# Average Rate of Change

p. 140 - 145 (2.6) # 2

The average rate of change of a function over an interval is:

1. $\dfrac{\text{amount of change}}{\text{length of interval}} = \dfrac{\Delta y}{\Delta x} = \dfrac{dy}{dx}$
2. Slope of the secant line through 2 points.
3. $\dfrac{f(b) - f(a)}{b - a}$ for [a, b]

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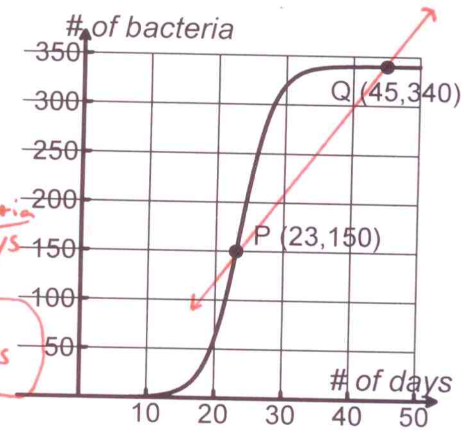
1. In an experiment of population of bacteria, find the average rate of change from $P$ to $Q$ and draw in the secant line.




$\dfrac{dy}{dx} = \dfrac{340 \text{ bacteria} - 150 \text{ bacteria}}{45 \text{ days} - 23 \text{ days}} = \dfrac{190}{22} \dfrac{\text{bacteria}}{\text{days}}$

$= \boxed{\dfrac{95}{11} \text{ bacteria/days} \approx 8.636 \text{ bacteria/days}}$

**(FR, calc.) 2. Traffic flow $F(t)$ is defined as the rate at which cars pass through an intersection, measured in cars per minute and $t$ is in minutes. The traffic flow at an intersection is modeled by the function $F$ defined by $F\left(t\right) = 82 + 4\sin\left(\dfrac{t}{2}\right)$ for $0 \le t \le 30$. What is the average rate of change of the traffic flow over the time interval $10 \le t \le 15$? Indicate units of measure.

(10, 78.164)
(15, 85.752)

$\dfrac{dF(t)}{dt} = \dfrac{85.752 \frac{\text{cars}}{\text{min}} - 78.164 \frac{\text{cars}}{\text{min}}}{15 \text{ min} - 10 \text{ min}} = \dfrac{7.588 \text{ cars/min}}{5 \text{ min}}$

$\boxed{= 1.5176 \text{ cars/min}^2}$

3. Using the table below, a) estimate $f'(1870)$ and
   b) interpret the meaning of your answer.

| t (yr) | 1850 | 1860 | 1870 | 1880 |
|---|---|---|---|---|
| f(t) (millions) | 23.1 | 31.4 | 38.6 | 50.2 |

a) $f'(1870) \approx \dfrac{50.2 \text{ millions} - 31.4 \text{ millions}}{1880 - 1860 \text{ yrs}} = \dfrac{18.8 \text{ millions}}{20 \text{ yrs}} = .94 \text{ mil/yr}$

b) The rate of increase from 1860 to 1880 averages .94 mil/yr.