x) = k$ , write down the value(s) of  $k$  for which the equation has equal roots. (2)

**[22]**

**TOTAL : 100**



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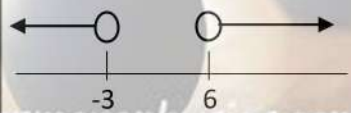
**GRADE 11**

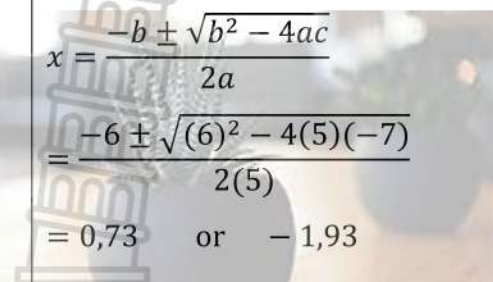

**MATHEMATICS P1 MEMORANDUM**

**JUNE 2024**

*Stanmorephysics.com*

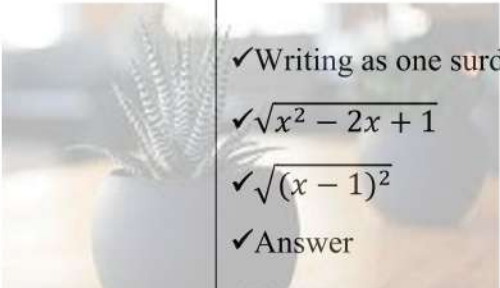
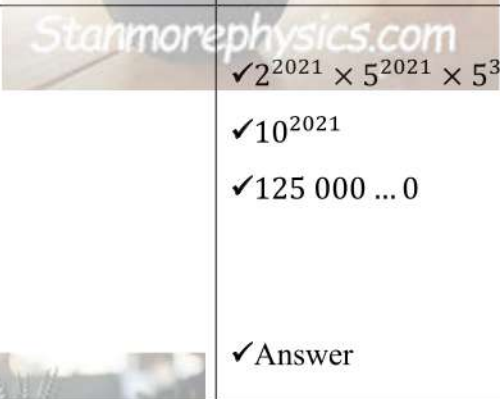
**MARKS: 100**

QUESTION 1		
1.1.1.	$x^2 + x - 12 = 0$ $(x + 4)(x - 3) = 0$ $x = -4$ or $x = 3$	✓Factors ✓ $x = -4$ ✓ $x = 3$ (3)
1.1.2.	$\sqrt{x-1} + 3 = x - 4$ $\sqrt{x-1} = x - 7$ $(\sqrt{x-1})^2 = (x-7)^2$ $x - 1 = x^2 - 14x + 49$ $x^2 - 15x + 50 = 0$ $(x - 10)(x - 5) = 0$ $x = 10$ or $x = 5$ $\therefore x = 10$	✓Isolating the $\sqrt{\quad}$ sign ✓Squaring both sides  ✓Standard form ✓Factors ✓ $x = 1$ or $x = 5$ ✓ $x = 10$ (6)
1.1.3.	$x^2 > 3(x + 6)$ $x^2 - 3x - 18 > 0$ $(x - 6)(x + 3) > 0$ $x = 6$ or $x = -3$ ( <i>critical values</i> )  $x < -3$ or $x > 6$	✓Standard form ✓critical values  ✓ $x < -3$ or $x \in (-\infty; -3)$ ✓ $x > 6$ or $x \in (6; \infty)$ (4)
1.1.4.	$2^{3x+1} + 2^{3x} = 12$ $2^{3x} \cdot 2 + 2^{3x} = 12$ $2^{3x}(2 + 1) = 12$ $2^{3x} = 4$ $2^{3x} = 2^2$ $\therefore 3x = 2$ $x = \frac{2}{3}$	✓ $2^{3x} \cdot 2$ ✓common factors  ✓Equating exponents ✓Answer (4)


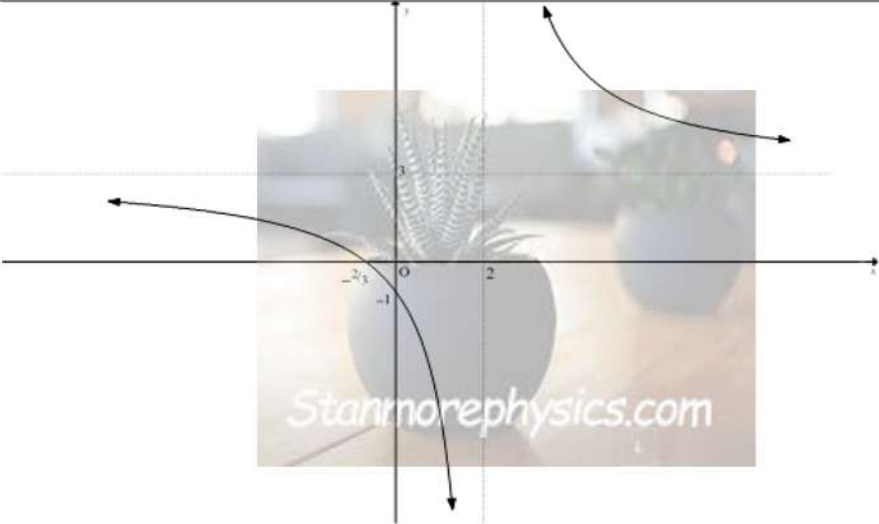
<p>1.2.1.</p>	$0 = 5x^2 + 6x - 7$  $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $= \frac{-6 \pm \sqrt{(6)^2 - 4(5)(-7)}}{2(5)}$ $= 0,73 \quad \text{or} \quad -1,93$	<p>✓Formula</p> <p>✓Substitution</p> <p>✓0,73</p> <p>✓-1,93</p> <p>(4)</p>
<p>1.2.2.</p>	$5x^2 + 6x - d = 0$ <p>For equal roots: <math>\Delta = 0</math></p> $\Delta = b^2 - 4ac$ $0 = (6)^2 - 4(5)(-d)$ $36 + 20d = 0$ $d = \frac{-9}{5}$	<p>✓ Substitution</p> <p>✓<math>36 + 20d = 0</math></p> <p>✓ Answer</p> <p>(3)</p>
<p>1.3.</p>	$y + x = 2 \dots(1)$ $x^2 + 3xy + 8 = 0 \dots(2)$ <p>From (1): <math>y = 2 - x \dots(3)</math></p> <p>Sub (3) into (2): <math>x^2 + 3x(2 - x) + 8 = 0</math></p> $x^2 + 6x - 3x^2 + 8 = 0$ $-2x^2 + 6x + 8 = 0$ $x^2 - 3x - 4 = 0$ $(x - 4)(x + 1) = 0$ $x = 4 \quad \text{or} \quad x = -1$ $y = -2 \quad \text{or} \quad y = 3$ <p><b>OR</b></p>	 <p>✓Equation (3)</p> <p>✓Substitution</p> <p>✓Standard form</p> <p>✓Factors</p> <p>✓Both values of <math>x</math></p> <p>✓Both values of <math>y</math></p> <p>(6)</p> <p><b>OR</b></p>

<p> <math>y + x = 2 \dots(1)</math>  <math>x^2 + 3xy + 8 = 0 \dots(2)</math>                  From (1): <math>x = 2 - y \dots(3)</math>                  Sub (3) into (2): <math>(2 - y)^2 + 3y(2 - y) + 8 = 0</math>  <math>4 - 4y + y^2 + 6y - 3y^2 + 8 = 0</math>  <math>-2y^2 + 2y + 12 = 0</math>  <math>y^2 - y - 6 = 0</math>  <math>(y - 3)(y + 2) = 0</math>  <math>y = 3 \quad \text{or} \quad y = -2</math>  <math>x = 4 \quad \text{or} \quad x = -1</math> </p>	<p>                     ✓Equation (3)                      ✓Substitution                        ✓Standard form                      ✓Factors                      ✓Both values of <math>y</math>                      ✓Both values of <math>x</math>      (6)                 </p>
	<p><b>[30]</b></p>

QUESTION 2		
<p>2.1.1</p>	$\frac{3^{m+4} - 6 \cdot 3^{m+1}}{7 \cdot 3^{m+2}}$ $= \frac{3^m(3^4 - 6 \cdot 3^1)}{3^m(7 \cdot 3^2)}$ $= \frac{3^m \cdot 63}{3^m \cdot 63}$ $= 1$ <p><b>OR</b></p> $\frac{3^{m+4} - 6 \cdot 3^{m+1}}{7 \cdot 3^{m+2}}$ $= \frac{3^{m+1}(3^3 - 6)}{3^{m+1}(7 \cdot 3^1)}$ $= \frac{3^{m+1} \cdot 21}{3^{m+1} \cdot 21}$ $= 1$	<p>✓ Common factor</p> <p>✓ <math>3^4 - 6 \cdot 3^1</math></p> <p>✓ Simplification</p> <p>✓ Answer (4)</p> <p><b>OR</b></p> <p>✓ Common factor</p> <p>✓ <math>3^3 - 6</math></p> <p>✓ Simplification</p> <p>✓ Answer (4)</p>
<p>2.1.2.</p>	$\frac{2^{n+2} \cdot 4^{n+1}}{8^{n-1}}$ $= \frac{2^{n+2} \cdot 2^{2n+2}}{2^{3n-3}}$ $= 2^{n+2+2n+2-3n+3}$ $= 2^7$ $= 128$ <p><b>OR</b></p> $\frac{2^{n+2} \cdot 4^{n+1}}{8^{n-1}}$ $= \frac{2^n \cdot 4^n \cdot 4^2}{8^n \cdot 8^{-1}}$ $= \frac{8^n \cdot 2^2 \cdot 2^2}{8^n \cdot 2^{-3}}$ $= 2^7$ $= 128$	<p>✓ Writing prime bases</p> <p>✓ Applying exp law</p> <p>✓ Answer (3)</p> <p><b>OR</b></p> <p>✓ Writing as separate bases</p> <p>✓ Applying exp law</p> <p>✓ Answer (3)</p>

<p>2.1.3.</p>	$\sqrt{x + \sqrt{2x - 1}} \cdot \sqrt{x - \sqrt{2x - 1}}$ $= \sqrt{(x + \sqrt{2x - 1})(x - \sqrt{2x - 1})}$ $= \sqrt{x^2 - 2x + 1}$ $= \sqrt{(x - 1)^2}$ $= x - 1$	 <p>✓ Writing as one surd                  ✓ <math>\sqrt{x^2 - 2x + 1}</math>                  ✓ <math>\sqrt{(x - 1)^2}</math>                  ✓ Answer (4)</p>
<p>2.2.</p>	$2^{2021} \times 5^{2024}$ $= 2^{2021} \times 5^{2021} \times 5^3$ $= 125 \times 10^{2021}$ $= 125\,000 \dots 0$ <p>∴ Sum of digits will be</p> $= 1 + 2 + 5 + 0 + 0 + 0 + \dots 0$ $= 8$	 <p>Stanmorephysics.com</p> <p>✓ <math>2^{2021} \times 5^{2021} \times 5^3</math>                  ✓ <math>10^{2021}</math>                  ✓ 125 000 ... 0                  ✓ Answer (4)</p>
		<p>[15]</p>

QUESTION 3		
	$AC(x - 2) = x^2 + 2x - 8$ $AC(x - 2) = (x + 4)(x - 2)$ $AC = (x + 4)cm$ $\therefore FD = (x + 4)cm$ $\therefore ED = (x + 4) - (x - 2)$ $ED = 6cm$	✓Statement ✓Factors ✓ $AC = (x + 4)cm$ ✓Method ✓Answer (5)
		<b>[5]</b>

QUESTION 4		
4.1.	$x = 2$ $y = 3$	✓ $x = 2$ ✓ $y = 3$ (2)
4.2.	<p><i>y - intercept</i></p> $y = \frac{8}{0-2} + 3$ $= -1$ <p><i>x - intercept</i></p> $0 = \frac{8}{x-2} + 3$ $-3(x - 2) = 8$ $-3x + 6 = 8$ $x = \frac{-2}{3}$	 <p>✓<math>y = -1</math> OR <math>(0; -1)</math></p> <p>✓<math>0 = \frac{8}{x-2} + 3</math></p> <p>✓<math>x = \frac{-2}{3}</math> OR <math>(\frac{-2}{3}; 0)</math> (3)</p>
4.3.		✓Asymptotes ✓Intercept with axes ✓Shape (3)

4.4.	$3 = 2 + k$ $k = 1$ <b>OR</b> $y = (x - 2) + 3$ $y = x + 1$ $\therefore k = 1$	✓Substitution ✓Answer (2) <b>OR</b> ✓ $y = x + 1$ ✓Answer (2)
4.5.	$g(x) = \frac{-8}{x-2} - 3$	✓✓Answer (2)
4.6.	$x \in R, x \neq 2$	✓✓Answer (2)
		<b>[14]</b>

<b>QUESTION 5</b>		
5.1.	$q = -6$	✓Answer (1)
5.2.	$-5\frac{1}{4} = a \cdot 2^{-1-1} - 6$ $\frac{3}{4} = \frac{1}{4}a$ $a = 3$	✓Substitution of $x$ ✓Substitution of $y$ ✓Simplification ✓Answer (4)
5.3.	x-intercept: $2^{x-1} = 2$ $\therefore x = 2$ $\therefore (2; 0)$ y-intercept: $3 \cdot 2^{-1} - 6 = -4\frac{1}{2}$ $\therefore (0; -4\frac{1}{2})$ Average gradient = $\frac{y_2 - y_1}{x_2 - x_1}$ $= \frac{0 + 4\frac{1}{2}}{2 - 0}$ $= \frac{9}{4}$ OR $2\frac{1}{4}$	✓ $2^{x-1} = 2$ ✓ $x = 2$ ✓ $y = -4\frac{1}{2}$  ✓Sub into the gradient formula ✓Answer (5)
5.4.	$g(x) = 3 \cdot 2^{x-3} - 6$	✓✓Answer (2)
5.5.	$y > -6$	✓✓Answer (2)
		<b>[14]</b>

QUESTION 6		
6.1.	$0 = -x^2 - x + 6$ $x^2 + x - 6 = 0$ $(x + 3)(x - 2) = 0$ $x = -3 \quad \text{or} \quad x = 2$ $\therefore B(-3; 0) \text{ and } C(2; 0)$	✓ $y = 0$ ✓ Factors ✓ $B(-3; 0)$ ✓ $C(2; 0)$
6.2.	$x = \frac{-b}{2a}$ $= \frac{-(-1)}{2(-1)}$ $= \frac{-1}{2}$ <p><b>OR</b></p> $x = \frac{x_2 + x_1}{2}$ $= \frac{-3 + 2}{2}$ $= \frac{-1}{2}$	✓ Substitution ✓ Answer (2)  <b>OR</b> ✓ Substitution ✓ Answer (2)
6.3.	$f\left(\frac{-1}{2}\right) = -\left(\frac{-1}{2}\right)^2 - \left(\frac{-1}{2}\right) + 6$ $= \frac{25}{4}$ <p>TP <math>\left(\frac{-1}{2}; \frac{25}{4}\right)</math></p> $\therefore \text{Range: } y \leq \frac{25}{4}$ <p><b>OR</b></p> $y \in \left(-\infty; \frac{25}{4}\right]$	✓ Substitution ✓ y-value of T.P ✓ Answer (3)
6.4.	$D(0; 6)$ $m_{AD} = \frac{y_2 - y_1}{x_2 - x_1}$ $= \frac{6 - 4}{0 - (-2)}$ $= 1$ $\therefore g(x) = x + 6$	✓ Coordinates of D  ✓ Gradient  ✓ Answer (3)
6.5.	Average gradient = gradient of $g$ $= 1$	✓ Answer (1)

6.6.	$f(x) = -(x + \frac{1}{2})^2 + \frac{25}{4}$ $h(x) = (x + \frac{1}{2} - 3)^2 - \frac{25}{4}$ $\therefore h(x) = (x - \frac{5}{2})^2 - \frac{25}{4}$ <p><b>OR</b></p> $f(x) = -x^2 - x + 6$ $h(x) = (x - 3)^2 + (x - 3) - 6$ $h(x) = x^2 - 5x$ $\therefore h(x) = (x - \frac{5}{2})^2 - \frac{25}{4}$	$\checkmark f(x) = -(x + \frac{1}{2})^2 + \frac{25}{4}$ $\checkmark (x - \frac{5}{2})^2$ $\checkmark -\frac{25}{4} \quad (3)$ <p><b>OR</b></p> $\checkmark (x - 3)^2 + (x - 3) - 6$ $\checkmark (x - \frac{5}{2})^2$ $\checkmark -\frac{25}{4} \quad (3)$
6.7.1.	$x < -3 \text{ or } x > 2$ <p><b>OR</b></p> $x \in (-\infty; -3) \text{ or } x \in (2; \infty)$	$\checkmark x < -3$ $\checkmark x > 2 \quad (2)$
6.7.2.	$-3 \leq x \leq 0$ <p><b>OR</b></p> $x \in [-3; 0]$	$\checkmark \checkmark \text{ Answer} \quad (2)$
6.8.	$k = \frac{25}{4}$ <p><b>OR</b></p> $-x^2 - x + 6 = k$ $-x^2 - x + 6 - k = 0$ <p>For equal roots: <math>\Delta = 0</math></p> $\Delta = b^2 - 4ac$ $0 = (-1)^2 - 4(-1)(6 - k)$ $1 + 24 - 4k = 0$ $4k = 25$ $k = \frac{25}{4}$	$\checkmark \checkmark k = \frac{25}{4} \quad (2)$ <p><b>OR</b></p> $\checkmark \checkmark k = \frac{25}{4} \quad (2)$
		<b>[22]</b>
<b>TOTAL:100</b>		