

**Test #1**

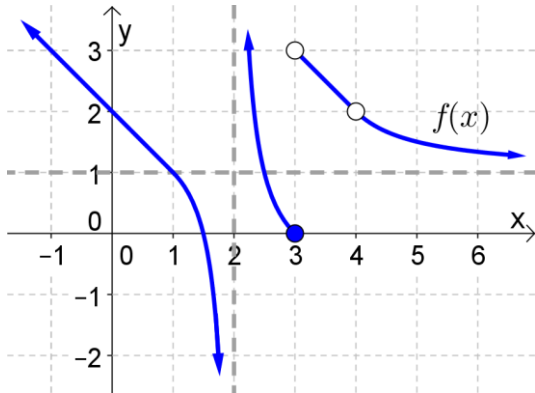
Name: \_\_\_\_\_

Math 180, Section 5, Prof. Beydler

Thursday, September 28, 2017

**Directions:** Show all work. No books or notes. A **scientific calculator** is allowed. Your desk and lap must be clear (no phones, no smart watches, etc.). If you have a phone in your lap or on your chair, it is considered cheating, and you will receive a zero on this test. Write your answers in the indicated places, or box your answers. Good luck!

1. (4 points) Find the following limits for the below graph of  $f(x)$ .



$$\lim_{x \rightarrow 3^-} f(x)$$

$$\lim_{x \rightarrow 3^+} f(x)$$

$$\lim_{x \rightarrow 3} f(x)$$

$$\lim_{x \rightarrow 2^+} f(x)$$

$$\lim_{x \rightarrow -1} f(x)$$

$$\lim_{x \rightarrow 4} f(x)$$

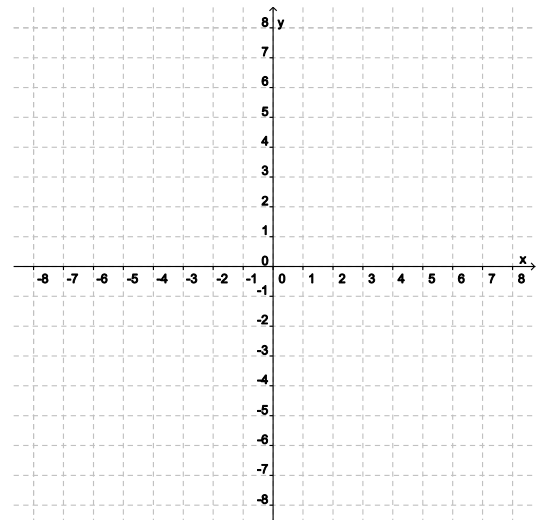
$$\lim_{x \rightarrow -\infty} f(x)$$

$$\lim_{x \rightarrow \infty} f(x)$$

2. (3 points) Using the graph of  $f(x)$  from the previous question, answer the following. No need to give reasons here.

- a) Is  $f$  continuous or discontinuous at  $x = 4$ ?    continuous    discontinuous    (circle one)
- b) Is  $f$  continuous from the left at  $x = 3$ ?    yes    no    (circle one)
- c) Is  $f$  continuous from the right at  $x = 2$ ?    yes    no    (circle one)
- d) Is  $f$  differentiable at  $x = 4$ ?    yes    no    (circle one)
- e) Find  $f'(3.5)$ . Answer: \_\_\_\_\_
- f) Find  $f'(3)$ . Answer: \_\_\_\_\_

3. (2 points) Sketch the graph of an example of a function  $f$  that satisfies  $\lim_{x \rightarrow \infty} f(x) = 3$ ,  $\lim_{x \rightarrow -4} f(x) = \infty$ , discontinuous at  $x = 1$ , and  $f(-7) = -2$ . Be sure to draw any asymptotes of  $f$ .



4. Find the following limits.

a) (2 points)  $\lim_{x \rightarrow 2} \frac{3x^2 - 5x - 2}{x^2 + 7x - 18}$

Answer: \_\_\_\_\_

b) (2 points)  $\lim_{x \rightarrow 1/2} \frac{x^2 - 2x - 6}{2x + 1}$

Answer: \_\_\_\_\_

c) (2 points)  $\lim_{x \rightarrow \infty} \frac{2x + 3}{\sqrt{9x^2 - 5x + 1}}$

Answer: \_\_\_\_\_

d) (2 points)  $\lim_{x \rightarrow 1^-} e^{\csc(x-1)}$

Answer: \_\_\_\_\_

e) (2 points)  $\lim_{x \rightarrow -\infty} (\sqrt{x^2 + 1} + x)$  (Be sure to explain your reasoning for full credit here!)

Answer: \_\_\_\_\_

5. (3 points) Use the Squeeze Theorem to prove that  $\lim_{x \rightarrow 0} x^2 \cos\left(\frac{1}{x}\right) = 0$ .

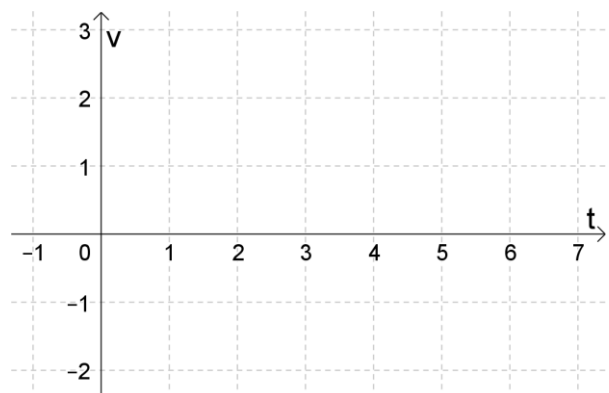
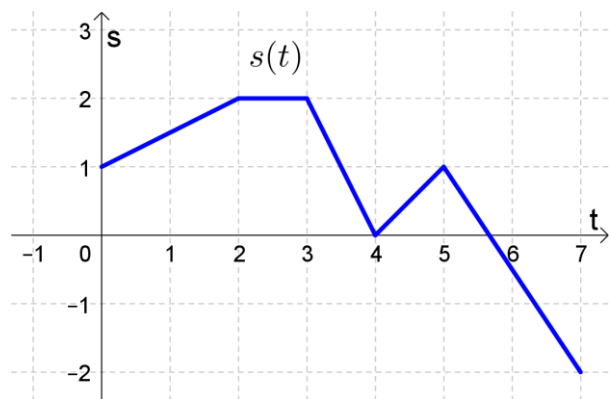
6. (2 points) Using the definition of continuity, explain why  $f(x) = \begin{cases} 3x + 1 & \text{if } x \leq -1 \\ 2x - 3 & \text{if } x > -1 \end{cases}$  is discontinuous at  $x = -1$ .

7. (3 points) Use the Intermediate Value Theorem to show that there is a root of  $3 - 2x = e^x$  in the interval  $(0, 1)$ .

8. (4 points) Find the derivative of  $f(x) = \frac{2}{x+1}$  using the limit definition.

Answer: \_\_\_\_\_

9. (2 points) Suppose you move back and forth along a line, and that your position over time is given by the function  $s(t)$  below. Graph the velocity function  $v(t)$ .



10. Differentiate the following functions.

a) (3 points)  $f(x) = 5^x + \frac{2}{\sqrt[3]{x}} + 3e^2 + 5 \ln x + \cot x + 2 \sin^{-1} x$

Answer: \_\_\_\_\_

b) (3 points)  $f(x) = \frac{x^3 + \cosh x}{\sin x}$  (for this one, don't worry about simplifying your answer)

Answer: \_\_\_\_\_

c) (4 points)  $f(x) = \frac{\csc x}{x^3 e^x}$  (for this one, don't worry about simplifying your answer)

Answer: \_\_\_\_\_

d) (3 points)  $f(x) = \cos^2(2^x)$  (for this one, don't worry about simplifying your answer)

Answer: \_\_\_\_\_

e) (3 points)  $f(x) = \sqrt{\ln(\sec x)}$  (for this one, don't worry about simplifying your answer)

Answer: \_\_\_\_\_

11. (3 points) Find an equation for the tangent line to  $y = (5x^2 + 2)e^x$  at the point  $(0, 2)$ .

Answer: \_\_\_\_\_

12. (2 points) Find the second derivative of  $y = \tan 3x$ .

Answer: \_\_\_\_\_