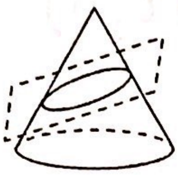
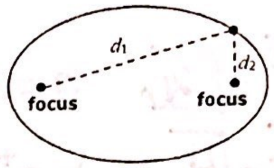
Name:	Date:
Topic:	Class:

Main Ideas/Questions	Notes/Examples

ELLIPSES



An ellipse is a set of points such that the **sum** of the distances from any point on the ellipse to two fixed points remains constant. These fixed points are called the foci of the ellipse.



$d_1 + d_2$ remains constant for all points on the ellipse!

MORE PARTS

Major Axis: The longer axis of symmetry.

Minor Axis: The shorter axis of symmetry.

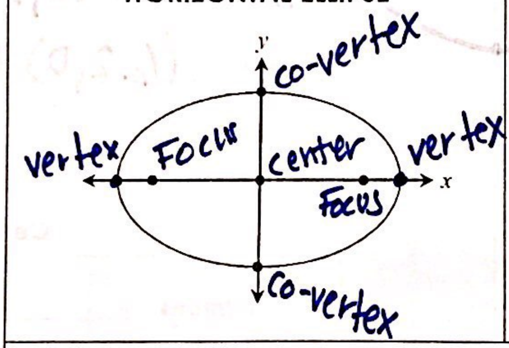
Center: The point at which the major and minor axis intersect.

Vertices: The endpoints of the major axis.

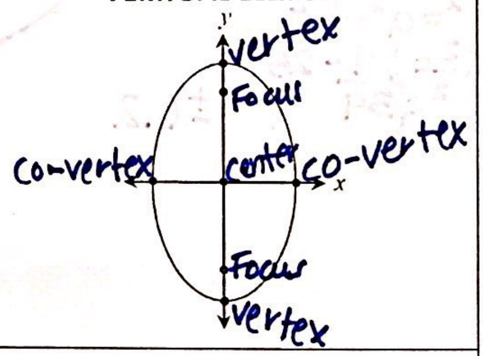
Co-Vertices: The endpoints of the minor axis.

TYPES OF ELLIPSES

HORIZONTAL ELLIPSE



VERTICAL ELLIPSE



- The vertices are $\pm a$ units away from the center.
- The co-vertices are $\pm b$ units away from the center.
- Length of Major Axis: $2a$; Length of Minor Axis: $2b$
- The foci are $\pm c$ units away from the center.
- **Formula to find c:** $c^2 = a^2 - b^2$

$a > b$

STANDARD FORM
Center at (0, 0)

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1 \quad \text{(Hori.)}$$

$$\frac{x^2}{b^2} + \frac{y^2}{a^2} = 1 \quad \text{(vert.)}$$

STANDARD FORM
Center at (h, k)

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

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

# GRAPHING ELLIPSES	✓ Write the equation in **standard form**. ✓ Graph the **center**, (h, k). ✓ Graph the **vertices**, using the larger denominator, a. ✓ Graph the **co-vertices**, using the smaller denominator, b. ✓ Use the formula $c^2 = a^2 - b^2$ to find and graph the **foci**.

Directions: Graph each ellipse. Identify the center, vertices, co-vertices, and foci.

1. $\frac{x^2}{4} + \frac{y^2}{36} = 1$

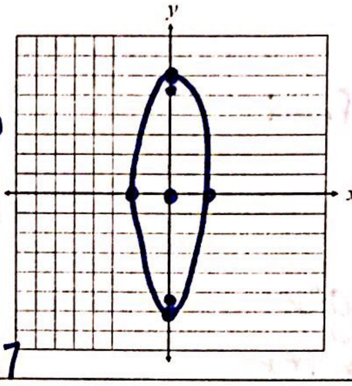
$\sqrt{a^2} = \sqrt{36}$ $a = \pm 6$

$\sqrt{b^2} = \sqrt{4}$ $b = \pm 2$

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

$c^2 = 36 - 4$

$\sqrt{c^2} = \sqrt{32}$ $c = \pm 5.7$



Center: (0,0)

a **Vertices:** (0, ±6)

b **Co-Vertices:** (±2, 0)

c **Foci:** (0, ±5.7)

2. $\frac{x^2}{64} + \frac{y^2}{25} = 1$

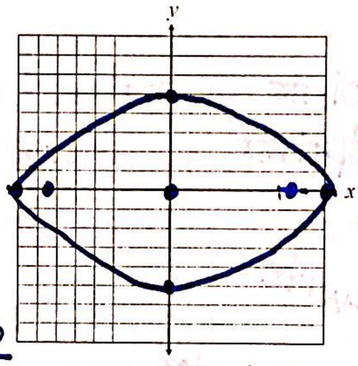
$\sqrt{a^2} = \sqrt{64}$ $a = \pm 8$

$\sqrt{b^2} = \sqrt{25}$ $b = \pm 5$

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

$c^2 = 64 - 25$

$\sqrt{c^2} = \sqrt{39}$ $c = \pm 6.2$



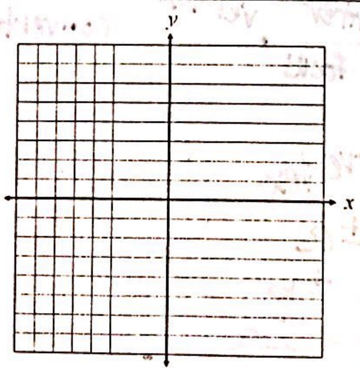
Center: (0,0)

a **Vertices:** (8,0) (-8,0)

b **Co-Vertices:** (0,5) (0,-5)

c **Foci:** (6.2,0) (-6.2,0)

3. $\frac{(x+1)^2}{49} + \frac{(y-2)^2}{9} = 1$



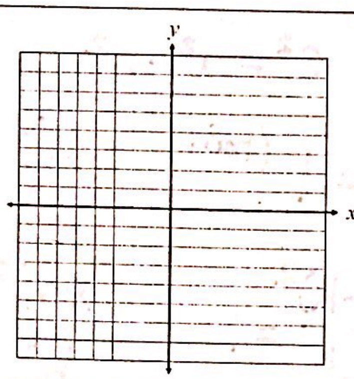
Center: ____________

Vertices: ____________

Co-Vertices: ____________

Foci: ____________

4. $\frac{(x-3)^2}{25} + \frac{(y-1)^2}{4} = 1$



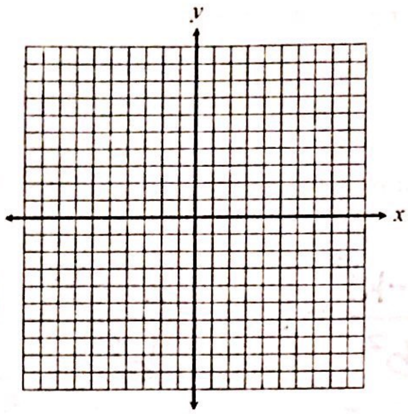
Center: ____________

Vertices: ____________

Co-Vertices: ____________

Foci: ____________

5. $\frac{(x+4)^2}{20} + \frac{(y+2)^2}{36} = 1$



Center: ____________

Vertices: ____________

Co-Vertices: ____________

Foci: ____________

6. $9x^2 + 16y^2 = 144$

$\frac{9x^2}{144} + \frac{16y^2}{144} = \frac{144}{144}$

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

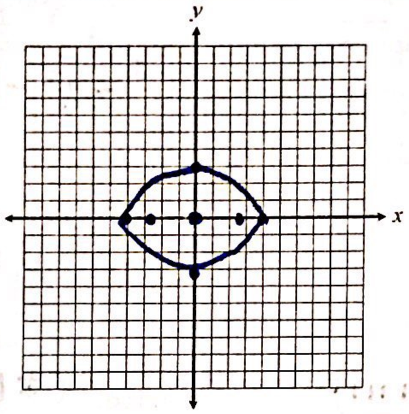
$a^2 = 16 \quad a = \pm 4$

$b^2 = 9 \quad b = \pm 3$

$c^2 = 16 - 9$

$c^2 = 7$

$c = \pm 2.7$



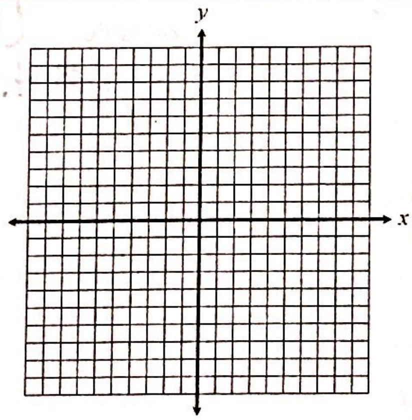
Center: (0,0)

Vertices: (±4,0)

Co-Vertices: (0,±3)

Foci: (±2.7,0)

7. $x^2 + 4y^2 - 10x = -9$



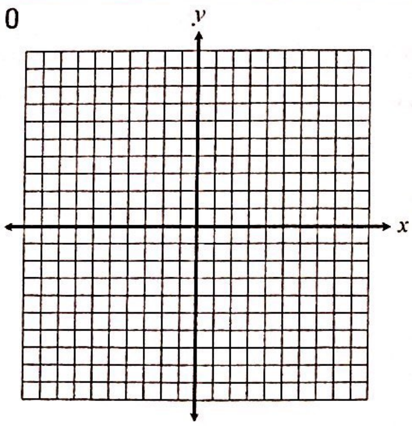
Center: ____________

Vertices: ____________

Co-Vertices: ____________

Foci: ____________

8. $4x^2 + y^2 - 32x + 8y + 76 = 0$



Center: ____________

Vertices: ____________

Co-Vertices: ____________

Foci: ____________

Name:	Date:
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Main Ideas/Questions	Notes/Examples
Writing Equations of **ELLIPSES**	**Standard Form for the Equation of an Ellipse at Center (h, k):**

HORIZONTAL ELLIPSE

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

VERTICAL ELLIPSE:

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

- __a__ is the distance from the center to the **vertices**; (MAJOR AXIS)
- __b__ is the distance from the center to the **co-vertices**; (MINOR AXIS)
- To find the **foci** use the formula, $c^2 = a^2 - b^2$ $a > b$

SET 1:
Given a Graph

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

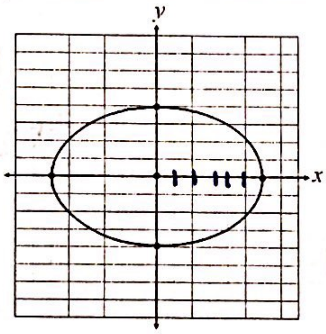
$c^2 = (6)^2 - (4)^2$

$\sqrt{c^2} = \sqrt{20}$

$c = \pm 4.5$

Directions: Write an equation for each ellipse. Identify the center, vertices, co-vertices, and foci.

1.



Equation: $y = \frac{x^2}{36} + \frac{y^2}{16}$

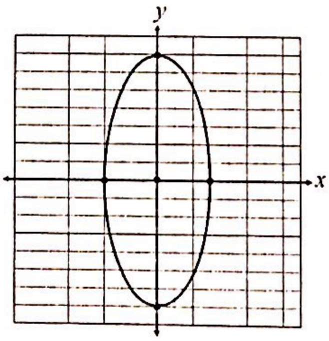
Center: $(0, 0)$

Vertices: $(\pm 6, 0)$

Co-Vertices: $(0, \pm 4)$

Foci: $(\pm 4.5, 0)$

2.



Equation: ______

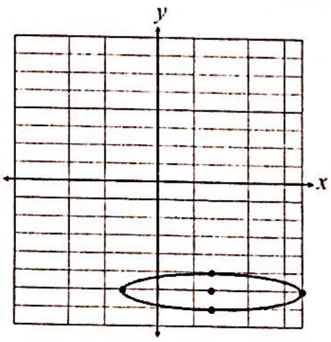
Center: ______

Vertices: ______

Co-Vertices: ______

Foci: ______

3.



Equation: ______

Center: ______

Vertices: ______

Co-Vertices: ______

Foci: ______

SET 2: *Given Vertices, Co-Vertices, & Foci*	✓ Find the **center** (h, k). (Use the midpoint formula with the vert. or co-vert.) ✓ Use the **vertices** to find a; Use the **co-vertices** to find b. *If given the foci, use the formula $c^2 = a^2 - b^2$ to find the missing part. ✓ Determine the direction of the ellipse to write the equation.

Directions: Write an equation for each ellipse with the given information.

4. Vertices: (-5, 0) and (5, 0)
Co-Vertices: (0, -2) and (0, 2)

C:(0,0)

$a = \pm 5 \quad a^2 = 25 \ (x)$

$b = \pm 2 \quad b^2 = 4 \ (y)$

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

5. Vertices: (0, -8) and (0, 8)
Co-Vertices: (-6, 0) and (6, 0)

C:(0,0)

$a = \pm 8 \quad a^2 = 64 \ (y)$

$b = \pm 6 \quad b^2 = 36 \ (x)$

$$\boxed{\frac{x^2}{36} + \frac{y^2}{64} = 1}$$

6. Vertices: (-5, 1) and (1, 1)
Co-Vertices: (-2, 3) and (-2, -1)

7. Vertices: (5, 8) and (5, -6)
Co-Vertices: (11, 1) and (-1, 1)

8. Vertices: (0, 6) and (-10, 6)
Foci: (-2, 6) and (-8, 6)

9. Vertices: (-9, -2) and (-9, -12)
Foci: (-9, -3) and (-9, -11)

10. Co-Vertices: (5, 0) and (-5, 0)
Foci: (0, 12) and (0, -12)

C:(0,0)

$b = \pm 5 \quad b^2 = 25 \ (x)$

$c = \pm 12 \quad c^2 = 144$

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

$144 = a^2 - 25$

$169 = a^2 \ (y)$

$$\boxed{\frac{x^2}{25} + \frac{y^2}{169} = 1}$$

11. Co-Vertices: (2, 7) and (2, -9)
Foci: (-4, -1) and (8, -1)