Senior College June 2015
Mathematics Paper 1
FORM 4

Examiner: Mrs A Gunning	Moderator: Mr R Steenhuisen
TIME: 2 hours	**TOTAL: 100 marks**

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY BEFORE ANSWERING THE QUESTIONS.

- This question paper consists of 6 pages. Please check that your question paper is complete.
- Read and answer all questions carefully.
- It is in your own interest to write legibly and to present your work neatly.
- Number your answers exactly as the questions are numbered.
- **All necessary working which you have used in determining your answers must be clearly shown.**
- Approved non-programmable calculators may be used except where otherwise stated. Where necessary give answers correct to 2 decimal places.
- Diagrams have not necessarily been drawn to scale.

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

QUESTION 1

(a) Solve for x in each of the following equations.

1. $(2x-1)(x+5)=0$ (2)
2. $(2x+3)(x-1)=2x$ (3)
3. $\sqrt{2x+5}=x-5$ (5)
4. $2x^2-4x+1=0$, leaving your answer in simplest surd form. (3)
5. $\frac{2}{x^2-1}-\frac{1}{x^2-x}=\frac{2}{x^2}$ (Remember to factorise all denominators fully first.) State the relevant restrictions. (5)

(b) Solve the following inequality, showing your solution on a number line.

$x^2+x-12>0$ (3)

(c) Solve for x by completing the square given $2x^2+5x-4=0$ leaving your answer in the simplest surd form. (4)

QUESTION 2

(a) Solve for x and y simultaneously given that

$x^2+y^2-2=0$ and $x+2y-1=0$ (6)

(b) Given $f(x)=x^2-5x+c$

Determine the value of c if it is given that the roots of $f(x)=0$ are 3 and 2 (1)

(c) Given $x^2+x=3x-k-2$

1. Rewrite this equation in standard form and hence show that $b^2-4ac=-4k-4$ (2)
2. What is the nature of the roots of the given equation if $k=-10$? (2)
3. Find the maximum value of k for which the equation will have real roots. (2)

QUESTION 3

(a) WITHOUT USING A CALCULATOR, simplify each of the following completely. Remember to show all relevant working detail.

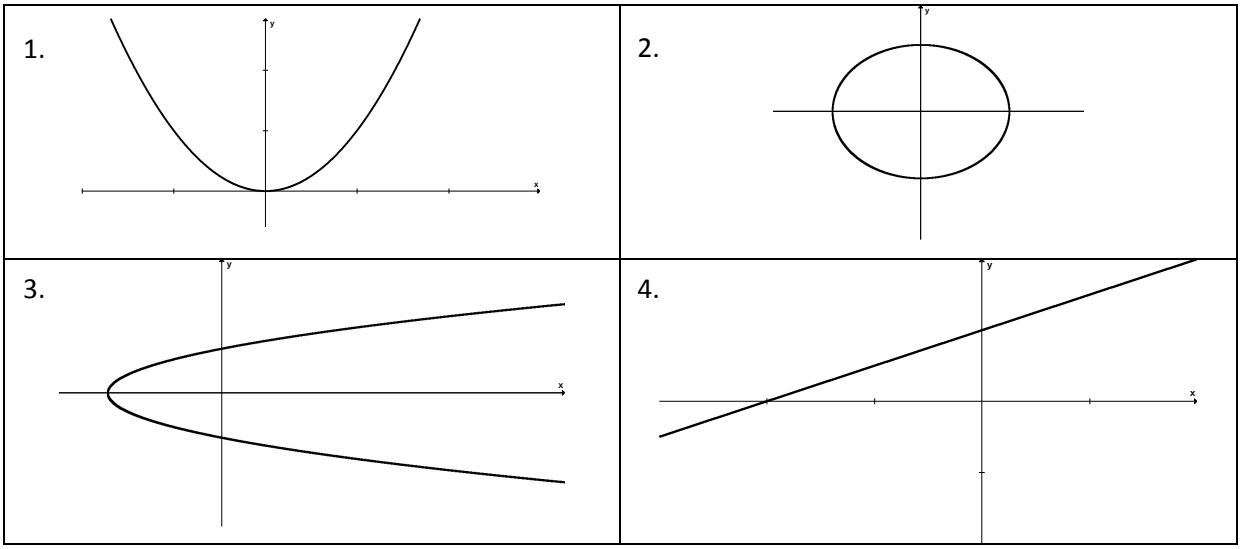
1. $\frac{4^{n+1}.8^{2n}}{16^{2n-1}}$ (3)
2. $\frac{6.2^{2n+3}-8.2^{2n-1}}{2.2^{2n+2}}$ (4)
3. $\frac{\sqrt{300}-\sqrt{75}}{\sqrt{48}}$ (3)

(b) Solve the following exponential equations

1. $3^{2x-1} = 27^{2x-1}$ (2)
2. $2^{x+1} + 2^{x} - 2^{x-1} = 20$ (4)

QUESTION 4

(a) For each of the following state whether or not it is a function, giving a reason to support your statement.



(4)

(b) Given $f(x) = x^2 - 3x + 1$ and $g(x) = -2x^2 - 1$,

1. Evaluate $f(1) + g(1)$ (2)
2. Solve for x given that $f(x) = 11$ (3)

QUESTION 5

Given in the table below are 8 graphs. You are also given a table of possible equations. You are asked to match each graph with an equation from the given list. In your answer script write down only the number of the graph, with what you think is the correct equation . Eg 1 $y = x^2$ and so on.

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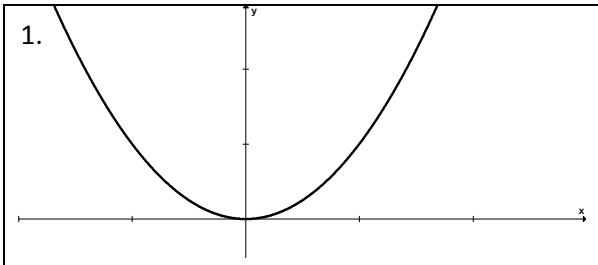
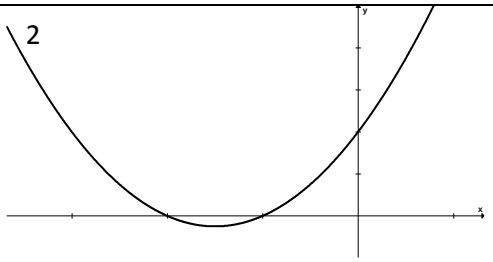
  </td><td>2
  </td></tr>
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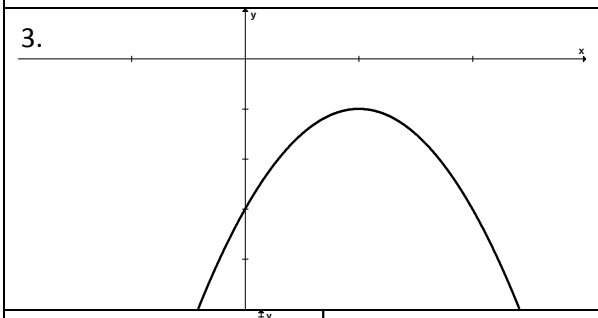
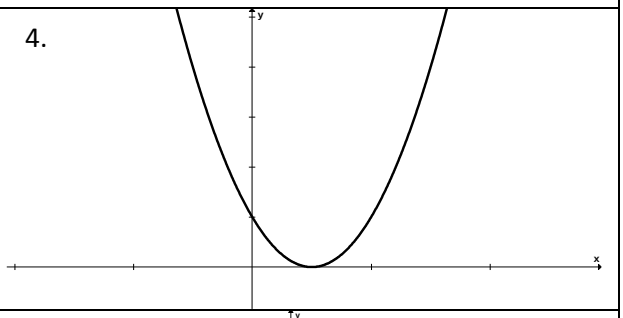
  </td><td>4.
  </td></tr>
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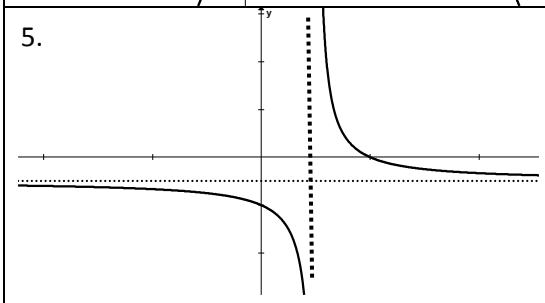
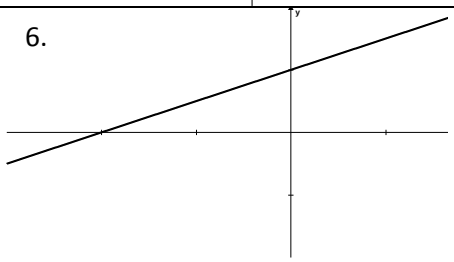
  </td><td>6.
  </td></tr>
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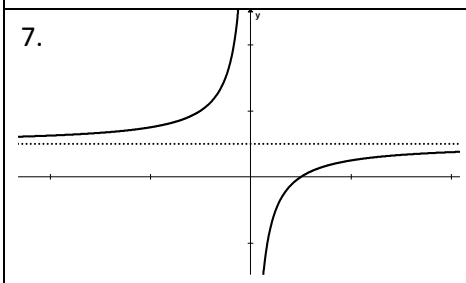
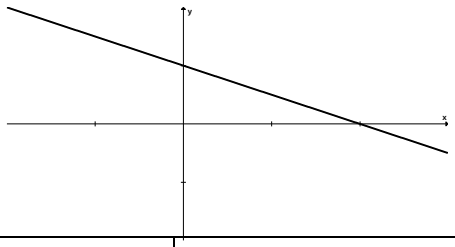
  </td><td>8.
  </td></tr>
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$y = -2(x-1)^2 - 1$	$y = -2(x+1)^2 - 1$	$y = x^2 + 3x + 2$
$y = x^2 - 3x + 2$	$y = (x-2)^2$	$y = x^2 - 2$
$y = \frac{-1}{x-1} - 1$	$y = \frac{1}{x-1} - 1$	$y = \frac{-1}{x} + 1$
$y = 2x + 1$	$2y = x + 2$	$2y + x - 2 = 0$
$2y + 2x = 2$	$y = x^2$	

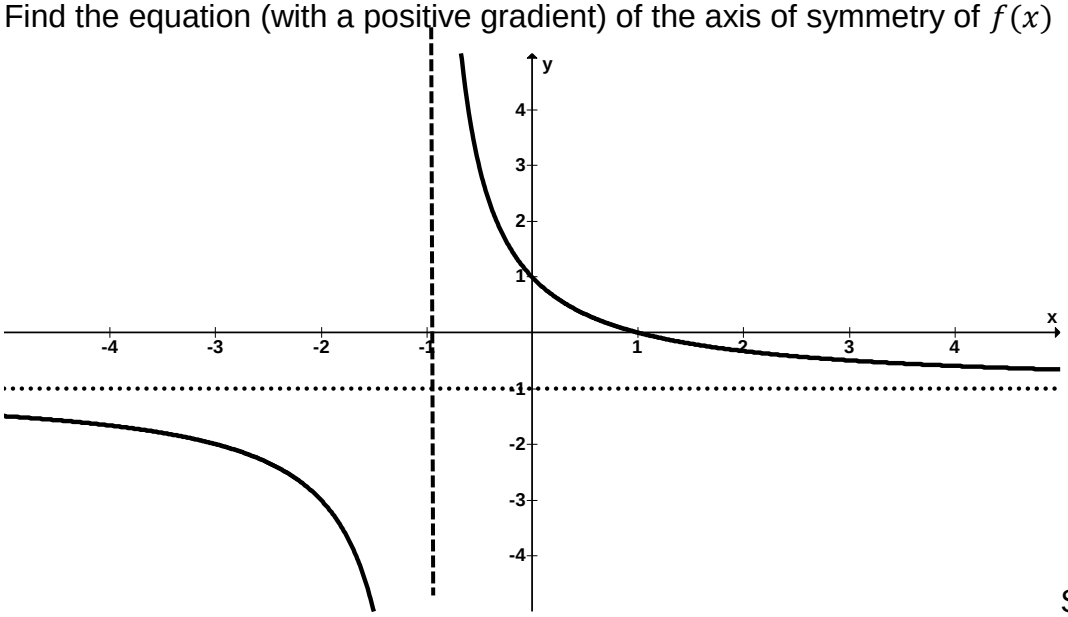
(7)

QUESTION 6

The graph shown below, defined by $f(x) = \frac{a}{x+p} + q$ has an x-intercept of 1.

(a) Determine the values of *a, p* and *q*. (5)

(b) Find the equation (with a positive gradient) of the axis of symmetry of $f(x)$ (2)



(c) State the domain of f. (2)

QUESTION 7

(a) Sketch the graph of f given that $f(x) = -2(x+1)^2 + 8$, showing clearly the axis of symmetry, the stationary point, and any x and y intercepts, if there are any. (6)

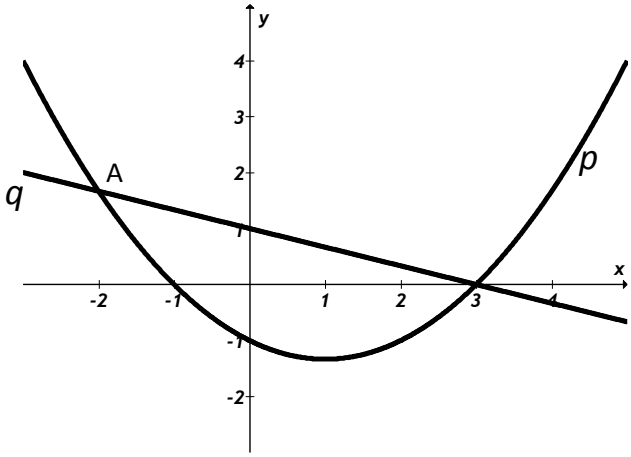
(b) Use your graph to assist you in answering the following questions

1. Does the graph have a maximum or minimum value? What is this value? (2)
2. Give the values of x for which the curve is increasing. (2)

QUESTION 8

Two graphs p and q are shown in the diagram below.

p passes through the points $(-1; 0), (3; 0)$ and $(0; -1)$.



(a) Determine the equation of p in the form $p(x) = ax^2 + bx + c$ (3)

(b) q passes through the point $(3; 0)$ and has a y-intercept of 1. Write down the equation of q. (2)

(c) Find the x coordinate of A, the point of intersection of p and q. (4)

(d) Write down the range of p. (2)