

## Instructions:

- Write your name and EID on **every page**.
  - Put your answers on the last sheet of paper.
  - This exam is **only** for students in the 12:30 class.
  - No other outside resources, such as books, notes, the internet, or other people, are allowed.
  - The max possible score is 105. It will be graded out of 100.
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1. (6 points) Which of the following is equal to  $\frac{4x^{-2}}{x + x^{-2}}$ .

- (A)  $\frac{4}{x^3} + 4$       (B)  $\frac{4}{x^2 - 1}$       (C)  $\frac{4}{x^3 + x}$       (D)  $\frac{4}{x^2 + x}$       (E)  $\frac{4}{x^3 + x^2}$       (F)  $\frac{4}{x^3 + 1}$

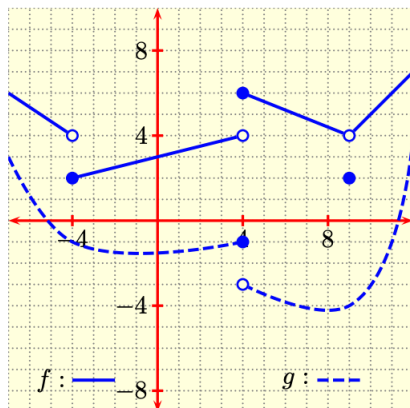
2. (6 points) The expression  $2\left(\frac{1}{4}\right)^{2x-1}$  can be written as  $a(2^{bx})$ . Which of the following equals  $2a + 3b$ ?

- (A) 0      (B) 4      (C) 8      (D) 12      (E) 16      (F) 20

3. (6 points) The position function of an object moving into Houston is given by  $s(t) = t^2 - 4t$ . Find the average velocity  $v_{[3, 3+h]}$ .

- (A) 3      (B)  $3 + h$       (C) 4      (D)  $4 + h$       (E) 2      (F)  $2 + h$

4. (6 points) The graphs of  $f$  and  $g$  are shown below:



Find  $\lim_{x \rightarrow 4} [f(x) + g(x)]$

- (A) 0      (B) 1      (C) 2      (D) 3      (E) Does not Exist

5. (6 points). Find  $\lim_{x \rightarrow 3} \frac{x^2 - x - 3}{x^2 - 3x + 2}$ .

- (A)  $\frac{5}{3}$       (B) 3      (C)  $\frac{7}{4}$       (D) 2      (E)  $\frac{3}{2}$       (F) 1

6. ( points) Find  $\lim_{x \rightarrow 0} \left( \frac{1}{x} - \frac{1}{x - 4x^2} \right)$

- (A) 0      (B) -1      (C) -2      (D) -3      (E) -4

7. ( points) The function  $f(x)$  is continuous:

$$f(x) \begin{cases} x + a & x < 2 \\ B & x = 2 \\ x^2 - a & x > 2 \end{cases}$$

Find  $B$ .

- (A) 2      (B) 3      (C)  $-4$       (D)  $-1$       (E) 6      (F) 0

8. ( points) Find  $\lim_{x \rightarrow \infty} \cos\left(\frac{1}{x^2}\right)$

- (A) 1      (B)  $\frac{1}{2}$       (C)  $\frac{\sqrt{3}}{2}$       (D) 0      (E) Does not Exist

9. ( points) Find  $\lim_{x \rightarrow \infty} \left(\sqrt{4x^2 + 16x} - 2x\right)$ .

- (A) 16      (B) 8      (C) 4      (D) 2      (E) 1      (F) 0

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

- (A) 4      (B) 2      (C) 1      (D) 0      (E)  $-1$       (F)  $-2$

11. ( points) Given the function  $f(x) = \frac{2}{x} - \frac{5}{x^2}$ , find  $f'(x)$

(A)  $\frac{6-2x}{x^3}$       (B)  $\frac{7-2x}{x^3}$       (C)  $\frac{8-2x}{x^3}$       (D)  $\frac{9-2x}{x^3}$       (E)  $\frac{10-2x}{x^3}$

12. (6 points) The function  $f(x) = x^5 + 2x$  is a 1-1 function. Find  $f^{-1}(-3)$ .

(A) 0      (B) 1      (C) -1      (D) -2      (E) 3

13. (3 points): True or False: If  $\lim_{x \rightarrow 2} \frac{f(x) - 13}{x - 2} = 10$ , then  $\lim_{x \rightarrow 2} f(x) = 10$ .

14. (3 points): True or False: If  $f(x) = 3x^3 - 5x + e^x$ , then  $f'(0) = -5$ .

15. (3 points): True or False:  $\lim_{x \rightarrow 2^+} \frac{x^2 - 5}{x - 2} = \infty$

16. (3 points): True or False: If  $f(x) = x^{10}$ , then  $f'(1) = \lim_{x \rightarrow 1} \frac{x^{10} - 1}{x - 1}$ .

17. (11 points) Draw a graph of a function on the interval  $[-3, 3]$  that has each of the following properties:

1)  $f(-3) = -2$

5)  $\lim_{x \rightarrow 2^+} f(x) = f(2) = -3$

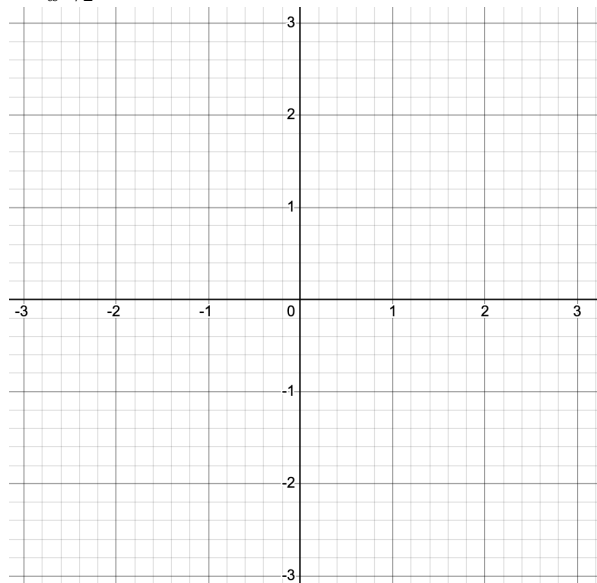
2)  $\lim_{x \rightarrow -1} f(x) = 1$

6)  $f(3) = 0$

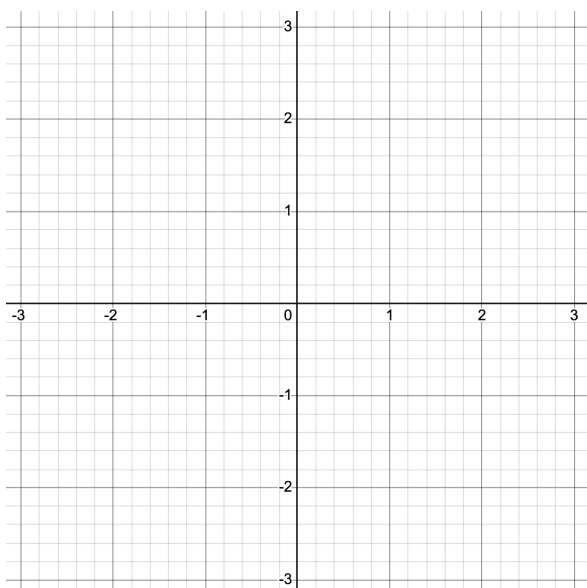
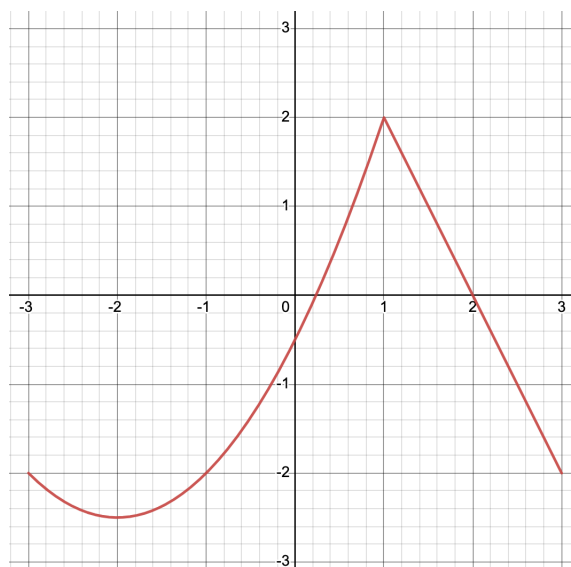
3)  $f(-1) = -2$

7)  $f(x)$  is continuous everywhere except  $x = -1, 2$

4)  $\lim_{x \rightarrow 2^-} f(x) = 2$



18. (10 points) The graph of  $f(x)$  is on the left. Sketch a graph of  $f'(x)$  on the xy-axis on the right.



Multiple Choice (6 points each):

1)

2)

3)

4)

5)

6)

7)

8)

9)

10)

11)

12)

True or False (3 points each):

13)

14)

15)

16)