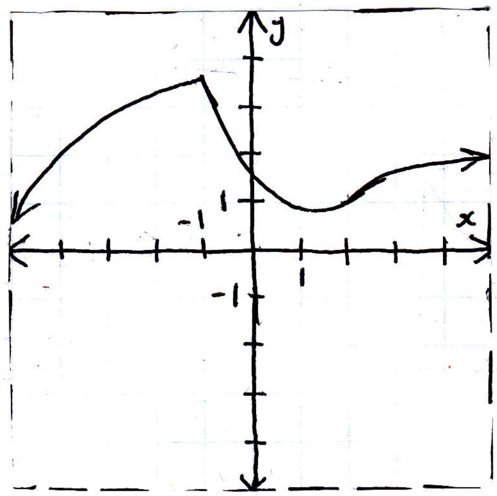
Keethik M.
Hollingsworth
Calculus I
10-10-2020

4.1 Velocity = f'(position), acceleration = f'(velocity)

$\therefore$ Acceleration is the dotted line because it has the lowest power. Velocity is the dashed line because the rule "if $f'(x)<0$, then $f(x)$ is decreasing and vice versa" correlates with the solid line. If acceleration is the dotted line and velocity the dashed, position is the solid line.

4.2



4.3 $f'(x) = \lim\limits_{x\to 0} \frac{\sqrt{x+h+1}}{h} - \frac{\sqrt{x+1}}{h} = \lim\limits_{h\to 0} \frac{(x+h+1)-(x+1)}{h(\sqrt{x+h+1}+\sqrt{x+1})} = \lim\limits_{h\to 0} \frac{1}{2\sqrt{x+1}} = \frac{1}{2\sqrt{x+1}}$

b.) $f'(3) = \frac{1}{2\sqrt{3+1}} = \frac{1}{2\cdot\sqrt{4}} = \frac{1}{4}$

c.) $f(x) = mx+b = \frac{x}{4} + f(3) - \frac{3}{4} = \boxed{\frac{1}{4}x + \frac{5}{4}}$

$\cancel{m = f'(3)}$

$\cancel{b = \frac{f(3)-1}{3-4} = \frac{1}{-1} = -1;\ \frac{x}{4} - 1}$

Keerthik M.
Calculus I
Hollingsworth
10 - 10 -20

Determine whether $\dot{f}(0)$ exists, where

$$f(x) = \begin{cases} x\sin\frac{1}{x} & \text{if } x \neq 0 \\ 0 & \text{if } x = 0 \end{cases}.$$

If $\dot{f}(0)$ exists, then

$$\dot{f}(0) = \lim_{h \to 0} \frac{-f(x) + f(x+h)}{h} = \lim_{h \to 0} \frac{h\sin\frac{1}{h}}{h} = \lim_{h \to 0} \sin\frac{1}{h}.$$

Therefore, if wecan prove $\lim_{x \to 0} \sin\frac{1}{x}$ doesn't exist, then $\dot{f}(0)$ does not exist.

Let $a > 0$, where $\sin\frac{1}{x} \geq a$ when $0 < |x| < b$ and $b > 0$. If $a = \frac{1}{2}$, we want to define x so that $|x| < b$, but $\frac{1}{x}$ is equal to $\frac{\pi}{2} + 2\pi n$.

Let x in $\sin\frac{1}{x} = \frac{1}{2}$ equal $\dfrac{1}{\frac{\pi}{2} + 2\pi n}$ where n is large enough for $|x| < b$.

Then $\sin\frac{1}{x} = \sin(\frac{\pi}{2} + 2\pi n) = 1$. Therefore $\lim_{h \to 0} \sin\frac{1}{h}$ or $\dot{f}(x)$ don't exist. This is because 1 is greater than $\frac{1}{2}$, or a.