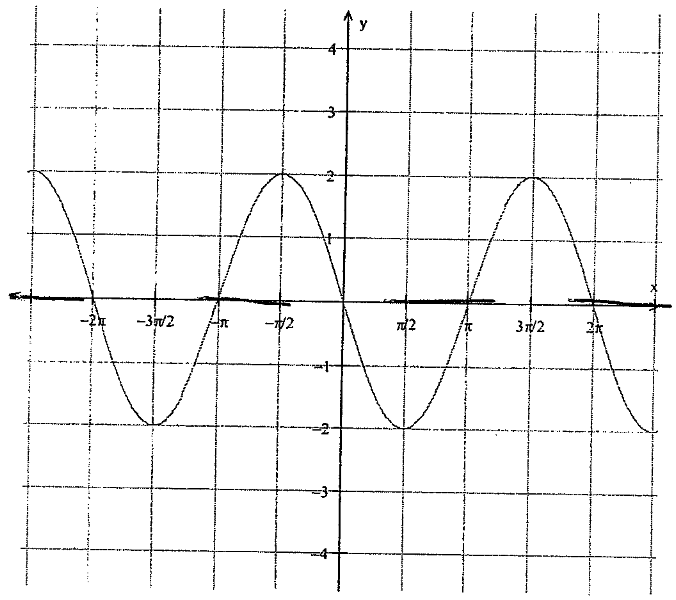
Intermediate Algebra

Name Key

WS 8.6B Applications of Trig Graphs

1. Find the key information and write the equation of the trig function using the y-intercept as the starting point.



General form: $f(x) = d + a\sin b(x - c)$

vertical shift: none　　　d value: —

amplitude: 2　　　a value: 2

period: 2π　　　b value: 1　　　$\frac{2\pi}{b} = 2\pi$

horizontal shift: none　　　c value: —　　　* reflection　　　$b = 1$

Equation: $-2\sin x$

Choose different starting points and write two more equations for the same curve – one a sine function and the other a cosine function.

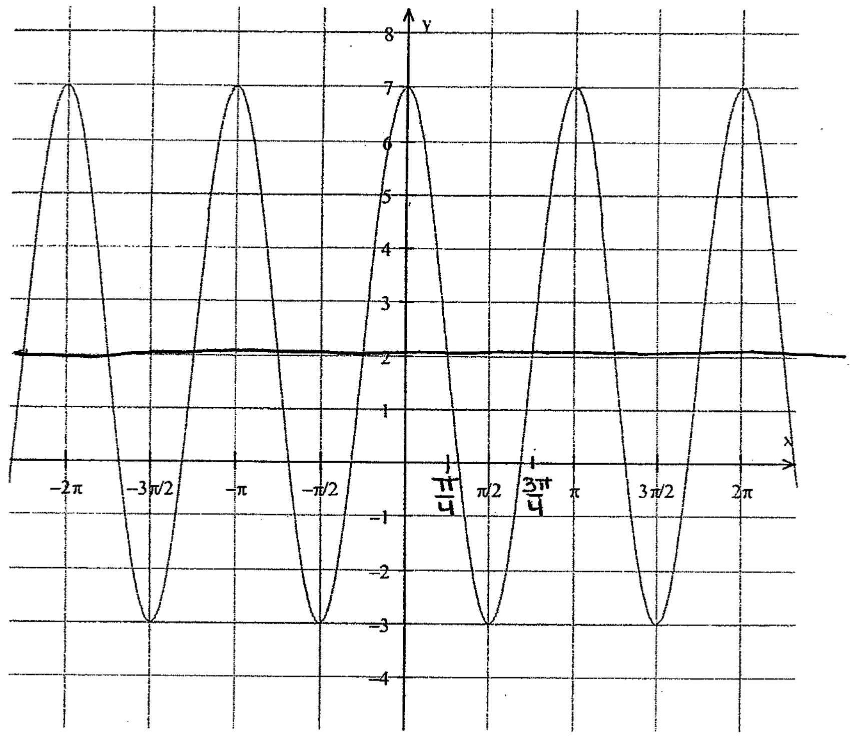
Equation: $2\sin(x - \pi)$

Equation: $-2\cos\left(x - \frac{\pi}{2}\right)$

or

$2\cos\left(x - \frac{3\pi}{2}\right)$

2. Find the key information and write the equation of the trig function using the y-intercept as the starting point.



vertical shift: up 2

d value: 2

amplitude: 5

a value: 5

period: π

b value: 2

horizontal shift: none

c value: —

$\frac{2\pi}{b} = \frac{\pi}{1}$

$\frac{2\pi}{\pi} = \frac{b \cdot \pi}{\pi}$

$b = 2$

Equation: $2 + 5\cos 2x$

Choose different starting points and write two more equations for the same curve – one a sine function and the other a cosine function.

Equation: $2 - 5\sin 2\left(x - \frac{\pi}{4}\right)$

Equation: $2 - 5\cos 2\left(x - \frac{\pi}{2}\right)$

or

$2 + 5\cos 2(x - \pi)$

3. A rodent population in a particular region varied with the number of predators which inhabit that region. At any time, you could predict the rodent population, ***r(t)*** using the model:

$$r(t) = 2500 + 1500\sin\left(\frac{\pi t}{4}\right),$$

where ***t*** is the number of years passed since 1990. This model was only valid for 20 years.

a) What was the population of rodents in 1990?

$t=0$ $\quad 2500 + 1500\sin\left(\frac{\pi(0)}{4}\right) = \boxed{2500 \text{ rodents}}$

b) What is the maximum number of rodents?

sinusoidal + amplitude

$2500 + 1500 = \boxed{4000 \text{ rodents}}$

c) What is the minimum number of rodents?

sinusoidal − amplitude

$2500 - 1500 = \boxed{1000 \text{ rodents}}$

d) How often does the minimum occur? What is this called?

The period

$\dfrac{2\pi}{\frac{\pi}{4}} = \boxed{8 \text{ years}}$

e) What is the average number of rodents over the 20 year time period?

sinusoidal axis! $\boxed{2500 \text{ rodents}}$

~~f) Find the average rate of change of number of rodents from 1994 to 1997.~~

do not need to do

4. The captain of a shipping vessel must consider the tides when entering a seaport because the depth of the water can vary greatly from one time of day to another. The depth of the water, D as a function of the elapsed time, t (number of hours since midnight) can be modeled by the equation, $D(t) = 8.55 + 2.05\sin(.52t - 1.05)$

a. What is the depth of the water at midnight? 6.77 feet $8.55 + 2.05\sin(.52(0) - 1.05)$

$t = 0$

b. What is the minimum depth of the water? 6.5 feet

$8.55 - 2.05 = 6.5$

c. What is the depth of the water at 5 AM? 10.6 feet

$t = 5$ $8.55 + 2.05\sin(.52(5) - 1.05)$

d. Approximately how many hours until the water will be at the same depth as it is at 5 AM? 12 hours

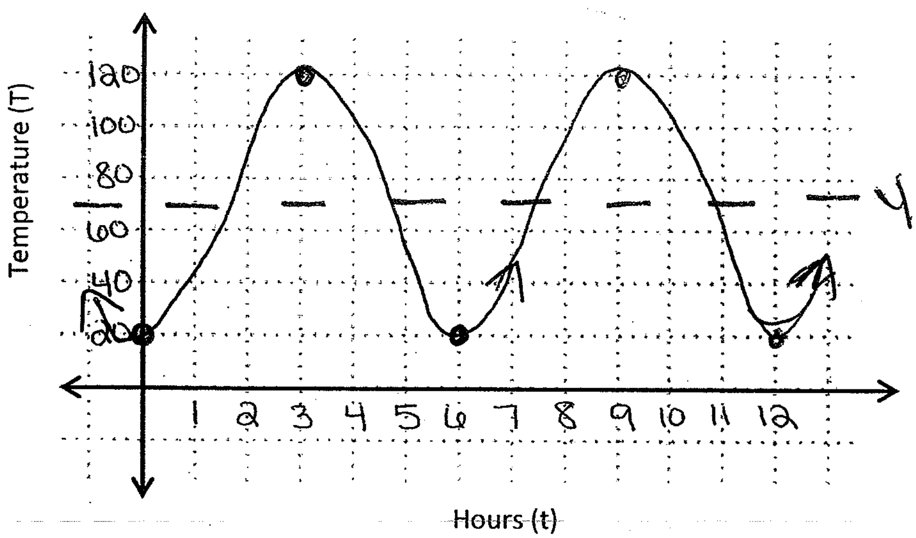
The period! $\frac{2\pi}{.52} = 12$

e. What is the average depth of the water? 8.55 feet

sinusoidal axis

5. The temperature of a chemical reaction oscillates between a low of 20°C and a high of 120°C. The temperature is at its lowest point when $t = 0$ and completes one cycle over a 6-hour period.

a. Sketch a graph of the temperature, T, against the elapsed time, t, over a 12-hour period.



$\frac{2\pi}{b} = \frac{6}{1}$

$\frac{2\pi}{6} = \frac{6 \cdot b}{6}$

$b = \frac{\pi}{3}$

b. Write a model to represent the relationship between time and temperature.

$$T = 70 - 50\cos\frac{\pi}{3}(t)$$

c. What will the temperature of the reaction be 14 hours after it began?

$$T = 70 - 50\cos\frac{\pi}{3}(14) = \boxed{95^\circ}$$