2.5 Videos Guide

2.5a

- The Chain Rule
  - If g is differentiable at x and f is differentiable at $g(x)$, then the composite function $F = f \circ g$ defined by $F(x) = f\big(g(x)\big)$ is differentiable at x and $F'(x) = f'\big(g(x)\big) \cdot g'(x)$
- Alternative form of the Chain Rule (Leibnitz notation)
  - If $y = f(u)$ and $u = g(x)$ are both differentiable functions, then $\frac{dy}{dx} = \frac{dy}{du}\frac{du}{dx}$

Exercises:

- Differentiate.
  - $y = \sin(x^2)$

2.5b

  - $y = \left(\sin\sqrt{x}\right)^3$
  - $f(t) = t\sin\pi t$
  - $y = \cos(ax)$

2.5c

  - $y = \sqrt{\sin(1 + x^2)}$
  - $y = x\sin\frac{1}{x}$
  - $y = \sin\left(t + \cos\sqrt{t}\right)$

2.5d

- The General Power Rule
  - $\frac{d}{dx}[[f(x)]^n] = n[f(x)]^{n-1}f'(x)$

Exercises:

- Differentiate.
  - $F(x) = (1 + x + x^2)^{99}$
  - $U(y) = \left(\frac{y^4+1}{y^2+1}\right)^5$

Proof:

- The differentiation formula for the secant function