

# 9.2 Ellipses

Questions on Circles 19, 35, 15

a) Center (0,0)       $x^2 + y^2 = 6561$   
 Radius = 81

b)  $60^2 + 45^2 \leq 81^2$       yes  
 $5625 \leq 6561$

c)  $\sqrt{5625} = 75$   
 $81 - 75 = 6 \text{ miles}$

conics: ellipses (part 1)

Nov 17-10:12 AM

**Ellipse**—the set of all points in a plane such that the sum of the distances from two fixed points is a constant

- ∅ **Foci**—the two fixed points
- ∅ **Major axis**—the longer axis
- ∅ **Vertices**—endpoints of the major axis
- ∅ **Minor axis**—the shorter axis
- ∅ **Co-vertices**—endpoints of the minor axis
- ∅ **Eccentricity** - measure of the ovalness

**Horizontal Ellipse centered at the origin**

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$$

$a > b$

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

length of major axis =  $2a$   
 length of minor axis =  $2b$   
 length between foci =  $2c$

eccentricity =  $\frac{c}{a}$

ellipse

horizontal

**Horizontal Ellipse centered at  $(h, k)$**

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

$a > b$

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

Center:  $(h, k)$     Foci:  $(h \pm c, k)$   
 Vertices:  $(h \pm a, k)$     Co-Vertices:  $(h, k \pm b)$     eccentricity =  $\frac{c}{a}$

horizontal

**Vertical Ellipse centered at the origin**

$$\frac{x^2}{b^2} + \frac{y^2}{a^2} = 1$$

$a > b$

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

eccentricity =  $\frac{c}{a}$

vertical

**Vertical Ellipse centered at  $(h, k)$**

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

$a > b$

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

Center:  $(h, k)$     Foci:  $(h, k \pm c)$   
 Vertices:  $(h, k \pm a)$     Co-Vertices:  $(h \pm b, k)$     eccentricity =  $\frac{c}{a}$

vertical

Use the equation to find the requested information and graph the ellipse.

$a=5$      $b=2$      $\frac{x^2}{25} + \frac{y^2}{4} = 1$

Foci  $c^2 = a^2 - b^2$   
 $c^2 = 25 - 4$   
 $\sqrt{c^2} = \sqrt{21}$   
 $c = \sqrt{21}$

Center:  $(0, 0)$   
 Vertices:  $(-5, 0)$   $(5, 0)$   
 Co-vertices:  $(0, 2)$   $(0, -2)$   
 Foci:  $(-\sqrt{21}, 0)$   $(\sqrt{21}, 0)$   
 Length of major axis:  $2a = 10$   
 Length of minor axis:  $2b = 4$   
 Eccentricity:  $\frac{\sqrt{21}}{5}$

examples

Use the equation to find the requested information and graph the ellipse.

$$\frac{(x-3)^2}{16} + \frac{(y+5)^2}{36} = 1$$

$$9x^2 + 4y^2 - 54x + 40y + 37 = 0$$

$a=6$   $b=4$   
 $c^2 = a^2 - b^2 = 36 - 16 = 20$   
 $c = 2\sqrt{5}$

Center:  $(3, -5)$   $(3, -5 \pm 6)$

Vertices:  $(3, 1)$   $(3, -11)$

Foci:  $(3, -5 + 2\sqrt{5})$   $(3, -5 - 2\sqrt{5})$

Eccentricity:  $\frac{2\sqrt{5}}{6} = \frac{\sqrt{5}}{3}$

Co-vertices:  $(7, -5)$   $(-1, -5)$   
 $3 \pm 4$

examples

Use the given information to write the equation of the ellipse in standard form.

vertices:  $(0, 8)$  and  $(0, -8)$   
 foci:  $(0, 4)$  and  $(0, -4)$

$a=8$   $b=?$   $c=4$   
 $4^2 = 8^2 - b^2$   
 $16 = 64 - b^2$   
 $-48 = -b^2$   
 $\sqrt{48} = \sqrt{b^2}$   
 $\pm\sqrt{48} = b$

$$\frac{x^2}{48} + \frac{y^2}{64} = 1$$

examples

Write the equation of the ellipse in standard form from the graph.

$(1, -3)$

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

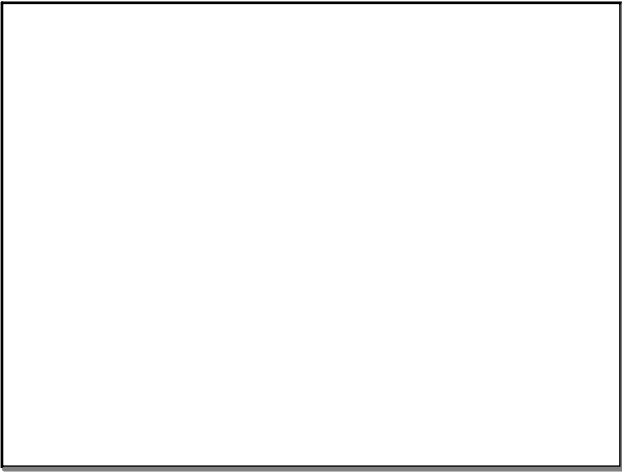
$$\frac{(x-1)^2}{16} + (y+3)^2 = 1$$

$a=4$   $b=1$

examples

## HOMEWORK

9.2 p 677: 1-6, 9-17odd, 23, 25, 31, 33



Oct 30-10:04 AM