

AP Free-Response Questions

1. The temperature outside a house during a 24-hour period is given by:

$$F(t) = 80 - 10\cos\left(\frac{\pi t}{12}\right), 0 \leq t \leq 24,$$

where $F(t)$ is measured in degrees Fahrenheit and t is measured in hours.

- (b) Find the average temperature, to the nearest degree Fahrenheit, between $t = 6$ and $t = 14$.
-
-
-

2. Water is pumped into an underground 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 $0 \leq t \leq 120$ minutes. At time $t = 0$, the tank contains 30 gallons of water.

- (a) What is the average number of gallons that leak out of the tank in the first three minutes?
-
-
-

-
- ⊠ 3. The rate at which water flows out of a pipe, in gallons per hour, is given by a differentiable function R of time t . The rate of water flow $R(t)$ can be approximated by $Q(t) = \frac{1}{79}(768 + 23t - t^2)$. Use $Q(t)$ to approximate the average rate of water flow during the 24-hour time period. Indicate units of measure.

-
- ⊠ 4. The temperature, in degrees Celsius ($^{\circ}\text{C}$), of the water in a pond is a differentiable function W of time t . A student proposes the function P , given by $P(t) = 20 + 10te^{(-t/3)}$, as a model for the temperature of the water in the pond at time t , where t is measured in days and $P(t)$ is measured in degrees Celsius. Find the average value, in degrees Celsius, of $P(t)$ over the time interval $0 \leq t \leq 15$ days.
-