Find the derivative of y with respect to x for $y = 29^x$.

$y' = (\ln 29) \cdot 29^x$

$\frac{d}{dx}(a^x) = (\ln a) a^x$

Differentiate.

GCF: $x^2(5.6)^x$

$g(x) = x^3 \cdot (5.6)^x \implies$

$g'(x) = x^3 [(\ln 5.6)(5.6)^x] + 5.6^x (3x^2)$

$= x^2 (5.6)^x [x \ln 5.6 + 3]$

Differentiate

$\frac{d}{dx}(a^u) = u' \cdot (\ln a) a^u$

$y = 11^{x^3+5} \implies$

$y' = 3x^2 \cdot (\ln 11) \cdot 11^{x^3+5}$

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Differentiate.

$$\frac{d}{dx}\left(\log_a x\right) = \frac{1}{x \ln a}$$

$y = \log_7 x \Rightarrow$

$$y' = \frac{1}{x \ln 7}$$

$$\frac{d}{dx}\left(\log_a u\right) = \frac{u'}{u \ln a}$$

Differentiate.

$y = \log_5 (x^6 + x)$

$$y' = \frac{6x^5 + 1}{(x^6 + x)\ln 5}$$

Differentiate.

$$g(x) = \frac{7^x}{6x+7}$$

$$g'(x) = \frac{(6x+7)\,7^x \ln 7 - 7^x(6)}{(6x+7)^2}$$

$$= \frac{7^x\left[(\ln 7)(6x+7) - 6\right]}{(6x+7)^2}$$

An office machine is purchased for \$5300. Under certain assumptions, its salvage value, V, in dollars, is depreciated according to a method called double declining balance, by basically 77% each year, and is given by $V(t) = 5300(0.77)^t$,

a) Find $V'(t)$.
b) Interpret the meaning of $V'(t)$.

a)

$$V(t) = 5300\underline{(0.77)^t}$$

$$V'(t) = 5300 \ln(0.77)(0.77)^t$$

b) Change in rate of the value t years after its purchase

The intensity of a sound is given by $I = I_0 10^{0.1L}$, where L is the loudness of the sound as measured in decibels and I_0 is the minimum intensity detectable by the human ear.

a) Find I, in terms of I_0, for the loudness of a small engine, which is 90 decibles.

b) Find I, in terms of I_0, for the loudness of a quiet sound, which is 30 decibles.

c) Compare your answers to parts (a) and (b).

d) Find the rate of change dI/dL.

e) Interpret the meaning of dI/dL.

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a) $I = I_0 \cdot 10^{0.1(90)}$

$= I_0 \cdot 10^9$

b) $I = I_0 \cdot 10^{0.1(30)} = I_0 \cdot 10^3$

c) $\dfrac{I_0 \cdot 10^9}{I_0 \cdot 10^3} = 10^6$

$I = I_0 \, \underline{10^{0.1L}}$

d) $\dfrac{dI}{dL} = I_0 \cdot (\ln 10) \cdot 10^{0.1L}$

e) Change in rate of intensity per change in decibels.