1. (10 points) Let $f(x)=2 \cos ^{-1}\left(\frac{x}{3}\right)+\pi$ on the domain $-3 \leq x \leq 3$.
a) What is $f^{-1}(x)$ ?
b) What is the domain and range of $f^{-1}(x)$ ?
2. (10 points) Shane has a small newspaper route. Without any help from his friends, it takes him 42 minutes to deliver his papers. Some days Shane gets his friends to help him. When 2 friends help, his paper route takes 18 minutes. However, no matter how many friends help, it always takes at least 6 minutes.
a) Find a linear-to-linear rational function $T(x)$ giving the time it takes Shane and his friends to complete the route, in terms of the number of friends $x$ helping Shane.
b) How many friends does Shane need to recruit so that he can be done with his paper route in 12 minutes?
3. (15 points)
a) At this time of year each day has an average high temperature of 52 degrees. The average low temperature is 38 degrees, and this occurs at 2 AM. Find a sinusoidal function which models the average temperature in terms of time measured in hours. Set $t=0$ at midnight.
b) Audrey lives in Holland, Michigan, and she only goes outside when the temperature is 20 degrees or higher. The function $H(t)=11 \sin \left(\frac{\pi}{12}(x-8.5)\right)+14$ gives the temperature in Holland, MI in terms of time, which is measured in hours after midnight. Find both the earliest time and the latest time each day that Audrey would go outside.
4. (15 points)
a) In the summers, Audrey likes to ride her bike to Lake Michigan. Last summer she bought a bike odometer to keep track of her miles. To use the odometer, Audrey first had to enter the radius of her bike wheels. Then when she rides, the odometer counts the number of revolutions that the bike wheels make. From these pieces of information, the odometer computes the distance. On Audrey's first trip, the odometer recorded that she had gone 36 miles, but from the trail markings, Audrey knew she had only gone 26 miles. Audrey figured she must have entered the wrong radius for her bike wheels. If Audrey's bike wheels have radius 13 inches, what is the radius she must have incorrectly entered into the odometer?
b) If Audrey bikes at speed of 24 feet per second, what is the angular velocity of her bike wheel? (Remember her bike wheel has radius 13 inches.)
c) At the time Audrey starts biking, a pebble gets stuck in the tread of her bike tire, that is, the pebble starts at the lowest point on the bike wheel. How high is the pebble off the ground after 1 minute? (Remember Audrey is biking at $24 \mathrm{ft} / \mathrm{sec}$ and her bike tire has radius 13 in .)
