2-2 Videos Guide

2-2a

- The derivative of f as a function of x
  - $f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$

Exercise:

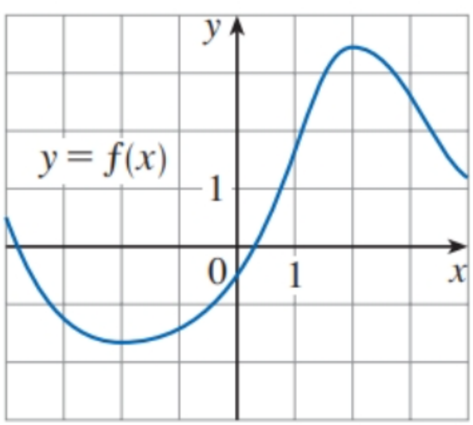
- Find the derivative of the function using the definition of derivative. State the domain of the function and the domain of its derivative.
  $f(x) = \sqrt{x - 6}$

- Notation for derivatives
  - $f'(x) = \frac{d}{dx}[f(x)] = y' = \frac{dy}{dx} = D_x$ all represent the derivative of f (or y) with respect to x
  - $f'(2) = \left.\frac{dy}{dx}\right|_{x=2}$ represents the derivative of f (or y) evaluated at $x = 2$
- Higher-order derivatives
  - $f''(x) = y'' = \frac{d}{dx}\left(\frac{dy}{dx}\right) = \frac{d^2y}{dx^2}$ represent a second derivative
  - $f'''(x)$ is the third derivative, but for the fourth and higher, we use $f^{(4)}(x)$, etc.
- Position, velocity, acceleration, and jerk
  - If $s(t)$ is a position function, then $v(t) = s'(t)$ is velocity, $a(t) = s''(t)$ is acceleration, and $j(t) = s'''(t)$ is the jerk.

Exercises:

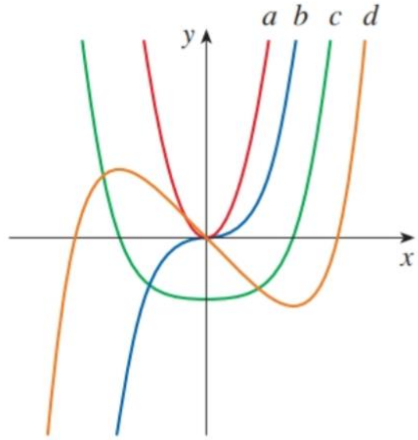
2-2b

- Use the given graph to estimate the value of each derivative. Then sketch the graph of f'.
  (a) $f'(-3)$ (b) $f'(-2)$ (c) $f'(-1)$ (d) $f'(0)$
  (e) $f'(1)$ (f) $f'(2)$ (g) $f'(3)$



2-2c

- The figure shows graphs of f, f', f'', and f'''. Identify each curve, and explain your choices.



2-2d

Definition: (differentiable)

- A function f is differentiable at a if $f'(a)$ exists. It is differentiable on an open interval (a, b) [or (a, ∞) or $(-\infty, b)$ or $(-\infty, \infty)$] if it is differentiable at every number in the interval.

Theorem (statement and proof):

- If f is differentiable at a, then f is continuous at a.