Basic Education

KwaZulu-Natal Department of Education
REPUBLIC OF SOUTH AFRICA

MATHEMATICS PAPER 1

COMMON TEST

JUNE 2015

NATIONAL SENIOR CERTIFICATE

GRADE 11

MARKS: 100

TIME: 2 hours

N.B. This question paper consists of 7 pages including this page and 2 Annexures.

INSTRUCTIONS AND INFORMATION

Read the following instruction carefully before answering the questions.

1. The question paper consists of 5 questions.
2. Answer **ALL** the questions. Question 4.2.2 and 5.4 must be done on the Annexures that are provided
3. Clearly show all calculations and diagrams that you have used in determining your answer.
4. You may use an approved scientific calculator (non-programmable and non-graphical).
5. If necessary round off answers to **TWO** decimal places, unless otherwise stated.
6. Answers only will not be awarded full marks.
7. Diagrams not necessarily drawn to scale.
8. Number the answers correctly according to the numbering system used in this question paper.
9. Write neatly and legibly.

education
Department:
Education
PROVINCE OF KWAZULU-NATAL

TO: THE CHIEF INVIGILATOR(S) OF ALL CENTRES OFFERING NATIONAL SENIOR CERTIFICATE – COMMON TEST JUNE 2015 GRADE 11: MATHEMATICS P1

ERRATA: MATHEMATICS P1

ERROR	CORRECTION
Page 6 Question 4.1: Diagram The label $x = 1$ next to the vertical line is incorrect	Page 6 Question 4.1: Diagram Should be $x = -1$

Kindly ensure that all candidates are informed of the Errata.

12/6/2015

MR R.C. PENNISTON
SENIOR MANAGER
PROVINCIAL EXAMINATION ADMINISTRATION

DATE

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QUESTION 1

1.1 Simplify fully, **without the use of a calculator.**

1.1.1 $27^{\frac{2}{3}} \cdot 81^{\frac{1}{2}}$ (3)

1.1.2 $\dfrac{64^{\frac{-2}{3}} \cdot \sqrt{8}}{\sqrt[7]{128} \cdot \sqrt{98}}$ (3)

1.1.3 $\dfrac{3^{n+4} - 6.3^{n+1}}{7.3^{n-2}}$ (4)

1.2

1.2.1 Simplify $\left(\sqrt{x} - \sqrt{y}\right)^2$ (2)

1.2.2 Hence, use the answer obtained in 1.2.1 to find the square root of $9 - \sqrt{80}$,without **the use of a calculator.** (Leave you answer in a simplified surd form. (4)

[16]

QUESTION 2

2.1 Solve for x

2.1.1 $(2x + 5)(x^2 - 2) = 0$ (3)

2.1.2 $x^2 + 5x = 5$ **(answer correct to 2 decimal places)** (4)

2.1.3 $\sqrt{x^2 + 16} = -2x + 1$ (4)

2.2 If $x^2 < 16$ and $x \geq 0$, determine the value(s) of x. (2)

2.3 Solve the following equations simultaneously.

$$y - x + 1 = 0$$

$$xy = 2y^2 + x^2 + 3x - 10$$ (6)

2.4 Shabangu was asked to solve the inequality $-3x^2 + x \leq 0$.

His solution was as follows:

Step 1 $x(-3x+1) \leq 0$

Step 2 $-3x+1 \leq 0$

Step 3 $-3x \leq -1$

Step 4 $x \leq \frac{1}{3}$

2.4.1 Explain the error in Step 2 (2)

2.4.2 There is another error in Shabangu's solution. Identify and correct it. (3)

2.5 Given $(x-y)(y-3) = 0$. **Calculate:**

2.5.1 y if $x = 2$ (2)

2.5.2 x if $y = 3$ (2)

[28]

QUESTION 3

3.1 Consider the sequence

-3; 2; 7; 12; .....

3.1.1 Write down the next **2** terms of the sequence. (2)

3.1.2 Determine the formula for the n^{th} term of the sequence. (2)

3.2 Determine the value of x if **1; 7; 19; x; 61**.....is a quadratic sequence. (2)

3.3 **16; 33; 56; 85;** ..... forms a quadratic sequence.

3.3.1 Write down the next term in the pattern. (1)

3.3.2 Determine the n^{th} term of the sequence. (4)

3.3.3 Which term of the sequence has a value of **2080?** (4)

3.3.4 **6; 23; 46; 75**..... continues in the same pattern as the one above.

Write down the formula for the n^{th} term of this sequence. (2)

[17]

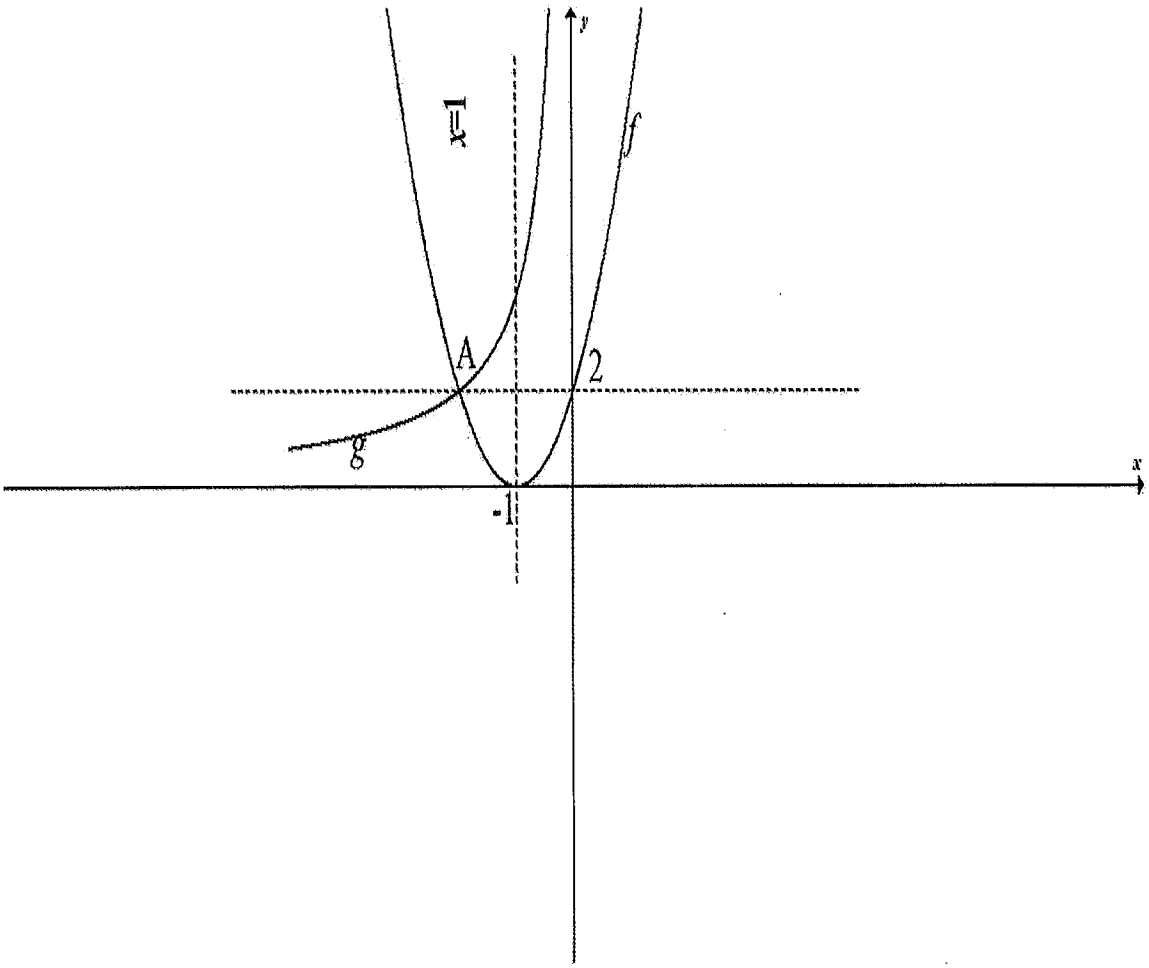
QUESTION 4

4.1 The sketch below shows the sketch of;

$f(x) = ax^2 + bx + c$, with the line of symmetry $x = -1$

$g(x) = \frac{k}{x}$; $x < 0$

and the line $y = 2$. The curves of f and g and the line $y = 2$ intersect at **A**.



4.1.1 Write down the co-ordinates of **A**. (1)

4.1.2 Show that $a = 2$, $b = +4$ and $c = 2$ (4)

4.1.3 Determine the equation of g. (3)

4.1.4 Write down the equations of the line of symmetry of g. (2)

4.1.5 For what values of x is f increasing? (1)

4.1.6 Determine the average gradient on the curve of f between $x = -1$ and $x = 0$ (2)

4.1.7 If the graph of f is shifted **2 units** to the **right** and **3 units down,** write down the equation of the new graph. (2)

[15]

4.2 Given $y = -2x^2 + 8x + 10$ and $y = -2x - 2$

4.2.1 Determine the x and y intercepts of $y = -2x^2 + 8x + 10$ (4)

4.2.2 Sketch both graphs on the system of axes provided. (6)

4.2. 3 Determine the coordinates of the points of intersection of the two graphs. (2)

[12]

QUESTION 5

Consider the following functions;

$$g(x) = \frac{3}{x-2} + 1$$

$$h(x) = 3^{x-2} - 1$$

5.1 State the x and y intercepts of g. (2)

5.2 Write down the y asymptote of h. (2)

5.3 State the range for g (2)

5.4 Sketch both graphs on the system of axes provided. (6)

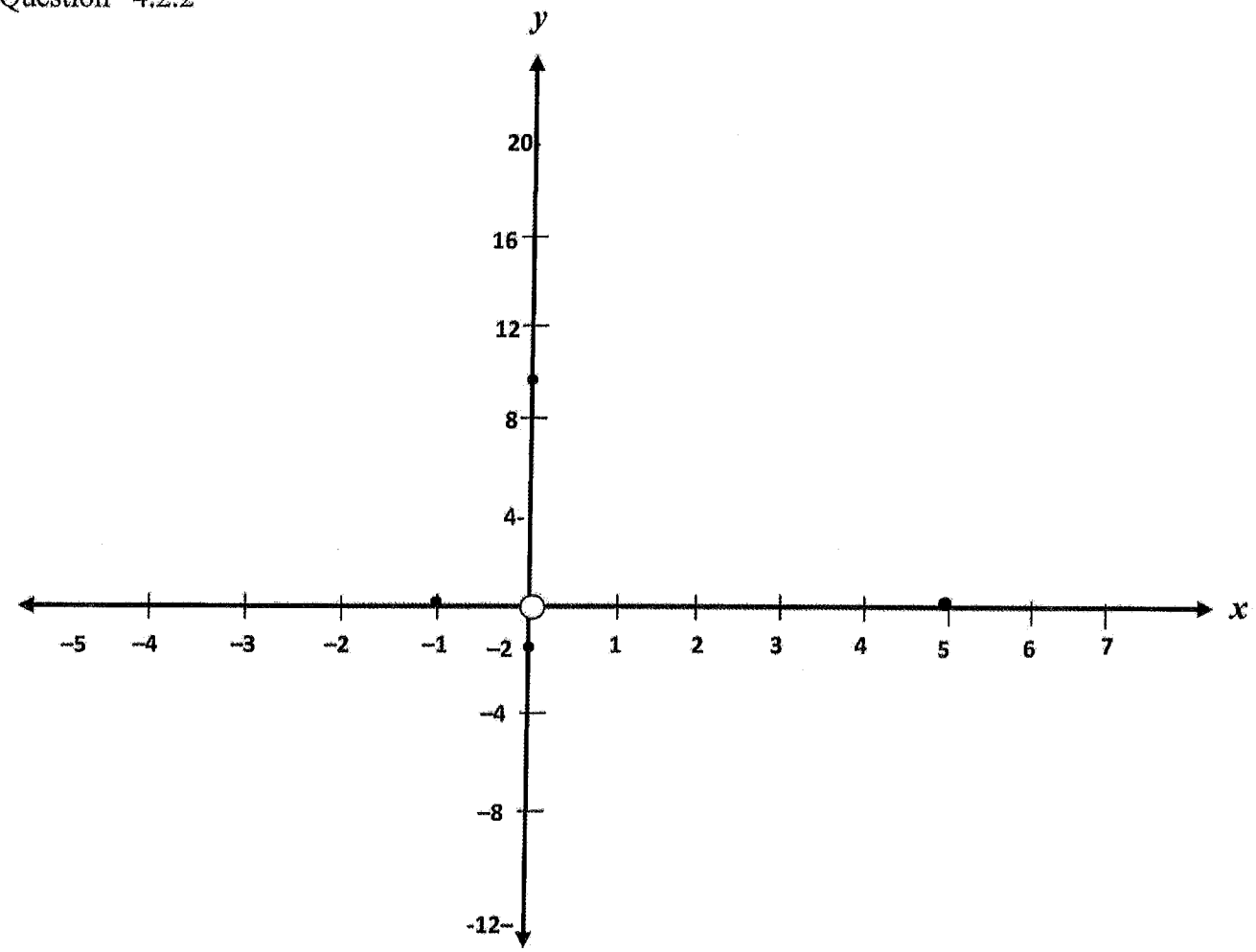
[12]

TOTAL MARKS [100]

NAME:_____ GRADE:_____

ANNEXURE A

Question 4.2.2

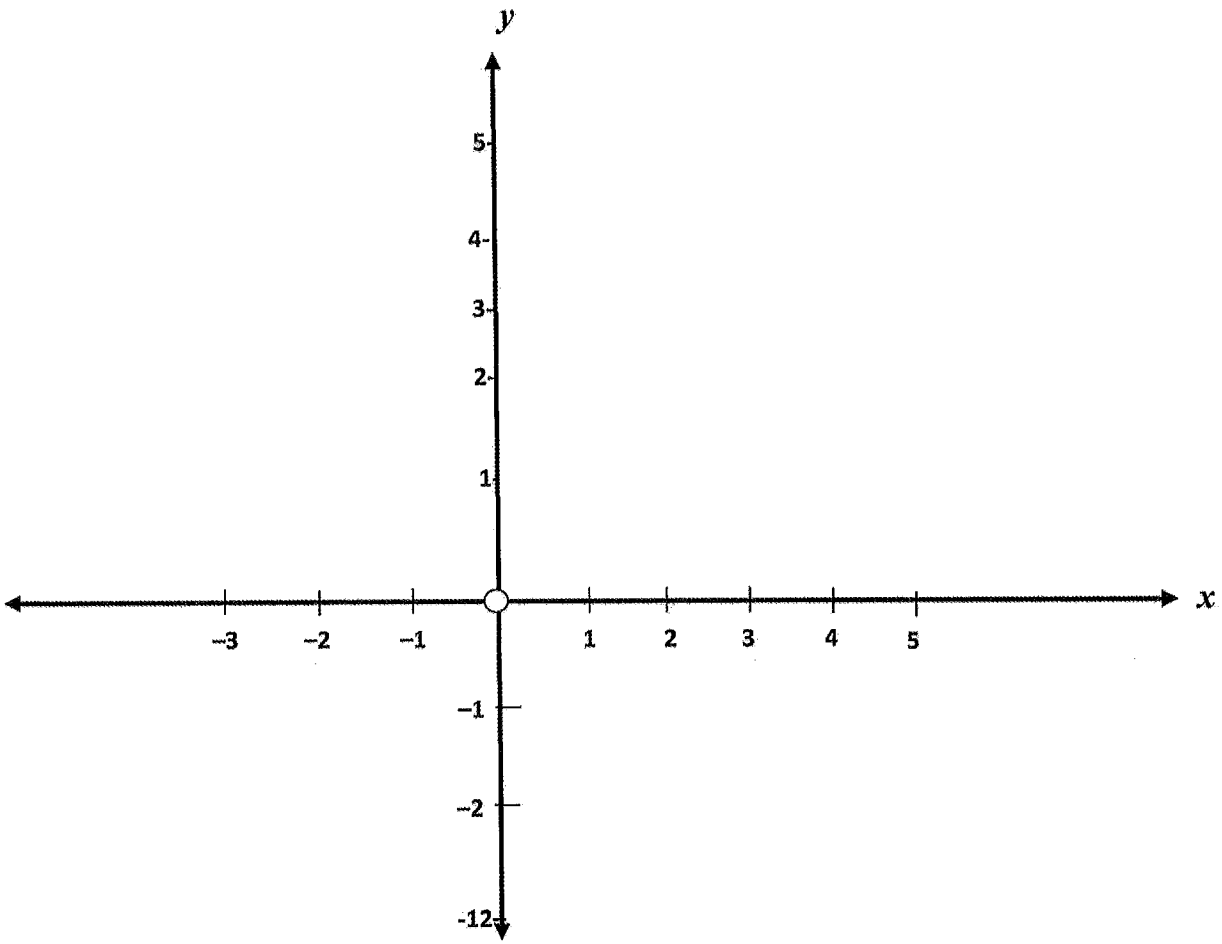


Tear off sheet

NAME:_____ GRADE:_____

ANNEXURE B

Question 5.2.4



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MEMORANDUM

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N.B. This memorandum consists of 10 pages.

QUESTION 1

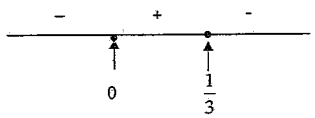
1.1.1	$(3^3)^{2/3} \cdot (3^4)^{1/2}$ ✓ $= 3^2 \cdot 3^2$ ✓ $= 9.9$ $= 81$ ✓	1A for writing as base 3 1A for simplifying 1A for correct answer (3)
1.1.2	$\frac{(2^6)^{-2/3}.2\sqrt{2}}{(2^7)^{1/7}.7\sqrt{2}}$ ✓✓ $=\frac{2^{-4}.2\sqrt{2}}{2.7\sqrt{2}}$ $= \frac{1}{16.7}$ ✓ $= \frac{1}{112}$ ✓	2A for writing denominator/ Numerator as base 2 1A for simplifying 1CA for answer (4)
1.1.3	$\frac{3^n(3^4-6.3)}{3^n(7.3^{-2})}$ ✓✓ $= \frac{63}{\frac{7}{9}}$ ✓ $= 81$ ✓	2A for correct factorization 1CA for simplification 1CA for answer (4)
1.2.1	$\left(\sqrt{x}-\sqrt{y}\right)^2$ $=x+y-2\sqrt{x.y}$ ✓✓	1 A for $x + y$ / 1A for $-2\sqrt{x.y}$
1.2.2	$\sqrt{9-\sqrt{80}}$ $=\sqrt{5+4-2\sqrt{5.4}}$ ✓ $=\sqrt{\left(\sqrt{5}-\sqrt{4}\right)^2}$ ✓ $=\sqrt{5}-2$ ✓	1A for writing 9 as 5+4 1A for $\sqrt{80}$ as $2\sqrt{5.4}$ 1CA for simplifying 1 CA for answer (3)

[16]

QUESTION 2

2.1.1 $x=\frac{5}{2}$ ✓ or $x=\pm\sqrt{2}$ ✓✓	3A for correct values of x (2)
2.1.2 $x^2+5x-5=0$ $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$ ✓ $=\frac{-5\pm\sqrt{5^2-(1)(-5)}}{2.1}$ ✓ $=5{,}85$✓ or $0{,}85$ ✓	1 M for correct formula 1 CA for substitution 2 CA for correct answer (4)
2.1.3 $x^2+16=(-2x+1)^2$ ✓ $x^2+16=4x^2-4x+1$ $3x^2-4x-15=0$ ✓ $(3x+5)(x-3)=0$ $x=\frac{-5}{3}$✓ or $x=3$✓ N/A	1A for squaring both sides 1CA for simplifying to a trinomial 1CA for x values 1 CA for selection / rejections (4)
2.2 $x^2<16$ $(x-4)(x+4)<0$ ✓ $-4<x<4$ $0<x<4$ ✓	1A for correct x values 1A for correct answer (2)
2.3 $y=x-1$ (3)✓ $xy=2y^2+x^2+3x-10$ (2) Substitute eqn. (3) in eqn.(2) $x(x-1)=2(x-1)^2+x^2+3x-10$✓ $x^2-x=2x^2-4x+2+x^2+3x-10$✓ $-2(x^2-4)=0$ $-2(x-2)(x+2)=0$✓ $x=2$ or $x=-2$✓ $y=1$ or $y=-3$ ✓	1A for making x the subject of the formula 1A for substitution 1CA for simplifying 1CA for factorising 1CA for correct x values 1CA for correct y values (6)

OR $x=y+1$ Substitute eqn. (3) in eqn.(2) $y(y+1)=2y^2+(y+1)^2+3(y+1)-10$✓ $y^2+y=2y^2+y^2+2y+1+3y+3-10$✓ $-2y^2-4y+6=0$ $-2(y+3)(y-1)=0$✓ $y=-3$ or $x=1$✓ $x=2$ or $x=-2$ ✓	1A for making x the subject of the formula 1A for substitution 1CA for simplifying 1CA for factorising 1CA for correct x values 1CA for correct y values (6)

2.4.1 Shabangu divided both sides of the inequality by x, hence losing one solution of x. ✓✓ 2.4.2 steps 3/4 should read as follows: $x(-3x+1)\leq 0$ $x=0$ or $x=\frac{1}{3}$ C V $x=0$ or 3 or -2  $(-\infty;0)$✓ ∪ $[\frac{1}{3};\infty]$✓	2A for correct justification 1A for correcting steps 2A for correct inequality as answer (3)

2.5.1 $y=2$ ✓ or $y=3$✓	2A for correct y values (2)
2.5.2 $y\in R$✓✓	2A For correct answer (2)

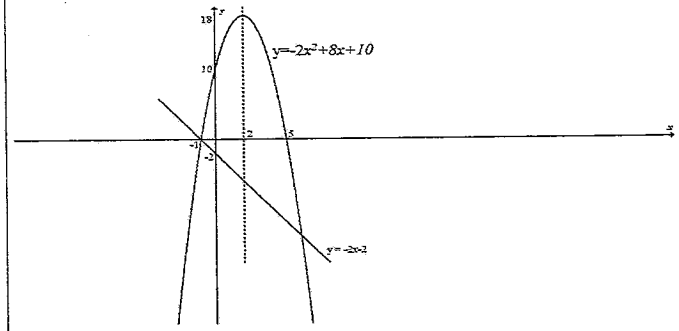
QUESTION 3 3.1.1 19; ✓ 24✓	2A for correct answer (2)
3.1.2 $T_n=an+b$ $7=5(3)+b$✓ $-8=b$	2A for correct answer (2)

	$\therefore T_n = 5n - 8$✓	
3.2	$x = 37$✓✓	2A for correct y values (2)
3.3.1	117✓	1A for correct y values (1)
3.3.2	16 33 56 85 117 17 23 29 32 6 6 6✓ $2a = 6$ $3a + b = 17$ $a + b + c = 16$ $a = 3$ $b = 8$ $c = 5$ $\therefore T_n = 3n^2 + 8n + 5$✓✓✓	A for correct second difference 3A for correct values of a, b and c (4)
3.3.3	$3n^2 + 8n + 5 = 2080$✓ $3n^2 + 8n - 2075 = 0$ $(3n + 83)(n - 25) = 0$✓ $n = 25$ ✓	1 CA for equation 1CA for answer (3)
3.3.4	$T_n = 3n^2 + 8n - 5$ ✓✓	2A for correct answer (2)

QUESTION 4	
4.1.1 (-2 ; 2) ✓	1A for correct coordinates (1)
4.1.2 $y = a(x+p)^2 + q$ $2 = a(-2+1)^2 + 0$ ✓ $2 = a$✓ $y = 2(x+1)^2$ ✓ $= 2x^2 + 4x + 2$✓ $a = 2$ $b = +4$ $c = 2$	1A for correct substitution 1CA for correct value of a 1CA for correct substitution of a/AOS 1CA for correct equation (4)
4.1.3 $y = \frac{k}{x}$ $2 = \frac{k}{-2}$ ✓ $-4 = k$ $\therefore y = \frac{-4}{x}$ ✓✓	1A for correct substitution 1 CA for k value 1CA for correct equation (3)

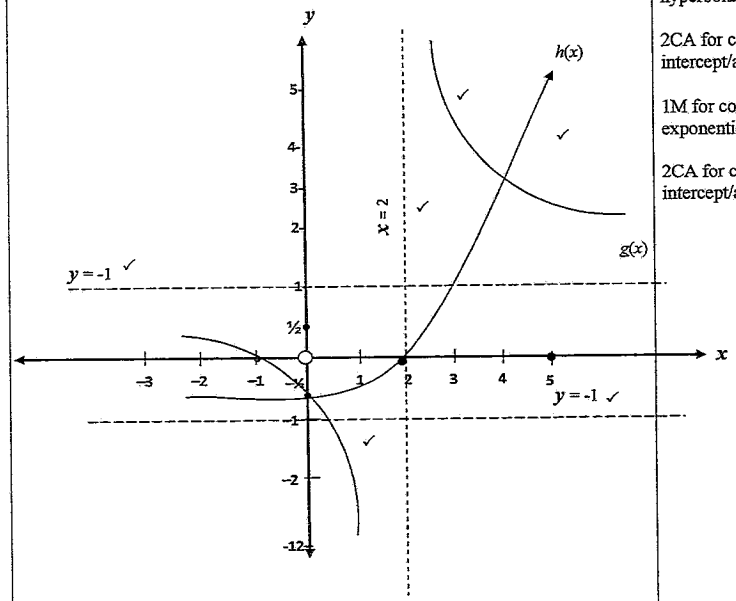
4.1.4 $y = x$ ✓	1A for correct answer (1)
4.1.5 $x > -1$ or $(-1; \infty)$ ✓	1A for correct (1)
4.1.6 average gradient $= \frac{0-2}{-1-0}$ ✓ $= 2$ ✓	1A for correct substitution in gradient Formula 1A for correct answer (2)
4.1.7 $y = 2(x-1)^2 - 3$✓✓	2A for correct equation (2)

4.2.1 y intercept is (0; 10) ✓ x intercept is (5;0) ✓ and (-1;0) ✓	1A for correct value of y 2A for correct value of x (3)

4.2.2 tp ; $x = \frac{-b}{2a}$ $= \frac{-8}{-4}$ $= 2$ $y = 18$ $(2;18)$  	Plotting of Quadratic; 1M for correct shape 2A for correct intercepts 1A for correct TP Straight Line; 2A for correct intercepts (6)

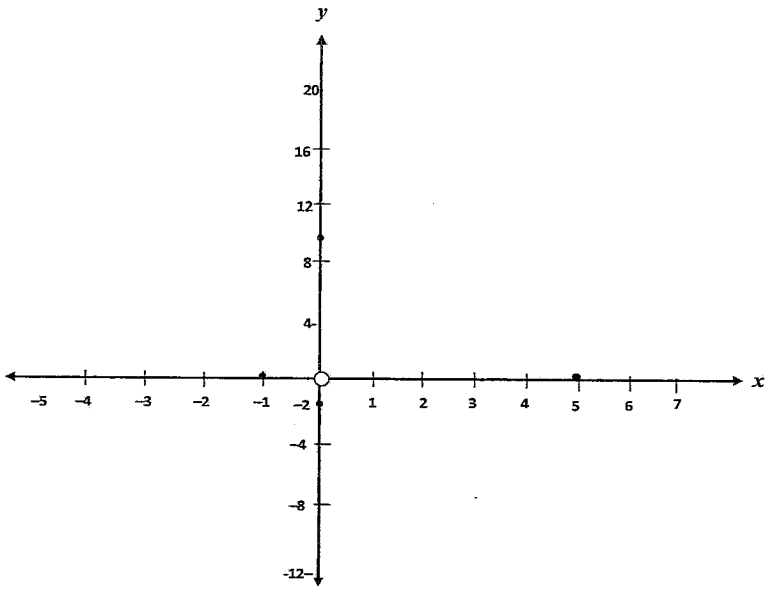
4.2.3 $(-1;0)$ ✓ and $(6;-14)$ ✓	2CA for correct points of intersection (2) **[26]**
QUESTION 5 5.1 $\frac{3}{x-2}$ $\frac{3}{x-2} = -1$ $-x+2=3$ $x=-1$ ✓ $y=\frac{1}{2}$ ✓	1A for correct x intercept 1A for correct y intercept (2)

5.2 $y = -1$ ✓✓	2A for correct asymptote (2)
5.3.1 $y / y \in R, y \neq 2$ or $(-\infty;\infty) \setminus \{2\}$	2CA for correct range (2)
5.3.2 $y \in R,\ y > -1$ or $(-1;\infty)$ ✓✓	2CA for correct range (2)

5.4  	1M for correct shape; hyperbola 2CA for correct intercept/asymptote 1M for correct shape; exponential 2CA for correct intercept/asymptote (6)

[14]

Question 4.2.2 Name: _____



Question 5.4 Name: _____