# BC Calculus

## Review #8 – More Integral Applications

2004B AB2 (calculator allowed)

For $0 \le t \le 31$, the rate of change of the number of mosquitoes on Tropical Island at time *t* days is modeled by $R(t) = 5\sqrt{t}\cos\left(\frac{t}{5}\right)$ mosquitoes per day. There are 1000 mosquitoes on Tropical Island at time *t = 0*.

(a) Show that the number of mosquitoes is increasing at time *t = 6*.

(b) At time *t = 6*, is the number of mosquitoes increasing at an increasing rate, or is the number of mosquitoes increasing at a decreasing rate? Give a reason for your answer.

(c) According to the model, how many mosquitoes will be on the island at time *t = 31*? Round your answer to the nearest whole number.

(d) To the nearest whole number, what is the maximum number of mosquitoes for $0 \le t \le 31$? Show the analysis that leads to your conclusion.

2000 AB4 (calculator allowed)

Water is pumped into an underground storage tank at a constant rate of 8 gallons per minute. Water leaks out of the tank at the rate of $\sqrt{t+1}$ gallons per minute, for $0 \le t \le 120$ minutes. At time *t = 0*, the tank contain 30 gallons of water.

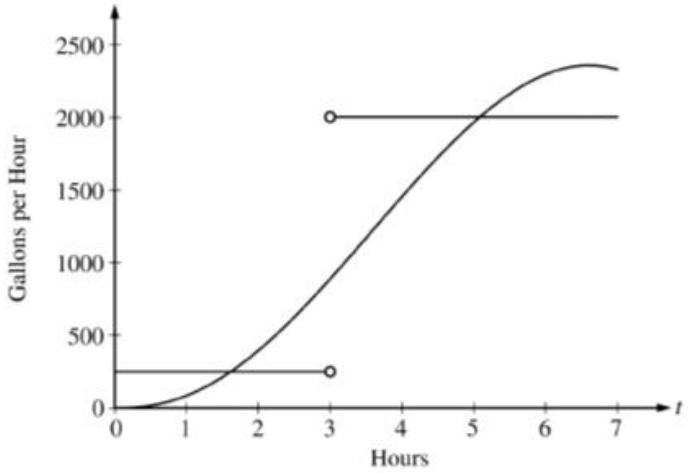
(a) How many gallons of water leak out of the tank from *t = 0* to *t = 3* minutes.

(b) How many gallons of water are in the tank at time *t = 3* minutes.

(c) Write an expression for *A(t)*, the total number of gallons of water in the tank at time *t*.

(d) At what time *t*, $0 \le t \le 120$, is the amount of water in the tank a maximum? Justify your answer.

2007 AB2 BC2 (calculator allowed)




The amount of water in a storage tank, in gallons, is modeled by a continuous function on the time interval $0 \le t \le 7$, where *t* is measured in hours. In this model, rates are given as follows:

(i) The rate at which water enters the tank is $f(t) = 100t^2 \sin\left(\sqrt{t}\right)$ gallons per hour for $0 \le t \le 7$.

(ii) The rate at which water leaves the tank is $g(t) = \begin{cases} 250 & for\ 0 \le t < 3 \\ 2000 & for\ 3 \le t \le 7 \end{cases}$ gallons per hour.

The graphs of *f* and *g,* which intersect at *t = 1.617* and *t =5.076*, are shown in the figure above. At time *t = 0*, the amount of water in the tank is 5000 gallons.

(a) How many gallons of water enter the tank during the time interval $0 \le t \le 7$? Round your answer to the nearest gallon.

(b) For $0 \le t \le 7$, find the time intervals during which the amount of water in the tank is decreasing. Give a reason for each answer.

(c) For $0 \le t \le 7$, at what time *t* is the amount of water in the tank the greatest? To the nearest gallon, compute the amount of water at this time. Justify your answer.