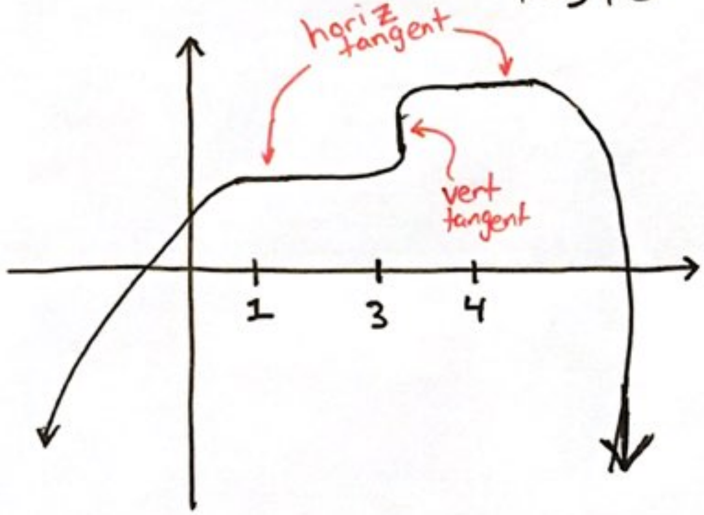
1.

$f'(x)=0 \iff$ f(x) has a horizontal tangent

$f'(x)$ undefined $\iff$ f(x) not continuous, has a vertical tangent, or is not smooth

$f'(x)>0 \iff$ f(x) increasing

$f'(x)=-x+4 \iff$ larger and larger x-values make f(x) decrease faster and faster



2.

$$f'(0)=\lim_{x\to 0}\frac{f(x)-0}{x-0}$$
$$=\lim_{x\to 0}\frac{x^{1/3}}{x}$$
$$=\lim_{x\to 0} x^{-2/3} = \frac{1}{\sqrt[3]{x^2}}$$
$$=\infty$$

So $f'(0)$ is not defined.

The tangent line to $f(x)=x^{1/3}$ at $x=0$ is the vertical line $x=0$ since the limit is infinite.

3. $$\lim_{x\to 0^-}\frac{f(x)-0}{x-0}=\lim_{x\to 0^-}\frac{|x|}{x}=\lim_{x\to 0^-}\frac{-x}{x}=-1$$

$$\lim_{x\to 0^+}\frac{f(x)-0}{x-0}=\lim_{x\to 0^+}\frac{|x|}{x}=\lim_{x\to 0^+}\frac{x}{x}=1$$

Since the left and right limits disagree, $\lim_{x\to 0}\frac{f(x)-0}{x-0}$ DNE.

L7 P3