

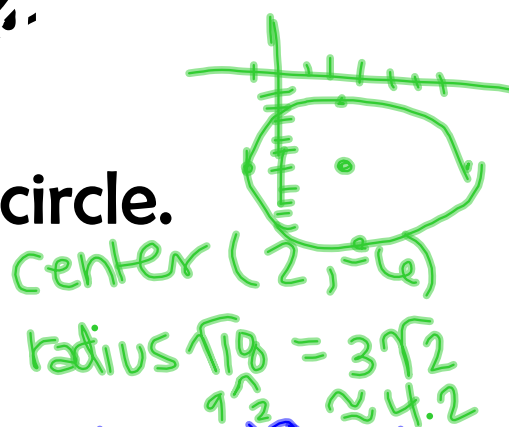
11.2 Ellipses

Warm-Up Tuesday

Sketch a graph of the circle.

$$\frac{2(x-2)^2}{2} + \frac{2(y+6)^2}{2} = \frac{36}{2}$$

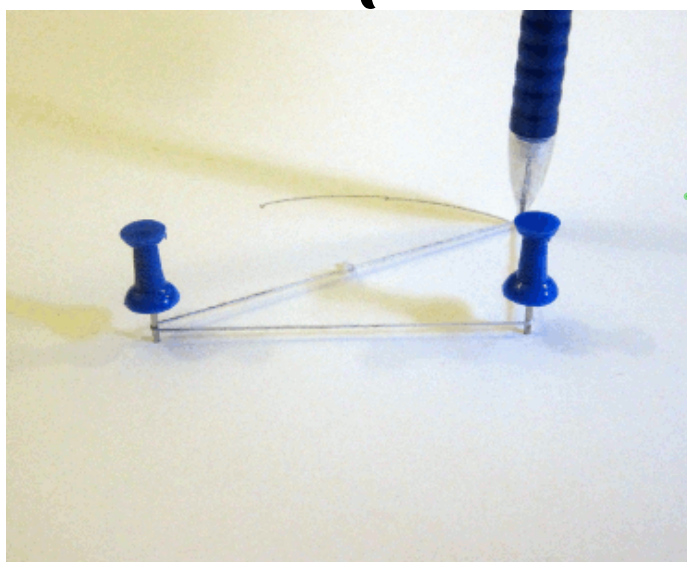
$$(x-2)^2 + (y+6)^2 = 18$$



About Me

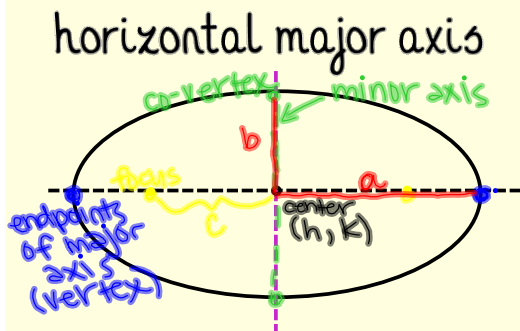
1. What's your favorite season?
2. Would you rather write something down, draw a picture, or type on a computer?

11.2 Ellipses



Ellipses

definition: Set of all points P in a plane such that the sum of the distances from P to two fixed points F_1 and F_2 , called the foci, is constant.



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

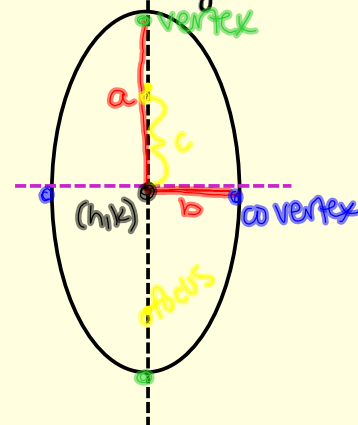
Center: (h, k)

Major Axis: horizontal, length 2a

Minor Axis: vertical, length 2b

Foci: along the horizontal axis, c units from the center

vertical major axis



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

Center: (h, k)

Major Axis: vertical, length 2a

Minor Axis: horizontal, length 2b

Foci: along the vertical axis, c units from the center

a^2 is always the bigger number!

Use $c^2 = a^2 - b^2$
to find the foci

examples

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

center (0, 0)

Vertical

$$c^2 = a^2 - b^2$$

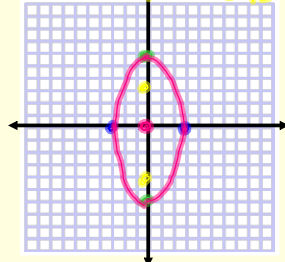
$$c^2 = 36 - 9 = 27 = 3^2 \cdot 3$$

$$a^2 = 36$$

$$b^2 = 9$$

$$a = 6$$

$$b = 3$$



2. $\frac{(x-1)^2}{25} + \frac{(y+1)^2}{9} = 1$

center (1, -1)

Horizontal

$$c^2 = 25 - 9$$

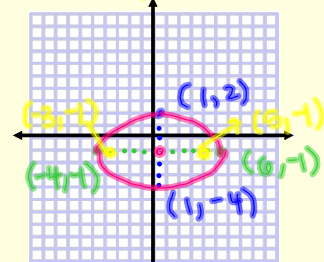
$$c^2 = 16 \Rightarrow c = 4$$

$$a^2 = 25$$

$$b^2 = 9$$

$$a = 5$$

$$b = 3$$



ELLIPSES

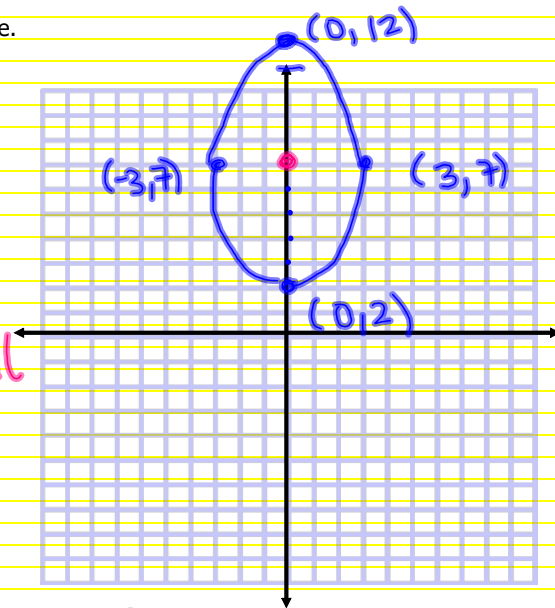
Find the center, a, b, and c, then graph the ellipse.

1. NOT in standard ☹️

$$\frac{25x^2}{225} + \frac{9(y-7)^2}{225} = \frac{225}{225}$$

$$\frac{x^2}{9} + \frac{(y-7)^2}{25} = 1$$

Center (0, 7) Vertical
 $a = 5$
 $b = 3$



GRAPHING TIPS

- Put equation in standard form.
 - Find the center.
 - Determine if the major axis is horizontal or vertical.
 - Find a - the length of the major axis is $2a$ - and plot the vertices.
 - Find b - the length of the minor axis is $2b$ - and plot the covertices.
 - Connect the vertices and covertices with a smooth curve.
- If given the focus, remember:
 $c^2 = a^2 - b^2$

ECCENTRICITY

measure of the ovalness of an ellipse

$$\frac{c}{a} = e \quad \text{If } \frac{c}{a} \text{ is closer to 0:}$$

Then, the foci are closer to the center.
 The Ellipse is more circular.

$$\frac{c}{a} = e \quad \text{If } \frac{c}{a} \text{ is closer to 1:}$$

Then, the foci are closer to vertices.
 The Ellipse is very elongated.

EXAMPLES

Find a and c. Find the eccentricity, then describe the ellipse.

1. $\frac{x^2}{16} + \frac{y^2}{25} = 1$

$$b^2 = 16 \quad a^2 = 25$$

$$c^2 = 25 - 16 = 9$$

$$c = 3$$

$$e = \frac{3}{5}$$

close to 1, elongated

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

$$c^2 = 8 - 1 = 7$$

$$c = \sqrt{7}$$

$$e = \frac{\sqrt{7}}{\sqrt{8}} \approx 0.9...$$

close to 1, elongated

#1-5 ALL, #6-17 EVENS

Student Practice – Ellipse Day 1

Name _____ Date _____ Period _____

Identify each equation as a circle or an ellipse. If it is an ellipse draw the graph and label the center, vertices, co-vertices. State the domain and range.

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

2. $9x^2 + y^2 = 144$

3. $3x^2 + 3y^2 = 21$

4. $\frac{(x+2)^2}{9} + \frac{(y+3)^2}{16} = 1$

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

Find the foci and vertices of each ellipse:

6. $\frac{x^2}{25} + \frac{y^2}{16} = 1$

7. $\frac{(y-5)^2}{169} + \frac{(x+1)^2}{144} = 1$

8. $\frac{y^2}{36} + \frac{(x+3)^2}{4} = 1$

9. $9(y-7)^2 + 25x^2 = 225$

10. $49x^2 + 16y^2 = 784$

11. $9(x-3)^2 + 81(y+3)^2 - 729 = 0$

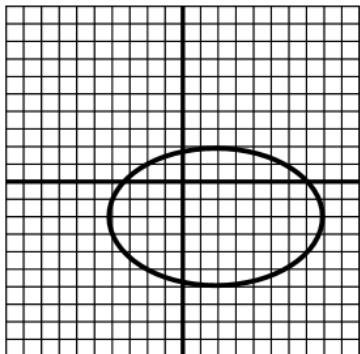
Write the equation in standard form.

12. $49x^2 + 64y^2 - 3136 = 0$

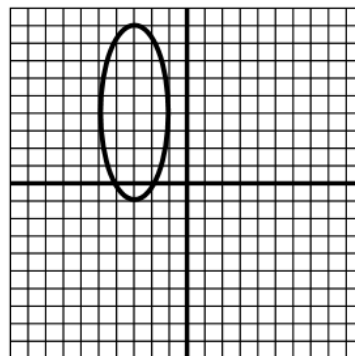
13. $4(x - \frac{1}{2})^2 + 9(y + \frac{2}{5})^2 - 72 = 0$

Write the equation in standard form.

14.



15.



16. Statuary Hall is an elliptical room in the United States Capitol in Washington, D.C. The room is 46 feet wide and 96 feet long. Because of a reflective property of an ellipse, a person standing at one focus can hear even a whisper spoken by a person standing at the other focus. (John Quincy Adams is said to have used this feature of the room to overhear conversations.)

A) Find an equation of the ellipse.

B) How far apart are the two foci?



17. An elliptically shaped garden is surrounded on all sides by a wooden walkway. The garden is 15 meters long and 8 meters wide. The walkway is 2 meters wide.

A) Find the equation describing only the garden.

B) Find the equation describing the garden and walkway together.

C) Find the area of just the walkway ($A = \pi ab$).