Clicker Questions

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Review of Limits

If a function $y = f(x)$ is not defined at $x = a$, then

a) $\lim_{x \to a} f(x)$ cannot exist.

b) $\lim_{x \to a} f(x)$ could be zero.

c) $\lim_{x \to a} f(x)$ must approach ∞

d) None of the above are true.

Derivative and LImits

Recall that we defined the *instantaneous velocity* as the limit of the average rate of change of position.

Can the average rate of change on an interval $[1, 2]$ equal the instantaneous velocity at $t = 1$?

a) Yes

b) No

Order derivative values

For the function $g(x)$ shown below, arrange the following numbers in increasing order.

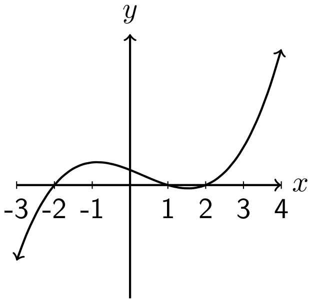
a) 0

b) $g'(-2)$

c) $g'(0)$

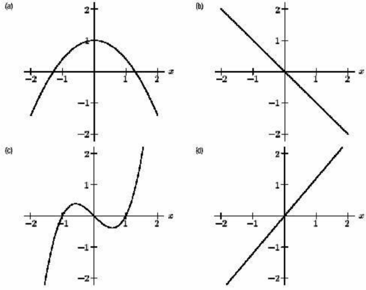
d) $g'(1)$

e) $g'(3)$



Derivative Function I

1. Which of the following graphs is the graph of the derivative of the function shown in Figure 2.6?



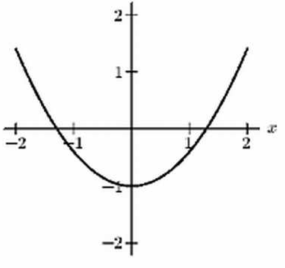
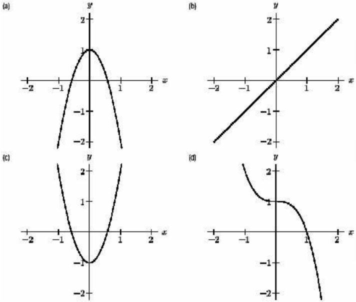


Figure 2.6

Derivative Function II

2. Which of the following graphs is the graph of the derivative of the function shown in Figure 2.8?



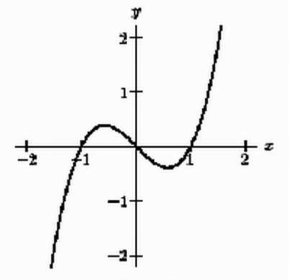


Figure 2.8

13. If $f(x) = x^2 + \frac{3}{x}$, then what is $f'(x)$?

(a) $2x - 3x^{-2}$

(b) $2x + 3x^{-1}$

(c) $2x - 3x^2$

(d) $x^2 - 3x^{-1}$

If $f(x) = \pi^2$, then what is $f'(x)$?

(a) 2π

(b) π^2

(c) 0

(d) 2

Derivative Rules III

The derivative of the function $f(x) = e^{x+2}$ is

a) $(x+2)e^{x+1}$
b) $e^2 e^x$
c) e^2
d) 0
e) Cannot be determined from what we know

The 10th derivative of $\sin x$ is

(a) $\sin x$

(b) $\cos x$

(c) $-\sin x$

(d) $-\cos x$

Product Rule I

1. $\frac{d}{dx}\left(x^2 e^x\right) =$

   (a) $2xe^x$

   (b) x^2e^x

   (c) $2xe^x + x^2e^{x-1}$

   (d) $2xe^x + x^2e^x$

Product Rule II

5. When differentiating a constant multiple of a function (like $3x^2$) the Constant Multiple Rule tells us $\frac{d}{dx}cf(x) = c\frac{d}{dx}f(x)$ and the Product Rule says $\frac{d}{dx}cf(x) = c\frac{d}{dx}f(x) + f(x)\frac{d}{dx}c$. Do these two rules agree?

   (a) Yes, they agree, and I am very confident.

   (b) Yes, they agree, but I am not very confident.

   (c) No, they do not agree, but I am not very confident.

   (d) No, they do not agree, and I am very confident.

11. $\frac{d}{dt}\frac{\sqrt{t}}{t^2+1} =$

(a) $\frac{\frac{1}{2}t^{-1/2}-2t}{(t^2+1)^2}$

(b) $\frac{\frac{1}{2}t^{-1/2}t^2-2t\sqrt{t}}{(t^2+1)^2}$

(c) $\frac{\frac{1}{2}t^{-1/2}(t^2+1)-2t\sqrt{t}}{(t^2+1)^2}$

(d) $\frac{t^{-1/2}(t^2+1)-2t\sqrt{t}}{(t^2+1)^2}$

Product Rule III

12. If $f(3) = 2$, $f'(3) = 4$, $g(3) = 1$, $g'(3) = 3$, and $h(x) = f(x)g(x)$, then what is $h'(3)$?

   (a) 2
   (b) 10
   (c) 11
   (d) 12
   (e) 14

14. If $h = \frac{ab^2e^b}{c^3}$ then what is $\frac{dh}{db}$?

(a) $\frac{2abe^b}{c^3}$

(b) $\frac{2abe^b}{3c^2}$

(c) $\frac{2abe^b + ab^2e^b}{c^3}$

(d) $\frac{2abe^bc^3 - 3c^2ab^2e^b}{c^6}$

3. $\frac{d}{dx}\sqrt{1-x} =$

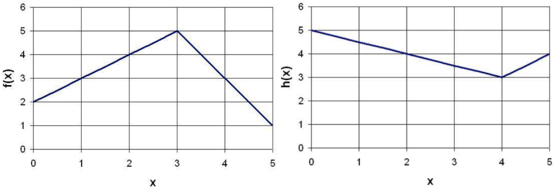
(a) $\frac{1}{2}(1-x)^{-1/2}$

(b) $-\frac{1}{2}(1-x)^{-1/2}$

(c) $-(1-x)^{-1/2}$

(d) $-\frac{1}{2}(1-x)^{1/2}$

12. The functions $f(x)$ and $h(x)$ are plotted below. The function $g(x) = f(h(x))$. What is $g'(2)$?



(a) $g'(2) = -\frac{1}{2}$

(b) $g'(2) = 1$

(c) $g'(2) = 3$

(d) $g'(2) = 4$

(e) $g'(2)$ is undefined

Inverse Functions I

The derivative of the function $f(z) = \ln(z^2 + 1)$ is

a) $2z\ln(z^2 + 1)$

b) $\dfrac{2z}{z^2 + 1}$

c) $\dfrac{-1}{z^2 + 1}$

d) None of the above

10. If $q = a^2 \ln(a^3 c \sin b + b^2 c)$, then $\frac{dq}{db}$ is

(a) $\frac{a^2}{a^3 c \sin b + b^2 c}$

(b) $\frac{a^5 c \cos b + 2a^2 bc}{a^3 c \sin b + b^2 c}$

(c) $\frac{a^3 c \cos b + 2bc}{a^3 c \sin b + b^2 c}$

(d) $\frac{6a^3 \cos b + 4ab}{a^3 c \sin b + b^2 c}$

Implicit Differentiation

The derivative of the implicit function $x^3 + y^3 - 9xy = 0$ is

a) $\dfrac{dy}{dx} = \dfrac{-3x^2 - y}{y^2 - 3x}$

b) $\dfrac{dy}{dx} = \dfrac{x^2}{y^2 + 3x}$

c) $\dfrac{dy}{dx} = \dfrac{3y - x^2}{y^2 - 3x}$

d) $\dfrac{dy}{dx} = -\dfrac{x^2 + y}{y^2 + 3x}$

e) None of the above

Local Linearization I

6. You wish to approximate $\sqrt{9.3}$. You know the equation of the line tangent to the graph of $f(x) = \sqrt{x}$ where $x = 9$. What value do you put into the tangent line equation to approximate $\sqrt{9.3}$?

   (a) $\sqrt{9.3}$

   (b) 9

   (c) 9.3

   (d) 0.3

Local Linearization II

Suppose that $f''(x) < 0$ for x near a. Then the local linearization $L(x)$ for $y = f(x)$ at $x = a$ is

a) more than the true value (an over-estimate)

b) less than the true value (an under-estimate)

c) we cannot tell from the given information

Mean Value Theorem I

5. On a toll road a driver takes a time stamped toll-card from the starting booth and drives directly to the end of the toll section. After paying the required toll, the driver is surprised to receive a speeding ticket along with the toll receipt. Which of the following best describes the situation?

   (a) The booth attendant does not have enough information to prove that the driver was speeding.

   (b) The booth attendant can prove that the driver was speeding during his trip.

   (c) The driver will get a ticket for a lower speed than his actual maximum speed.

   (d) Both (b) and (c).

Mean Value Theorem II

8. Two racers start a race at the same moment and finish in a tie. Which of the following must be true?

   (a) At some point during the race the two racers were not tied.

   (b) The racers' speeds at the end of the race must have been exactly the same.

   (c) The racers must have had the same speed at exactly the same time at some point in the race.

   (d) The racers had to have the same speed at some moment, but not necessarily at exactly the same time.

3. **True or False:** If $x = p$ is not a local minimum or maximum of f, then $x = p$ is not a critical point of f.

   (a) True, and I am very confident

   (b) True, but I am not very confident

   (c) False, but I am not very confident

   (d) False, and I am very confident

6. Imagine that you are skydiving. The graph of your speed as a function of time from the time you jumped out of the plane to the time you achieved terminal velocity is

    (a) increasing and concave up
    (b) decreasing and concave up
    (c) increasing and concave down
    (d) decreasing and concave down

True or False: If $x = p$ is in the domain of $y = f(x)$ not a local minimum or a local maximum, then it is **not** a critical point.

a) True and I am very confident
b) True but I am not very confident
c) False but I am not very confident
d) False and I am very confident

Derivatives and Graphing IV

Let $f(x) = ax + \dfrac{b}{x}$. Suppose that a and b are positive. What are the critical points of $y = f(x)$?

a) $-b/a$
b) 0
c) $\pm\sqrt{b/a}$
d) $\pm\sqrt{-b/a}$
e) No critical points

Derivatives and Graphing V

True or False: A local maximum of $y = f(x)$ only occurs at a point where $f'(x) = 0$.

a) True and I am very confident
b) True but I am not very confident
c) False but I am not very confident
d) False and I am very confident