Bell Work

Identify any equations of a circle from the following list.

1) \((x + 2)^2 + (y - 5)^2 = 4\)
2) \(\frac{5x^2 + 5y^2}{5} = \frac{125}{5}\) \(\Rightarrow x^2 + y^2 = 25\) \(\Rightarrow r = 5\)
3) \(x^2 + y^2 = 100\)
4) \((x - 6)^2 + (y + 4)^2 = 16\) \(\Rightarrow r = 4\)

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**10.2 Parabolas**

Parabola - set of all points in a plane that are the same distance from a fixed line and a fixed point not on the line.

- **Focus of the Parabola** - the fixed point \((a, c)\)
- **Directrix** - the fixed line \(y = -c\)
- **Focal length** - distance between the vertex and focus

Each point on the parabola is equidistance from the focus and the directrix.

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**Standard equation of a vertical parabola:**

\[ y = \frac{1}{4c} x^2 \]
- Focus \((0, c)\)
- Directrix \(y = -c\)

**Standard equation of a horizontal parabola:**

\[ x = \frac{1}{4c} y^2 \]
- Focus \((c, 0)\)
- Directrix \(x = -c\)

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**Parabolas with equations \(y = ax^2\)**

What is the equation of the parabola with vertex \((0, 0)\) and focus \((0.2)\)?

- **Step 1** - Vertical or horizontal parabola?
  - **Vertical Parabola** - focus is above the origin

- **Step 2** - Find \(c\)
  \[ c = \frac{1}{2} \]

- **Step 3** - Write the equation
  \[ y = \frac{1}{4c} x^2 \]
  \(\Rightarrow y = \frac{1}{8} x^2\)
  \(\Rightarrow y = -2\)
Parabolas with equations $x = ay^2$
What is the equation of the parabola with vertex $(0,0)$ and directrix $x = 1.25$?

**Horizontal Parabola - directrix is to the right of the vertex**

Use: $x = \frac{1}{4c} y^2$

$x = -c$, so $c = \frac{1}{4} \cdot \frac{1}{1.25} = \frac{1}{5}$

Focus $(-\frac{1}{5}, 0)$

$X = \frac{1}{y(-\frac{1}{5})} y^2$

$x = -\frac{1}{5} y^2$

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The parabola with vertex $(0,0)$ can be translated to one with vertex $(h,k)$

<table>
<thead>
<tr>
<th>vertical parabola</th>
<th>vertex $(0,0)$</th>
<th>vertex $(h,k)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>equation</td>
<td>$y = \frac{1}{4c} x^2$</td>
<td>$y = \frac{1}{4c} (x - h)^2 + k$</td>
</tr>
<tr>
<td>focus</td>
<td>$(0,c)$</td>
<td>$(h, k + c)$</td>
</tr>
<tr>
<td>directrix</td>
<td>$y = -c$</td>
<td>$y = k - c$</td>
</tr>
</tbody>
</table>

**Horizontal parabola**

| equation          | $x = \frac{1}{4c} y^2$ | $x = \frac{1}{4c} (y - k)^2 + h$ |
| focus             | $(c,0)$ | $(h + c, k)$ |
| directrix         | $x = -c$ | $x = h - c$ |

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Write the equation of the parabola with vertex $(1,4)$ and focus $(1.6)$.

**Step 1 - Determine if vertical or horizontal**

**Step 2 - Find c**

$(h,k) = (1,4)$ and $(h,c) = (1,4)$

$c = 2$

**Step 3 - Put all this information into the equation for a horizontal parabola**

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

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Parabolas with equations $x = ay^2$
What are the vertex, focus, and directrix of the parabola with equation $x = .75y^2$?

1) $a = .75$ horizontal parabola $X = \frac{1}{4c} y^2$

2) Solve for $c$

$\frac{1}{\sqrt{c}} = .75$

3) Focus $(\frac{1}{2}, 0)$

$\frac{1}{4c} = \frac{3}{4}$

4) Directrix $x = \frac{1}{2}$

$\frac{1}{3} = c$

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Write the equation of the parabola with vertex $(3,7)$ and focus $(5.7)$.

**Step 1 - Determine if vertical or horizontal**

**Step 2 - Find c**

$(h,k) = (3,7)$ and $(h+c,k) = (5,7)$

$c = 2$

**Step 3 - Put all this information into the equation for a horizontal parabola**

$X = \frac{1}{8} c (y-k)^2 + h$

$X = \frac{1}{8} (y-7)^2 + 3$

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Class work:

Pg 259 3,4,7,9,12,13, 22, 23, 25

Homework:

Pg 259 5,6,8,10,14,15, 21, 24, 26

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