**8.*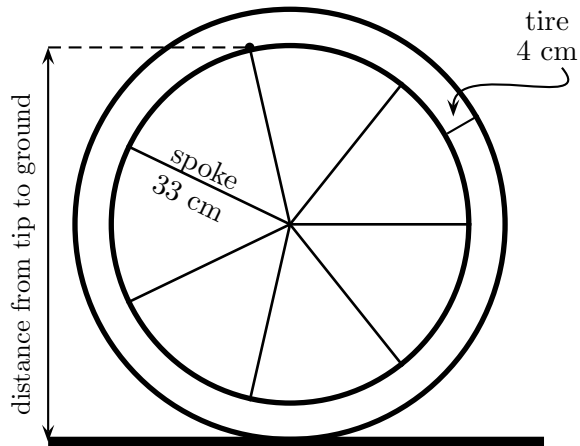* [14 points]   There is a bicycle wheel surrounded by a tire of uniform thickness.  The wheel itself is 33 centimeters in radius, and the tire is 4 centimeters thick.  The wheel has seven evenly-spaced spokes, one of which is initially pointing straight to the right.  (See diagram below.)



*Figure not drawn to scale*

**a.** [2 points]   What is the exact angle (in radians) between two adjacent spokes?

**Answer:** _____

**b.** [4 points]  Find the distance from the tip of the highest spoke to the ground.
   (*This distance is labeled as "distance from tip to ground" in the diagram above.*)
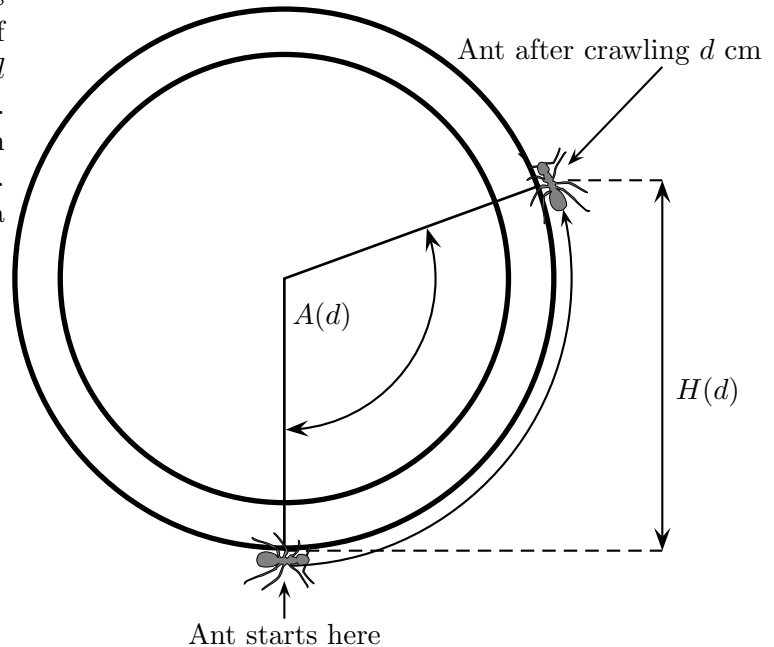
**Answer:** _____

*This problem continues on the next page.*

*This is a continuation of the problems from the previous page.*

Recall: There is a bicycle wheel surrounded by a tire of uniform thickness. The wheel itself is 33 centimeters in radius, and the tire is 4 centimeters thick.

**c**. [4 points] One day, while the bicycle is parked, an ant crawls onto the bottom of the tire. The ant crawls for a distance of $d$ centimeters along the outside of the tire. Let $A(d)$ denote the angle, measured in radians, through which the ant crawled. (See diagram on right.) Find a formula for $A(d)$ in terms of $d$.

Ant after crawling $d$ cm

$A(d)$

$H(d)$

Ant starts here

**Answer:** $A(d) = $ _____

**d**. [4 points] The ant from part (c), after crawling through a distance of $d$ centimeters, drops off of the tire and falls to the ground. Let $H(d)$ denote the distance, in centimeters, that the ant falls. (See diagram above.) Find a formula for $H(d)$ in terms of $d$.

**Answer:** $H(d) = $ _____