21-P-FA-AG-009

You are a hapless adventurer running from a creature of darkness that moves with a maximum speed of V meters per second. You spot a very tall cylindrical tower. As you approach, running for your life, you notice that it has a long pole going down the middle, D_1 meters away from any edge. You begin to form a plan. If you manage to outrun the creature going up the staircase then slide back down the pole, you'll be able to successfully make your escape.

What is the minimum angular velocity you would need to run at?

You remember that in your "Adventuring 101" course, you practiced running R revolutions per minute up a staircase with radius D_2. Will your escape plan work?

ANSWER:

The maximum angular velocity of the creature is easily found by the following formula.

$$angular\ velocity = \frac{V}{D1}\ \frac{rad}{s}$$

To determine if the plan will work, the maximum velocity of the adventurer must be found. First, convert revolutions per minute to rads per second, then multiply by the radius.

$$R\ \frac{revolutions}{minute} \times \frac{1\ minute}{60\ seconds} \times \frac{2\pi\ rad}{revolution} = \frac{2\pi R}{60}\ \frac{rad}{s}$$

$$velocity = \frac{2\pi R}{60}\ \frac{rad}{s} \times D2\ m = \frac{\pi R \cdot D2}{30}\ \frac{m}{s}$$

If $\frac{2\pi R D_2}{60}\ \frac{m}{s} \geq V$, then your plan will work.