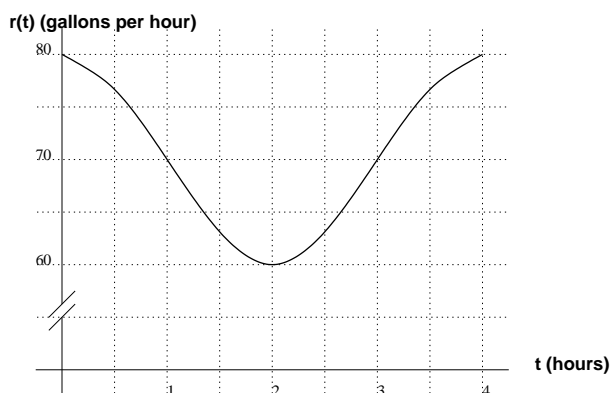


- (3.) (9 points) A large tank is being filled with water. The flow rate of water into the tank, in units of gallons per hour, is given by

$$r(t) = 70 + 10 \cos\left(\frac{\pi t}{2}\right),$$

where t is measured in hours.

- (a) Sketch an accurate graph of $r(t)$ on the following axes.



- (b) Use a definite integral to express the area under the graph of $r(t)$ between the vertical lines $t = 0$ and $t = 3$.

$$\int_0^3 r(t) dt$$

- (c) What is the practical meaning of integral in part (b)? Be sure to include units in your answer.

The integral represents the total number of gallons of water that flowed into the tank during the three hours from $t = 0$ to $t = 3$. This is *not* necessarily the same as the total amount of water in the tank at $t = 3$ hours, because the tank may not have been empty at $t = 0$ hours.

- (d) Give an expression for the average flow rate between $t = 0$ and $t = 3$? Do not estimate—i.e., leave your answer as a formula.

$$\frac{1}{3} \int_0^3 r(t) dt$$