

NAME: \_\_\_\_\_

## Calculus I - Spring 2014

### Midterm Exam I, March 5, 2014

In all non-multiple choice problems you are required to show all your work and provide the necessary explanations everywhere to get full credit. In all multiple choice problems you don't have to show your work.

1. Find the domain of  $f(x) = \sqrt{2-x} + \sqrt{x+5}$ .

Ⓐ  $(-\infty, -5]$

Ⓑ  $(-\infty, 2]$

Ⓒ  $[-5, 2]$

Ⓓ  $[2, 5]$

Ⓔ  $[-2, 5]$

2. The function  $f(x) = \sin^2 x$  is

Ⓐ even

Ⓑ odd

Ⓒ neither even nor odd

3. Find  $\lim_{x \rightarrow \infty} (\sqrt{x^2 + 4x} - x)$ .

Ⓐ 0

Ⓑ 1

Ⓒ 2

Ⓓ 3

Ⓔ None of the above

4. Find  $\lim_{x \rightarrow 2} \frac{x^3 - 8}{x^2 - 4}$ .

- (A) 0
- (B) 1
- (C) 2
- (D) 3
- (E) None of the above

5. Find  $\lim_{x \rightarrow 1} \frac{\frac{1}{x+2} - \frac{1}{3}}{x-1}$ .

- (A)  $-\frac{1}{9}$
- (B)  $\frac{1}{9}$
- (C)  $\frac{1}{3}$
- (D)  $-\frac{1}{3}$
- (E) None of the above

6. Find  $\lim_{x \rightarrow 0} \frac{\sin 3x}{4x}$ .

- (A) Does not exist
- (B)  $\frac{3}{4}$
- (C)  $\frac{4}{3}$
- (D) 0
- (E) None of the above

7. Find  $\lim_{x \rightarrow -1^-} \frac{1}{1+x}$ .

- (A) Does not exist and neither  $\infty$  nor  $-\infty$
- (B)  $-\infty$
- (C)  $\infty$
- (D) 1
- (E) None of the above

8. Find  $\lim_{x \rightarrow -1^-} \frac{1}{1+x^2}$ .

- (A)  $\infty$
- (B)  $-\infty$
- (C) Does not exist and neither  $\infty$  nor  $-\infty$
- (D) 1
- (E) None of the above

9. Find  $\lim_{x \rightarrow -1} \frac{1}{1+x}$ .

- (A) 1
- (B)  $\infty$
- (C)  $-\infty$
- (D) Does not exist and neither  $\infty$  nor  $-\infty$
- (E) None of the above

10. Find  $\lim_{x \rightarrow -1} \frac{1}{(1+x)^2}$ .

- (A) Does not exist and neither  $\infty$  nor  $-\infty$
- (B) 1
- (C)  $-\infty$
- (D)  $\infty$
- (E) None of the above

11. If  $f(x) = \sqrt{2x}$ , which one of the following limits correspond to  $f'(a)$ ?

Ⓐ  $\lim_{h \rightarrow 0} \frac{\sqrt{2a + 2h} - \sqrt{2a}}{h}$

Ⓑ  $\lim_{h \rightarrow 0} \frac{\sqrt{2a + h} - \sqrt{2a}}{h}$

Ⓒ  $\lim_{h \rightarrow 0} \frac{\sqrt{2a - h} - \sqrt{2a}}{h}$

Ⓓ  $\lim_{x \rightarrow 0} \frac{\sqrt{2x} - \sqrt{2a}}{x - a}$

Ⓔ  $\lim_{a \rightarrow 0} \frac{\sqrt{2x} - \sqrt{2a}}{x - a}$

12. Let  $f(x)$  be a function which is differentiable for all  $x$  values. Which of these is the derivative of  $g(x) = \frac{1}{f(\sqrt{x})}$ ?

Ⓐ  $\frac{f'(\sqrt{x})}{2(f(\sqrt{x}))^2}$

Ⓑ  $\frac{f'(\sqrt{x})}{\sqrt{x}(f(\sqrt{x}))^2}$

Ⓒ  $-\frac{f'(\sqrt{x})}{\sqrt{x}(f(\sqrt{x}))^2}$

Ⓓ  $\frac{f'(\sqrt{x})}{2\sqrt{x}(f(\sqrt{x}))^2}$

Ⓔ  $-\frac{f'(\sqrt{x})}{2\sqrt{x}(f(\sqrt{x}))^2}$

13. Let  $f(x) = \cos x$ , then the second derivative of  $f$  is

- Ⓐ  $\sin x$
- Ⓑ  $-\sin x$
- Ⓒ  $\cos x$
- Ⓓ  $-\cos x$
- Ⓔ None of the above

14. Let  $f(x) = (1 + 3x)^8$ , then  $f'(x)$  is

- Ⓐ  $24(1 + 3x)^7$
- Ⓑ  $8(1 + 3x)^7$
- Ⓒ  $3(1 + 3x)^7$
- Ⓓ  $(1 + 3x)^7$
- Ⓔ  $8(1 + 3x)^9$

15. Suppose that  $s(t) = 1 + 5t - 2t^2$  is the position function of a particle, where  $s$  is in meters and  $t$  is in seconds. Find the particle's instantaneous velocity at time  $t = 2$  s.

- Ⓐ 1 m/s
- Ⓑ 0 m/s
- Ⓒ -1 m/s
- Ⓓ -2 m/s
- Ⓔ -3 m/s

1. Let  $f(x) = \frac{x + 1}{\sqrt{3x^2 - 1}}$ .

(a) Find all horizontal asymptotes of  $f$ .

(b) Find all vertical asymptotes of  $f$ .

2. Let

$$f(x) = \begin{cases} -x + 5 & \text{if } x < -1 \\ \sin(x^2 - 1) & \text{if } -1 \leq x \leq 1 \\ \sqrt{x} & \text{if } x > 1 \end{cases}$$

Find all points where  $f$  is discontinuous. **Use limits to justify your answer!**



3. Let  $f(x) = \sqrt{2x + 5}$ . Use the **definition of the derivative** to find  $f'(x)$ .