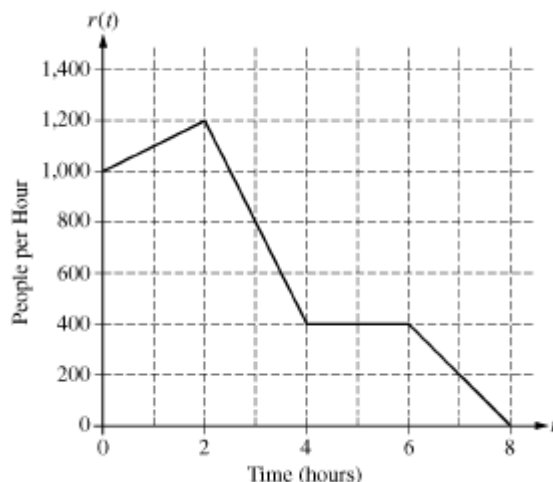


“MR. CALCULUS” ANSWERS TO THE 2010 FREE RESPONSE QUESTIONS

AB 3



When $t = 0$, 700 people are in line. While in line, people move onto the ride at $800 \frac{\text{people}}{\text{hour}}$.

- (a) Between $t = 0$ and $t = 3$, the number of people that arrive is

$$\int_0^3 r(t) dt = \frac{1}{2}(2)(1000 + 1200) + \frac{1}{2}(1)(1200 + 800) = \boxed{3200 \text{ people}}$$

- (b) When $2 \leq t \leq 3$, more than 800 people are arriving at the ride per hour. Hence the number of people waiting in line to get on the ride is **increasing** on this interval.
- (c) The line for the ride is the longest at **$t = 3$ hours** because at this time, $r(t)$ changes from greater than 800 to less than 800. This means that the number of people waiting in line changes from increasing to decreasing at $t = 3$.

The number of people in line when $t = 3$ is the initial number of people in line plus the number of people that arrive between $t = 0$ and $t = 3$ less the number of people that move onto the ride in those 3 hours: $\boxed{700 + 3200 - 800(3)}$ or $\boxed{1500 \text{ people}}$

- (d) The earliest time at which there is no longer a line: $\boxed{700 + \int_0^t r(x) dx - 800t = 0}$