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.

1. (6 points) Which of the following is equal to $\dfrac{4x^{-2}}{x + x^{-2}}$.

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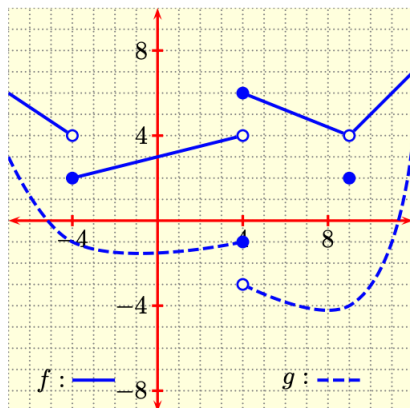
2. (6 points) The expression $2\left(\dfrac{1}{4}\right)^{2x-1}$ can be written as $a(2^{bx})$. Which of the following equals $2a + b$?

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

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

Find $\lim\limits_{x \to 4} [f(x) + g(x)]$

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

5. (6 points). Find $\lim\limits_{x \to 3} \dfrac{x^2 - x - 3}{x^2 - 3x + 2}$.

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

6. (6 points) Find $\lim\limits_{x \to 0} \left(\dfrac{1}{x} - \dfrac{1}{x - 2x^2} \right)$

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

7. (6 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) -4 (B) -1 (C) 2   (D) 3   (E) 6   (F) 0

8. (6 points) Find $\displaystyle \lim_{x \to \infty} \cos\left(\frac{1}{x^2}\right)$

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

9. (6 points) Find $\displaystyle \lim_{x \to \infty} \left(\sqrt{4x^2 + 16x} - 2x\right)$.

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

10. (6 points) Find $\displaystyle \lim_{x \to -\infty} \frac{\sqrt{4x^2 + x + 3}}{3 - x}$

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

11. (6 points) Given the function $f(x) = \dfrac{2}{x} - \dfrac{4}{x^2}$, find $f'(x)$

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

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

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

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

14. (3 points): True or False: If $f(x) = 3x^3 - 5x + e^x$, then $f'(0) = -4$.

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

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

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

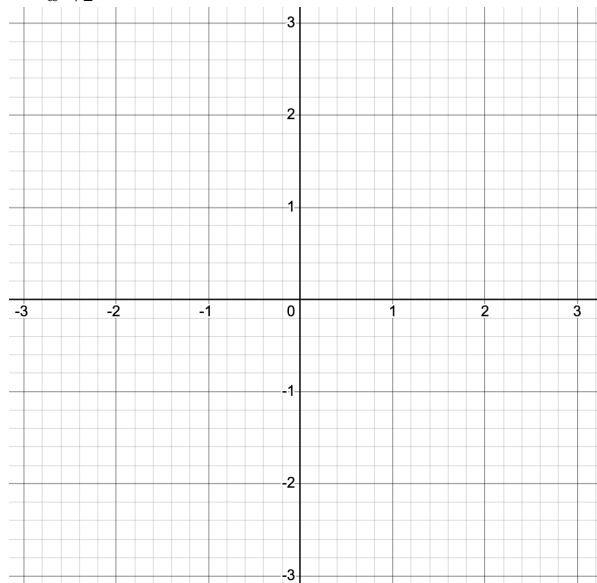1) $f(-3) = 3$

5) $\lim\limits_{x \to 2^+} f(x) = f(2) = -2$
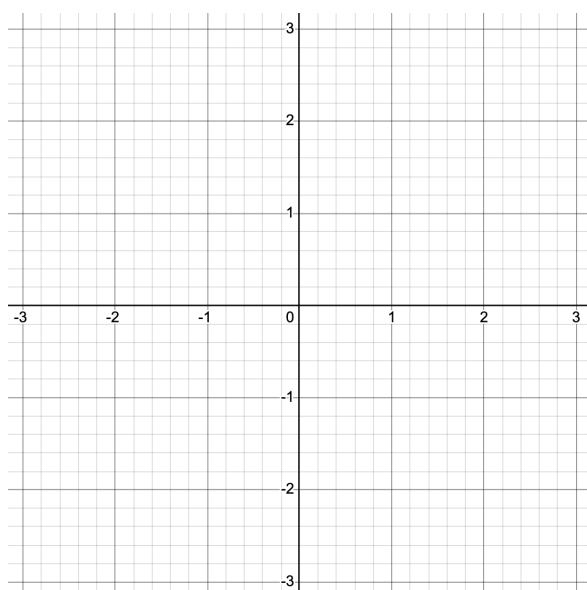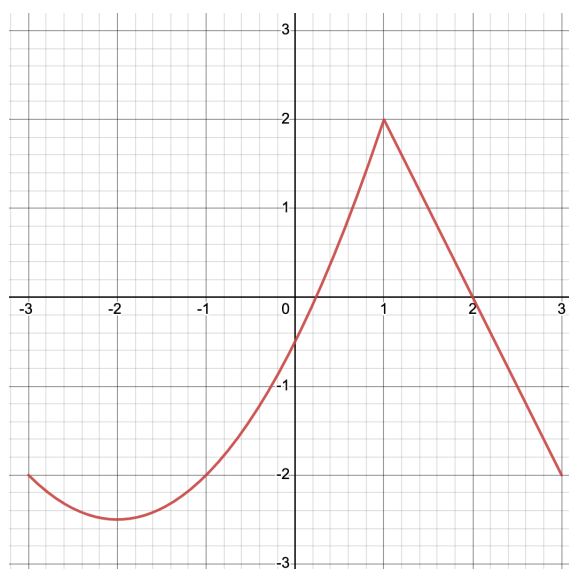
2) $\lim\limits_{x \to -1} f(x) = 1$

6) $f(3) = 0$

3) $f(-1) = 2$

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

4) $\lim\limits_{x \to 2^-} f(x) = 3$

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) [ ]