1. (4pt) Find $l$ and $\theta$ in the figures below. Round to two decimal places. (Assume that the figures are not drawn to scale.)

\[ \tan\left(\frac{\pi}{3}\right) = \frac{14}{l} \]

\[ l = \frac{14}{\tan\left(\frac{\pi}{3}\right)} \]

\[ l \approx 13.41 \]

\[ \sin(\theta) = \frac{8}{10} \]

\[ \theta = \arcsin\left(\frac{8}{10}\right) \]

\[ \theta \approx 0.53 \]

2. (3pt) A telephone pole is 40 ft tall. There is a cable which runs from the very top of the pole to the ground. For safety purposes it is required that the cable makes an angle of $\frac{\pi}{11}$ with the ground. When these telephone poles are installed, how far apart (on the ground) are the base of the pole and the base of the cable? Round to two decimal places.

\[ \tan\left(\frac{\pi}{11}\right) = \frac{40}{l} \]

\[ l = \frac{40}{\tan\left(\frac{\pi}{11}\right)} \]

\[ l \approx 5.45 \]

3. (3pt) In a particular city, Market street, Exchange street, and State street meet at three different intersections forming a triangle. Exchange street and State street intersect at a right angle. If you leave the intersection of Exchange street and Market street then getting to State street is a 380 m trip along Exchange street and a 500 m trip along Market street. Find the acute angle at which State street and Market street intersect.

\[ \sin(\theta) = \frac{380}{500} \]

\[ \theta = \arcsin\left(\frac{380}{500}\right) \]

\[ \theta \approx 0.86 \]
4. (10pt) In the figure below assume that the arc on the left is a portion of a circle of radius 15. Use the space below the figure to answer the following questions. Make sure that you indicate and distinguish your answers clearly. All numerical answers should be left in exact form.

(a) Find $\theta$.
(b) There is no right angle indicated in the larger triangle. Explain why it is actually a right triangle by explaining how you can be sure that the angle which looks like a right angle is definitely a right angle. (One or two sentences should be enough.)
(c) Find $y$.
(d) Find $x$.

\[ \tan(\theta) = \frac{5\sqrt{3}}{15} = \frac{\sqrt{3}}{3} \]
\[ \Rightarrow \theta = \arctan\left(\frac{\sqrt{3}}{3}\right) = \frac{\pi}{6} \]

(b) The angle indicated as $\phi$ in the diagram satisfies $5\pi = 15\phi$, so $\phi = \frac{\pi}{3}$. Then $\phi + \theta + \alpha = \pi$ (where $\alpha$, as indicated in the diagram) so $\alpha = \pi - \frac{\pi}{6} - \frac{\pi}{3}$ and $\alpha = \frac{\pi}{2}$. Hence the larger triangle is a right triangle.

\[
\begin{align*}
\text{Area of the small triangle} & = \frac{1}{2}(5\sqrt{3})(15) = \frac{75\sqrt{3}}{2} \\
\text{Area of the large triangle} & = \frac{1}{2}(30)(10\sqrt{3}) = 150\sqrt{3} \\
\text{Area of the wedge} & = \left(\frac{\pi}{3}\right)\left(\pi(15)^2\right) = \frac{225\pi}{2} \\
\text{Total Area} & = \frac{45}{2}\sqrt{3} + 150\sqrt{3} + \frac{45\pi}{2}
\end{align*}
\]

Bonus: What is the area of the entire figure in problem 4?