Section 5.1, Problem 106: The circumference of the car wheel is

$$2\pi r = 2\pi \cdot 15\text{in} = 30\pi\text{in} \quad (\approx 94.24\text{in}),$$

so for every revolution that the wheel makes, the car travels 30πin. In one second, the wheel revolves 3 times, so in one second the car travels a distance of 90π, i.e., it is traveling at

$$90\pi\text{in/sec} \approx 282.7\pi\text{in/sec}.$$

In one minute, the car travels $60 \cdot 90\pi$ inches, and in one hour, the car travels

$$60 \cdot 60 \cdot 90\pi \text{ inches} \approx 1,017,876 \text{ inches}.$$

There are $63,360$ inches in a mile, so in one hour, the car travels approximately

$$\frac{1,017,876}{63,360} \approx 16.1 \text{ miles}.$$

I.e., the car is traveling about 16.1 mph.

Section 5.2, Problem 54: Observe that

$$\frac{13\pi}{6} = \frac{\pi}{6} + 2\pi,$$

so

$$\cos(13\pi/6) = \cos(\pi/6) = \frac{\sqrt{3}}{2} \quad \text{and} \quad \sin(13\pi/6) = \sin(\pi/6) = \frac{1}{2}.$$

It follows that

$$\tan(13\pi/6) = \frac{1/2}{\sqrt{3}/2} = \frac{1}{\sqrt{3}}, \quad \cot(13\pi/6) = \frac{\sqrt{3}/2}{1/2} = \sqrt{3}, \quad \sec(13\pi/6) = \frac{1}{\sqrt{3}/2} = \frac{2}{\sqrt{3}}$$

and

$$\csc(13\pi/6) = \frac{1}{1/2} = 2.$$

Section 5.2, Problem 132: The viewing angle to the moon in radians is

$$\vartheta = 0.52° \times \frac{\pi \text{ rad}}{180°} \approx 0.009 \text{ rad},$$

and half the viewing angle is $\vartheta/2 \approx 0.0045$. The diameter of the moon (which is that same as its height, because it is a ball) is twice its radius, $2r$. Using the formula that appears before problem 129, and using 384400 km as the viewing distance, we find that

$$\tan(0.00455) = \frac{\not{2}r}{\not{2} \cdot 384400} \quad \Rightarrow \quad r = 384400 \cdot \tan(0.0045) \approx 1744 \text{ km}.$$

This formula is illustrated in the figure on the following page, in the right-triangle whose hypotenuse is the upper line, whose long leg is the dashed line (representing the distance to the moon), and whose short leg is the radius of the moon. From this illustration, we see that

$$\tan(\vartheta/2) = \frac{\text{opposite}}{\text{adjacent}} = \frac{r}{384400}.$$
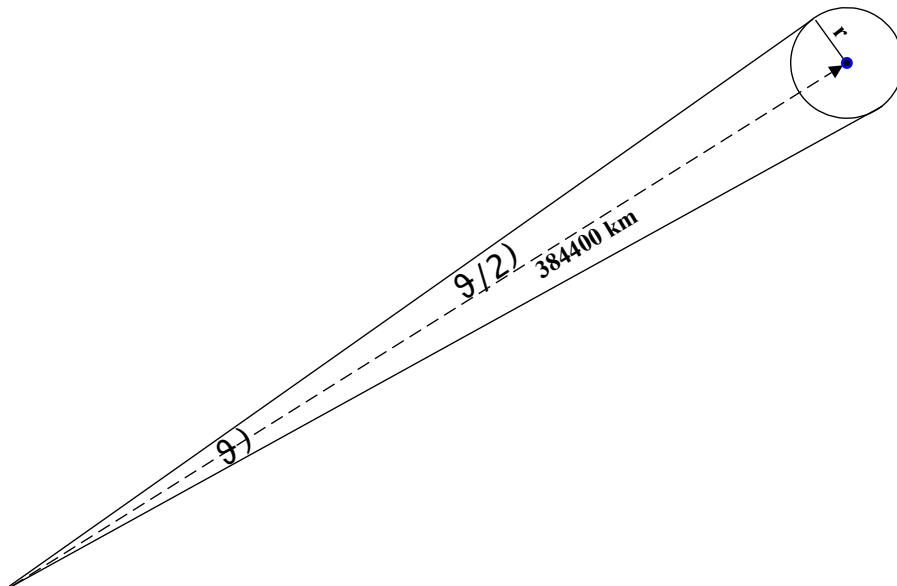
Section 5.3, Problem 44: From the identity

$$\sin^2\theta + \cos^2\theta = 1,$$

and the fact that $\cos\theta = \dfrac{3}{5}$, we conclude that

$$\sin^2\theta = 1 - \cos^2\theta = 1 - \frac{9}{25} = \frac{16}{25} \quad \Rightarrow \quad \sin\theta = \pm\sqrt{16/25} = \pm\frac{4}{5}.$$

Next, because θ is in quadrant IV, we know that $\sin\theta < 0$, and we conclude that $\sin\theta = -\dfrac{4}{5}$, and

$$\sec\theta = \frac{1}{3/5} = \frac{5}{3}, \quad \csc\theta = \frac{1}{-4/5} = -\frac{5}{4}, \quad \tan\theta = \frac{-4/5}{3/5} = -\frac{4}{3} \;\text{ and }\; \cot\theta = \frac{3/5}{-4/5} = -\frac{3}{4}.$$