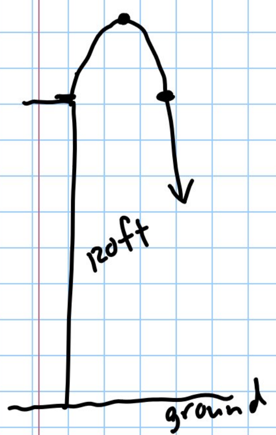
WARMUP - In Notes

A rock is thrown upward from a height of 120 ft with a velocity of 40 ft/sec. Its height is given by $h(t) = -16t^2 + 40t + 120$.
How long does it take for the rock to reach its highest height?
With what velocity does the rock hit the ground?



$$h(t) = -16t^2 + 40t + 120$$

$$v(t) = h'(t) = -32t + 40$$

Set $v(t) = 0$ to find when highest height

$$-32t + 40 = 0$$

$$-32t = -40$$

$$t = 1.25 \text{ seconds}$$

For 2nd question set $h(t) = 0$

$$\underbrace{-16t^2 + 40t + 120}_{\text{graph it}} = 0$$

$$t = 4.26 \text{ seconds}$$

$$v(4.26) = -32(4.26) + 40 = -96.32 \text{ ft/sec}$$

31) $f(x) = \ln(\sin x + \cos x)$

$$f'(x) = \frac{\cos x - \sin x}{\sin x + \cos x}$$

32) $f(x) = \ln(\underset{\overset{\downarrow}{f(x)}}{\ln x}) + \overbrace{\ln(\ln 2)}$

$$\frac{d}{dx}\left(a^{f(x)}\right) = a^{f(x)} \cdot \ln a \cdot f'(x)$$

$$f'(x) = \frac{\frac{1}{x}}{\frac{\ln x}{1}} + 0$$

$$f'(x) = \frac{1}{x} \cdot \frac{1}{\ln x} = \frac{1}{x \ln x}$$

DERIVATIVE RULES

$$\frac{d}{dx}[c] = 0$$

$$\frac{d}{dx}[x] = 1 \qquad \frac{d}{dx}[cx] = c$$

$$\frac{d}{dx}[c\,f(x)] = c\,f'(x) \qquad \frac{d}{dx}[c + f(x)] = f'(x)$$

$$\frac{d}{dx}[f(x) \pm g(x)] = f'(x) \pm g'(x)$$

PRODUCT: $$\frac{d}{dx}[f(x)\cdot g(x)] = f(x)\cdot g'(x) + g(x)\cdot f'(x)$$

1^{st} · deriv of 2nd + 2nd · deriv of 1st

QUOTIENT: $$\frac{d}{dx}\left[\frac{f(x)}{g(x)}\right] = \frac{g(x)\cdot f'(x) - f(x)\cdot g'(x)}{[g(x)]^2} = \frac{\text{bot}\cdot\text{der top} - \text{top}\cdot\text{der bot}}{\text{bot}^2}$$

CHAIN: $$\frac{d}{dx}[f(g(x))] = f'(g(x))\cdot g'(x)$$

$$\frac{d}{dx}[x^n] = nx^{n-1} \qquad \frac{d}{dx}\left[(f(x))^n\right] = n(f(x))^{n-1}\cdot f'(x)$$

$$\frac{d}{dx}[e^x] = e^x \qquad \frac{d}{dx}[e^{kx}] = ke^{kx} \qquad \frac{d}{dx}[e^{f(x)}] = e^{f(x)}\cdot f'(x)$$

$$\frac{d}{dx}[a^x] = a^x \ln a \qquad \frac{d}{dx}[a^{f(x)}] = a^{f(x)}\cdot \ln a\cdot f'(x)$$

$$\frac{d}{dx}[\sin x] = \cos x \qquad \frac{d}{dx}[\sin(f(x))] = \cos(f(x))\cdot f'(x)$$

$$\frac{d}{dx}[\cos x] = -\sin x \qquad \frac{d}{dx}[\cos(f(x))] = -\sin(f(x))\cdot f'(x)$$

$$\frac{d}{dx}[\tan x] = \sec^2 x \qquad \frac{d}{dx}[\tan(f(x))] = \sec^2(f(x))\cdot f'(x)$$

$$\frac{d}{dx}[\ln x] = \frac{1}{x} \qquad \frac{d}{dx}[\ln(f(x))] = \frac{f'(x)}{f(x)}$$