2.1 B Differentiation

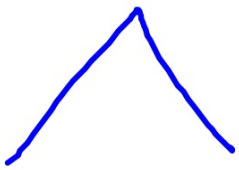
A. **Derivative** - the instantaneous rate of change at a point
- Slope of the tangent line of a graph at a point

1. **Differentiation** - the act of taking a derivative

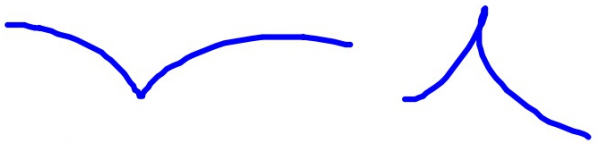
2. $y \rightarrow y'$
   $f(x) \rightarrow f'(x)$
   $\left.\begin{matrix} \\ \\ \end{matrix}\right\} \frac{dy}{dx}$

B. Special Cases

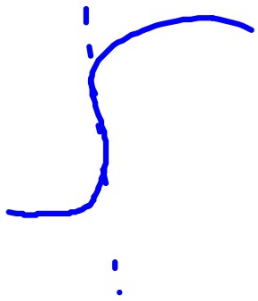
1. Sharp Turn



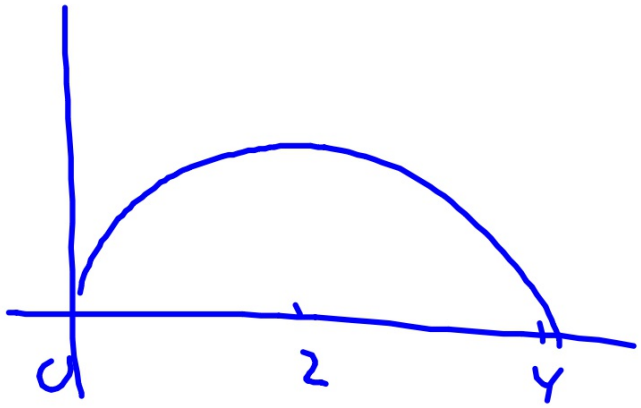
2. Cusps

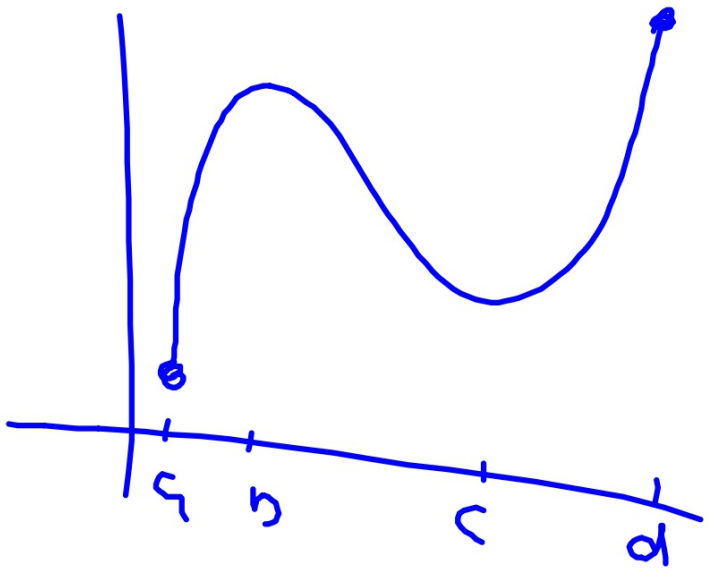


3. Vertical



C. Graphs




a
b
c
d

Ex. Find the equation of the tangent line to $y = 2x^2$ at $(2, 8)$

$$\lim_{\Delta x \to 0} \frac{f(x+\Delta x) - f(x)}{\Delta x} = \frac{2(x+\Delta x)^2 - 2x^2}{\Delta x}$$

$$= \frac{2x^2 + 4x\Delta x + 2\Delta x^2 - 2x^2}{\Delta x}$$

$$\lim_{\Delta x \to 0} 4x + 2\Delta x \qquad \frac{\Delta x(4x + 2\Delta x)}{\Delta x}$$

$$4x$$

$$= 4(2) = 8$$

$$(2, 8)$$

$$y - y_1 = m(x - x_1)$$

$$y - 8 = 8(x - 2)$$

$$y = 8(x - 2) + 8$$

P. 103

1, 2, 7, 9

25 - 27 (a only)