

Air Glider on a Spring

Demonstration

Explain:

* x_{resting} — resting position of air glider

* A — amplitude — demonstrate amplitude-independence of period

* T, f — Period and frequency
— units of frequency

* Spring constant

$$a = -\frac{k}{m} (x - x_{\text{resting}})$$

* Mass

* Why only $\frac{k}{m}$ is important

Expectation that T will be longer if spring is weaker or mass is higher

Where in cycle is acceleration most positive?
Most negative? Zero?

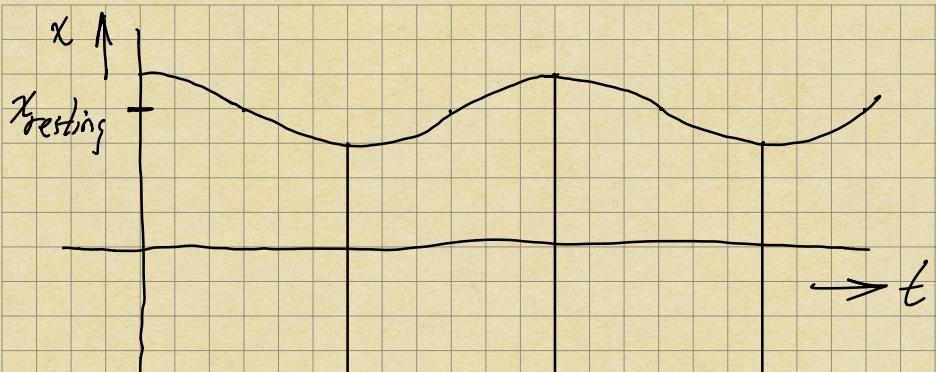
i	v_i
0	-1.0 m/s
1	-1.5 m/s
2	-1.0 m/s
3	0 m/s
4	1.0 m/s
5	1.5 m/s
6	1.0 m/s
7	0 m/s

Let $a_i = a_{i \rightarrow i+1} = \frac{v_{i+1} - v_i}{t_{i+1} - t_i}$

What is

$$a_0 = \frac{v_1 - v_0}{t_1} = -0.5 \frac{\text{m}}{\text{s}^2}$$

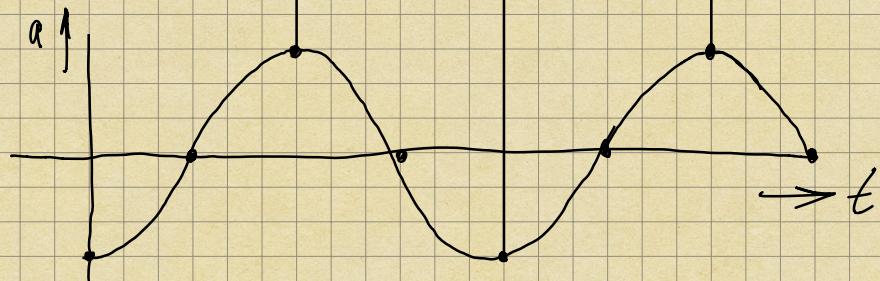
Discuss all four cases for sign of acceleration.



Looks like
a cosine?



Looks like
-sine?



Looks like
-cosine?

Add damping (friction)

$$a = -\frac{k}{m}(x - x_{resting}) - \frac{b}{m}v$$

In drag racer add air resistance

$a = 12 \leftarrow$ a constant if no air resistance

$$a = 12 - 0.006v^2$$