This picture is great! It summarizes practically all of the basic relations between the trigonometric functions at once.

Look closely. Since this is a unit circle (radius = 1), all the labels work by similar triangles and the following definitions:

- $\sin \theta = \text{opp./hyp.}$
- $\cos \theta = \text{adj./hyp.}$
- $\tan \theta = \text{opp./adj.}$
- $\cot \theta = 1/\tan \theta = \text{adj./opp.}$
- $\csc \theta = 1/\sin \theta = \text{hyp./opp.}$
- $\sec \theta = 1/\cos \theta = \text{hyp./adj.}$

- $\tan \theta$ and $\cot \theta$ even lie in a line tangent to the circle.

Every right triangle in the picture gives you a trig identity by the Pythagorean theorem:

- from the sublime (and famous)
  - $\sin^2 \theta + \cos^2 \theta = 1$
  - $1 + \tan^2 \theta = \sec^2 \theta$
  - $1 + \cot^2 \theta = \csc^2 \theta$

- to the ridiculous (try this out on your friends in Engineering!)
  - $\csc^2 \theta + \sec^2 \theta = (\tan \theta + \cot \theta)^2$

Points to ponder:

- How long is the arc from the $x$-axis to where the radius intersects the circle?
- How long would it be if the radius were 2?
- How would the labels in the picture have to change if the radius were 2? (the unit circle is nice, eh?)
- This picture shows $\theta$ in the first quadrant. How would it be different if $\theta$ were in each of the other quadrants?
- In particular, in each quadrant what happens to the sign (plus or minus) of:

<table>
<thead>
<tr>
<th>Quadrant</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\sin \theta$</td>
<td>+</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\csc \theta$</td>
<td>+</td>
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<tr>
<td>$\cos \theta$</td>
<td>+</td>
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<td>$\sec \theta$</td>
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<td>$\tan \theta$</td>
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<tr>
<td>$\cot \theta$</td>
<td>+</td>
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</tbody>
</table>

- If the $x$- and $y$- axes are labelled as usual, even most of the signs above "take care of themselves" from the picture. (i.e. The coordinate axes show you the sign directly.)

- Which do not?