WARMUP

Calculate $f'(x)$ using $f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$

for $f(x) = 3x^2 + 5x - 7$

$$f'(x) = \lim_{h \to 0} \frac{\left(3(x+h)^2 + 5(x+h) - 7\right) - \left(3x^2 + 5x - 7\right)}{h}$$

$$= \lim_{h \to 0} \frac{3(x^2 + 2xh + h^2) + 5x + 5h - 7 - 3x^2 - 5x + 7}{h}$$

$$= \lim_{h \to 0} \frac{\cancel{3x^2} + 6xh + 3h^2 + \cancel{5x} + 5h - \cancel{7} - \cancel{3x^2} - \cancel{5x} + \cancel{7}}{h}$$

$$= \lim_{h \to 0} \frac{\cancel{h}(6x + 3h + 5)}{\cancel{h}} = 6x + 3 \cdot 0 + 5 = 6x + 5$$

Section 2.5 Interpretations of the Derivative

One notation for derivative of a function is $f'(x)$.

There are other notations:

If $y = f(x)$, then $\frac{dy}{dx} = f'(x)$

derivative of y with respect to x.

If s is the position function of an object, then $\frac{ds}{dt}$ is instantaneous velocity so $v = \frac{ds}{dt}$

$$h(t) = -16t^2 + v_0 t + h_0$$

$$\frac{dh}{dt} = v(t) = -32t + v_0$$

$\frac{d}{dx}\left(f(x)\right)$, $\frac{d}{dx}(y)$, $\left.\frac{dy}{dx}\right|_{x=2}$

derivative evaluated at $x=2$, so it means $f'(2)$.

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$T = f(t)$

t — time in minutes

T — temperature in °F

a) What is the sign of $f'(t)$?

$f'(t) > 0$ since $f(t)$ is increasing

b) $f'(20)$

$$f'(t) = \frac{dT}{dt}$$

$$f'(20) = \left.\frac{dT}{dt}\right|_{t=20}$$ units are °F/min

What does $f'(20) = 2$ mean?

At $t = 20$ minutes temp is increasing at 2°/min

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price = \$p

quantity = q

$q = f(p)$

$$\frac{dq}{dp} = f'(p)$$

$$\frac{dq}{dp} = \frac{\text{\# of items}}{\$}$$

a) $f(150) = 2000$

price → 150, quantity → 2000

when \$150 is price, 2000 are sold

$f^{-1}(300) = 100$

300 items are sold when price is \$100

$(f^{-1})'(q) = \frac{dp}{dq}$

b) $f'(150) = -25$

when \$150 is price, quantity sold decreases at 25 items/\$

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