High School
Mathematics Test 2014

Year 10

Non Linear Relations

Non Calculator

Skills and Knowledge Assessed:

- Graph simple non-linear relations with and without the use of digital technologies and solve simple related equations (ACMNA296)
- Explore the connection between algebraic and graphical representations of relations such as simple quadratics, circles and exponentials using digital technology as appropriate (ACMNA239)
- 10A Describe, interpret and sketch parabolas, hyperbolas, circles and exponential functions and their transformations (ACMNA267)

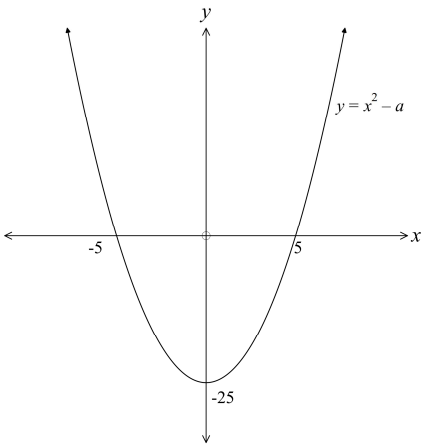
Name_____

Section 1 Short Answer Section

Write all working and answers in the spaces provided on this test paper.

1. The graph of $y = x^2 - a$ is shown.

What is the value of a?



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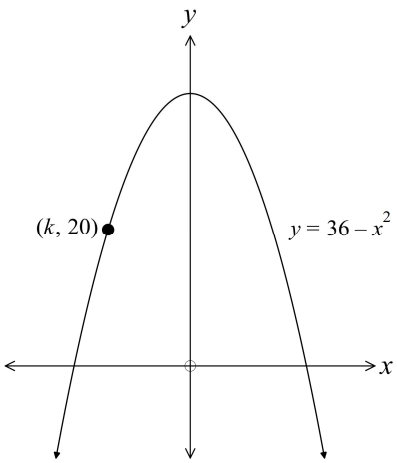
2. The equation of the graph shown is $y = 36 - x^2$.
The graph passes through the point $(k, 20)$.

What is the value of k ?



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3. The equation of the graph shown is $y = 5^x$.
The graph crosses the y axis at$(0, m)$.

What is the value of m ?

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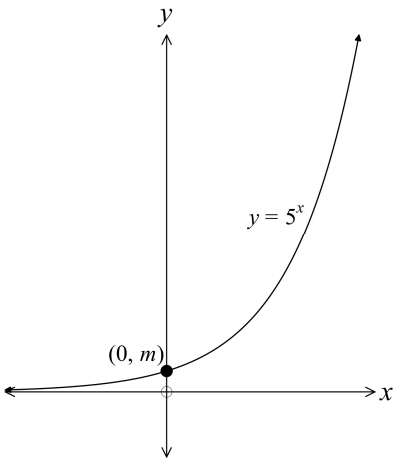

4. The graph shown is a circle with its centre at the origin.

What is the equation of the graph?

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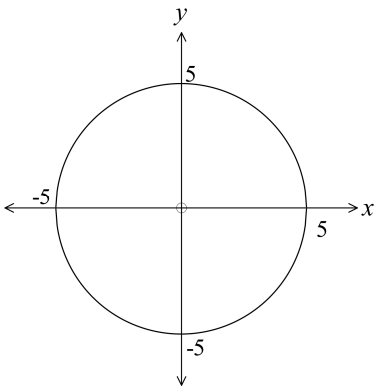

5. The graph of $y = x^2 + 4x$ is shown.
The dotted line is its axis of symmetry.

What are the x - ordinates of the points A and B?

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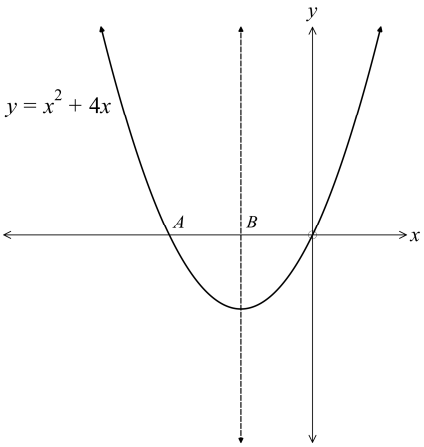

6. The curve below has equation $y = (x + 6)(x + 4)$.
The axis of symmetry is shown by the dotted line.
What are the coordinates of the points C and D ?

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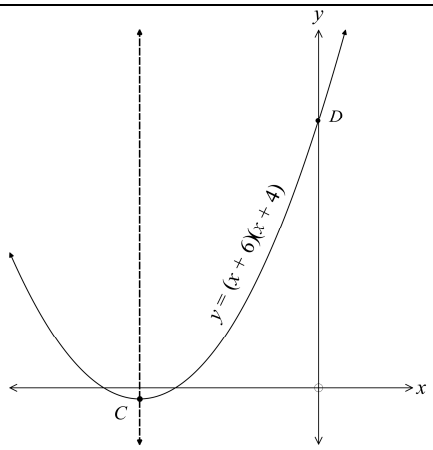

7. The graph of $y = 2^x$ is shown.
What is the value of r?

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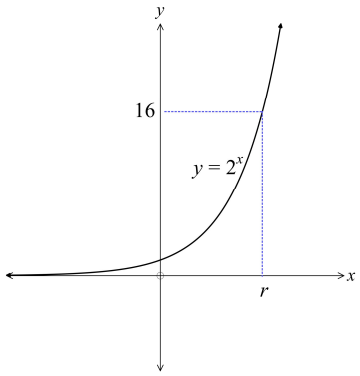

8. Sketch the circle which has an equation $x^2 + y^2 = 144$.

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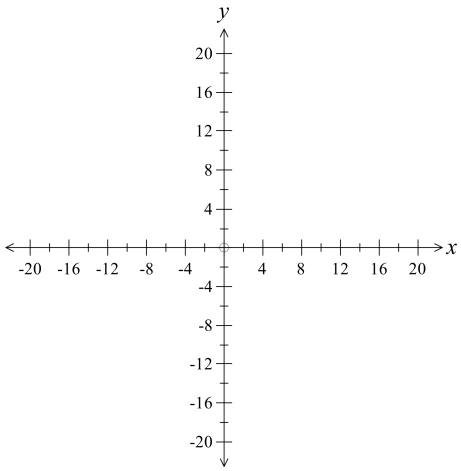
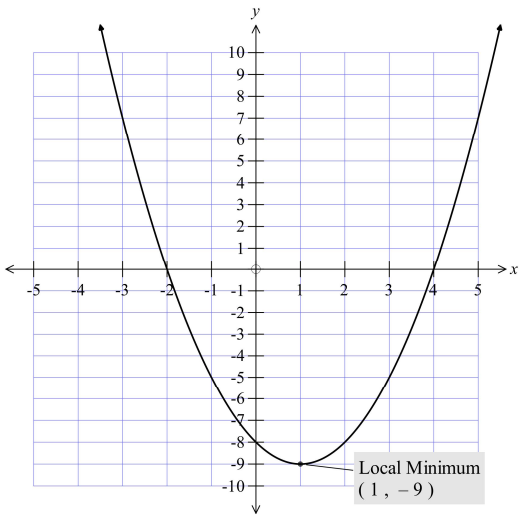


9. The equation of the parabola shown is $y = x^2 + bx - 8$.

What is the value of b?



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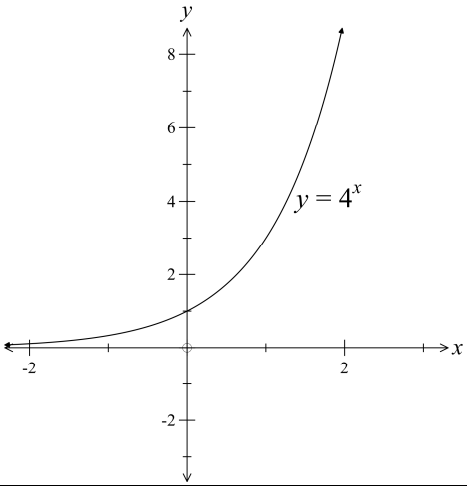
10. The graph of $y = 4^x$ is shown.
Draw a quick sketch, on the same set of axes, of $y = 4^x - 1$.



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11. What is the centre and radius of the circle which has an equation of $(x-2)^2 + (y+5)^2 = 25$

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12. What is the centre and radius of the circle which has an equation of $x^2 - 10x + y^2 - 6y = 15$.

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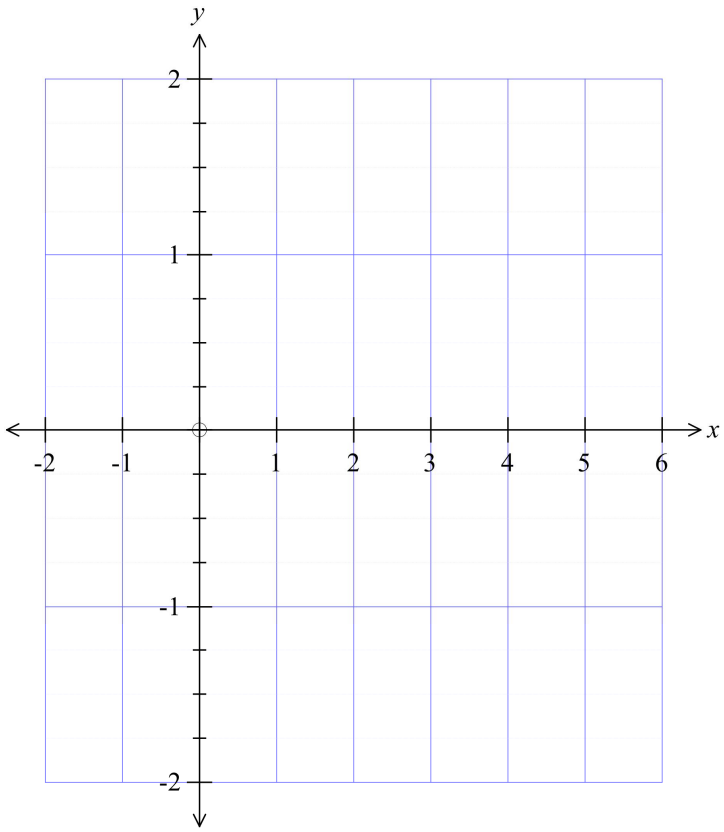
13. Complete the table of values for the equation

$$y = \frac{1}{x-2}$$

x	-2	0	1	2	3	4	6
y				Undefined			

14. Draw a sketch of $y = \frac{1}{x-2}$ using the table in question 14.



High School
Mathematics Test 2014

Year 10

Non Linear Relations

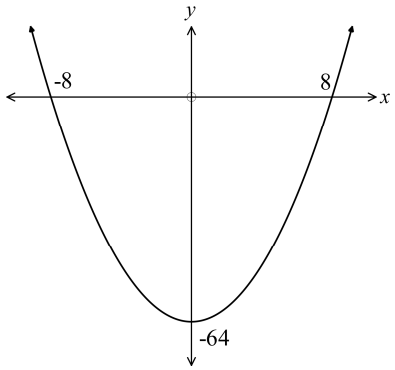
Calculator Allowed

Name_____

Section 2 Multiple Choice Section

Mark all your answers on the accompanying multiple choice answer sheet, not on this test paper. You may do any working out on this test paper. Calculators are allowed for this section.

1. Which equation could describe the graph shown?



A. $y = x^2 - 8$

B. $y = x^2 + 8$

C. $y = x^2 - 64$

D. $y = 64 - x^2$

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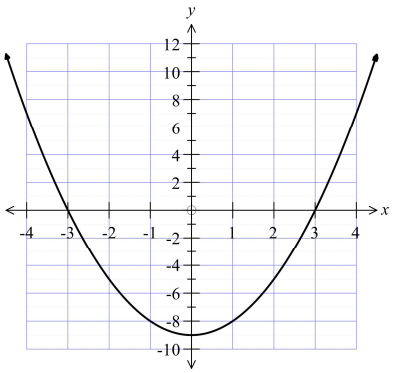
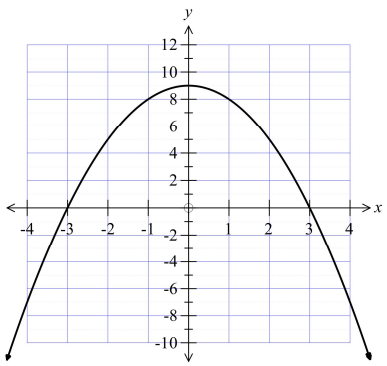
2. Which graph below could have an equation of $y = 9 - x^2$?

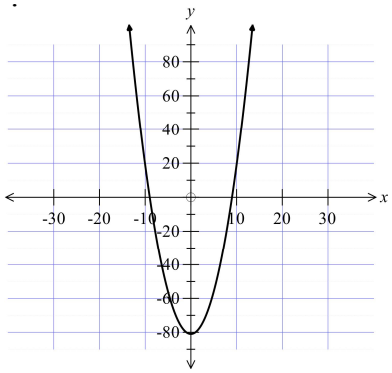
A.



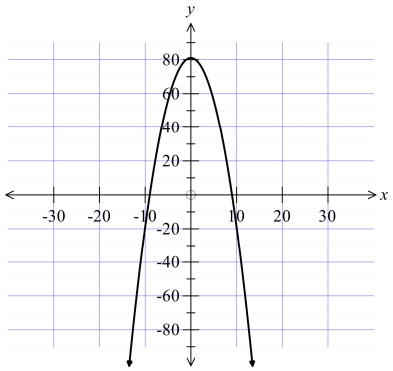
B.



C .



D.



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3. Which equation below would represent a parabola?

A. $y = 5x$ B. $y = \frac{5}{x}$ C. $y = 5x^2$ D. $y = 5^x$

4. A circle on the number plane with centre at the origin and a radius of 9 units would have as its equation:

A. $x^2 + y^2 = 3$.

B. $x^2 + y^2 = 9$.

C. $x^2 + y^2 = 18$.

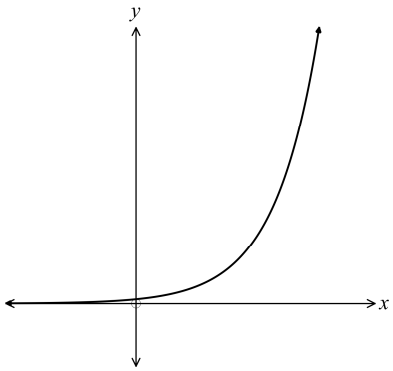
D. $x^2 + y^2 = 81$.

5. Which curve has a vertex at $(0, 5)$?

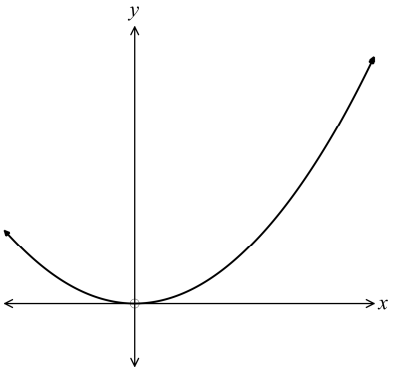
A. $y = -5 - x^2$ B. $y = x^2 - 5$ C. $y = x^2 + 25$ D. $y = 5 - x^2$

6. Which diagram below could be the graph of $y = 12^x$?

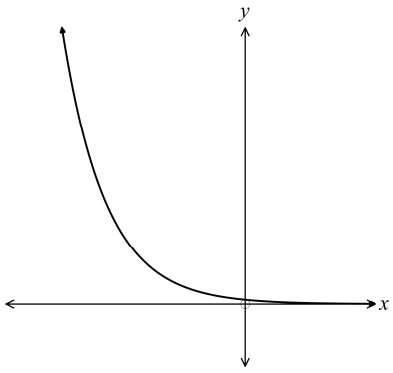
A.



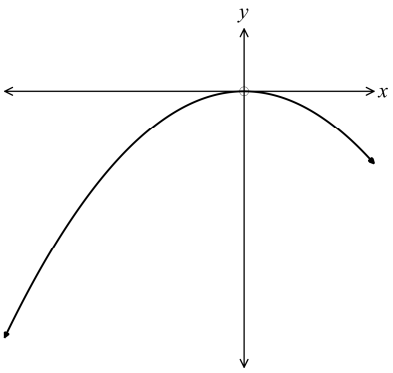
B.



C



D.



7. The graph of $x^2 + y^2 = 121$ would have y intercepts at:

A. $y = 0$ and $y = 11$.

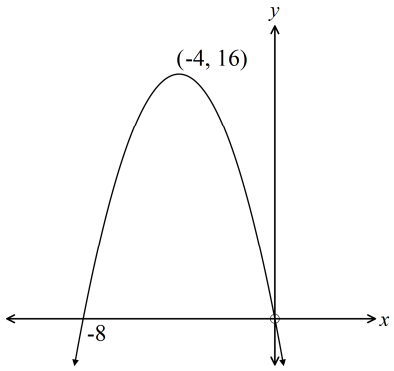
B. $y = 0$ and $y = -11$.

C. $y = -11$ and $y = 11$.

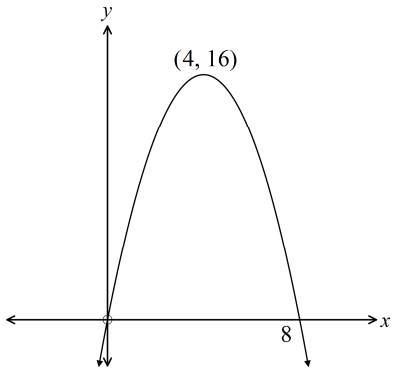
D. $y = -121$ and $y = 121$.

8. Which diagram shows the graph of $y = x^2 + 8x$?

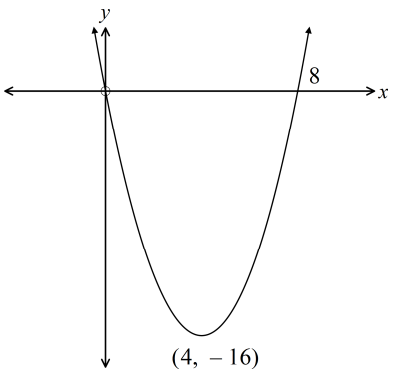
A.



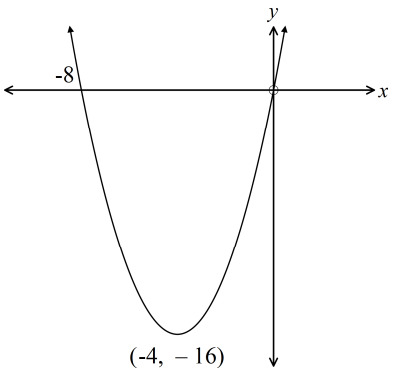
B.



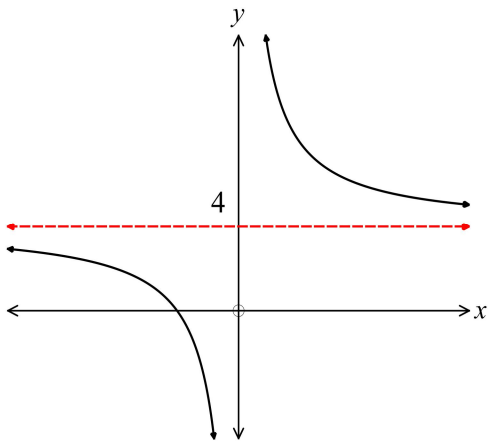
C.



D.



9. Which equation could describe the graph shown?



A. $y = 6^x + 4$

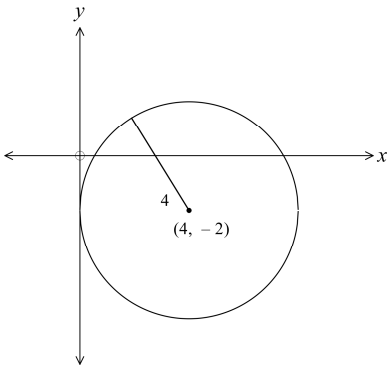
B. $y = \frac{6}{x} + 4$

C. $y = 6x^2 + 4$

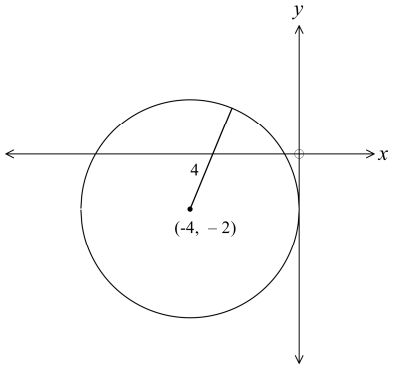
D. $x^2 + y^2 = 4$

10. Which diagram shows the graph of $(x-4)^2 + (y+2)^2 = 16$?

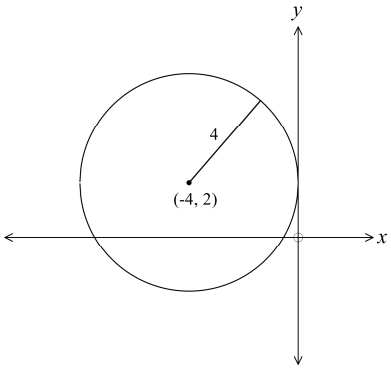
A.



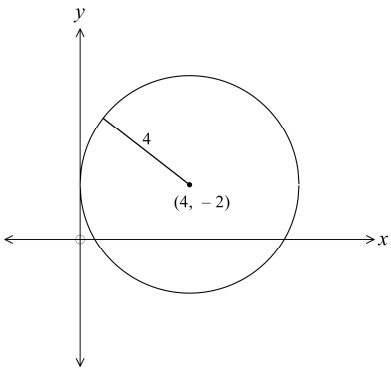
B.



C.

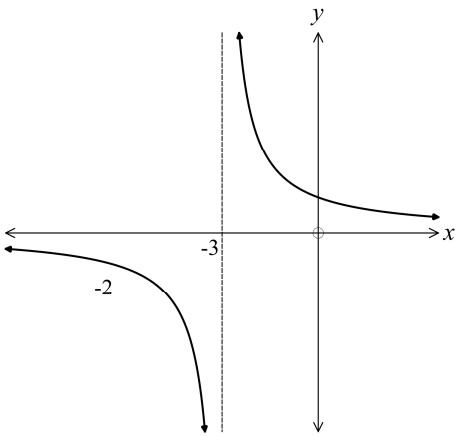


D.

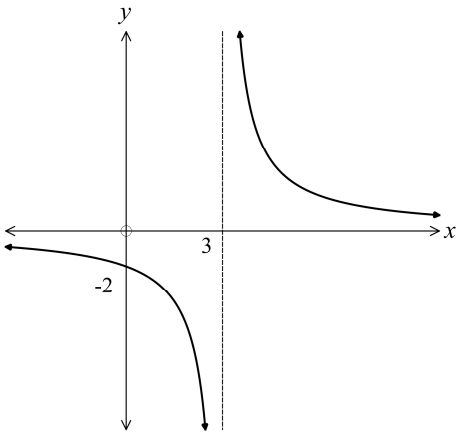


11. Which is the graph of $y = \dfrac{6}{x-3}$?

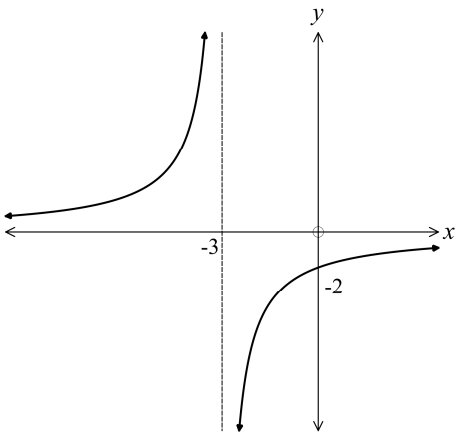
A.



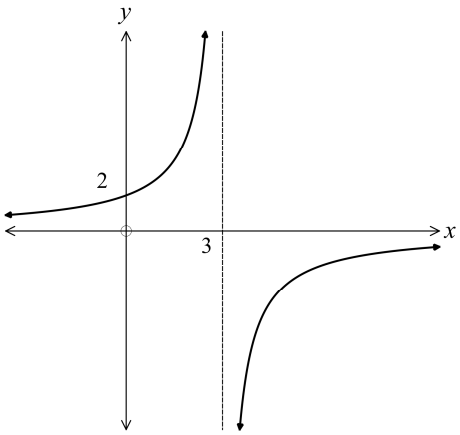
B.



C



D.



12. Which equation describes a circle with centre at (–2, 7) and radius 4 units?

A. $x^2 + 4x + y^2 - 14y + 37 = 0$ B. $x^2 - 4x + y^2 + 14y + 69 = 0$

C. $x^2 - 4x + y^2 + 14y + 69 = 0$ D. $x^2 + 4x + y^2 - 14y + 69 = 0$

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Calculator Allowed

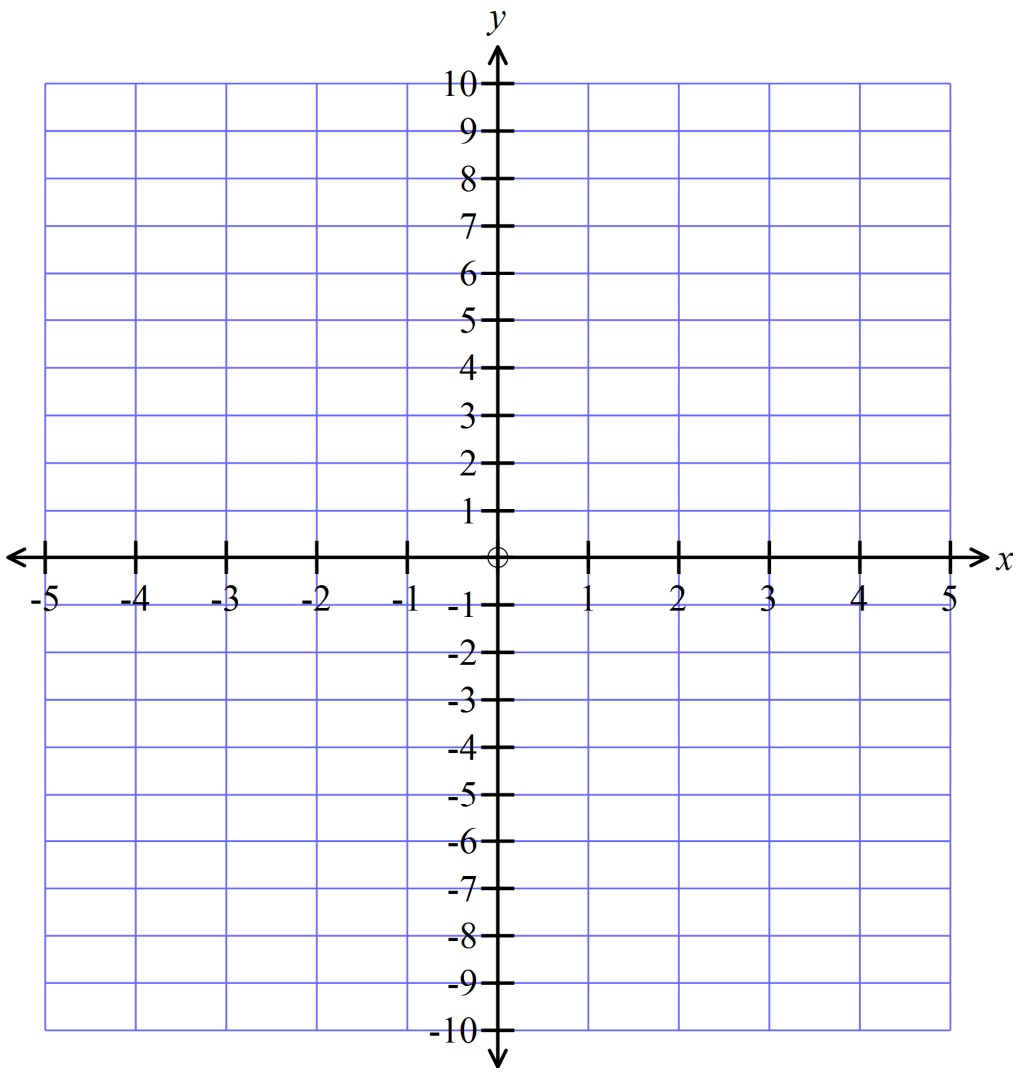
Name_____

Section 3 Longer Answer Section

Answers should be supported by relevant mathematical reasoning and/or calculations.
Write all working and answers in the spaces provided on this test paper.

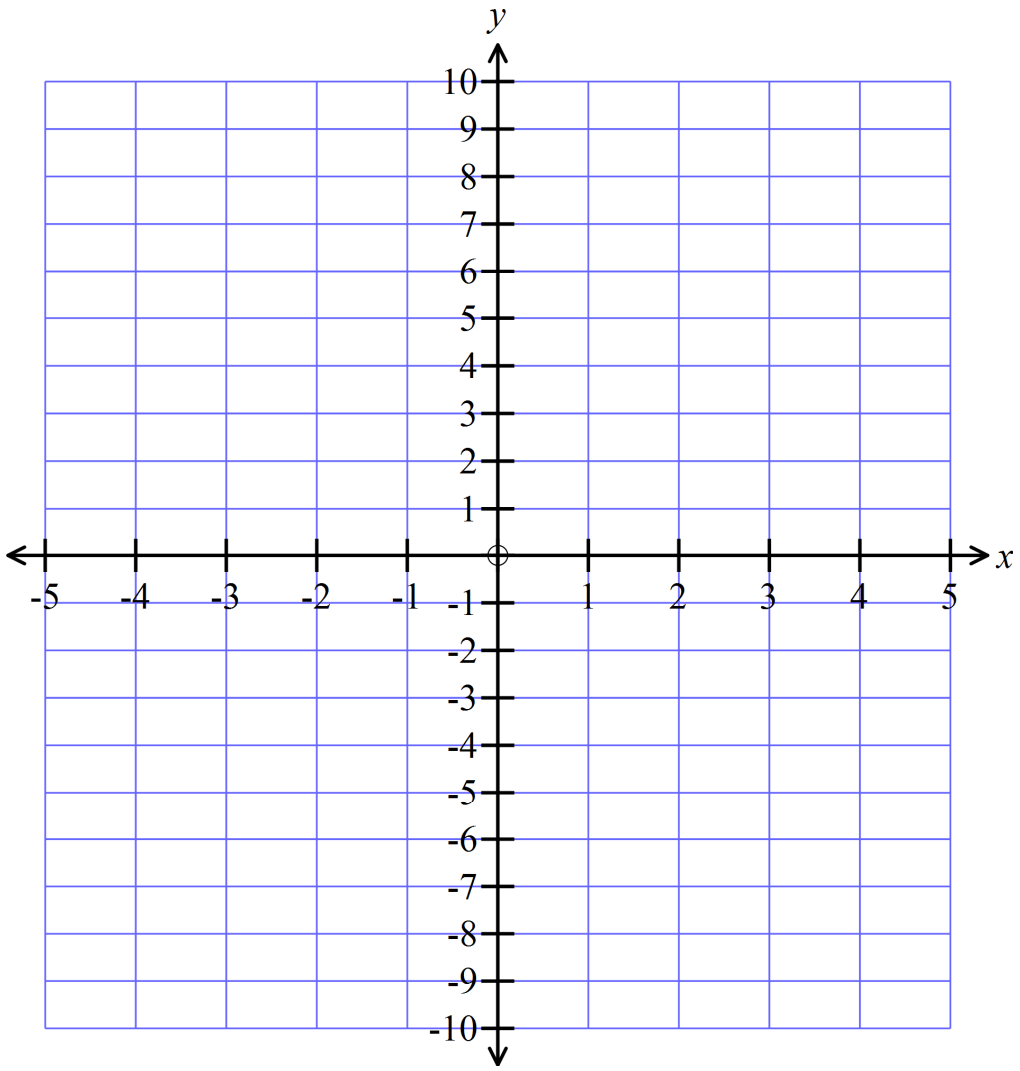
Marks

1. On the axes provided draw neat sketches of $y = x^2 - 4$ and $y = 9 - x^2$. **4**
Clearly mark the x and y intercepts and the vertex of each graph.



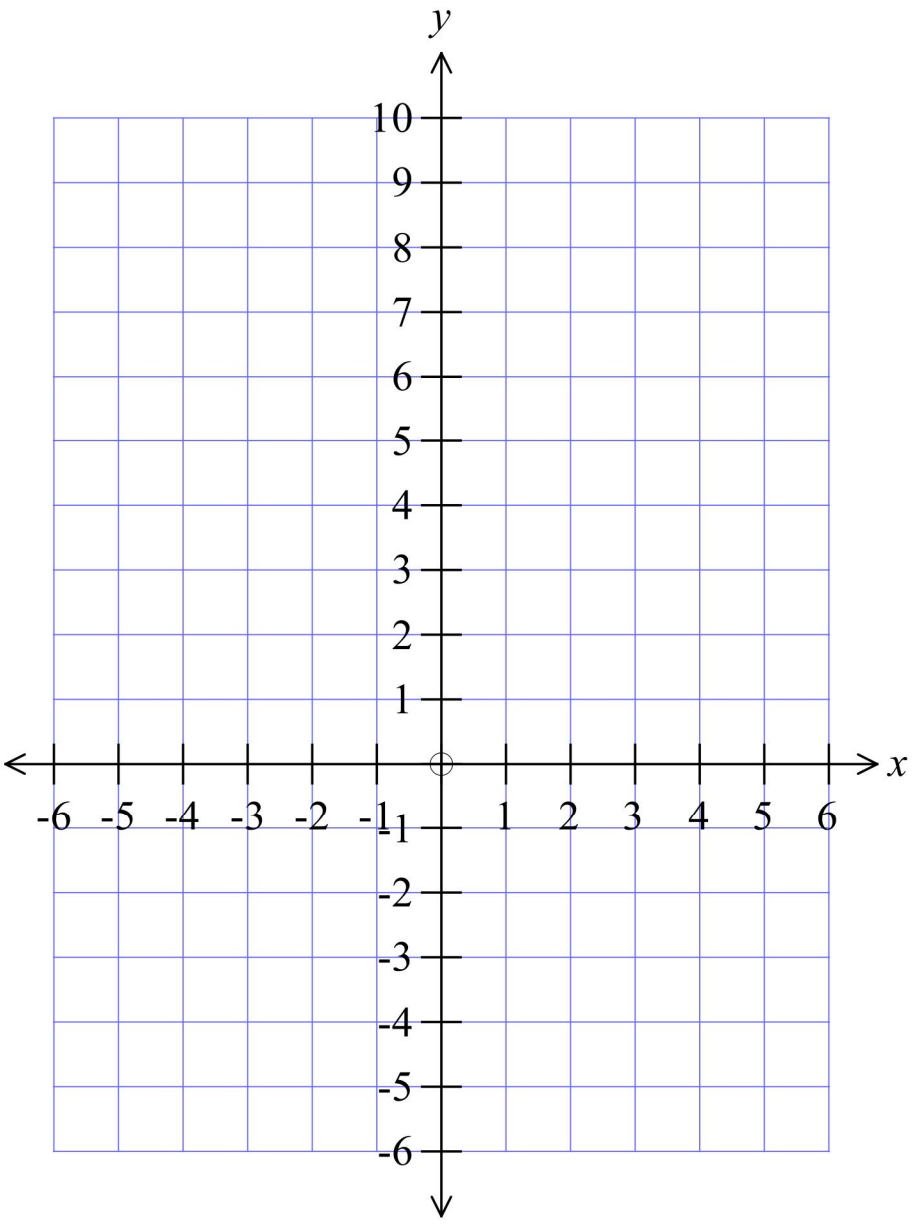
Marks

2. On the axes provided draw neat sketches of $y = x(x + 4)$ and $y = x^2 - 2x - 8$. **4**
Clearly mark the x and y intercepts and the vertex of each graph.



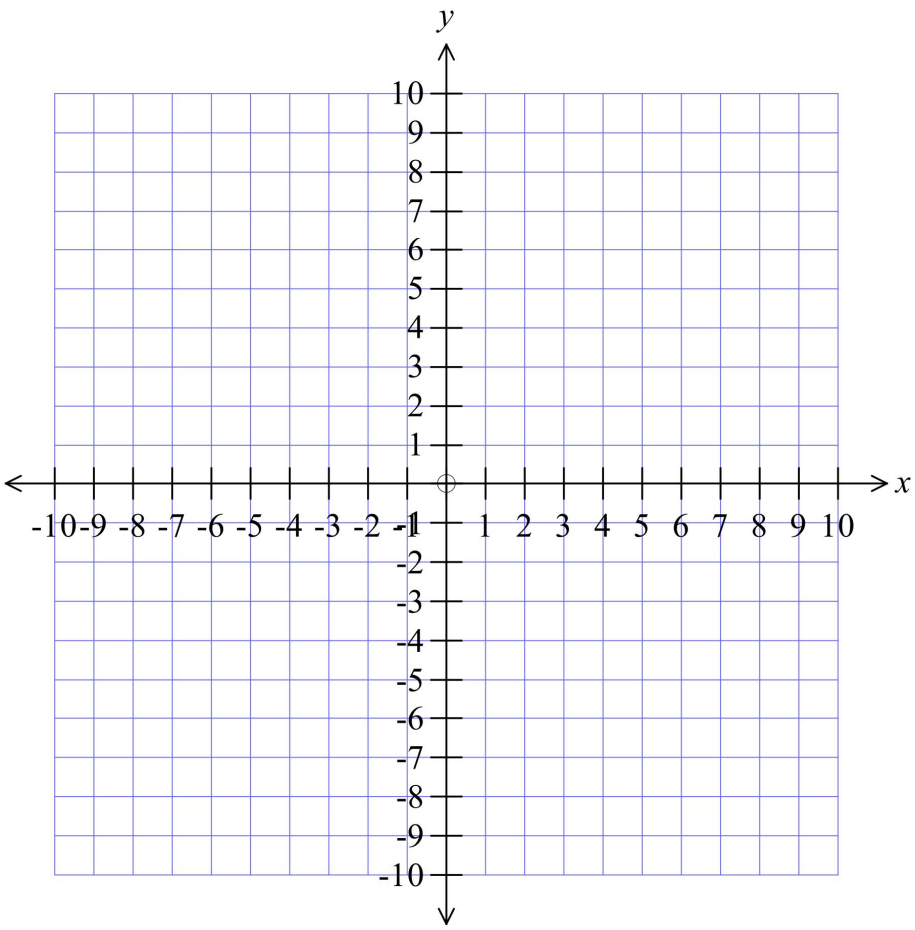
Marks

3. On the axes provided draw neat sketches of $y = 3^x$ and $x^2 + y^2 = 25$. **4**
Clearly mark the x and y intercepts of each graph.



Marks

4. On the axes provided draw neat sketches of $y = \frac{1}{x-3}$ and $x^2 - 2x + y^2 - 6y - 6 = 0$. **4**
Clearly mark the x and y intercepts and the vertex of each graph.



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Multiple Choice Answer Sheet

Name _____

Completely fill the response oval representing the most correct answer.

1.	A ⬭	B ⬭	C ⬭	D ⬭
2.	A ⬭	B ⬭	C ⬭	D ⬭
3.	A ⬭	B ⬭	C ⬭	D ⬭
4.	A ⬭	B ⬭	C ⬭	D ⬭
5.	A ⬭	B ⬭	C ⬭	D ⬭
6.	A ⬭	B ⬭	C ⬭	D ⬭
7.	A ⬭	B ⬭	C ⬭	D ⬭
8.	A ⬭	B ⬭	C ⬭	D ⬭
9.	A ⬭	B ⬭	C ⬭	D ⬭
10.	A ⬭	B ⬭	C ⬭	D ⬭
11.	A ⬭	B ⬭	C ⬭	D ⬭
12.	A ⬭	B ⬭	C ⬭	D ⬭

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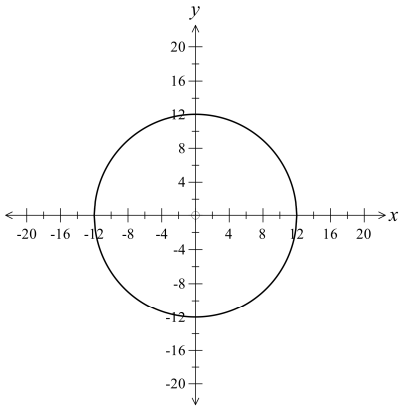
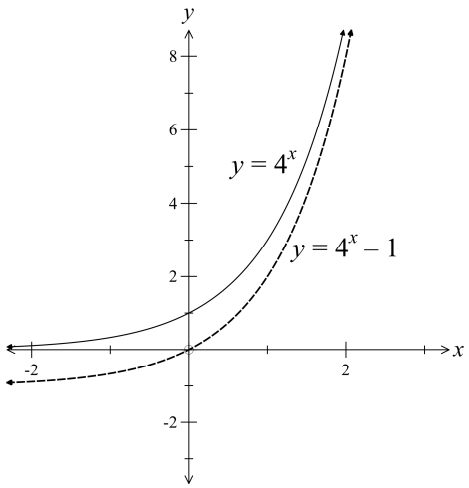
Non Linear Relations

ANSWERS

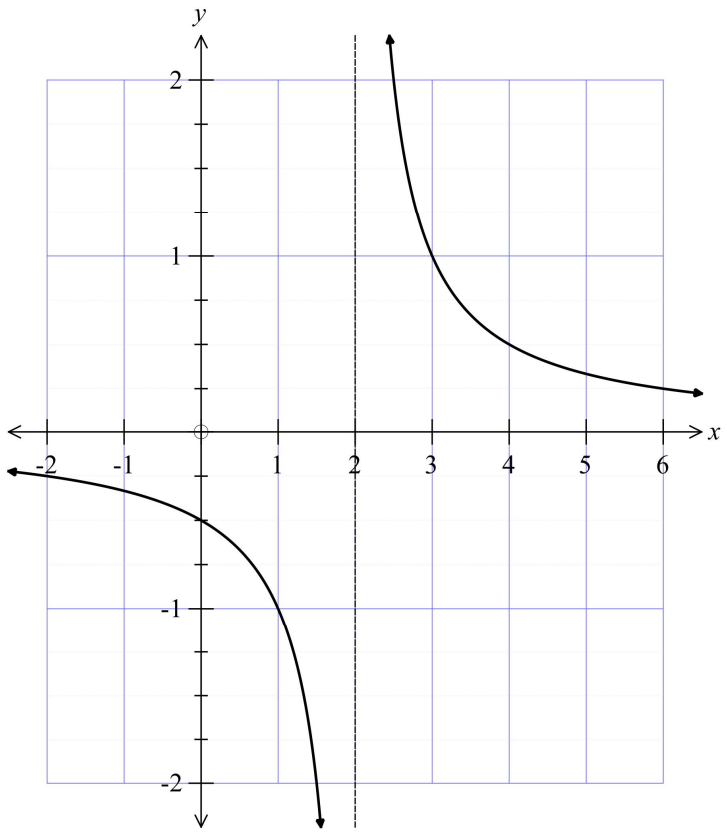
Section 1 (1 mark each)	
	Working and Answers
1.	Since it crosses the y axis at -25, $y = x^2 - 25$ so a = 25.
2.	$y = 36 - x^2$ $y = 20$ $20 = 36 - x^2$ $x^2 = 16$ $x = \pm 4$ Since point is to the left of y axis, $k = -4$
3.	As it is an exponential graph, it crosses the y axis at $y = 1$. m=1
4.	Centre at the origin, radius 5. $x^2 + y^2 = 25$
5.	$y = x^2 + 4x = x(x + 4)$ X intercepts at $x = 0$ and $x = -4$. so **A = –4** Bis midway between the intercepts $x = 0$ and $x = -4$. ***B* is –2**
6.	$y = (x + 6)(x + 4)$ x intercepts at $x = -4$ and $x = -6$ Vertex is midway between these on axis $x = -5$ $y = (-5 + 6)(-5 + 4) = 1 \times -1 = -1$ C is $(-5, -1)$ Y intercept when $x = 0$ $y = (0 + 6)(0 + 4) = 6 \times 4 = 24$ D is $(0, 24)$
7.	$y = 2^x$ $y = 16$ $16 = 2^x$ $2^4 = 2^r$ $r = 4$

8.	
9.	Intercepts at $x = -2$ and $x = 4$ $y = (x + 2)(x - 4)$ $y = x^2 - 2x - 8$ $\therefore\ b = -2$
10.	
11.	$(x-2)^2 + (y+5)^2 = 25$ $(x-2)^2 + (y+5)^2 = 5^2$ Centre $(2, -5)$ and radius 5.
12.	$x^2 - 10x + y^2 - 6y = 15$ $x^2 - 10x + 25 + y^2 - 6y + 9 = 15 + 25 + 9$ $(x-5)^2 + (y-3)^2 = 49 = 7^2$ Centre $(5, 3)$ radius 7.

13. $y = \dfrac{1}{x-2}$

x	-2	0	1	2	3	4	6
y	$\frac{1}{-4}$	$\frac{1}{-2}$	-1	Undefined	1	$\frac{1}{2}$	$\frac{1}{4}$

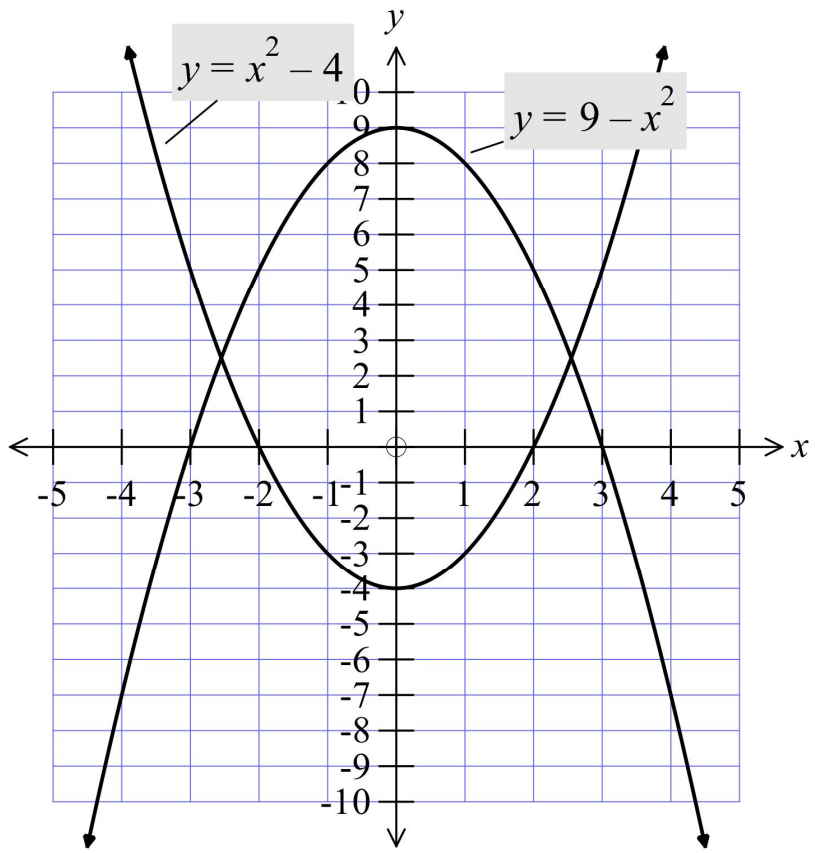
14.



Section 2 (1 mark each)		
	Working	Answers
1.	Crosses axis at $x = \pm 8$, and is concave up, so equation is $y = (x + 8)(x - 8)$ $y = x^2 - 64$	C
2.	$y = 9 - x^2$ Has a maximum of (0, 9) and concave down. Crosses the x axis when $(3 - x)(3 + x) = 0$ Crosses at $x = \pm 3$. Graph B	B
3.	$y = ax^2 + bx + c$ Parabola Equation C is the correct form $y = 5x^2$.	C
4.	Circle has equation $x^2 + y^2 = r^2$ $x^2 + y^2 = 9^2$ $x^2 + y^2 = 81$	D
5.	$y = 5 - x^2$ has a maximum at (0,5).	D
6.	$y = 12^x$ Exponential graph, so always above x axis. Positive exponent so grows to the right of y axis. Approaches x to left of y axis. Crosses y axis at $y = 1$. Graph A	A
7.	$x^2 + y^2 = 121$ Circle centre at the origin, radius = $\sqrt{121} = 11$. y intercepts 11 units above and below origin. $y = -11$ and $y = 11$.	C
8.	$y = x^2 + 8x = x(x + 8)$ Parabola crosses x axis at $x = 0$ and $x = -8$. Parabola is concave up. Graph D.	D
9.	Hyperbola with discontinuity at x=0, raised by 4 units. Equation B is in the form of a hyperbola.	B
10.	Centre (4, -2) radius 4. Graph A	A
11.	$y = \frac{6}{x - 3}$ Discontinuity at $x = 3$. When $x = 0$, $y = \frac{6}{-3} = -2$ Graph B	B
12.	$(x + 2)^2 + (y - 7)^2 = 4$ $x^2 + 4x + 4 + y^2 - 14y + 49 = 16$ $x^2 + 4x + y^2 - 14y + 37 = 0$	A

Section 3

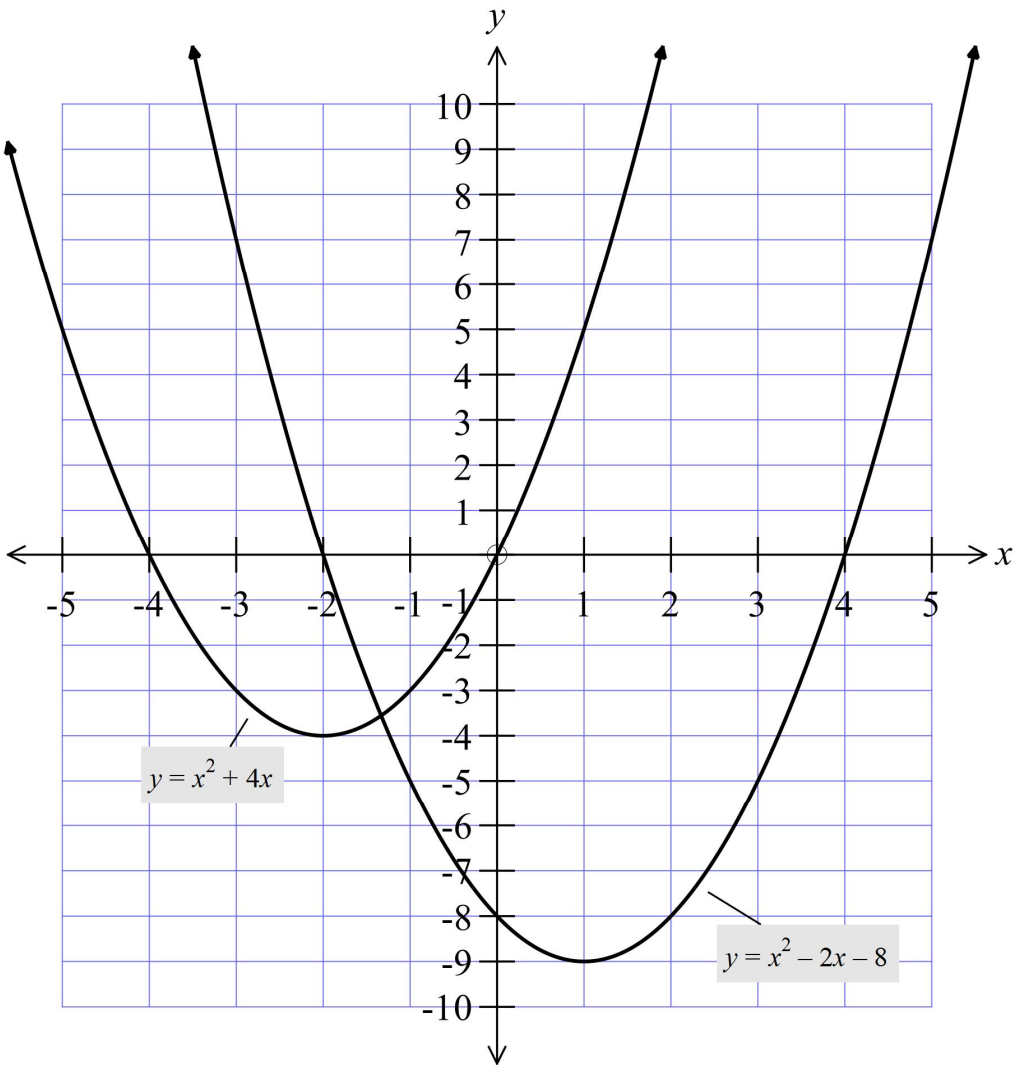
1. On the axes provided draw neat sketches of $y = x^2 - 4$ and $y = 9 - x^2$.
Clearly mark the x and y intercepts and the vertex of each graph.



2 marks for each graph

Allow 1 for correct shape and 1 for correct details

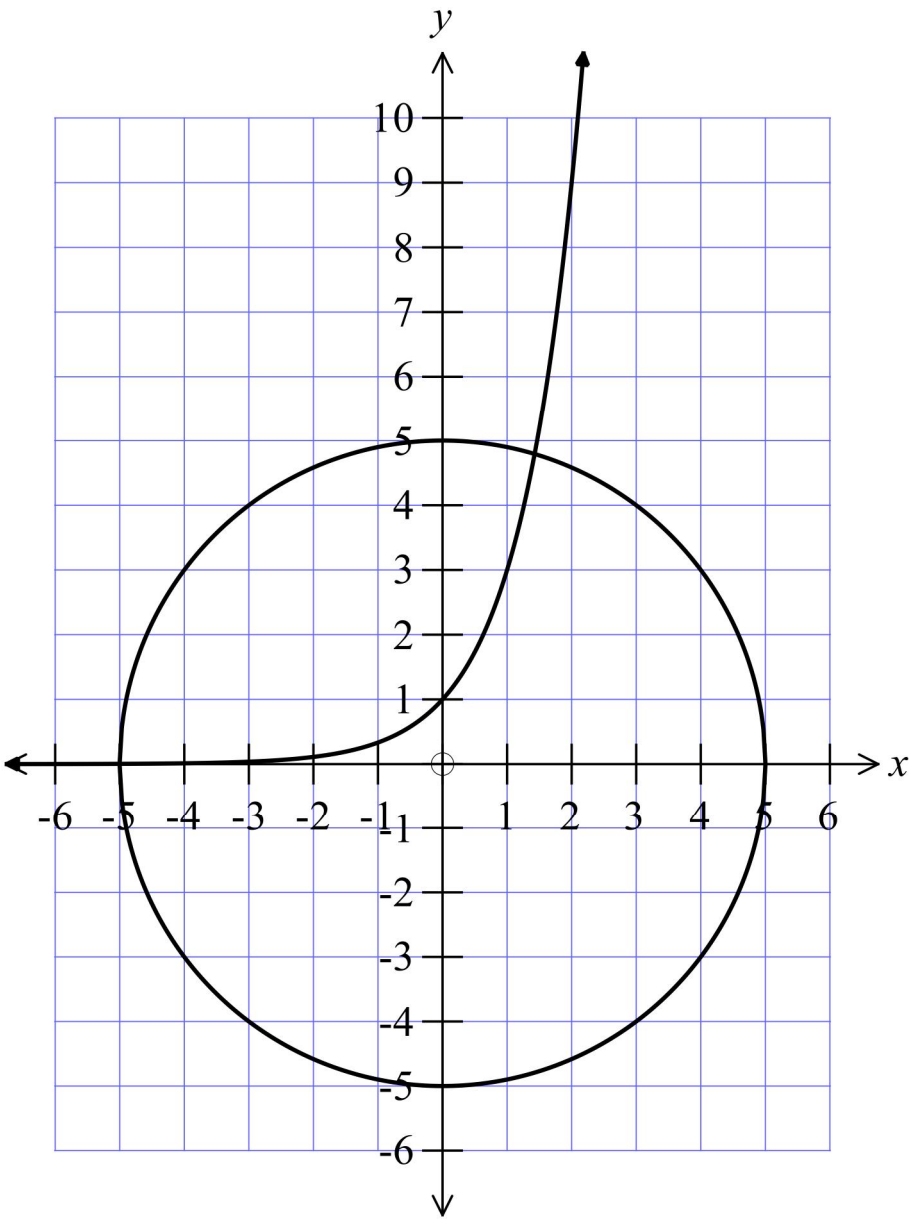
2. On the axes provided draw neat sketches of $y = x(x + 4)$ and $y = x^2 - 2x - 8$.
Clearly mark the x and y intercepts and the vertex of each graph.



2 marks for each graph

Allow 1 for correct shape and 1 for correct details

3. On the axes provided draw neat sketches of $y = 3^x$ and $x^2 + y^2 = 25$.
Clearly mark the x and y intercepts of each graph.

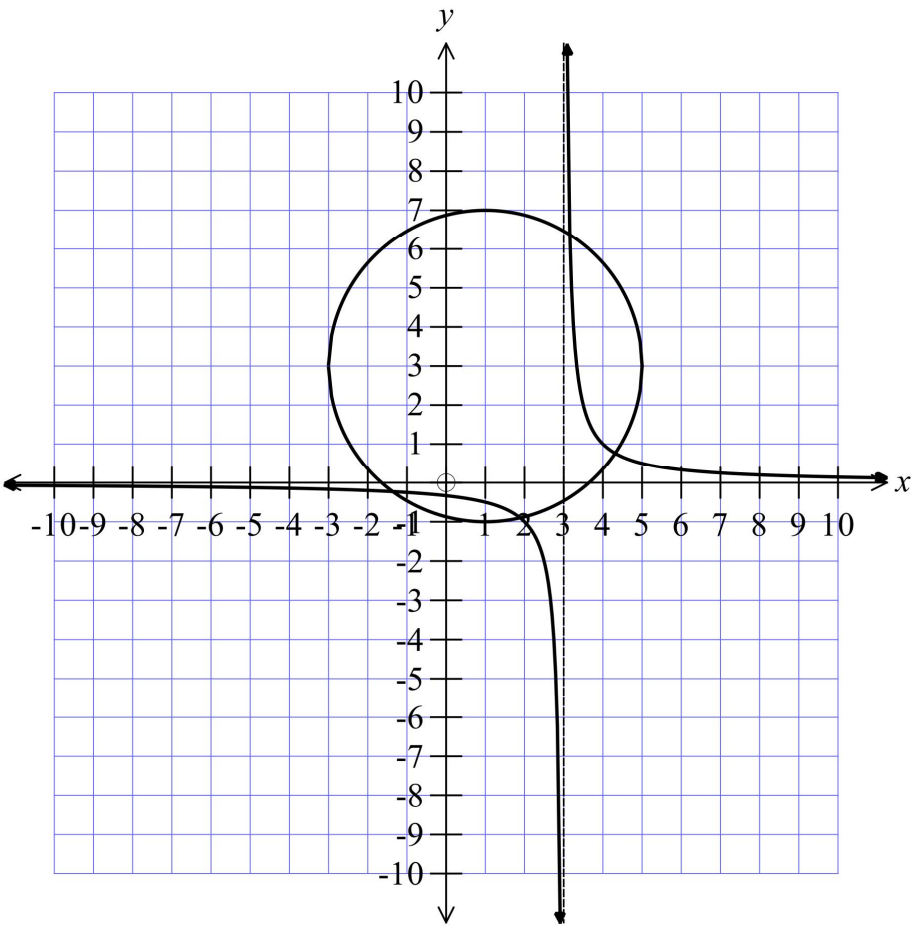


2 marks for each graph

Allow 1 for correct shape and 1 for correct details

4. On the axes provided draw neat sketches of $y = \frac{1}{x-3}$ and $x^2 - 2x + y^2 - 6y - 10 = 0$.
Clearly mark the x and y intercepts and the vertex of each graph.

$$x^2 - 2x + y^2 - 6y - 6 = 0$$
$$x^2 - 2x + y^2 - 6y = 6$$
$$x^2 - 2x + 1 + y^2 - 6y + 9 = 6 + 10$$
$$(x-1)^2 + (y-3)^2 = 16$$
Centre is (1, 3) with radius = 4.



2 marks for each graph

Allow 1 for correct shape and 1 for correct details

High School
Mathematics Test 2014

Non Linear Relations

Multiple Choice Answer Sheet

Name __Marking Sheet

Completely fill the response oval representing the most correct answer.

1.	A ○	B ○	C ●	D ○
2.	A ○	B ●	C ○	D ○
3.	A ○	B ○	C ●	D ○
4.	A ○	B ○	C ○	D ●
5.	A ○	B ○	C ○	D ●
6.	A ●	B ○	C ○	D ○
7.	A ○	B ○	C ●	D ○
8.	A ○	B ○	C ○	D ●
9.	A ○	B ●	C ○	D ○
10.	A ●	B ○	C ○	D ○
11.	A ○	B ●	C ○	D ○
12.	A ●	B ○	C ○	D ○