

5.4-5.5 Quiz ReviewDerivatives of Exponential function e^x and a^x Find $\frac{dy}{dx}$

1. $f(x) = \ln \frac{(3+4x)^5}{\sqrt[4]{1-3x}}$

2. $y = \log_3 \left(\frac{3x^5}{2x^4 - 3} \right)^3$

3. $f(x) = xe^{2-x^2}$

4. $f(x) = \log_5 \left(\frac{3-x}{\sqrt{1-x}} \right)$

5. $f(x) = 8^{x-3x^2} (\log(3-2x)^3)$

5.4-5.5 Quiz Review

Derivatives of Exponential function e^x and a^x

Solution Key

Find $\frac{dy}{dx}$

$$= \ln(3+4x)^5 - \ln(1-3x)^{1/4}$$

$$1. f(x) = \ln \frac{(3+4x)^5}{\sqrt[4]{1-3x}} = 5\ln(3+4x) - \frac{1}{4}\ln(1-3x)$$

$$f'(x) = 5\left(\frac{4}{3+4x}\right) - \frac{1}{4}\left(\frac{-3}{1-3x}\right) = \boxed{\frac{20}{3+4x} + \frac{3}{4(1-3x)}}$$

$$2. y = \log_3 \left(\frac{3x^5}{2x^4-3} \right) = 3 \log_3 \left(\frac{3x^5}{2x^4-3} \right) = 3 \log_3(3x^5) - 3 \log_3(2x^4-3)$$

$$y' = 3 \cdot \frac{1}{\ln 3} \left(\frac{15x^4}{3x^5} \right) - 3 \left(\frac{1}{\ln 3} \right) \left(\frac{16x^3}{2x^4-3} \right)$$

$$= \boxed{\frac{3}{\ln 3} \left(\frac{5}{x} \right) - \frac{3}{\ln 3} \left(\frac{16x^3}{2x^4-3} \right)}$$

$$\text{Reminder} \quad \frac{d}{dx} \log_a u = \frac{1}{\ln a} \left[\frac{u'}{u} \right]$$

$$3. f(x) = x e^{2-x^2}$$

$$f'(x) = (1) e^{2-x^2} + x \cdot e^{2-x^2} (-2x)$$

$$= \boxed{e^{2-x^2} (1-2x^2)}$$

* product rule

$$4. f(x) = \log_5 \left(\frac{3-x}{\sqrt{1-x}} \right) = \log_5(3-x) - \log_5(1-x)^{1/2} = \log_5(3-x) - \frac{1}{2} \log_5(1-x)$$

$$f'(x) = \frac{1}{\ln 5} \left(\frac{-1}{3-x} \right) - \frac{1}{2} \left(\frac{1}{\ln 5} \right) \left(\frac{-1}{1-x} \right)$$

$$= \boxed{\frac{-1}{\ln 5(3-x)} + \frac{1}{2 \ln 5(1-x)}}$$

$$\text{Reminder} \quad \frac{d}{dx} a^u = \ln a \cdot a^u \cdot u'$$

$$5. f(x) = 8^{x-3x^2} (\log(3-2x))^3$$

$$f(x) = 8^{x-3x^2} \cdot 3 \log_{10}(3-2x)$$

$$f'(x) = (\ln 8) 8^{x-3x^2} \cdot (1-6x) \cdot \log(3-2x)^3 + 8^{x-3x^2} \cdot \frac{3}{\ln 10} \left(\frac{-2}{3-2x} \right)$$

$$\boxed{8^{x-3x^2} \left[(\ln 8)(1-6x) \log(3-2x)^3 - \frac{6}{\ln 10(3-2x)} \right]}$$