Applications of Sine & Cosine Curves Name ___________________

1) A Ferris wheel with radius 25 feet makes one complete turn every 80 seconds. The height from the ground to the bottom of the wheel is 8 feet. A rider's height h above the ground is modeled by the equation $h = a \cos(bt) + c$, where h and c are given in feet and t is given in seconds. Assuming the rider gets on at the bottom, and the Ferris wheel doesn't stop for the first 3 rotations…

What are the maximum and minimum heights of the rider?

How far above ground is the center of the wheel?

Draw a sketch of the graph of this information. (time will be the x-axis, and height will be the y-axis)

What is the amplitude of the graph you drew?

What is the period of the graph you drew?

Use this information to determine the values of a, b, and c, and the complete equation.

How high above the ground will the rider be 2 minutes after she stars riding at the bottom?

2) On the shore of the Cape yesterday, the high tide occurred at 3:00 am. The water was measured at the end of the Bass River Pier as 14 feet deep. At 9:00 am it was low tide, and the water was measured at 8 feet deep.

Sketch a sine curve to model the height h (in feet) of the tide as a function of time t (in hours – consider 12am hour zero).

Write an equation you could use to determine the height of the water at the end of the Bass River Pier as a function of time.

Use the function to determine the height of the tide at midnight, 6am, and noon.

3) A sailboat floats in the ocean. A series of waves makes the sailboat bob up and down, with a maximum height of 30 feet above the ocean floor and a low of 22 feet above the ocean floor, with 6 seconds between each 30-foot height. Assume the height of the water is modeled by a sinusoidal function of time.

How high above the ocean floor was the sailboat before the waves began? (You can assume that the initial height is the center-line of the curve – the wave makes the boat rise above and below the starting point an equal amount.)

Sketch a graph of the function.

Write an equation to model the height h (in feet) of the sailboat as a function of time t.

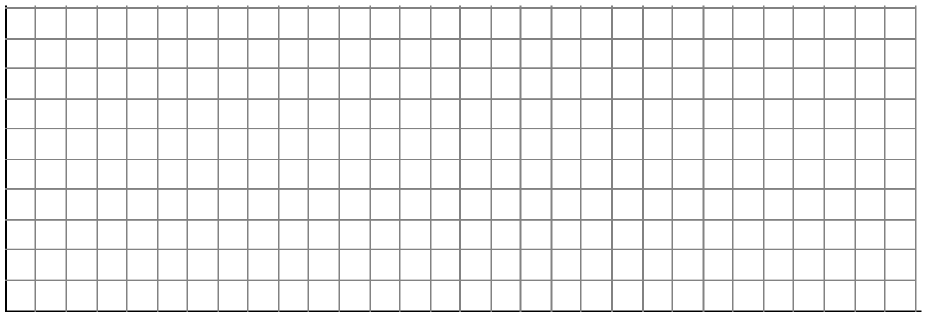
How high will the sailboat be after 10 seconds?

4) The function $y = 30\sin 2\pi t + 120$ if a very rough model of a person's blood pressure (in millimeters of mercury) measured in t seconds. Blood pressure is measured as systolic(maximum)/diastolic(minimum).

What is this person's blood pressure?

What is the period of this function?

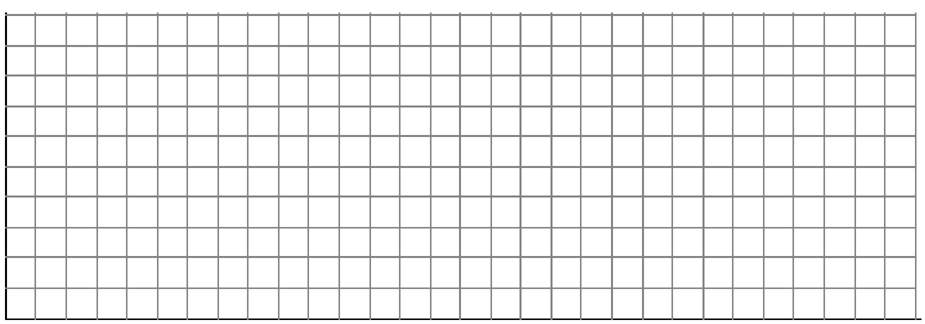
Sketch a graph of this function to model a 5-second time interval.



What is the sinusoidal equation that represents someone with blood pressure 120/80? (Assume the period doesn't change.)

5) The number of hours of daylight measured in one year in Pleasantville can be modeled by a trig function. During 2006, (not a leap year), the longest day occurred on June 21 with 15.7 hours of daylight. The shortest day of the year occurred on December 21 with 8.3 hours of daylight.

Sketch a graph of daylight hours throughout the year. (For simplicity let's assume each month has the same number of days. You can use the 21^{st} of each month as your x-axis scale.)



Write a sine or cosine equation to model the hours of daylight in Pleasantville.

How many hours of daylight would you expect there to be on August 21, 2006?

6) A weight on the end of a spring is at rest 120 cm above the ground. it is pulled down 50 cm and released at time t=0. It takes 6 seconds for the weight to return to the low position.

Sketch a graph modeling the height as a function of time using either a sine or cosine graph.

Determine the equation of your model function.

Find the height of the weight after 4 seconds.

Find the first four times the mass reached 95 cm.