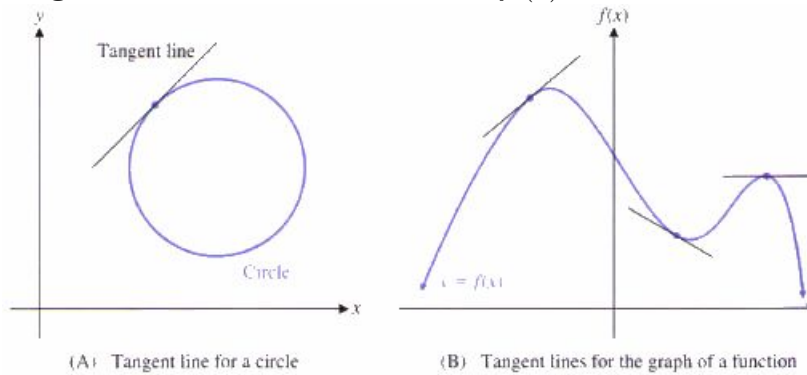


Section 2.7: Tangents, Velocities, and Other Rates of Change

Definition: The **instantaneous rate of change** of a function $f(x)$ at $x = a$ is the slope of the **tangent line** at $x = a$ and is denoted $f'(a)$.

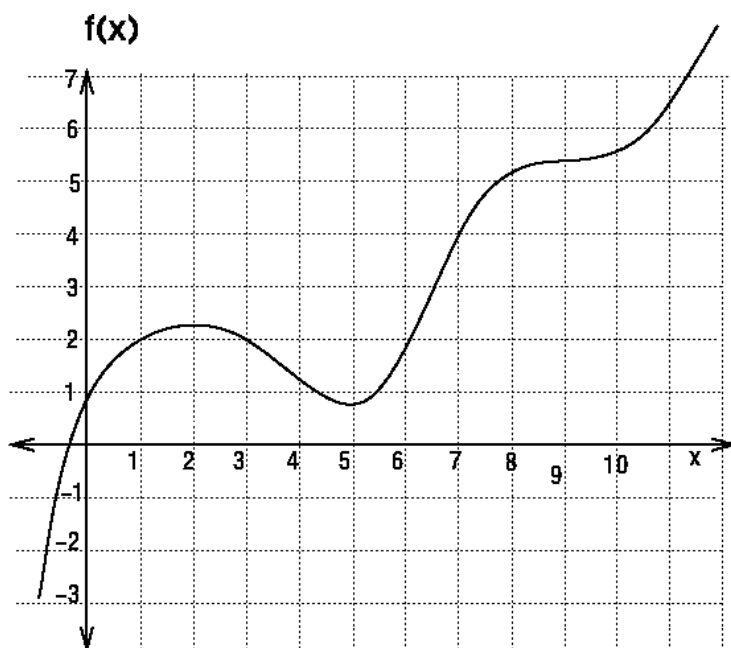


Example: Use this graph to answer these questions.

A) Estimate the instantaneous rate of change at $x = 1$.

B) Find the equation of the tangent line at $x = 1$.

C) At what values of x does $f(x)$ have an instantaneous rate of change of 0?



Example: Find the average rate of change of $f(x) = 2x^2 - x$ from

A) $x = 1$ to $x = 6$

B) $x = 1$ to $x = 5$

C) $x = 1$ to $x = 3$

Definition: The slope of the tangent line (instantaneous rate of change) at $x = a$ is

$$m_{tan} = \lim_{x \rightarrow a} \frac{f(x) - f(a)}{x - a}$$

Example: Find the slope of the tangent line for $f(x) = 2x^2 - x$ at $x = 1$. Also give the equation of the tangent line at $x = 1$.

Example: Find the instantaneous rate of change at $x = 9$ for $f(x) = \sqrt{x}$.