

# Algebra 2 Honors

# Ellipses

## Lesson 3: Ellipses

### DEFINITION OF AN ELLIPSE

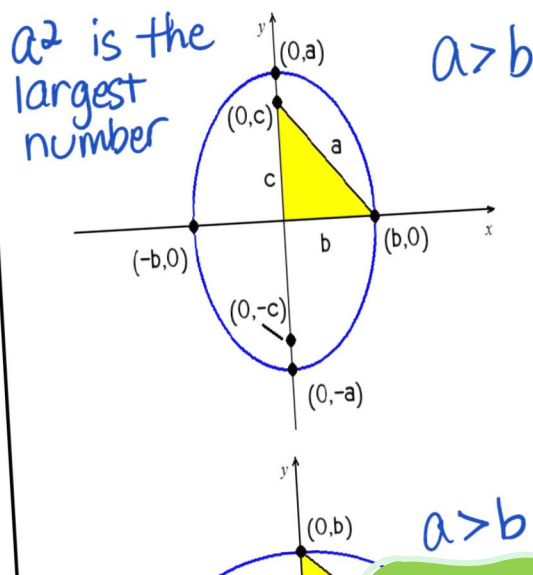
An ellipse is the set of all points  $P$  in a plane whose sum of the distances from  $P$  to two fixed points  $F_1$  and  $F_2$  is a given sum  $k$ .

#### Verbal Vocabulary

The center of an ellipse is the point on the focal axis midway between the foci.

The segment that contains the foci of the ellipse and has endpoints on the ellipse is known as the major axis, while the segment that is perpendicular to the major axis at its midpoint and has endpoints on the ellipse is called the minor axis. The endpoints of the minor

#### Visual Vocabulary



# Completely Editable

# 10.3

## Lesson 3: Ellipses

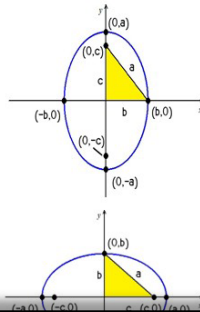
### DEFINITION OF AN ELLIPSE

An ellipse is the set of all points P in a plane whose sum is the distances from P to two fixed points  $F_1$  and  $F_2$  is a given sum  $k$ .

#### Verbal Vocabulary

The \_\_\_\_\_ of an ellipse is the point on the focal axis midway between the foci.  
The segment that contains the foci of the ellipse and has endpoints on the ellipse is known as the \_\_\_\_\_ axis, while the segment that is perpendicular to the major axis at its midpoint and has endpoints on the ellipse is called the \_\_\_\_\_ axis. The endpoints of the minor axis are known as \_\_\_\_\_. The \_\_\_\_\_, plural of focus, are the fixed points

#### Visual Vocabulary



### Finding Vertices and Foci

EX #1:  $\frac{x^2}{25} + \frac{y^2}{16} = 1$

$a =$  \_\_\_\_\_  $b =$  \_\_\_\_\_  $c =$  \_\_\_\_\_

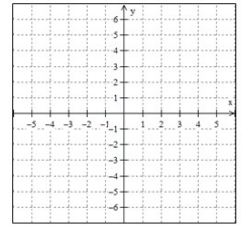
Major axis \_\_\_\_\_

Center \_\_\_\_\_

Major vertices \_\_\_\_\_

Co-vertices \_\_\_\_\_

Foci \_\_\_\_\_



### Writing an Equation of an Ellipse

EX #2: Find the equation in standard form of an ellipse centered at the origin with

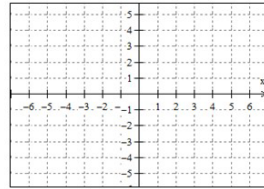
### Standard Form of an Ellipse

EX #3: Find the standard form of the equation, the vertices and foci. Draw the ellipse.

$4x^2 + 25y^2 = 100$

Standard Form:

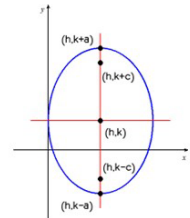
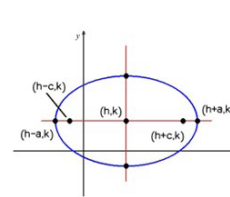
|                |  |
|----------------|--|
| Major axis     |  |
| Major Vertices |  |
| Minor Vertices |  |
| Foci           |  |



EX #4: Write an equation for an ellipse in standard form whose center is at the origin

A. Vertex is  $(-4, 0)$ , co-vertex  $(0, 3)$

### Ellipses with Center $(h, k)$



Equation

$\frac{(x-h)^2}{a^2} + \frac{(y-k)^2}{b^2} = 1$

$\frac{(y-k)^2}{a^2} + \frac{(x-h)^2}{b^2} = 1$

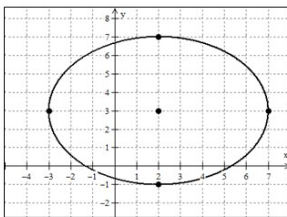
Major Axis

Foci

Vertices

### Working Backwards from a Graph

EX #6: Use the sketch of the ellipse to complete the chart:



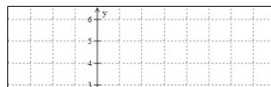
|                |  |
|----------------|--|
| Center:        |  |
| Major axis:    |  |
| Major Vertices |  |
| Minor Vertices |  |
| Foci:          |  |
| Standard Form: |  |

### Finding an Equation of an Ellipse

EX #7: Find the equation in standard form for an ellipse whose major vertices are  $(-2, 1)$  and  $(6, 1)$  and co-vertices are  $(2, 4)$  and  $(2, -2)$ .

Equation: \_\_\_\_\_

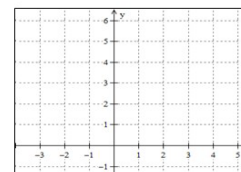
Major axis:



### Completing the Square

EX #8: Complete the square to find the center vertices and foci. Draw a graph.

$4x^2 + y^2 - 8x - 2y - 11 = 0$



Center:

Major Vertices:

Minor Vertices:

Foci:

# NOTES

Name \_\_\_\_\_ Date \_\_\_\_\_

10.3

## Ellipses Practice

**Problems 1 – 4,** write an equation of an ellipse in standard form with center at the origin and with given vertices.

1.  $(\pm 5, 0), (0, \pm 6)$

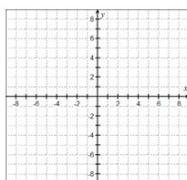
2.  $(\pm 1, 0), (0, \pm 3)$

3.  $(\pm 7, 0), (0, \pm 5)$

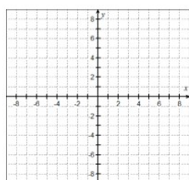
4.  $(\pm \sqrt{15}, 0), (0, \pm \sqrt{12})$

**Problems 5 – 10,** find the foci for each equation of an ellipse. Then graph the ellipse.

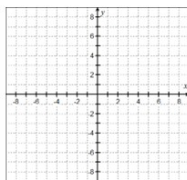
5.  $\frac{x^2}{25} + \frac{y^2}{9} = 1$



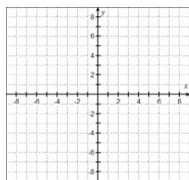
6.  $\frac{x^2}{4} + \frac{y^2}{25} = 1$



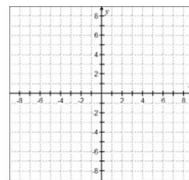
7.  $\frac{x^2}{9} + \frac{y^2}{16} = 1$



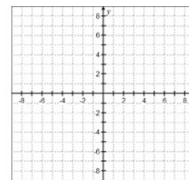
8.  $\frac{x^2}{36} + \frac{y^2}{9} = 1$



9.  $4x^2 + 16y^2 = 64$



10.  $25x^2 + 16y^2 = 400$

**Problems 11 – 13,** find the distance between the foci of an ellipse. The lengths of the major and minor axes are listed.

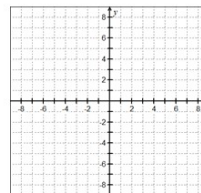
11. 20 and 16

12. 30 and 16

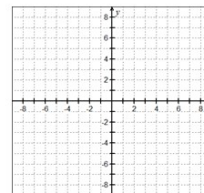
13. 28 and 7

**Problems 14 – 17,** find the center, vertices, and foci, and draw each graph.

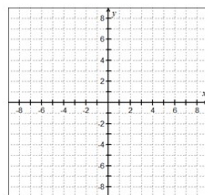
14.  $\frac{(x-2)^2}{4} + \frac{(y-3)^2}{9} = 1$



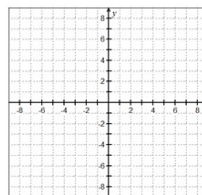
15.  $\frac{(x+4)^2}{25} + \frac{y^2}{16} = 1$



16.  $9(x+4)^2 + 25(y-3)^2 = 225$

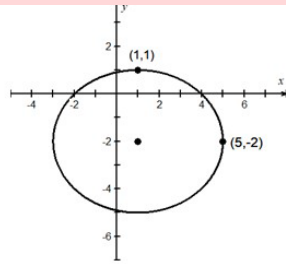


17.  $4(x-3)^2 + 3(y-1)^2 = 192$

**Problems 17 – 19,** Write an equation of an ellipse in standard form with the given characteristics.17. Major vertices are located at  $(2, 8)$ ,  $(2, -2)$  and foci are at  $(2, 6)$ ,  $(2, 0)$ 18. Complete the square to find the equation of the ellipse.  $x^2 + 9y^2 - 8x + 18y - 11 = 0$ 

# Practice Sets

# Lesson Warm-Ups



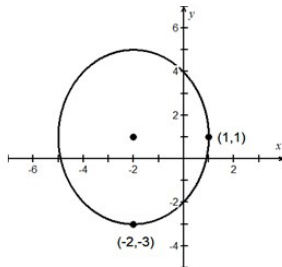
3. Use symmetry of the ellipse to find two more points on the ellipse.

Name \_\_\_\_\_ Date \_\_\_\_\_ Period \_\_\_\_\_

## Lesson 10.3: Ellipses

## Warm-Up #2

1. Use the graph of the ellipse to answer the following questions.



2. Identify the center and length of the major axis and the length of the minor axis.

3. Use symmetry of the ellipse to find two more points on the ellipse.

Form A

10.3 Ellipses

Form B

Name \_\_\_\_\_

Date \_\_\_\_\_ Period \_\_\_\_\_

1. Write an equation of an ellipse in standard form with center at the origin and with vertices at  $(\pm 4, 0)$  and  $(0, \pm 3)$ .

Questions 2-3: Find the vertices and foci of the ellipse and sketch the graph in the grid below.

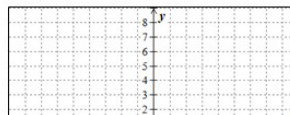
$$2. \frac{x^2}{25} + \frac{y^2}{4} = 1$$

Major vertices: \_\_\_\_\_

Minor vertices: \_\_\_\_\_

Foci: \_\_\_\_\_

3. Graph:



Questions 2-3: Find the vertices and foci of the ellipse and sketch the graph in the grid below.

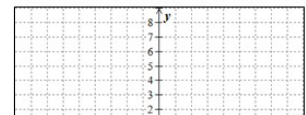
$$2. \frac{x^2}{9} + \frac{y^2}{16} = 1$$

Major vertices: \_\_\_\_\_

Minor vertices: \_\_\_\_\_

Foci: \_\_\_\_\_

3. Graph:



# Daily Lesson Quiz

Grade: \_\_\_\_\_

Grade: \_\_\_\_\_