Translations of Ellipses

Horizontal and vertical translations can be used to graph ellipses that are not centered on the origin. Figure AP illustrates the graph of

\[
\frac{(x-1)^2}{9} + \frac{(y+3)^2}{4} = 1
\]

The center is at (1, -3), and the major and minor axes are horizontal and vertical, respectively. The foci are located at (1 ± c, -3), where c = \sqrt{a^2 - b^2}.

Table 3.1 - Standard Forms of Equations of Ellipses Centered at (1, -3)

<table>
<thead>
<tr>
<th>Equation</th>
<th>Center</th>
<th>Major Axis</th>
<th>Minor Axis</th>
<th>Graph</th>
</tr>
</thead>
<tbody>
<tr>
<td>\frac{x^2}{4} + \frac{y^2}{9} = 1</td>
<td>(0, 0)</td>
<td>x-axis</td>
<td>y-axis</td>
<td>ellipse centered at (0, 0)</td>
</tr>
<tr>
<td>\frac{(x-1)^2}{9} + \frac{(y+3)^2}{4} = 1</td>
<td>(1, -3)</td>
<td>x-axis</td>
<td>y-axis</td>
<td>ellipse centered at (1, -3)</td>
</tr>
</tbody>
</table>

Graph the Ellipse and Locate the Foci.

\[
\frac{(x-1)^2}{9} + \frac{(y+3)^2}{4} = 1
\]

- **Center**: (1, -3)
- **Major Vertices**: (2, -3), (4, -3)
- **Minor Vertices**: (1, -5), (1, -1)
- **Foci**: (1 ± 2.2, -3)

Major Axis Endpoints (-2, -3) and (-2, 7)

- **Length of Major Axis**: 2a
- **Length of Minor Axis**: 2b
- **Distance between Foci**: 2c

Center of ellipse is the midpoint between the endpoints of each axis.

What's My Equation?

Center (2.2, -3)

\[
\frac{x^2}{4} + \frac{y^2}{9} = 1
\]
Convert to Standard Form.

Graph the Ellipse. Locate the foci.

\( 3x^2 + 5y^2 - 12x + 30y + 42 = 0 \)

\( \frac{3(x-2)^2}{15} + \frac{5(y+3)^2}{15} = 1 \)

Center: \((2, -3)\)

\( a^2 = 5, \quad b^2 = 3, \quad c^2 = 2 \)

A semielliptic archway has a height of 20 feet and a width of 50 feet, as shown in the figure. Can a truck 14 feet high and 10 feet wide drive under the archway without going into the other lane?

Assignment

Lesson 9.1

33 - 41 odd
49, 51, 53
65, 67
83, 85, 89