AP Calculus – 2.2b Notes - Interpreting Limit Definitions of a Derivative

General Limit Definition of the Derivative:

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

Alternate Limit Definition of a derivative:

$$f'(c) = \lim_{x \to c} \frac{f(x) - f(c)}{x - c}$$

Identify the function we are working with. Then identify the x-value for the instantaneous rate of change (slope of the tangent line at a point).

1. $\lim_{h \to 0} \frac{5\ln\left(\frac{2}{4+h}\right) - 5\ln\left(\frac{1}{2}\right)}{h}$

Function: $f(x) =$

Instantaneous rate at $x =$

2. $\lim_{x \to \frac{\pi}{2}} \frac{\sin x - 1}{x - \frac{\pi}{2}}$

Function: $f(x) =$

Instantaneous rate at $x =$

24. $\lim_{h \to 0} \frac{3(1+h)^2 - 7(1+h) + 1 + (3)}{h}$

Function: $f(x) =$

Instantaneous rate at $x =$

25. $\lim_{x \to \frac{\pi}{2}} \frac{6x^2 \sin x - \frac{3\pi^2}{2}}{x - \frac{\pi}{2}}$

Function: $f(x) =$

Instantaneous rate at $x =$

26. $\lim_{h \to 0} \frac{\log(2 - 4(h-5)) - \log(22)}{h}$

Function: $f(x) =$

Instantaneous rate at $x =$

27. $\lim_{x\to 5}\frac{\frac{1}{\sqrt{3x}}-\frac{1}{\sqrt{15}}}{x-5}$

Function: $f(x) =$

Instantaneous rate at $x =$

28. $\lim_{h\to 0}\frac{e^{6(3+h)+1}-e^{19}}{h}$

Function: $f(x) =$

Instantaneous rate at $x =$

29. Let f be the function defined by $f(x) = \ln 7x$. The average rate of change of f over the interval $[2, a]$ is 41, where $a > 2$. Which of the following is an equation that could be used to find the value of a?

(A) $f(a) = 41$

(B) $f(a) - f(2) = 41$

(C) $\frac{f(a)-f(2)}{a-2} = 41$

(D) $\frac{f(a)+f(2)}{2} = 41$

30. Find the average rate of change of $f(x) = \sin x \ln x$ on the interval $1 \le x \le a$.

31) Let $f'(x) = \lim_{h\to 0}\frac{(x+h)^2-x^2}{h}$. For what value of x does $f(x) = 4$?

(A) -4 (B) -1 (C) 1 (D) 2 (E) 4