Derivatives and Differentiability with Piece-Wise Defined Functions

Name_____
Period_____

Use your knowledge of the following functions to find the derivatives at the given points. Then find the general derivative function for any point. Also determine any points where the derivative fails to exist.

1. $y = \begin{cases} x, & x \le 0 \\ x^2, x > 0 \end{cases}$

    a)   Find $\dfrac{dy}{dx}$ for x = 3.

    b)   Find $\dfrac{dy}{dx}$ for any point.

    c)   Is there any point where $\dfrac{dy}{dx}$ fails to exist?

2. $y = \begin{cases} x - 3, & x \le 1 \\ -x, x > 1 \end{cases}$

    a)   Find $\dfrac{dy}{dx}$ for x = 3.

    b)   Find $\dfrac{dy}{dx}$ for any point.

    c)   Is there any point where $\dfrac{dy}{dx}$ fails to exist?

3. $y = \begin{cases} x^3 + 1, & x \le 0 \\ e^x, x > 0 \end{cases}$

    a)   Find $\dfrac{dy}{dx}$ for x = -2.

    b)   Find $\dfrac{dy}{dx}$ for any point.

    c)   Is there any point where $\dfrac{dy}{dx}$ fails to exist?

4. $y = \begin{cases} |x|, & x \le 3 \\ \cos x, & x > 3 \end{cases}$

a) Find $\dfrac{dy}{dx}$ for x = 4.

b) Find $\dfrac{dy}{dx}$ for any point.

c) Is there any point where $\dfrac{dy}{dx}$ fails to exist?

5. $y = \begin{cases} x^2, & x \le 1 \\ 1, & 1 < x \le 3 \\ x - 2, & x > 3 \end{cases}$

a) Find $\dfrac{dy}{dx}$ for x = 2.

b) Find $\dfrac{dy}{dx}$ for any point.

c) Is there any point where $\dfrac{dy}{dx}$ fails to exist?