AP Problems Chapter 2

Limits
Calculator okay

81. The graph of the function \( f \) is shown below. The value of \( \lim_{x \to 1} \sin f(x) \) is

A) 0.909  B) 0.841  C) 0.141  D) -0.416  E) nonexistent

![Graph of f](image)

78. The graph of a function \( f \) is shown above. For which of the following values of \( c \) does \( \lim_{x \to c} f(x) = 1 \)?

A) 0 only  B) 0 and 3 only  C) -2 and 0 only  D) -2 and 3 only  E) -2, 0, and 3

1. If \( f(x) = -x^2 + x \), which of the following expressions represents \( f'(x) \)?

(A) \( \lim_{h \to 0} \frac{(-x^2 + x + h) - (-x^2 + x)}{h} \)  
(B) \( \lim_{h \to 0} \frac{(-x^2 + x + h) - (-x^2 + x)}{h} \)

(C) \( \lim_{h \to 0} \frac{[-(x+h)^2 + (x+h)] - (-x^2 + x)}{h} \)  
(D) \( \lim_{h \to 0} \frac{[-(x+h)^2 + (x+h)] - (-x^2 + x)}{h} \)

(E) None of the above
13. The graph of a function $f$ is shown above. At which value of $x$ is $f$ continuous, but not differentiable?

A) a  B) b  C) c  D) d  E) e

76. The graph of the function $f$ is shown above. Which of the following statements must not be true.

A) $f(a)$ exists  
B) $f(x)$ is defined for $0 < x < a$  
C) $f$ is not continuous at $x = a$  
D) $\lim_{x \to a} f'(x)$ exists  
E) $\lim_{x \to a} f''(x)$ exists

19. $\lim_{h \to 0} \frac{f(4 + h) - f(4)}{h} = 6$ is equivalent to

(A) $f(4) = 6$  
(B) $f'(h) = 2$  
(C) $f'(4) = 6$  
(D) $\lim_{h \to 0} \frac{f(h)}{h} = 6$  
(E) $\lim_{h \to 0} \frac{f(4 - h) + f(4)}{h} = 6$
Let $f$ be a function defined by

$$f(x) = \begin{cases} 
1 - 2\sin x & \text{for } x \leq 0 \\
e^{-4x} & \text{for } x > 0 
\end{cases}$$

Show that $f$ is continuous at $x = 0$.

6. Let $f$ be the function defined below. Which of the following statements about $f$ are true?

$$f(x) = \begin{cases} 
x^2 - 4 & \text{if } x \neq 2 \\
x - 2 & \text{if } x = 2 
\end{cases}$$

I. $f$ has a limit at $x = 2$
II. $f$ is continuous at $x = 2$
III. $f$ is differentiable at $x = 2$

A) I only
B) II only
C) III only
D) I and II only
E) I, II, and III only

1. Grass clippings are placed in a bin, where they decompose. For $0 \leq t \leq 30$, the amount of grass clippings remaining in the bin is modeled by $A(t) = 6.687(0.931)^t$, where $A(t)$ is measured in pounds and $t$ is measured in days.

a) Find the average rate of change of $A(t)$ over the interval $0 \leq t \leq 30$. Indicate units of measure.

21. The line $y = 5$ is a horizontal asymptote to the graph of which of the following?

A) $y = \frac{\sin 5x}{x}$  B) $y = 5x$  C) $y = \frac{1}{x - 5}$  D) $y = \frac{5x}{1 - x}$  E) $y = \frac{20x^2 - x}{1 + 4x^2}$