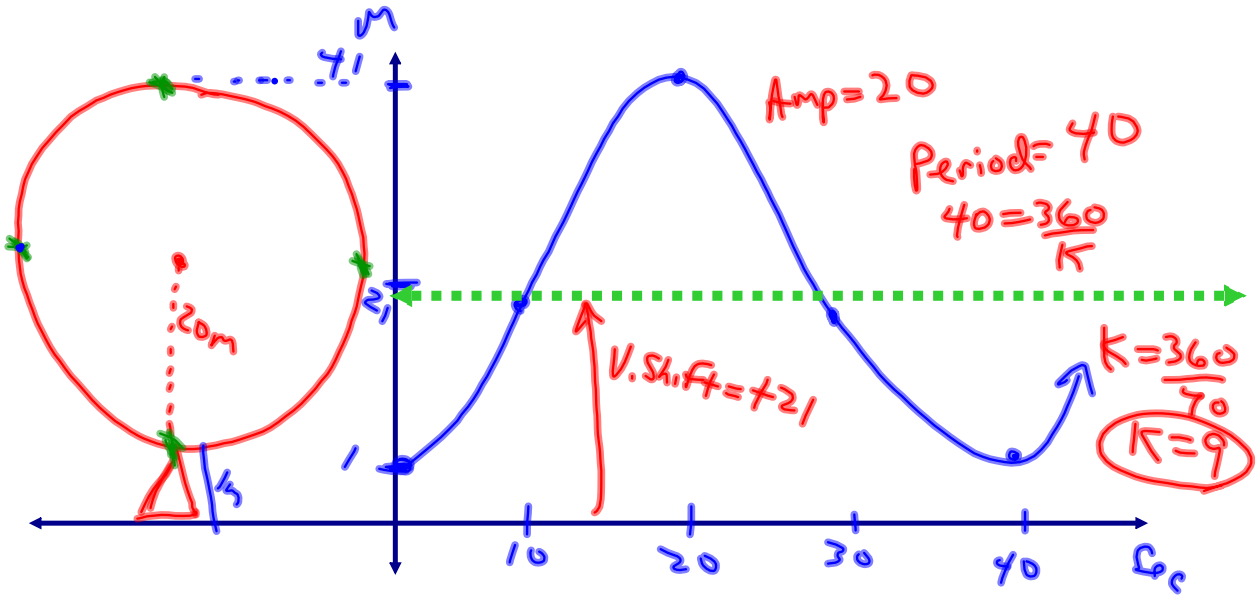
Applications of Sinusoidal Functions

Example: A Ferris Wheel with a radius of 20 m rotates every 40 s. Passengers get on a seat that is 1 m above ground level. How high above the ground would a passenger be situated 3 minutes and 17 seconds after starting this ride?



$y = -20\cos[9t] + 21$

3 min and 17 sec ... > 197 sec

$y = -20\cos(9(197)) + 21$

$y = 3.18\text{ m}$

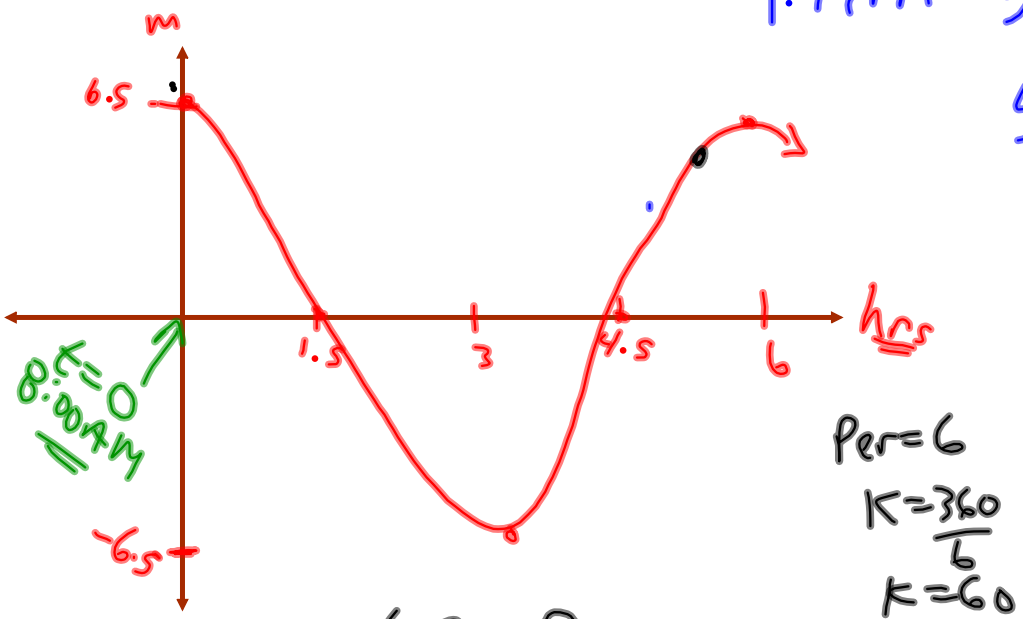
Ocean Tides

The alternating half-daily cycles of the rise and fall of the ocean are called tides. Tides in one section of the Bay of Fundy caused the water level to rise 6.5m above mean sea-level and to drop 6.5m below. The tide completes one cycle every 6 h. Assume the height of water with respect to mean sea-level to be modelled by a sinusoidal relationship. If it is high tide at 8:00 AM, determine where the water level would be at 1:47 PM.

1:47 PM = 5h & 47 min.

$5\frac{47}{60} = \frac{347}{60}$

$5.78\overline{3}\text{ h}$



Per = 6

$K = \frac{360}{6}$

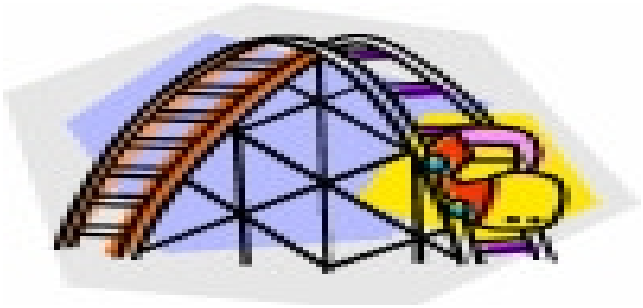
$K = 60$

$y = 6.5\cos[60t]$

$y = 6.5\cos\left[60\left(\frac{347}{60}\right)\right]$

$y = 6.3\text{ m}$

Roller Coaster

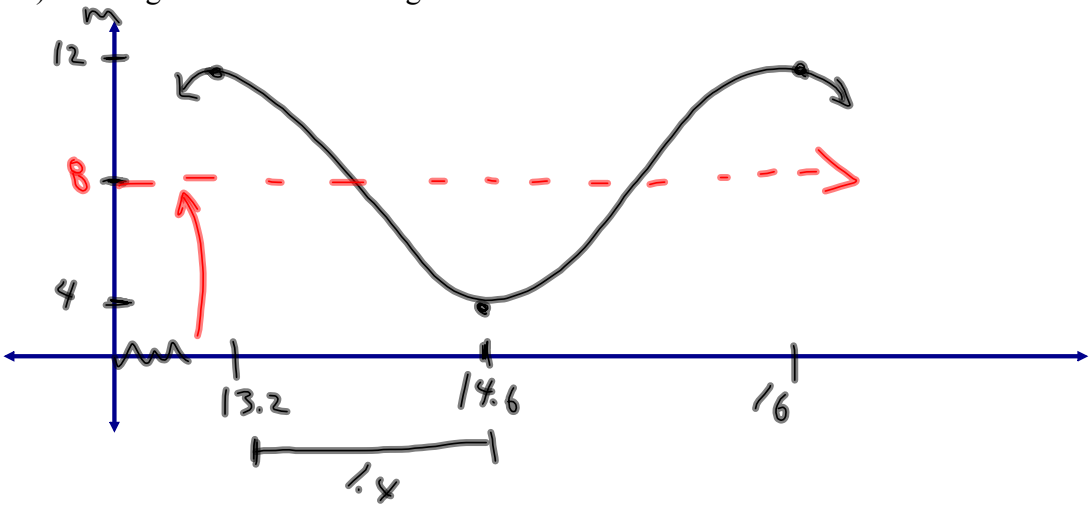


John climbs on a roller coaster at Six Flags Amusement Park. An observer starts a stopwatch and observes that John is at a maximum height of 12 m at t = 13.2 s. At t = 14.6 s, John reaches a minimum height of 4 m.

a) Sketch a graph of the function.

b) Find an equation that expresses John's height in terms of time.

c) How high is John above the ground at t = 20.8 s?



Amp = 4
V. shift = +8

$2.8 = \frac{360}{K}$

$K = \frac{360}{2.8}$

$y = 4\cos\left[\frac{360}{2.8}(t-13.2)\right]+8$

$y = 4\cos\left[\frac{360}{2.8}(20.8-13.2)\right]+8$

$y = 7.11\text{ m}$

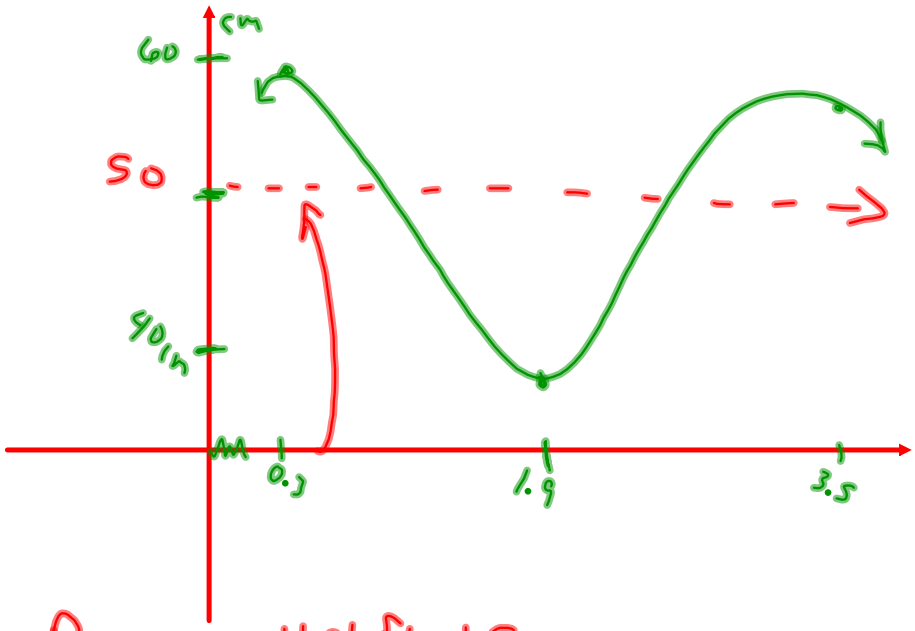
Spring Problem

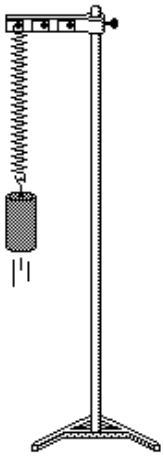
A weight attached to a long spring is being bounced up and down by an electric motor. As it bounces, its distance from the floor varies periodically with time. You start a stopwatch. When the stopwatch reads 0.3 seconds, the weight reaches its first high point 60 cm above the ground. The next low point, 40 cm above the ground, occurs at 1.9 seconds.

a) Sketch a graph of the function.

b) Write an equation expressing the distance above the ground in terms of the numbers of seconds the stopwatch reads.

c) How high is the mass above the ground after 17.2 seconds?





Per = 3.2
B = 360 / 3.2
k = 112.5

V.Shift = +50
Amp = 10

$y = 10\cos[112.5(t-0.3)]+50$

$y = 10\cos[112.5(17.2-0.3)]+50$

$= 48.05$ cm