Finding Values of Derivatives Using the Graphing Calculator

For each of the functions below, find the value of $f'(x)$ at the indicated value of x using the graphing calculator. Then, determine if the function is increasing, decreasing, has a horizontal tangent or has a vertical tangent. Give a reason for your answer.

Function	Value of $f'(a)$	Is $f(x)$ increasing or decreasing, or does $f(x)$ have a horizontal or a vertical tangent?
1. $f(x) = 3e^x \sin x$	$a = -2$ $f'(-2) \approx -0.538$	$f(x)$ is decreasing at $x = -2$ b/c $f'(-2) < 0$
2. $f(x) = 3e^x \sin x$	$a = 1$ $f'(1) \approx 11.268$	$f(x)$ is increasing at $x = 1$ b/c $f'(1) > 0$
3. $f(x) = \frac{\ln(\cos x)}{x^2}$	$a = \frac{\pi}{3}$ $f'(\frac{\pi}{3}) \approx -0.372$	$f(x)$ is decreasing at $x = \frac{\pi}{3}$ b/c $f'(\frac{\pi}{3}) < 0$
4. $f(x) = \frac{\ln(\cos x)}{x^2}$	$a = \pi$ $f'(\pi) = DNE$	$f(x)$ has a vertical tangent at $x = \pi$ b/c $f'(\pi) = DNE$
5. $f(x) = e^{\tan(0.34x)}$	$a = 0$ $f'(0) \approx 0.340$	$f(x)$ is increasing at $x = 0$ b/c $f'(0) > 0$
6. $f(x) = 5\sin^2(\ln x)$	$a = 1$ $f'(1) \approx 0$	$f(x)$ has a horizontal tangent at $x = 1$ b/c $f'(1) = 0$

When the value of the derivative of a function is positive, we say that the function is increasing. When the value of the derivative of a function is negative, we say that the function is decreasing. When speaking of quantities increasing or decreasing, they do so at a certain rate. We already understand the derivative to be the SLOPE OF THE TANGENT LINE. Slope is a rate. Therefore, the derivative of a function actually represents the RATE AT WHICH A FUNCTION IS CHANGING.

7.	The number of people entering a concert can be modeled by the function $f(t) = 560e^{\sin t}$, where t represents the number of hours after the gates are open.
a.	Find the values of $f\left(\frac{1}{2}\right)$ and $f'\left(\frac{1}{2}\right)$. Using correct units, explain what each value represents in the context of this problem. $f(\frac{1}{2}) = 904.482 \Rightarrow$ $\frac{1}{2}$ an hour after the gates open, the number of people entering the concert is 904 people. $f'(\frac{1}{2}) = 793.757 \Rightarrow$ $\frac{1}{2}$ an hour after the gates open, the number of people entering the concert is increasing by 793 people per hour.
b.	How many people ~~have~~ are entered ing the concert 2 hours after the gates are opened? Is the number of people entering increasing or decreasing at this time? Justify your answer. $f(2) = 1390. \Rightarrow$ 2 hours after the gates open, the number of people entering the concert is 1390 people. $f'(2) = -578.545$ 2 hours after the gates opened, the number of people entering is decreasing b/c $f'(2) < 0$.

8.	After being poured into a cup, coffee cools so that its temperature, $T(t)$, is represented by the function $T(t) = 70 + 110e^{-t/2}$, where t is measured in minutes and $T(t)$ is measured in degrees Fahrenheit.
a.	What is the temperature of the coffee 5 minutes after it has been poured into the cup? $T(5) = 79.029°F$
b.	Is the temperature decreasing faster 1 minute after it is poured or 3 minutes after it is poured? Give a reason for your answer. $T'(1) = -33.359°F/min$ $T'(3) = -12.272°F/min$ The temperature is decreasing faster at $t=1$ because $\lvert T'(1)\rvert > \lvert T'(3)\rvert$