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Multiple Choice

1.(2 pts.) Find the derivative of the function $f(x) = \log_{10}(e^x + 1)$.

(a) $\dfrac{1}{(\ln 10)(e^x + 1)}$

(b) 0

(c) $\dfrac{e^x}{(\ln 10)(e^x + 1)}$

(d) $\dfrac{e^x}{10}$

(e) $\dfrac{1}{(\ln 10)(e^x)}$

Solution:

Using the chain rule, and recalling that $\dfrac{d}{dx}\log_a(x) = \dfrac{1}{(\ln a)x}$, we have that:

$$f'(x) = \frac{1}{(\ln 10)(e^x + 1)}\frac{d}{dx}(e^x + 1) = \frac{e^x}{(\ln 10)(e^x + 1)}$$

2.(2 pts.) If you put \$1000 in an account that pays 10% interest, compounded continuously, how long (in years) will it take for the balance to reach \$10000?

(a) $\dfrac{\ln(10)}{10}$ (b) $10\ln(10)$ (c) $\dfrac{1}{\ln(10)}$

(d) $\ln(10)$ (e) $\dfrac{1}{10\ln(10)}$

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Solution:

Continuously compounded interest satisfies the exponential growth formula $A(t) = A(0)e^{rt}$, where $A(t)$ is the amount of money after t years, and r is the decimal rate of interest per year. Putting this together, we see that $A(t) = 1000e^{t/10}$. To find when the balance reaches 10000, we need to find when:

$$10000 = 1000e^{t/10}$$
$$10 = e^{t/10}$$
$$\frac{t}{10} = \ln(10)$$

Giving us that $t = 10\ln(10)$ years.