Write the equation of the parabola in standard form and sketch the graph of the parabola, labeling all points, and using the focal width as a guide for the width of the parabola. Find the vertex, focus, and directrix.

\[ x^2 + 4x + 6y - 2 = 0 \]

standard form: _______________

Vertex: __________

Focus: __________

directrix: __________

focal width: __________
Write the equation of the parabola in standard form and sketch the graph of the parabola, labeling all points, and using the focal width as a guide for the width of the parabola. Find the vertex, focus, and directrix.

\[ x^2 + 4x + 6y - 2 = 0 \]
\[ x^2 + 4x + 4 = -6y + 2 + 4 \]
\[ (x + 2)^2 = -6y + 6 \]
\[ (x + 2)^2 = -6(y - 1) \]

standard form: _______________

Vertex: \((-2, 1)\)
Focus: \((-2, -0.5)\)
directrix: \(y = 2.5\)
focal width: 6
Write the equation of the parabola in standard form and sketch the graph of the parabola, labeling all points, and using the focal width as a guide for the width of the parabola. Find the vertex, focus, and directrix.

\[ y^2 - 6y + 12x + 21 = 0 \]
Write the equation of the parabola in standard form and sketch the graph of the parabola, labeling all points, and using the focal width as a guide for the width of the parabola. Find the vertex, focus, and directrix.

\[ y^2 - 6y + 12x + 21 = 0 \]

\[ y^2 - 6y + 9 = -12x - 21 + 9 \]
\[ (y - 3)^2 = -12x - 12 \]
\[ (y - 3)^2 = -12(x + 1) \]

4p = -12
p = -3

\[ (y - 3)^2 = -12(x + 1) \]

standard form: _______________

Vertex: (-1, 3)
Focus: (-4, 3)
directrix: x = 2
focal width: 12
Objective: To learn about the equation and parts of ellipses (and circles) and write their equations.

Why: Ellipses are the paths of planets and comets around the Sun, or of moons around planets.
Obj: To learn about the equation and parts of ellipses (and circles) and write their equations.

What would happen if you stretched the circle horizontally by the factor $a$ and vertically by the factor $b$?
Obj: To learn about the equation and parts of ellipses (and circles) and write their equations.

**Defn.**

**Ellipse:** the set of all points in a plane whose distances from two fixed points (foci) have a constant sum.

\[ d_1 + d_2 = \text{constant} \]
Obj: To learn about the equation and parts of ellipses (and circles) and write their equations.
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Standard Equation of an Ellipse

\[
\frac{(x-h)^2}{a^2} + \frac{(y-k)^2}{b^2} = 1 \quad \text{major axis horizontal}
\]

\[
\frac{(x-h)^2}{b^2} + \frac{(y-k)^2}{a^2} = 1 \quad \text{major axis vertical}
\]

Eccentricity: \( e = \frac{c}{a} \)

\( 0 < e < 1 \)

Circle

Segment
Obj: To learn about the equation and parts of ellipses (and circles) and write their equations.

Find the center, vertices, foci, and eccentricity. Draw an accurate sketch.

\[
\frac{(x-2)^2}{16} + \frac{(y+1)^2}{1} = 1
\]

Center: \((2, -1)\)

Vertices: \((6, -1), (-2, -1)\)

Covertices: \((2, 0), (2, -2)\)

Foci: \((2+\sqrt{15}, -1), (2-\sqrt{15}, -1)\)

\[e = \frac{\sqrt{15}}{4} \approx 0.97\]
Obj: To learn about the equation and parts of ellipses (and circles) and write their equations.

2. \[ 4x^2 + y^2 = 36 \]

\[
\frac{x^2}{9} + \frac{y^2}{36} = 1
\]
3. \[ 4x^2 + y^2 - 8x + 4y - 8 = 0 \]

\[
\begin{align*}
4(x^2 - 2x + 1) + y^2 + 4y + 4 &= 8 + 4 + 4 \\
\frac{4(x-1)^2}{16} + \frac{(y+2)^2}{16} &= 1 \\
\end{align*}
\]

\[
\begin{align*}
\frac{(x-1)^2}{4} + \frac{(y+2)^2}{16} &= 1 \\
\end{align*}
\]

Center \((1, -2)\), \(a^2 = 16\), \(a = 4\)

Vert. \((1, 2), (1, -6)\)

Covert. \((-1, -2), (3, -2)\)

Foci \((1, -2 + 2\sqrt{3}), (1, -2 - 2\sqrt{3})\)

\[e = \frac{2\sqrt{3}}{4} = \frac{\sqrt{12}}{4} = 0.87\]
Obj: To learn about the equation and parts of ellipses (and circles) and write their equations.

HW:

(REG) (8.2) Pg. 590: 7-10, 13, 15, 37, 39, 45
Obj: To learn about the equation and parts of ellipses (and circles) and write their equations.

Write the equation of the ellipse in standard form.

1. Major axis 14 on x-axis, minor axis length 10.
Obj: To learn about the equation and parts of ellipses (and circles) and write their equations.

2. Major axis endpoints are (-5,2) and (3,2), minor axis length 6.

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

\[
\frac{(x+1)^2}{16} + \frac{(y-2)^2}{9} = 1
\]
Obj: To learn about the equation and parts of ellipses (and circles) and write their equations.

3. Foci (-2,1) and (-2,5) and major axis endpoints (-2,-1) and (-2,7).

\[
\begin{align*}
\frac{(x-2)^2}{12} + \frac{(y-3)^2}{16} &= 1 \\
\frac{(x+2)^2}{12} + \frac{(y-3)^2}{16} &= 1
\end{align*}
\]
Obj: To learn about the equation and parts of ellipses (and circles) and write their equations.
Obj: To learn about the equation and parts of ellipses (and circles) and write their equations.

HW:

(REG) (8.2) Pg.590: 7-10, 13, 15, 37, 39, 45

(REG) (8.2) Pg.591: 21-35 odd, 47
Kepler's First Law of Planetary Motion (1609) states that the path of a planet's orbit is an ellipse with the Sun at one of the foci.
Obj: To learn about the equation and parts of ellipses (and circles) and write their equations.

Calculate the aphelion distance and perhelion distance of Earth.

Table 8.1 Semimajor Axes and Eccentricities of the Planets and Pluto

<table>
<thead>
<tr>
<th>Object</th>
<th>Semimajor Axis (Gm)</th>
<th>Eccentricity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mercury</td>
<td>57.9</td>
<td>0.2056</td>
</tr>
<tr>
<td>Venus</td>
<td>108.2</td>
<td>0.0068</td>
</tr>
<tr>
<td>Earth</td>
<td>149.6</td>
<td>0.0167</td>
</tr>
<tr>
<td>Mars</td>
<td>227.9</td>
<td>0.0934</td>
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<tr>
<td>Jupiter</td>
<td>778.3</td>
<td>0.0485</td>
</tr>
<tr>
<td>Saturn</td>
<td>1427</td>
<td>0.0560</td>
</tr>
<tr>
<td>Uranus</td>
<td>2869</td>
<td>0.0461</td>
</tr>
<tr>
<td>Neptune</td>
<td>4497</td>
<td>0.0050</td>
</tr>
<tr>
<td>Pluto</td>
<td>5900</td>
<td>0.2484</td>
</tr>
</tbody>
</table>