Which of the following four graphs is the graph of the function

\[ f(x) = 7x^5 - 3x^2? \]
Let $f$ be the function

$$f(x) = \frac{4x^4 - 5.5x^2 + x}{3x^7 - 5x^2}.$$ 

Then $f(0.02)$ is approximately:

(A) 3  (B) $-10$  (C) $-0.0008$  (D) $\frac{5.5}{5}$
Which of the following limits do not exist?

(A) \( \lim_{x \to -2} \frac{x^2 - 4}{x - 2} \)

(B) \( \lim_{x \to 2} \frac{x^2 - 4}{x - 2} \)

(C) \( \lim_{x \to 2} \frac{x + 2}{x - 2} \)

(D) More than one.

(E) All three exist.
For which number $a$ is the function

$$f(x) = \begin{cases} \frac{ax + 1}{ x > 1} \\ -3 & , x \leq 1 \end{cases}$$

continuous?

(A) $-4$

(B) $-3$

(C) $3$

(D) For some other value of $a$.

(E) For no number $a$. 
Lecture 3: Related exam problem

Let $f(x) = \sqrt{x}$. Calculate $f'(x)$ from the definition of the derivative at $x$. Hint:

$$\frac{\sqrt{a} - \sqrt{b}}{\sqrt{a} + \sqrt{b}} (\sqrt{a} + \sqrt{b}) = \frac{a - b}{\sqrt{a} + \sqrt{b}}$$
For any function $g$, answer the following questions with (A) true or (B) false.

a) If $g$ is continuous at $a$, then $g$ has a tangent at $a$. 
For any function $g$, answer the following questions with (A) true or (B) false.

a) If $g$ is continuous at $a$, then $g$ has a tangent at $a$.

b) If $g$ has a tangent at $a$, then $g$ is continuous at $a$. 
For any function $g$, answer the following questions with (A) true or (B) false.

a) A tangent of $g$ can intersect the graph of $g$ in several points.
For any function $g$, answer the following questions with (A) true or (B) false.

a) A tangent of $g$ can intersect the graph of $g$ in several points.

b) Suppose that $g$ is increasing. A tangent of $g$ has to stay on the same side of the graph of $g$. 
Lecture 4: Related exam problem

The following three graphs represent position $x(t)$, velocity $v(t)$ and acceleration $a(t)$. Label them.
Suppose that the energy expenditure of a fish swimming at velocity $v$ is $E(v) = \alpha \left( \frac{1}{v} + \beta v \right)$, where $\alpha, \beta > 0$ are constant. The derivative of $E$ with respect to $v$ is

(A) $\alpha (v + \beta)$
(B) $\alpha \left( \frac{1}{v^2} + \beta \right)$
(C) $\alpha \left( -\frac{1}{v^2} + \beta v \right)$
(D) $\alpha \left( -\frac{1}{v^2} + \beta \right)$
(E) $\alpha (1 + \beta)$
Suppose that
\[ f(x) = (3 + x^2)g(x) \]
and that
\[ g(2) = 2, \quad g'(2) = -1. \]
Compute \( f'(2) \).
Let \( f(x) = 3x - 2 \), \( g(x) = -2x + 1 \) and \( h(x) = g(f(x)) \). Which of the following statements is true?

(A) \( h(x) = -6x + 5 \)

(B) \( h(x) = -6x^2 + 7x - 2 \)

(C) \( h(x) \) is a quadratic polynomial

(D) More than one of the above.

(E) None of the above.
Lying on a 10 meter platform, you are throwing down a ball. The ball leaves your hand with a downwards speed of $3 \text{m/s}$. Which function $y(t)$ describes the height of the ball in meters at time $t$ in seconds?

(A) $y(t) = -\frac{9.81}{2} \frac{m}{s^2} t^2 + 10m$

(B) $y(t) = -\frac{9.81}{2} \frac{m}{s^2} t^2 - 3 \frac{m}{s} t + 10m$

(C) $y(t) = -\frac{9.81}{2} \frac{m}{s^2} t^2 + 3 \frac{m}{s} t + 10m$

(D) $y(t) = \frac{9.81}{2} \frac{m}{s^2} t^2 + 3 \frac{m}{s} t + 10m$
5. (2 pts) Consider the function \( h(x) = f(g(x)) \) where the graphs of \( f \) and \( g \) are shown in the figure below.

Circle the letter next to the true statement.

(a) \( h'(0.5) > 0 \).
(b) \( h'(1.5) > 0 \).
(c) \( h'(2.5) = 0 \).
(d) None of the above.
Let \( f(x) = x^3 \) and \( x_0 \neq 0 \). We use linear approximation to estimate \( f(x) \) for \( x \) close to \( x_0 \). Which of the following statements is true?

(A) Our approximation overestimates \( f(x) \).

(B) Our approximation is an overestimate if \( x_0 > 0 \).

(C) Our approximation is an underestimate if \( x_0 < 0 \).

(D) More than one is true.

(E) None is true.
Using linear approximation to estimate $\sqrt{99}$, you would calculate the tangent line at:

(A) 100
(B) 99
(C) 10
(D) 1
(E) 0
Using linear approximation to estimate $\sqrt{99}$, the equation of the tangent line at 100 yields

(A) an overestimate.

(B) an underestimate.

(C) I don’t know.
Consider the function \( f(x) = \frac{3}{x-2} \). At which points \((a, f(a))\) does the graph of this function have tangent lines parallel to the line \( y = -x \)? What is the equation of the tangent line at each of these points?