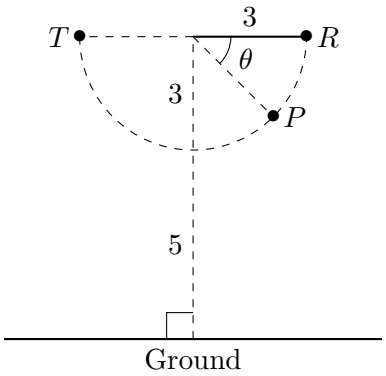
**10**. [9 points] A pendulum is swinging in a semi-circular arc of radius 3 feet pictured below. The pendulum starts at the point $R$ and swings along the arc until it reaches the point $T$. Then, it swings back to the point $R$ along the arc. The motion then repeats.

Assume that the line through the points $T$ and $R$ is parallel to the ground.




**a**. [4 points] Suppose $h(t)$ is the height of the pendulum above the ground $t$ seconds after it is at the point $R$. Find the amplitude and midline of the graph of $y = h(t)$.

*Solution:* The maximum and minimum heights reached by the pendulum are 8 feet and 5 feet above the ground respectively. We can then compute the amplitude as $\frac{8-5}{2} = \frac{3}{2}$, and the midline as $y = \frac{8+5}{2} = \frac{13}{2}$.

Amplitude: $\frac{3}{2}$ Midline: $y = \frac{13}{2}$

**b**. [2 points] The function $h(t)$ defined in part (a) has period 4. Find the period of the function $3h(5t)$.

*Solution:* The period is affected by the horizontal compression. Since we compress by a factor of $\frac{1}{5}$, the new period is $\frac{4}{5}$.

Period of $3h(5t)$: $\frac{4}{5}$

**c**. [3 points] The angle $\theta$ measures $\frac{3\pi}{10}$ radians. Find the height of the pendulum above the ground when it is at the point $P$. Give your answer in **exact** form.

*Solution:* This is like finding the point on a circle of radius 3 with center at $(0, 8)$. The height corresponding to $P$ would then be $3\sin(-\theta) + 8 = -3\sin(\theta) + 8$.

Height of pendulum at $P$: $-3\sin(\theta) + 8$