School Name
Mathematics Test 2017

Year 10 **Non-Linear Relations** Non Calculator

Skills and Knowledge Assessed:

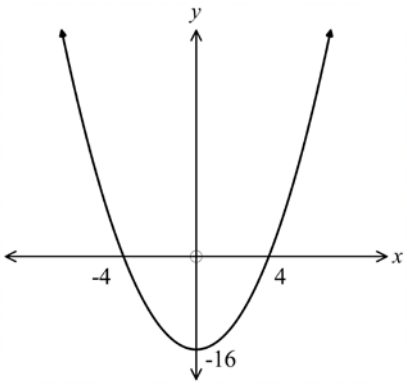
- Graph simple non-linear relations with and without the use of digital technologies and solve simple related equations (ACMNA296)
- Explore the connection between algebraic and graphical representations of relations such as simple quadratics, circles and exponentials using digital technology as appropriate (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. What equation could describe the graph shown?



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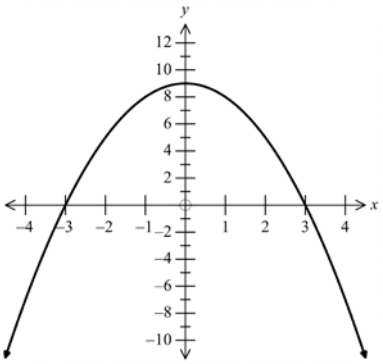
2. Give the equation of the graph shown.



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3. The equation of the graph shown is $y = 5^x$.
The graph passes through the point $(x, 125)$.

What is the value of x ?

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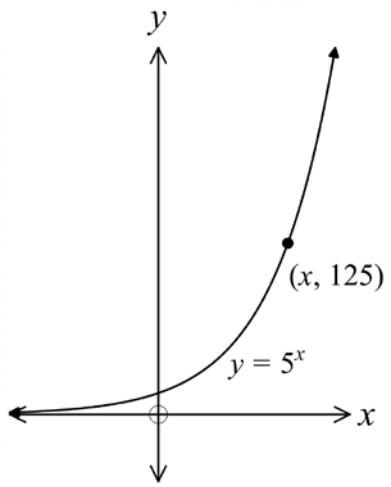

4. The graph shown has as its equation: $x^2 + y^2 = 36$.

What is the value of b?

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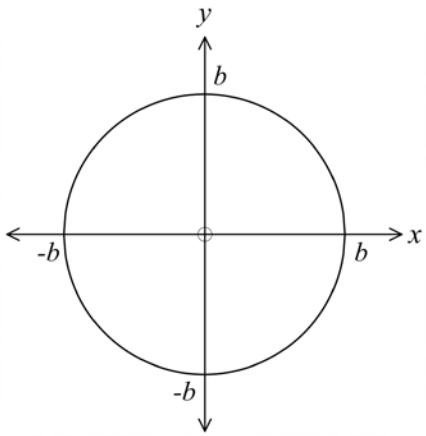

5. The graphs of $y = 3x^2 - 6$ and $y = 6 - 3x^2$ are shown.
One is drawn with a broken line and one with an unbroken line.
Describe which graph is which and explain why you made this decision.

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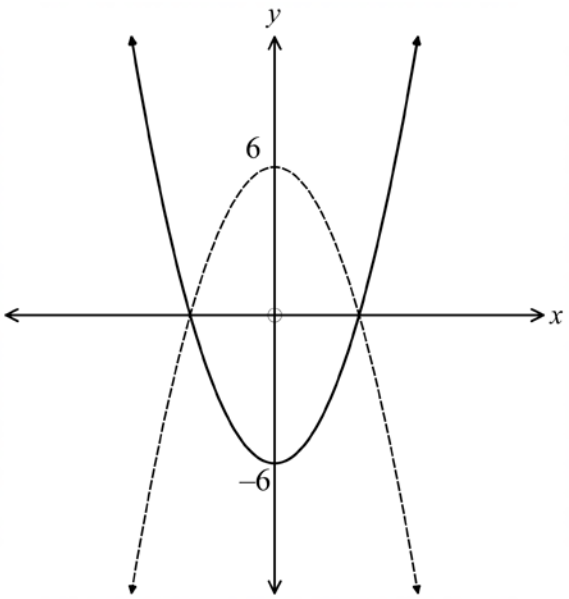
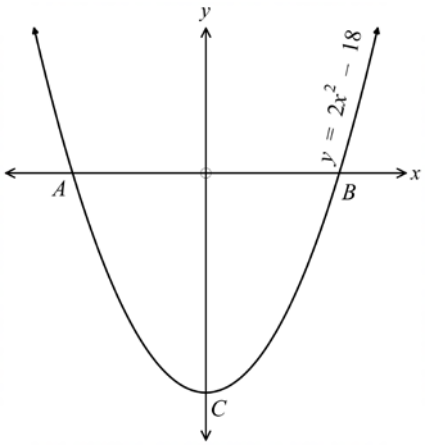


6. The graph of $y = 2x^2 - 18$ is shown.
What are the coordinates of the y intercept C?



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7. What are the coordinates of the x intercepts A and B for the curve in Question 6?

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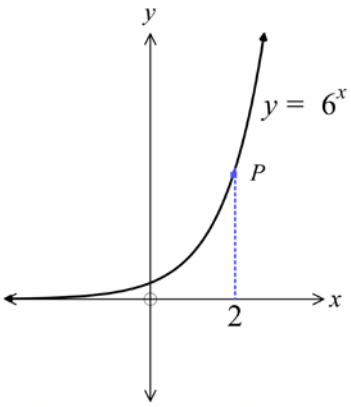
8. The graph of $y = 6^x$ is shown.
What are the coordinates of the point P?



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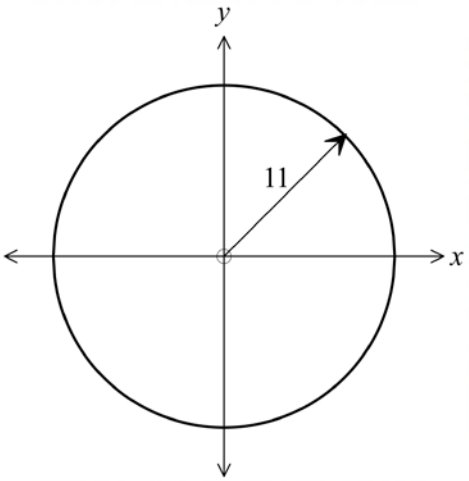
9. What is the equation of the circle shown?



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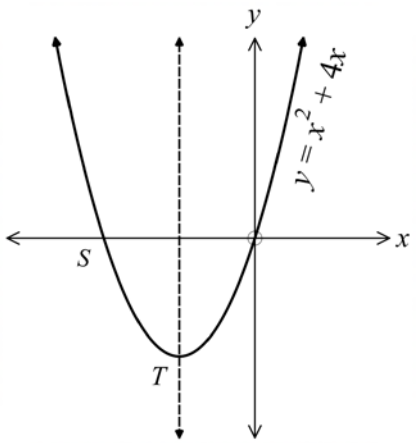
10. The graph of $y = x^2 + 4x$ is shown.
The dotted line is its axis of symmetry.

What are coordinates of the x intercept S?



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11. In the graph in question 10, what are coordinates of the vertex T?

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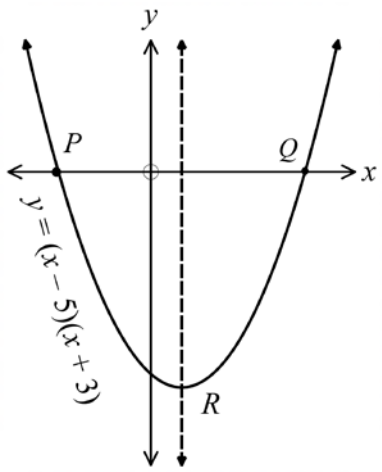
12. The curve below has equation $y = (x - 5)(x + 3)$.
The axis of symmetry is shown by the dotted line.
What are the coordinates of the points P and Q ?



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13. In the graph in question 12, what are coordinates of the vertex R?

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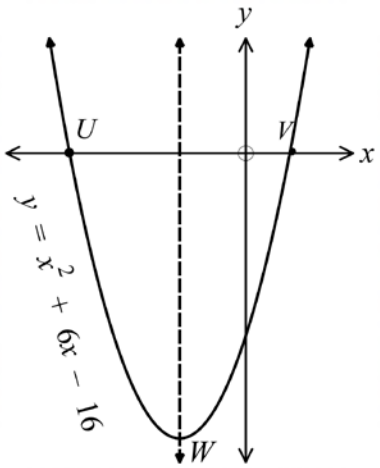
14. The curve below has equation $y = x^2 + 6x - 16$.
The axis of symmetry is shown by the dotted line.
What are the coordinates of the points U and V?



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15. In the graph in question 14, what are coordinates of the vertex W?

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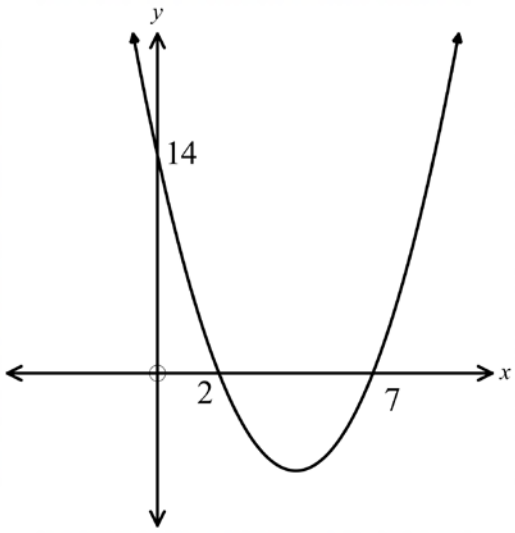
16. The intercepts on the x and y axes are shown for the parabola below.

What is the equation of the parabola?



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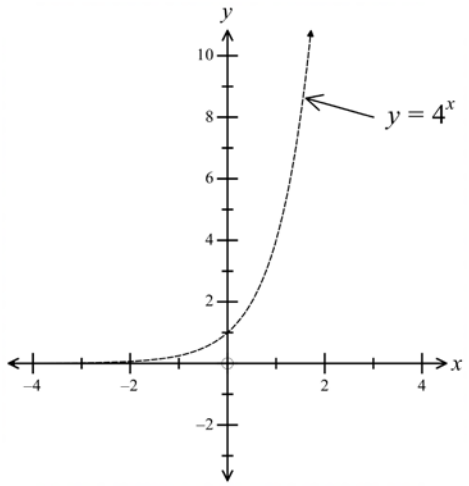
17. The graph of $y = 4^x$ is shown.
Draw a quick sketch, on the same set of axes, of $y = 2^x$



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18. What is the centre and radius of the circle which has an equation of $(x + 7)^2 + (y - 9)^2 = 25$

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School Name
Mathematics Test 2017

Calculator Allowed

Year 10

Non-Linear Relations

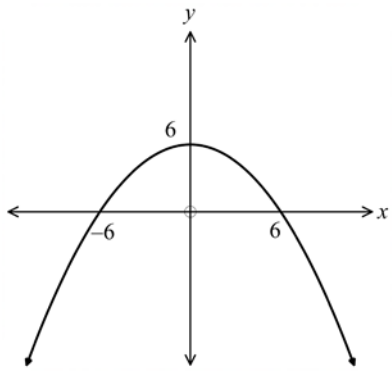
Name_____

Section 2 Multiple Choice Section

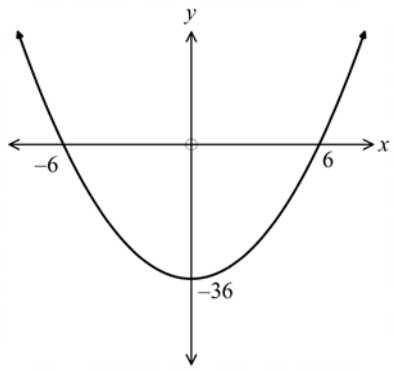
Mark all your answers on the accompanying multiple choice answer sheet, not on this test paper. You may do any working out on this test paper. Calculators are allowed for this section.

1. Which graph below could have an equation of $y = 36 - x^2$?

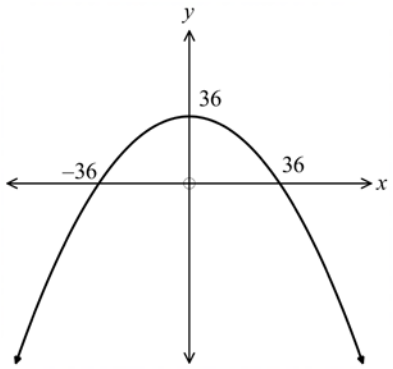
A.



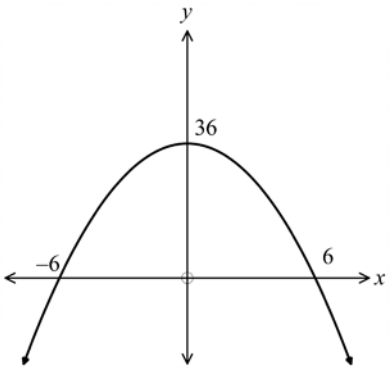
B.



C.

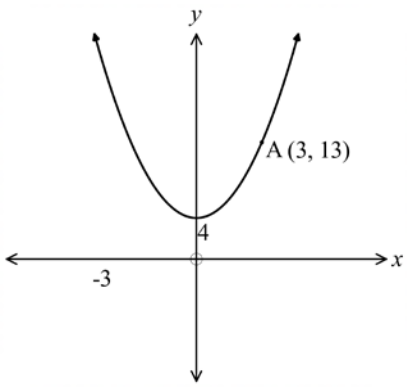


D.



2. The parabola shown, passes through the point (3, 13).

Which equation could describe the parabola?



A. $y = x^2 - 4$

B. $y = x^2 + 4$

C. $y = 4x^2$

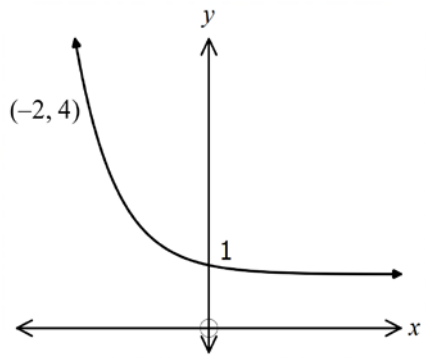
D. $y = 13x^2 + 4$

3. Which equation could represent a circle?

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

4. Which sketch shows the graph of $y = 2^x$?

A.



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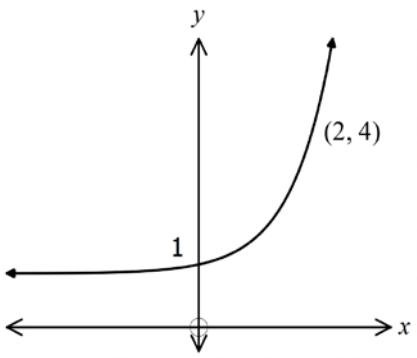
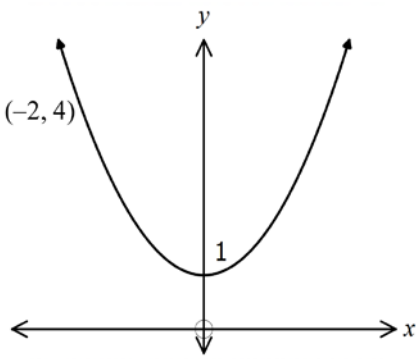


C.



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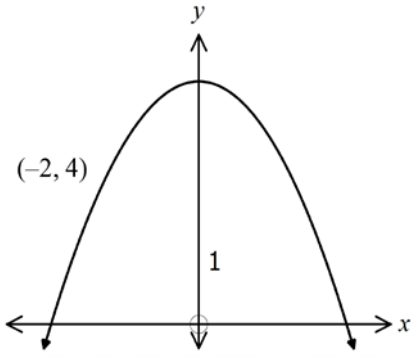
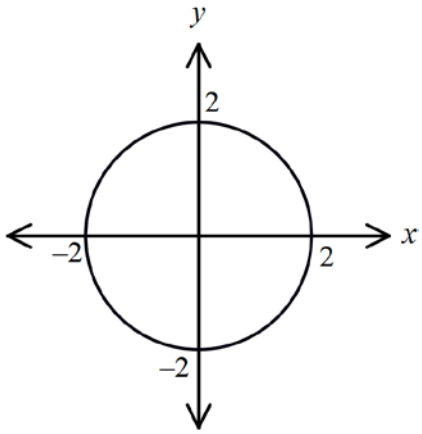


5. Which equation could describe the graph shown?



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

B. $y = 4^x$

C. $y = 4x^2$

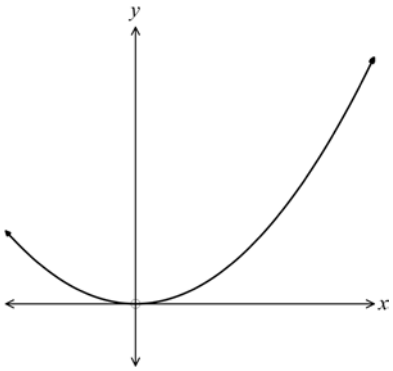
D. $x^2 + y^2 = 2$

6. Which parabola has a vertex at $(0, 8)$?

A. $y = x^2 + 8$ B. $y = x^2 - 8$ C. $y = 8x^2$ D. $y = x^2 + 16$

7. Which diagram below could be the graph of $y = -6x^2$?

A.



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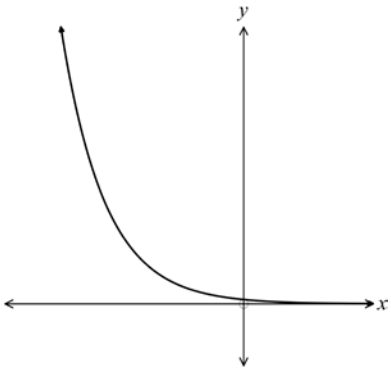
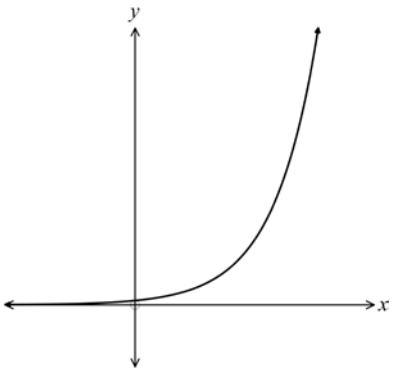
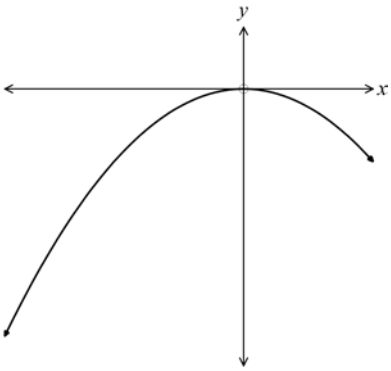


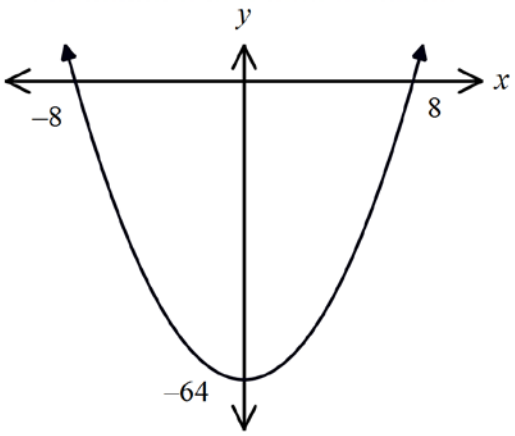
C



D.



8. What is the equation of the curve shown?



A. $x^2 + y^2 = 16$

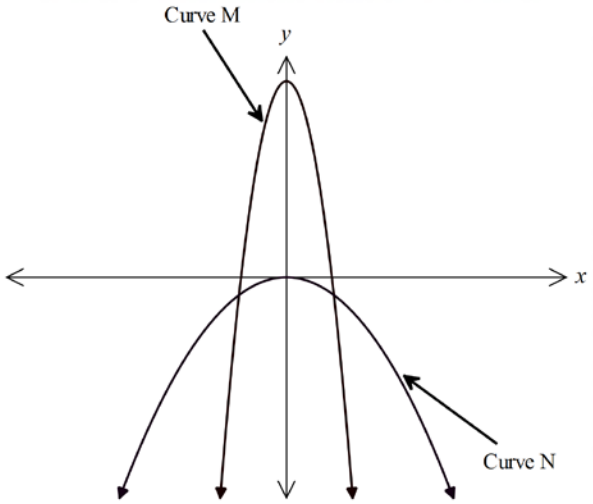
B. $x^2 + y^2 = 64$

C. $y = x^2 + 64$

D. $y = x^2 - 64$

9. The graphs of two curves are shown, labelled curves M and N.

Which statement is not true of both graphs?



A. Both curves are parabolas.

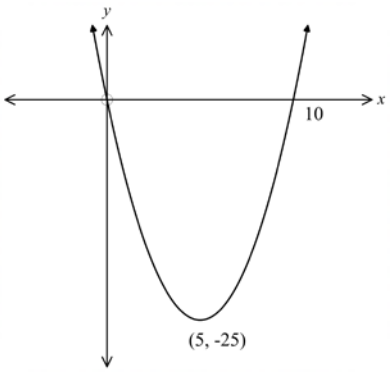
B. Both curves are concave down.

C. Both curves are symmetric about the *y* axis.

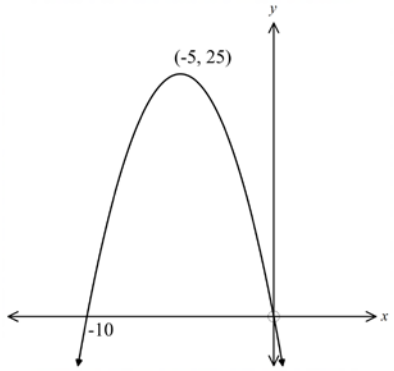
D. The origin is the vertex of both curves.

10. Which diagram shows the graph of $y = x^2 - 10x$?

A.



B.



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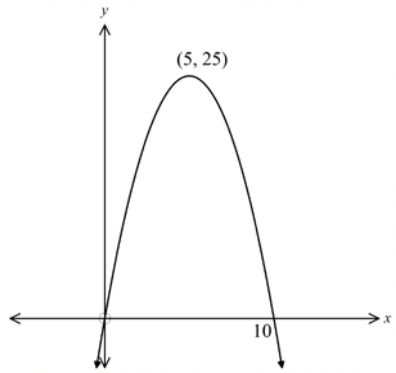
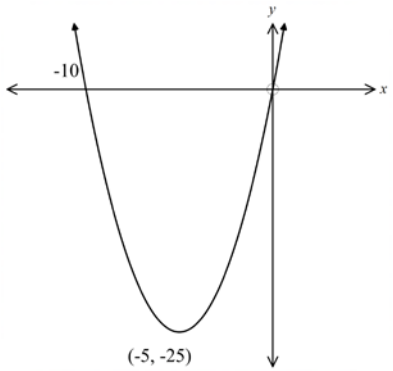
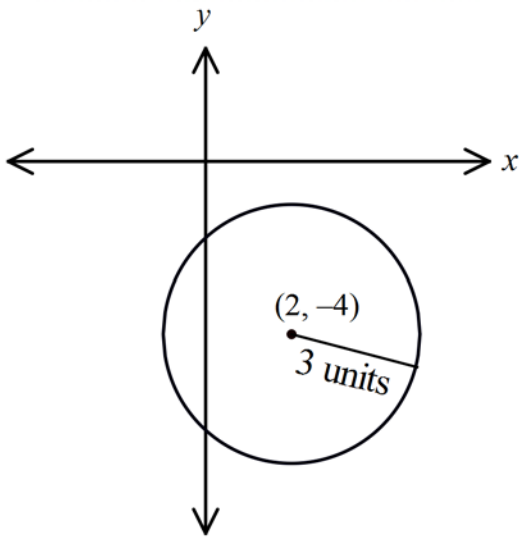


D.



11. What is the equation of the circle shown on the number plane?



A. $(x-2)^2 + (y+4)^2 = 3$

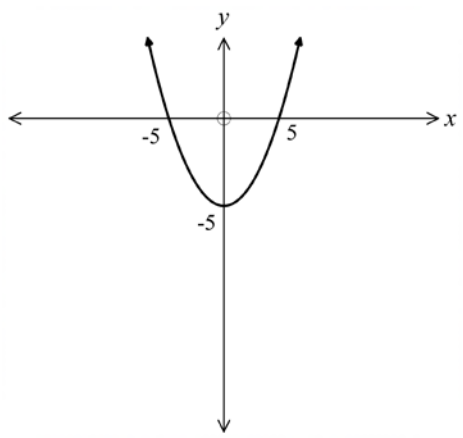
B. $(x-2)^2 + (y+4)^2 = 9$

C. $(x+2)^2 + (y-4)^2 = 3$

D. $(x+2)^2 + (y-4)^2 = 9$

12. Which is the graph of $y = (x + 5)^2$?

A.



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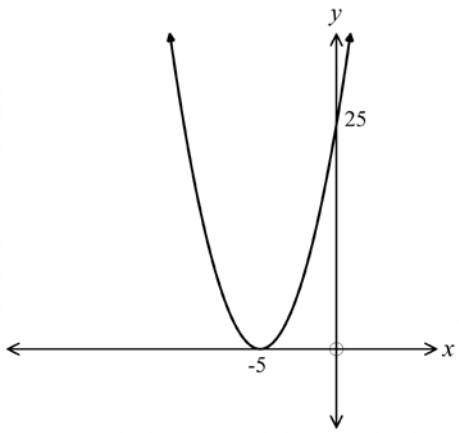

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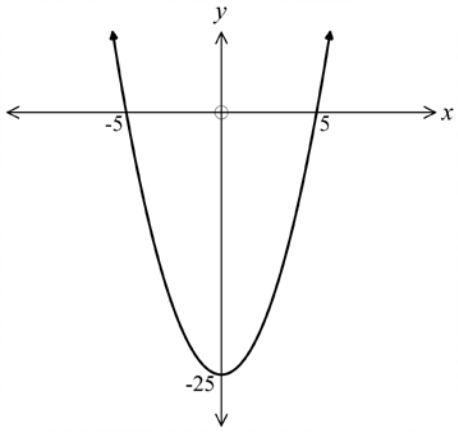

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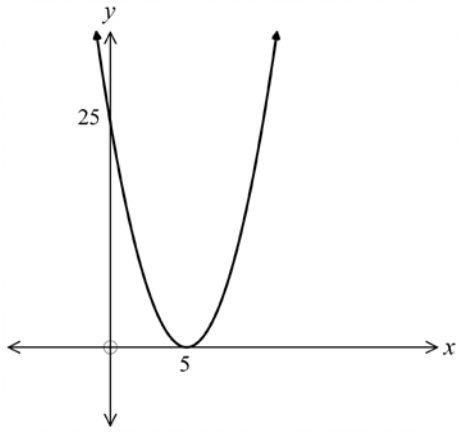


13. Which equation describes a circle with a radius of 9 units and centre at (5, – 7) ?

A. $x^2 - 10x + y^2 + 14y - 155 = 0$ B. $x^2 - 10x + y^2 + 14y - 7 = 0$

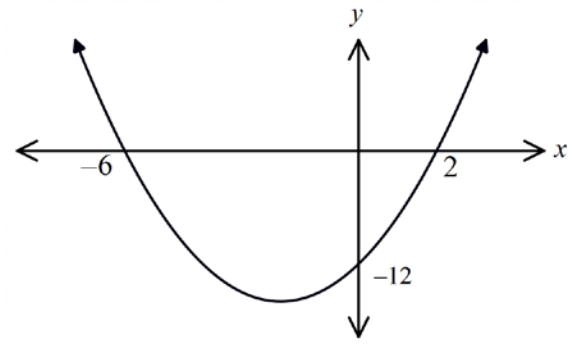
C. $x^2 + 10x + y^2 - 14y - 7 = 0$ D. $x^2 + 10x + y^2 - 14y + 155 = 0$

14. What is the y intercept of the curve $y = 2(x - 7)(x + 3)$?

A. $y = -42$ B. $y = -21$ C. $y = 0$ D. $y = 42$

15. Which is the graph of $y = x^2 + x - 12$?

A.



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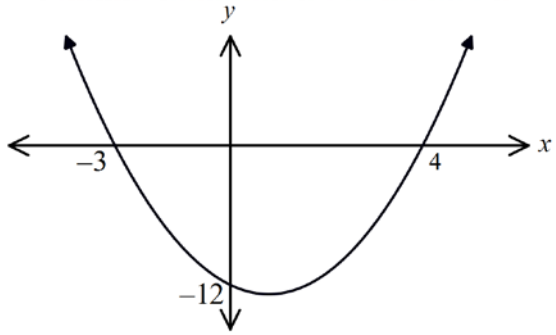
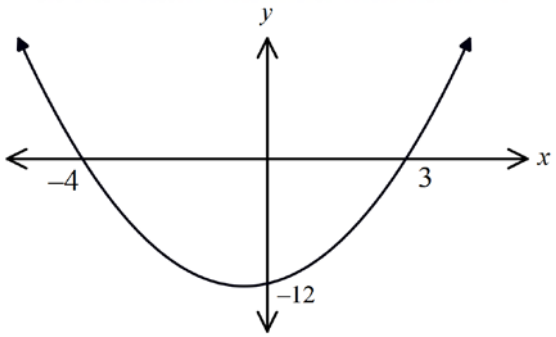


C.



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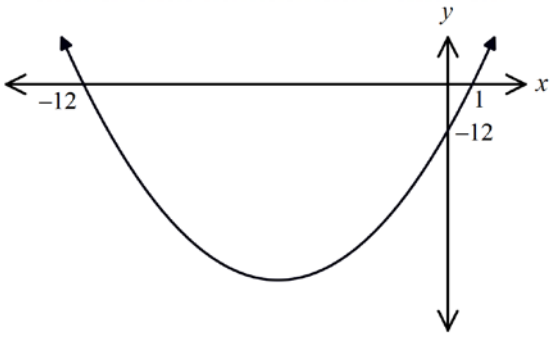


16. What is the vertex of the curve $y = x^2 - 2x - 63$?

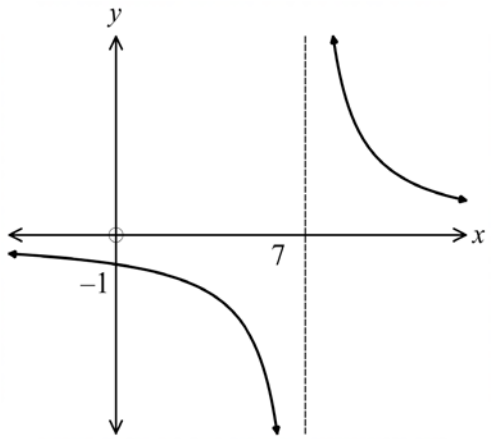
A. $(-1, -60)$ B. $(-1, -64)$ C. $(1, -60)$ D. $(1, -64)$

17. What are the intercepts on the x axis for the curve $y = x^2 + 5x - 66$?

A. $x = -11$ and $x = 6$. B. $x = -6$ and $x = 11$.

C. $x = -3$ and $x = 22$. D. $x = -1$ and $x = 66$.

18. Which equation could describe the graph shown?



A. $y = \frac{7}{x} - 1$

B. $y = \frac{7}{x + 7}$

C. $y = \frac{7}{x - 7}$

D. $y = 7^x$

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Calculator Allowed

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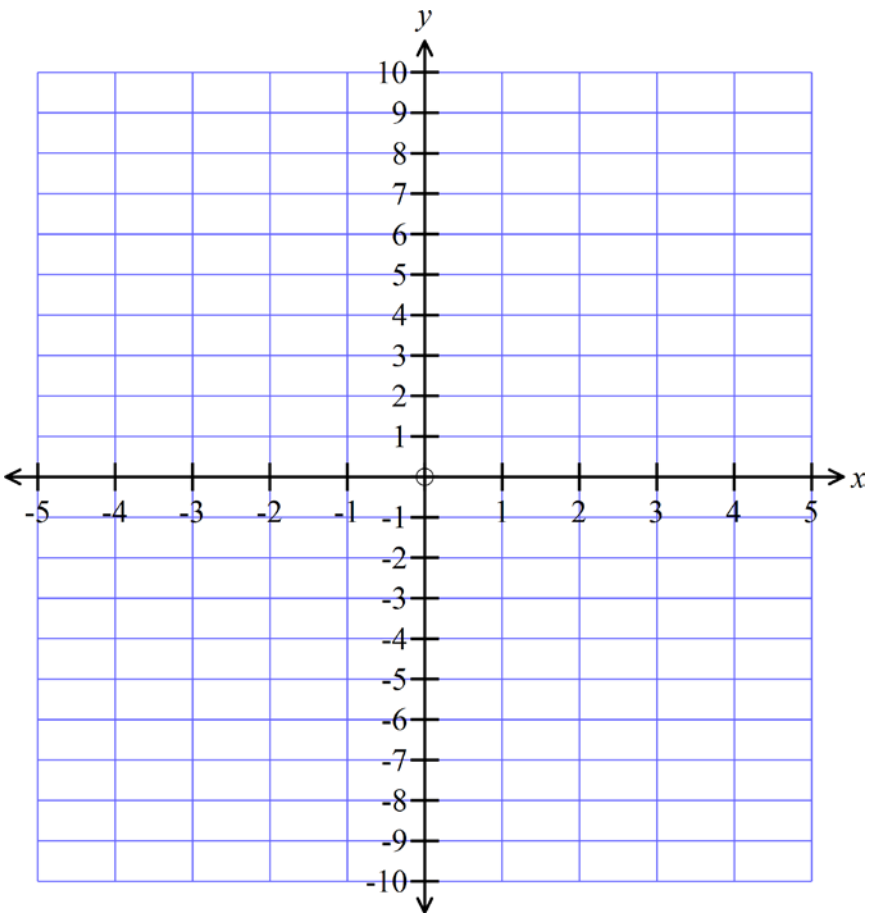
Section 3 Longer Answer Section

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

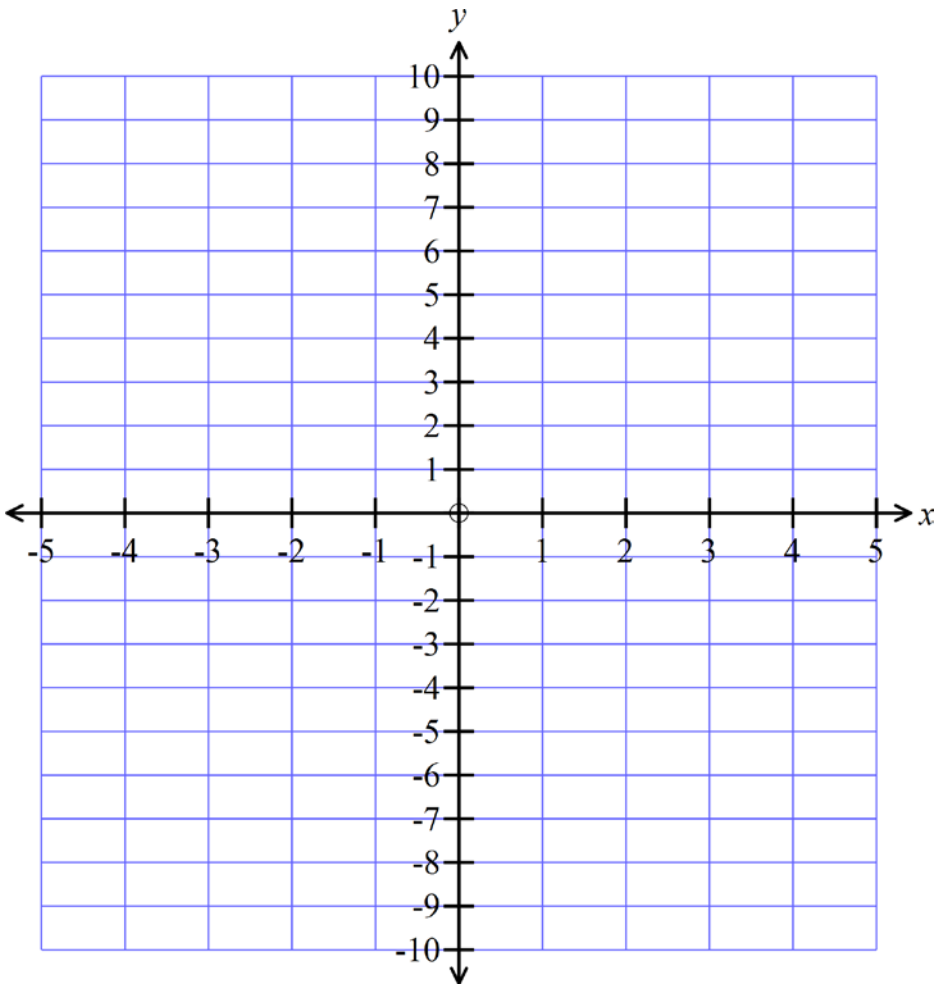
Marks

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



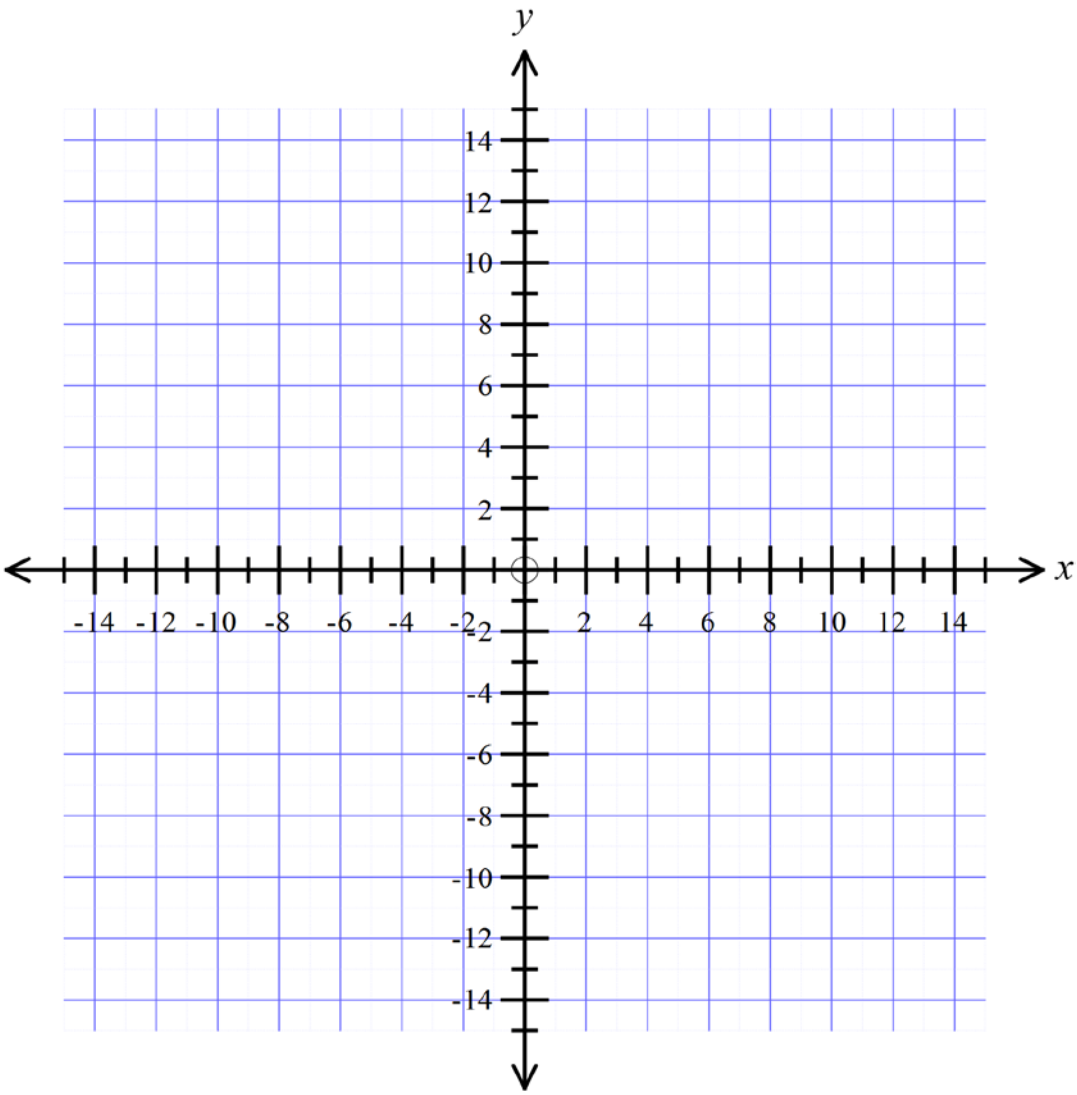
Marks

2. On the axes provided draw neat sketches of $y = (x - 5)(x + 1)$ and $y = 4x - x^2$. **4**
Clearly mark the x and y intercepts and the vertex of each graph.



Marks

3. On the axes provided draw neat sketches of $y = 2^x + 1$ and $x^2 + y^2 = 81$. **4**
Clearly mark the *x* and *y* intercepts of each graph.



Marks

4. On the axes provided draw neat sketches of $y = \frac{1}{x-5}$ and $y = x^2 - 5x - 6$. **4**

Clearly mark the x and y intercepts and the vertex or asymptote (where appropriate) of each graph.

School Name

Mathematics 2017

Multiple Choice Answer Sheet

Non-Linear Relations

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 ⬭
13. A ⬭ B ⬭ C ⬭ D ⬭
14. A ⬭ B ⬭ C ⬭ D ⬭
15. A ⬭ B ⬭ C ⬭ D ⬭
16. A ⬭ B ⬭ C ⬭ D ⬭
17. A ⬭ B ⬭ C ⬭ D ⬭
18. A ⬭ B ⬭ C ⬭ D ⬭

School Name
Mathematics Test 2017

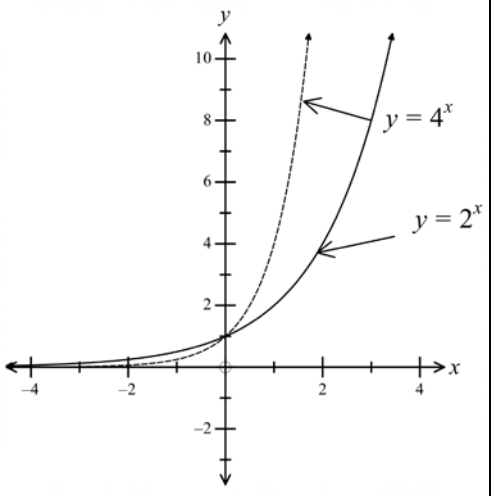
Year 10 *Non-Linear Relations*

Non Calculator Section

ANSWERS

Question	Working and Answer
1.	$y = (x + 4)(x - 4)$ $y = x^2 - 16$
2.	$y = (x - 3)(3 - x)$ $y = 9 - x^2$
3.	At $(x, 125)$, $y = 125$ $5^x = 125$ so (, since $5^3 = 125$) $x = 3$
4.	$x^2 + y^2 = 36$ $x^2 + y^2 = 6^2$ $x^2 + y^2 = b^2$ so $b = 6$
5.	The broken line is $y = 6 - 3x^2$ as it is concave down, and the unbroken line is $y = 3x^2 - 6$
6.	The y intercept occurs where $x = 0$. $y = 2(0)^2 - 18$ $= -18$ Point is $(0, -18)$
7.	The x intercepts are where $y = 0$. $0 = 2x^2 - 18$ $2x^2 = 18$ $x^2 = 9$ $x = \pm 3$ Points are $(-3, 0)$ and $(3, 0)$

Question	Working and Answer
8.	At P, $x = 2$, $y = 6^2 = 36$ Point is (2, 36)
9.	Radius of circle is 11 units and centre is the origin, so its equation is $x^2 + y^2 = 11^2$. $x^2 + y^2 = 121$.
10.	$y = x^2 + 4x$ x intercept where $y = 0$ $x^2 + 4x = 0$ $x(x + 4) = 0$ $x = 0$ or $x = -4$ Since $x = 0$ is origin, ***S* is (–4, 0)**
11.	x coordinate of vertex is midway between the x intercepts x coordinate if vertex is $x = -2$ Sub $x = -2$ into $y = x^2 + 4x$ $y = (-2)^2 + 4(-2)$ $= 4 - 8$ $y = -4$ **Vertex is (–2, –4)**
12.	P and Q are the x intercepts, so $y = 0$ $0 = (x - 5)(x + 3)$ $x = 5$ or $x = -3$ **Points are *P*(–3, 0) and *Q* (5, 0)**
13.	x coordinate of vertex is midway between the $x = -3$ and $x = 5$ x coordinate if vertex is $x = \frac{-3 + 5}{2} = \frac{2}{2} = 1$ Sub $x = 1$ into $y = (1 - 5)(1 + 3)$ $y = (-4)(4)$ $y = -16$ **Vertex is (1, –16)**
14.	$y = x^2 + 6x - 16$ $y = (x - 2)(x + 8)$ x intercepts at when $y = 0$ $(x - 2)(x + 8) = 0$ $x = -8$ and $x = 2$ ***U* is (–8, 0) and *V* is (2, 0)**

Question	Working and Answer
15.	x coordinate of vertex is midway between $x = -8$ and $x = 2$ x coordinate if vertex is $x = \dfrac{-8+2}{2} = -\dfrac{6}{2} = -3$ Sub $x = -3$ into $y = (-3)^2 + 6(-3) - 16$ $y = 9 - 18 - 16$ $y = -25$ **Vertex is (–3, –25)**
16.	x intercepts are $x = 2$ and $x = 7$, so parabola has form $y = a(x-2)(x-7)$ $y = a(x^2 - 9x + 14)$ when $x = 0, y = 14$ $14 = a(0 + 0 + 14)$ $14a = 14$ $a = 1$ Equation is $\boldsymbol{y = (x-2)(x+7)}$ or $\boldsymbol{y = x^2 - 9x + 14}$
17.	$y = 2^x$ should be below $y = 4^x$ for $x > 0$ and above for $x < 0$, both should cross y axis at $y = 1$. 
18.	**Centre is at (–7, 9) and radius is $\sqrt{25} = 5$**

School Name
Mathematics Test 2017

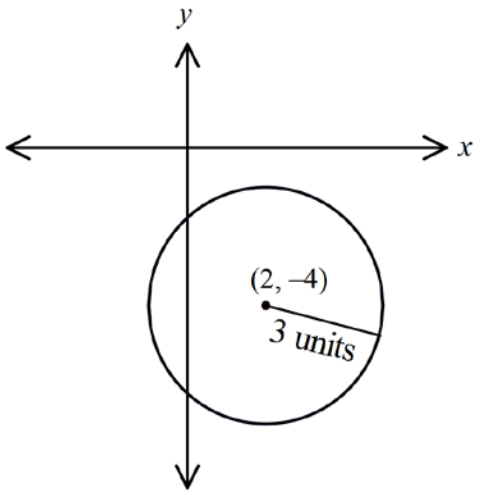
Year 10

Non-Linear Relations

Calculator Allowed
Multiple Choice
Section

ANSWERS

Question	Working	M C Answer
1.	$y = 36 - x^2$ is concave down and has y intercept of 36 and x intercepts of $x = 6$ and $x = -6$.	**D**
2.	It will be of the form $y = ax^2 + 4$ since it has an intercept of 4. Sub (3, 13) :$13 = a(3)^2 + 4$ $9 = 9a$ So a = 1 Equation $y = x^2 + 4$	**B**
3.	$x^2 + y^2 = 25$ is a circle, A and B are parabolas and D is an exponential..	**C**
4.	$y = 2^x$ is an exponential where y increases without bound as x increases	**B**
5.	A and D are circles, A has a radius of 2, and D of $\sqrt{2}$	**A**
6.	A has a vertex at (0, 8), B at (0, –8) C at (0, 0) and D at (0, 16).	**A**
7.	Needs to be a parabola which is concave down and through the origin.	**D**
8.	It is a parabola which is concave up and has a y intercept of -64, so equation is $y = x^2 - 64$.	**D**

9.	The first three statements apply to both curves, but curve M has its vertex above the origin on the y axis, so statement D is incorrect.	**D**
10.	$y = x^2 - 10x = x(x - 10)$ Curve is concave up and crosses x axis at 0 and 10. When $x = 5$, $y = 5(5 - 10) = -25$	**A**
11.	Centre is $(2, -4)$ and radius = 3. Equation is $(x - 2)^2 + (y - -4)^2 = 3^2$ $(x - 2)^2 + (y + 4)^2 = 9$ 	**B**
12.	$y = (x + 5)^2$ When $x = 0$, $y = -5^2 = 25$ When $y = 0$, $(x + 5)^2 = 0$ $x + 5 = 0$ $x = -5$ y intercept is 25 and there is only one x intercept at –5.	**B**
13.	Centre at $(5, -7)$ and radius 9 units gives equation $(x - 5)^2 + (y + 7)^2 = 9^2$ $x^2 - 10x + 25 + y^2 + 14y + 49 = 81$ $x^2 - 10x + y^2 + 14y - 7 = 0$	**B**
14.	y intercept is when $x = 0$ Sub $x = 0$ into $y = 2(x - 7)(x + 3)$?. $y = 2(0 - 7)(0 + 3)$ $= 2 \times -7 \times 3$ $y = -42$	**A**

15.	$y = x^2 + x - 12$ $y = (x + 4)(x - 3)$ x intercepts at $x = -4$ and $x = 3$ y intercept when $x = 0$, so $y = -12$	**C**
16.	$y = x^2 - 2x - 63$ $= (x - 9)(x + 7)$ x intercepts $x = 9$ or $x = -7$ The intercepts are equally spaced either side of the vertex Vertex has x value $x = \frac{9 - 7}{2} = \frac{2}{2} = 1$ Sub into $y = (1)^2 - 2 \times 1 - 63$ $= 1 - 2 - 63$ $= -64$ Vertex $(1, -64)$	**D**
17.	$y = x^2 + 5x - 66$ $y = (x - 6)(x + 11)$ Intercepts when $y = 0$ $(x - 6)(x + 11) = 0$ $x = -11$ and $x = 6$	**A**
18.	Since two branches it is a hyperbola. Because asymptote is at $x = 7 \Rightarrow x \neq 7 \Rightarrow x - 7 \neq 0$ So denominator is $x - 7$. Test y intercept $x = 0$ $y = \frac{7}{0 - 7} = \frac{7}{-7} = -1$	**C**

School Name

Mathematics 2017

Multiple Choice Answer Sheet

Non-Linear Relations

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 ○
13.	A ○	B ●	C ○	D ○
14.	A ●	B ○	C ○	D ○
15.	A ○	B ○	C ●	D ○
16.	A ○	B ○	C ○	D ●
17.	A ●	B ○	C ○	D ○
18.	A ○	B ○	C ●	D ○

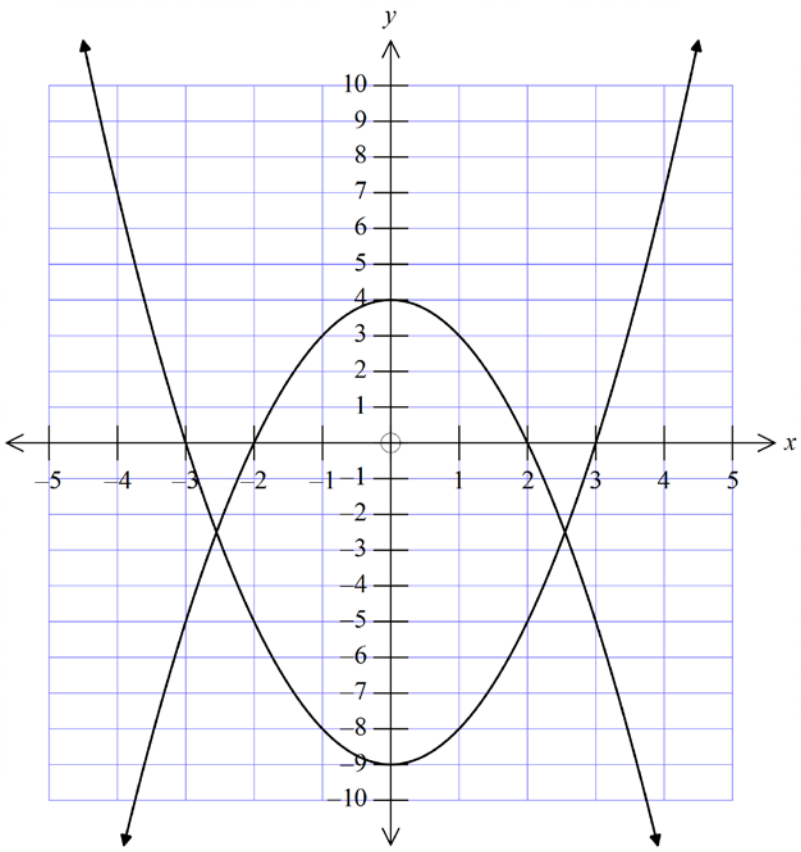
School Name
Mathematics Test 2017

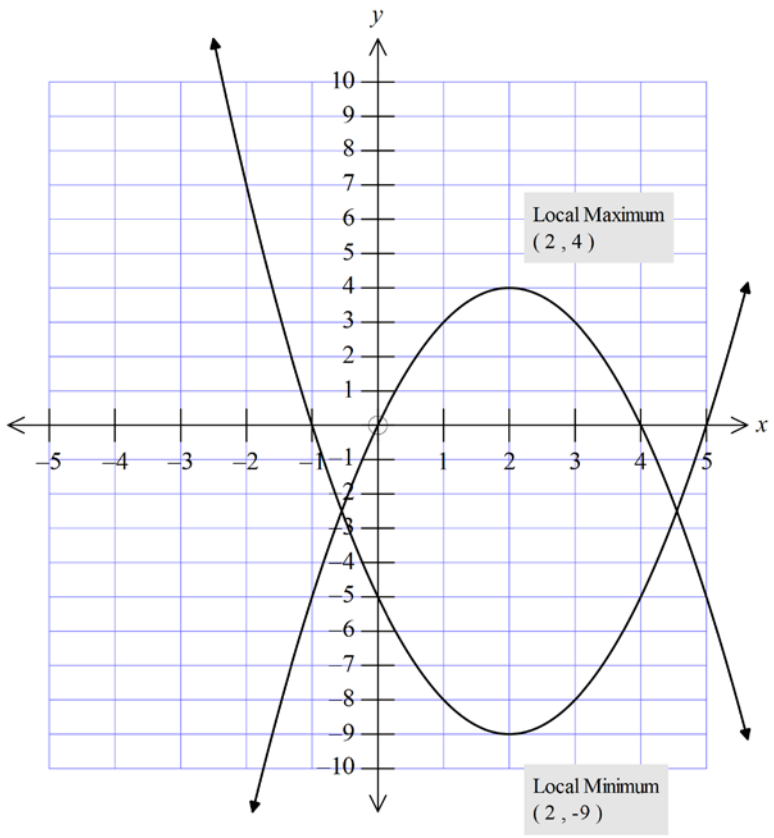
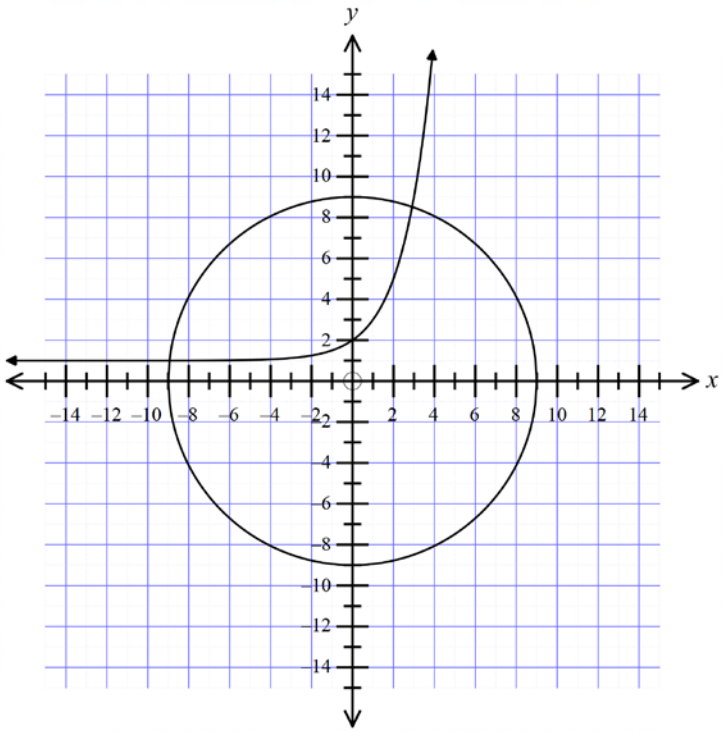
Year 10

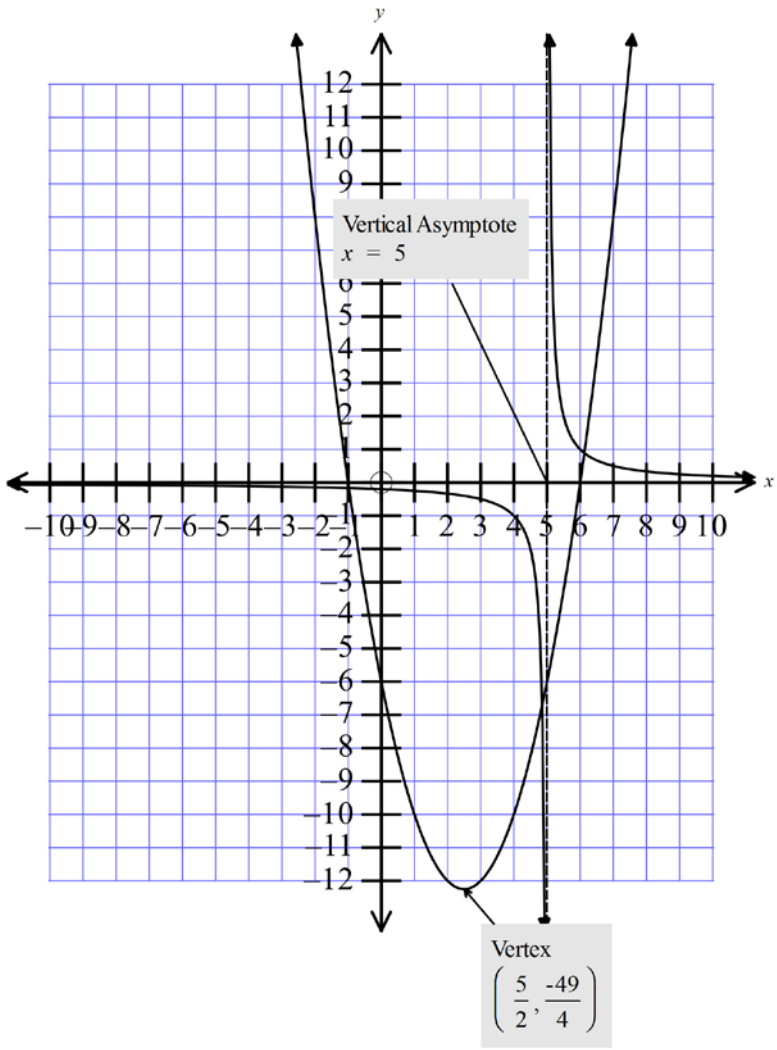
Non-Linear Relations

Calculator Allowed
Longer Answer Section

ANSWERS

Question	Working and Answer	**Marks**
1.		**2 marks for each graph with correct *x* and *y* intercepts.** **1 mark for either of the graphs with right shape but *x* or *y* intercepts incorrect.**

Question	Working and Answer	**Marks**
2.		**2 marks for each graph with correct *x* and *y* intercepts and vertex** **1 mark for either of the graphs with right shape but x or y intercepts or vertex incorrect**
3.		**2 marks for each graph with correct *x* and *y* intercepts.** **1 mark for either of the graphs with right shape but *x* or *y* intercepts incorrect.**

Question	Working and Answer	**Marks**
4.		**2 marks for each graph with correct *x* and *y* intercepts vertex or parabola and asymptote of hyperbola.** **1 mark for either of the graphs with right shape but one of the other details incorrect.**