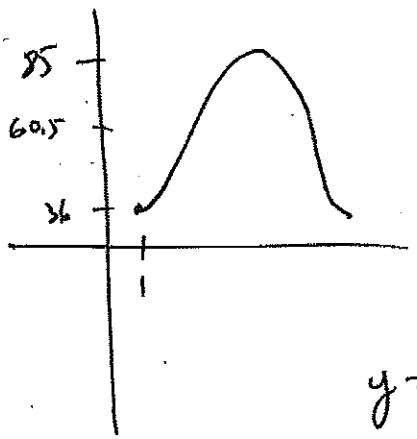
Precalculus Notes 4.4 **Name:** KEY

Writing Trig Equations to Model Real-life Applications

1. Model the average high temperature data for Columbus with a sine or cosine function. Overlay the function on the data with your calculator to ensure that the function fits the data well.

J	F	M	A	M	J	J	A	S	O	N	D
36	39	50	62	73	82	85	84	77	65	51	40



$V.S. = \frac{36+85}{2} = 60.5$

$A = 85 - 60.5 = 24.5$

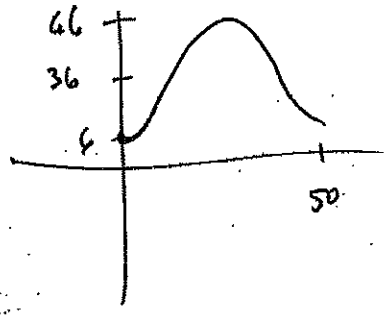
$R.S. = 1$ (for cosine)

$P = 12$ (months)

$y = -24.5 \cos \frac{2\pi}{12}(x-1) + 60.5$

$y = -24.5 \cos \frac{\pi}{6}(x-1) + 60.5$

2. A Ferris wheel that is 60 feet in diameter makes one revolution every 50 seconds. If the center of the wheel is 36 feet above the ground, write a trig equation to model time versus height above the ground.



$V.S. = \frac{6+66}{2} = 36$

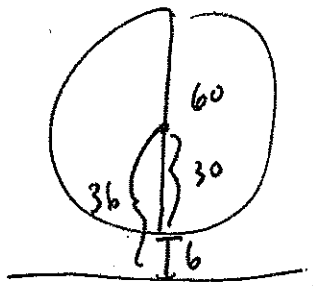
$A = 66 - 36 = 30$

$P.S. = 0$ (cosine)

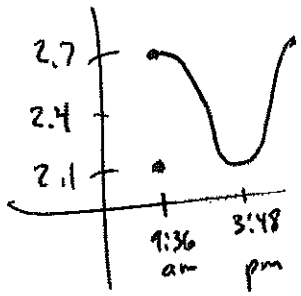
$P = 50$

$y = -30 \cos \frac{2\pi}{50} x + 36$

$y = -30 \cos \frac{\pi}{25} x + 36$



3. One day in Galveston, Texas, high tide occurred at 9:36 A.M. At that time, the water at the end of the 61st Street Pier was 2.7 meters deep. Low tide occurred at 3:48 P.M., at which the water was only 2.1 meters deep. Assume that the depth of the water is a sinusoidal function of time with a period of half a lunar day or roughly 12 hours 24 minutes.



$V.S. = \frac{2.7+2.1}{2} = \frac{4.8}{2} = 2.4$

$A = 2.7 - 2.4 = 0.3$

$P.S. = 9 + \frac{36}{60} = 9.6$

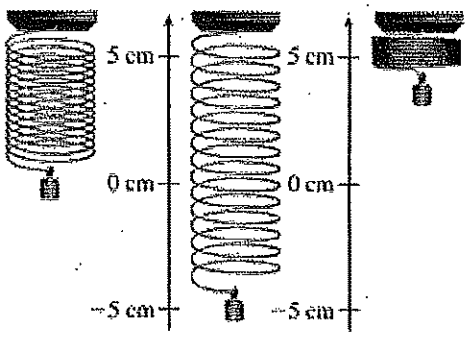
$P = 12 + \frac{24}{60} = 12.4$

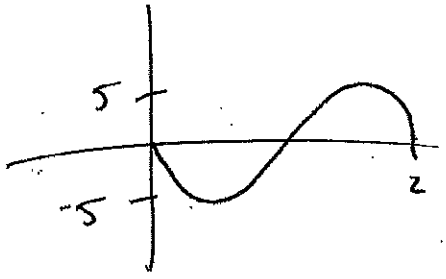
$y = +0.3 \cos \frac{2\pi}{12.4}(x - 9.6) + 2.4$

$y = +0.3 \cos \frac{2\pi}{6.2}(x - 9.6) + 2.4$

EXAMPLE 6 Calculating Harmonic Motion

A mass oscillating up and down on the bottom of a spring (assuming perfect elasticity and no friction or air resistance) can be modeled as harmonic motion. If the weight is displaced a maximum of 5 cm, find the modeling equation if it takes 2 seconds to complete one cycle. (See Figure 4.97.)





$y = -5 \sin \frac{2\pi}{2} x$

$y = -5 \sin \pi x$