Trig Modelling

KNOW	DO	UNDERSTAND
How to identify the period of a sinusoidal situation.	Can estimate the solution to a trig model based on the graph.	*Function Characteristics:* Create meaningful models for trig functions and use the models to predict the behaviour of different scenarios. *Inverses*: Fluently solve trig models using inverse operations.
Vocab & Notation • None		

When we have a trig situation we want to model, we are going to look for unique characteristics of the situation. Typically, the max and min value and the period. From this we can build a cosine function relatively easily.

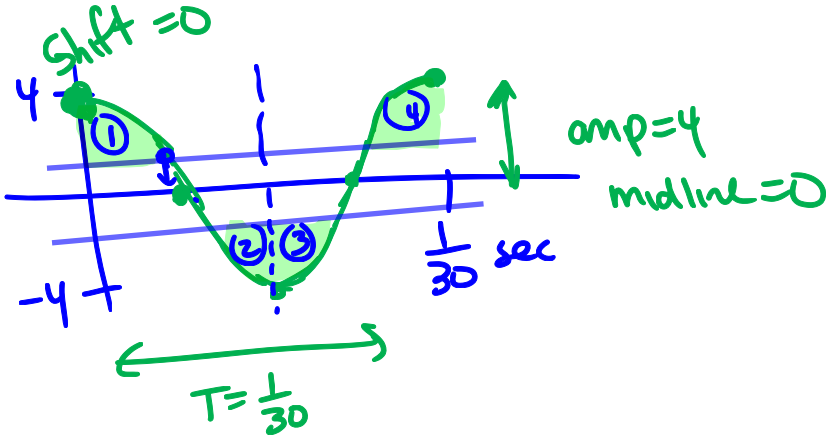
** A good picture goes a long way.

Example: The voltage of an alternating electrical circuit completes 30 cycles a second and goes between +4 volts and -4 volts. Determine a function for the voltage, V, in terms of time t in seconds. Determine the percent of a cycle that the absolute value of the voltage is greater than 1 volt.

$V(t) = 4\cos(60\pi(t-0)) + 0$

$V: \mathbb{Q} \to [-4,4]$

$b = \frac{2\pi}{T} = \frac{2\pi}{1/30} = 60\pi$



$V(t) = 1 = 4\cos(60\pi t)$

$60\pi t = \pm 1.32 + 2\pi n \quad n \in \mathbb{Z}$

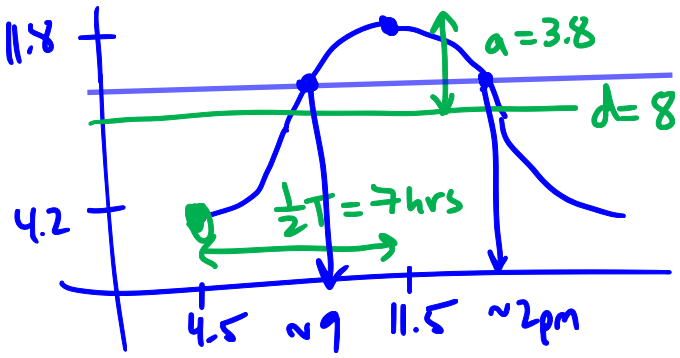
$t = \pm 0.007 + \frac{1}{30}n$

1st time at 1V is $t_0 = 0.007s$

Total time above 1V is $4t_0 = 0.028$ sec

$\% = \frac{0.028}{1/30} = 84\%$

Example: A low tide of 4.2 m in White Rock occurs at 4:30am and the next high tide of 11.8 m occurs at 11:30am. Determine a function for the height of the tide, h, at time t in hours. Determine when the tide is above 9 m.



$h(t) = -3.8\cos\left(\frac{2\pi}{14}(t-4.5)\right) + 8$

$T = 14 \Rightarrow b = \frac{2\pi}{14}$

$t=0$ is midnight

$h(t) = 9 = -3.8\cos\left(\frac{\pi}{7}(t-4.5)\right) + 8$

$\Rightarrow \cos\theta = -0.263$

$\theta = \pm 1.837 + 2\pi n, n \in \mathbb{Z} = \frac{\pi}{7}(t-4.5)$

$t - 4.5 = \pm 4.093 + 14n$

$t = 0.4$ or $8.6 + 14n$

$+14$

$= 14.4$

$\Rightarrow$ we are above 9 m from 8:36 am to 2:24 pm

$h: \mathbb{Q} \to [4.2, 11.8] \cap \mathbb{Q}$

Practice Problems: 5.4 # 6-23