

Block days 2/4 and 2/5

A chance to show that you really do know your Chapter 4 stuff! [If you were absent on block day then go to the last page]

Take out a clean piece of paper and your trusty TI.

Solve the following free response problem within the next 15 minutes.

You may not consult anything – no other person, no notes, no old assessments, etc.

A tank contains 125 gallons of heating oil at time $t = 0$. During the time interval $0 \leq t \leq 12$ hours, heating oil is pumped into the tank at the rate

$$H(t) = 2 + \frac{10}{1 + \ln(t+1)} \text{ gallons per hour}$$

During the same interval, heating oil is removed from the tank at the rate

$$R(t) = 12 \sin\left(\frac{t^2}{47}\right) \text{ gallons per hour}$$

- How many gallons of heating oil are pumped into the tank during the time interval $0 \leq t \leq 12$ hours?
- Is the level of heating oil rising or falling at $t = 6$ hours? Give a Calculus-based reason for your answer.
- How many gallons of heating oil are in the tank at $t = 12$ hours?
- At what time t , for $0 \leq t \leq 12$, is the volume of heating oil in the tank the least? Show all work.

If you were not in class, then you may do this problem.

Traffic flow is defined as the rate at which cars pass through an intersection, measured in cars per minute. The traffic flow at a particular intersection is modeled by the function F defined by

$$F(t) = 82 + 4 \sin\left(\frac{t}{2}\right) \text{ for } 0 \leq t \leq 30,$$

where $F(t)$ is measured in cars per minute and t is measured in minutes.

- (a) To the nearest whole number, how many cars pass through the intersection over the 30-minute period?
- (b) Is the traffic flow increasing or decreasing at $t = 7$? Give a reason for your answer.
- (c) What is the average value of the traffic flow over the time interval $10 \leq t \leq 15$? Indicate units of measure.
- (d) What is the average rate of change of the traffic flow over the time interval $10 \leq t \leq 15$? Indicate units of measure.