AP® Calculus BC
2002 Sample Student Responses

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Work for problem 2(a)

$$\int_9^{17} E(t)\,dt = \int_9^{17} 15600/(t^2-24t+160)\,dt = 6004.27$$

$\boxed{\approx 6004 \text{ people}}$

Work for problem 2(b)

$$\int_9^{23} \left(\frac{15600}{t^2-24t+160}\right) dt = \text{TOTAL ENTERED}$$

$= 7275.55 \approx 7276$ PEOPLE

$$\begin{array}{r} 7276 \\ -\ 6004 \\ \hline 1272 \end{array}$$

AFTER 5 → 1272 × \$11 = \$13,992

BEFORE 5 6004 × \$15 = \$90,060

\$13,992 + \$90,060 = \$104,052 made on the given day

Work for problem 2(c)

$$H(17) = \int_9^{17} \left(\frac{15600}{t^2 - 24t + 160}\right) - \left(\frac{9890}{t^2 - 38t + 370}\right) dt = 3725$$

$$H'(17) = \left(\frac{15600}{(17^2) - 24(17) + 160}\right) - \frac{9890}{(17^2 - 38(17) + 370)}$$

$$= 380 - 760$$

$H'(17) = -380 \longrightarrow$ This is the rate of change at 5 o'clock THAT PEOPLE ARE ENTERING THE PARK COMPARED TO THOSE LEAVING THE PARK MORE PEOPLE LEAVING THAN ENTERING AT $t = 17$

$H(17) = 3725 \longrightarrow$ THIS IS THE AMOUNT OF PEOPLE INSTANTANEOUSLY AT THE PARK.

Work for problem 2(d)

$$H'(t) = \frac{15600}{(t^2 - 24t + 160)} - \frac{9890}{t^2 - 38t + 370} = 0$$

$$t = 15.7948$$

Work for problem 2(a)

$$\int_9^{17} \frac{15600}{(t^2-24t+160)}\,dt = 6004 \text{ people}$$

Work for problem 2(b)

$$15\int_9^{17} \frac{15600}{(t^2-24t+160)}\,dt + 11\int_{17}^{23} \frac{9890}{(t^2-38t+370)}\,dt$$

$$90064 + 54950$$

$$\$\,145{,}014$$

Work for problem 2(c)

$H'(t) = E(t) - L(t)$

$H'(17) = 380.4878 - 760.7692$

$H'(17) = -452.2814$

H(17) represents the number of people in the park at t=17. H'(17) represents the rate at which the population of the park is changing at t=17

Work for problem 2(d)

$E(t) - L(t) = 0$

$\frac{15600}{(t^2 - 24t + 160)} - \frac{9890}{t^2 - 38t + 370} = 0; \; t = \boxed{15.79481}$