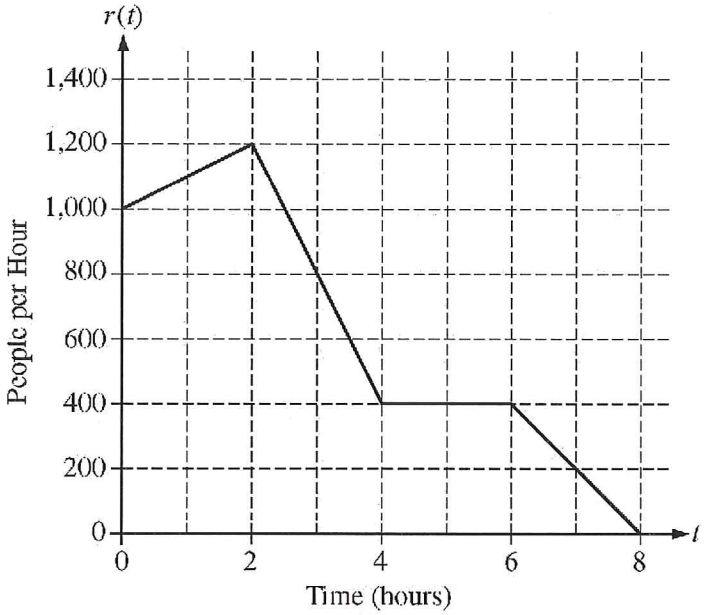
AP Calculus Name _____

2010 AB/BC 3 Modified
Rate of Change and Definite Integrals



There are 700 people in line for a popular amusement–park ride when the ride begins operation in the morning. Once it begins operation, the ride accepts passengers until the park closes 8 hours later. While there is a line, people move onto the ride at a rate of 800 people per hour. The graph above shows the rate, $r(t)$, at which people arrive at the ride throughout the day. Time t is measured in hours from the time the ride begins operation

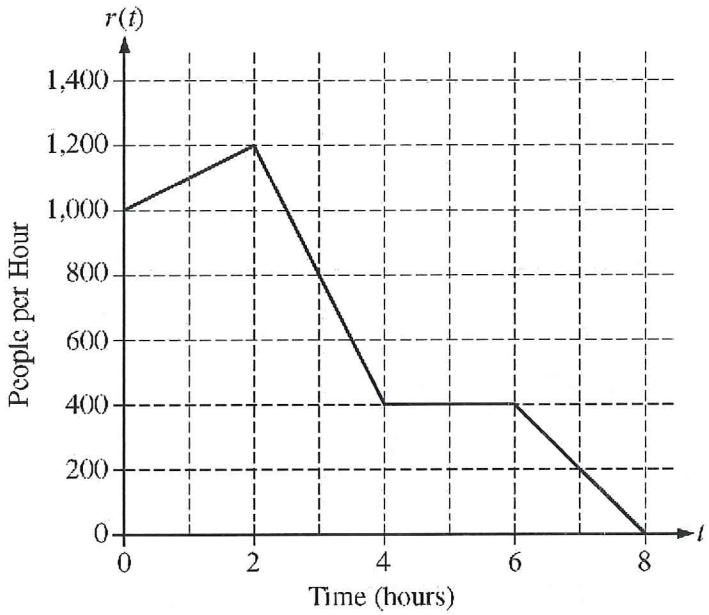
(a) How many people arrive at the ride between $t = 0$ and $t = 3$? Show the computations that lead to your answer.

$\frac{2}{2}(1000 + 1200) + \frac{1}{2}(1200 + 800) = 3200$ people

(b) What is the value of $r'(2.5)$? Using appropriate units, what is the meaning of $r'(2.5)$ in the context of this problem?

$r'(2.5) = -400 \frac{\text{people/hr}}{\text{hr}}$

it is the rate of change of people/hr arriving at the ride.
The amount of people/hr arriving is decreasing.



(c) Let $w(t)$ be the number of people waiting in line t hours after the ride begins operation. Complete the table below. Explain how you arrived at your answers.

t	$w(t)$
0	700
1	950
2	1300

$\frac{1}{2}(1000 + 1100) = 1050$ people

-800 people

$= 250$ people

$\frac{1}{2}(1100 + 1200) = 1150$ people

-800

350 people

(d) Is the number of people waiting in line $w(t)$ to get on the ride increasing or decreasing between $t = 2$ and $t = 3$? Justify your answer.

$w'(t)$ tells inc or dec.

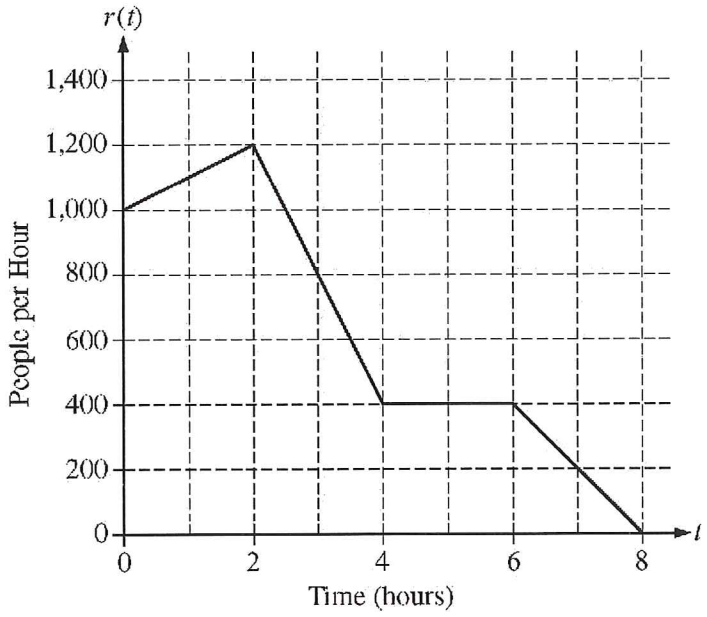
$w'(t) = r(t) - 800$

$800 < r(t) < 1200$

$-800 \quad -800$ Getting on ride

$0 < w'(t) < 400$

increasing



(e) What is the value of $w'(2.5)$? Using appropriate units, what is the meaning of $w'(2.5)$ in the context of this problem?

$w'(t) = r(t) - 800$

$w'(2.5) = r(2.5) - 800$

$= 200$ people /hr

Increase in people waiting in line at 2.5 hrs.

(f) What is the value of $w'(3.5)$? Using appropriate units, what is the meaning of $w'(3.5)$ in the context of this problem?

$w'(3.5) = -200$ people /hr

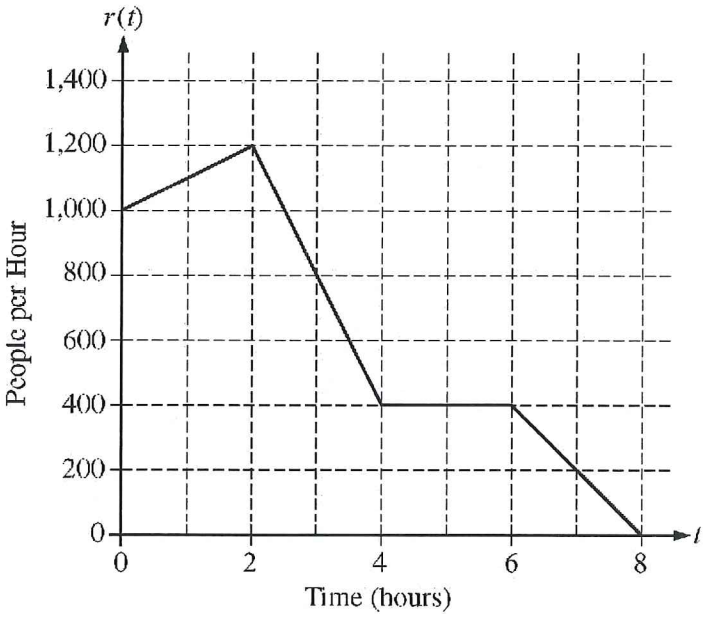
decrease in people waiting

(g) Is there a time when $w'(t) = 0$? Justify your answer.

$0 = r(t) - 800$

$r(t) = 800$

yes $t = 3$, also IVT.



(h) When is the number of people waiting in line the largest? Justify your answer.

$t = 3$ since $r(t) > 800$ from $t = 0$ to $t = 3$.

after $t = 3$ $r(t) \leq 800$

(i) What is the earliest time when there is no longer a line? Justify your answer.

2, 1300

3, 1500

4, 1300

5, 900

6, 500

7, 0 ←

8, -700