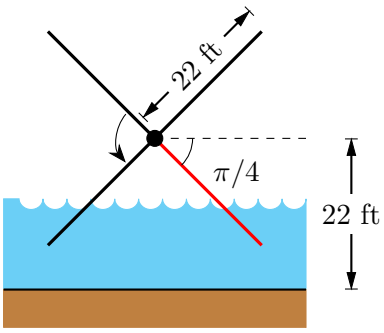
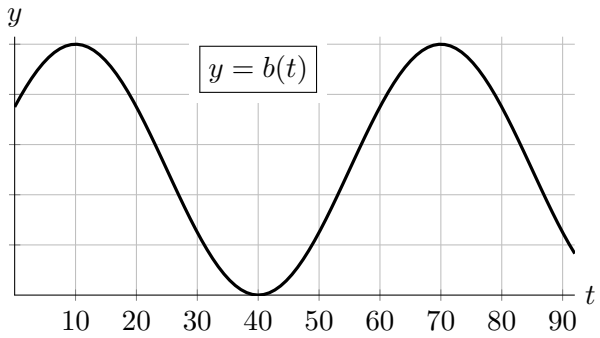
3. [11 points] You are standing by a river, watching three water wheels, each of which is rotating counterclockwise at a different but constant speed.

a. [4 points] The first water wheel takes 48 seconds to complete a full revolution. Each blade of the wheel is 22 feet long, and one of the blades is painted red. When each blade is at its lowest point, it just barely scrapes the bottom of the river. At the moment you begin watching, the red blade is exactly $\frac{\pi}{4}$ radians below the horizontal, as depicted to the right.



Write a formula for $r(t)$, the height, in feet, of the tip of the red blade above the bottom of the river t seconds after you begin watching.

b. [4 points] Now you begin watching the second water wheel, which has one blade painted blue. Let $b(t)$ be the height, in feet, of the tip of the blue blade above the bottom of the river t seconds after you begin watching. A portion of the graph of $b(t)$ is shown. Note that the scale on the y-axis is unknown.



The first time the blue blade reaches the water, since you began watching, is at $t = 28$.

i. At what time t does the tip of the blue blade leave the water?

ii. At what time t does the tip of the blue blade enter the water a second time?

c. [3 points] Finally, the third water wheel has a blade painted yellow, and you have determined that the height, in feet, of the tip of this blade above the bottom of the river t seconds after you began watching is given by

$$40 + 35\sin(Bt),$$

where B is some nonzero constant.

i. What is the length, in feet, of this yellow blade?

ii. How many feet above the bottom of the river is the center spoke of this water wheel?

4. [11 points]

a. [6 points] Consider the given table of values for the function $R(t)$.

t	1	4	10
$R(t)$	2	6	18

i. Could $R(t)$ be a linear function? Write YES or NO, show your work, and briefly explain your answer.

ii. Could $R(t)$ be an exponential function? Write YES or NO, show your work, and briefly explain your answer.

b. [5 points] Consider a different function $S(t)$, which is equal to 5 at $t = 0$, and decreases by 40% every 4 units of time. For which value of t will $S(t)$ be equal to 1? *Show every step of your work, and give your final answer in exact form.*