

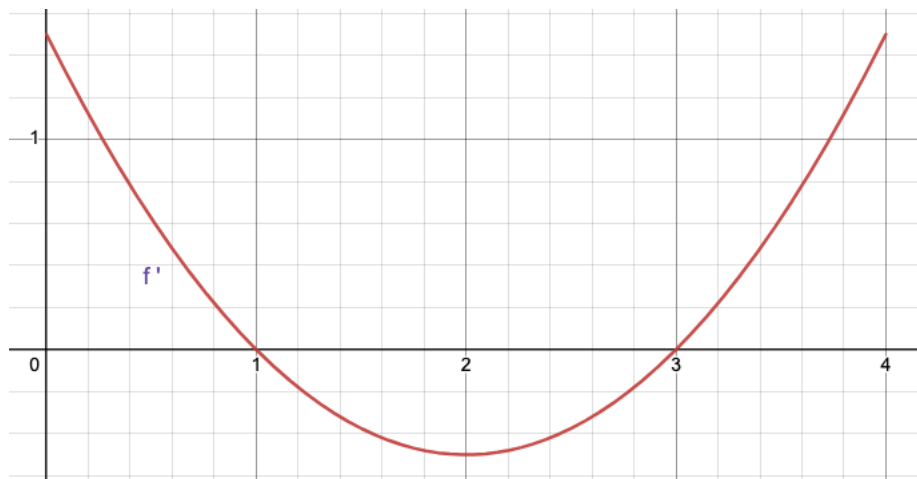
## Instructions:

- Write your name and EID on **every page**.
- Put your answers on the last sheet of paper.
- No other outside resources, such as books, notes, the internet, or other people, are allowed.
- There are 110 possible points. It will be graded out of 100. The maximum score is 105.

1. ( points) Let  $f(x) = \frac{x^2 - 3}{x - 2}$ . Which of the following is the y-value of the **local minimum** of  $f$ ?

- (A) 2      (B) 3      (C) 4      (D) 5      (E) 6      (F) None of These

2. (6 points) The graph of the derivative  $f'$  of a continuous function  $f$  on the interval  $[0, 4]$  is shown below:



On what interval is  $f$  concave down?

- (A)  $(0, 1)$       (B)  $(0, 2)$       (C)  $(1, 3)$       (D)  $(2, 3)$       (E)  $(2, 4)$       (F)  $(0, 4)$       (G) None

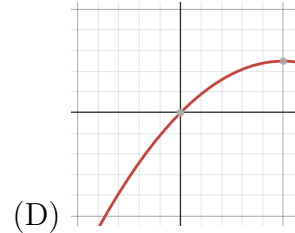
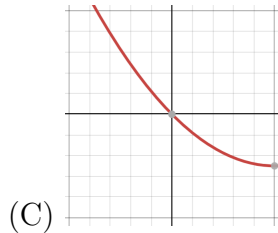
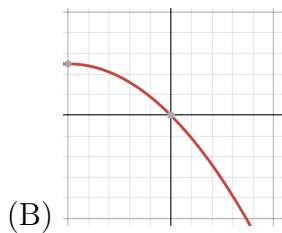
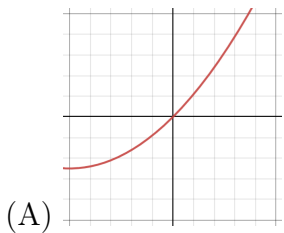
3. (6 points) Find  $\lim_{x \rightarrow 0} \left( \frac{e^{2x} + e^{-2x} - 2}{e^{2x} - 2x - 1} \right)$ .

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

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

- (A) 0      (B)  $\frac{1}{4}$       (C) 4      (D)  $\frac{1}{2}$       (E) 1      (F) Does not Exist

5. (6 points) Which choice looks most like the graph of  $y = xe^x - 2x^2$  at the point  $(0, 0)$ ?



6. (6 points) Find the absolute max of  $f(x) = \frac{\sin(x)}{2 + \cos(x)}$  on the interval  $[0, \pi]$ .

- (A) 0      (B)  $\frac{1}{2}$       (C)  $\frac{\sqrt{3}}{2}$       (D)  $\frac{\sqrt{3}}{3}$       (E)  $\frac{\sqrt{2}}{2}$       (F)  $\frac{1}{3}$

7. (6 points) Evaluate  $\int_1^2 \frac{1}{x^2} \cos\left(\frac{\pi}{x}\right) dx$ .

- (A) 0      (B)  $\frac{\pi}{2}$       (C)  $\frac{-1}{\pi}$       (D)  $\frac{2}{\pi}$       (E)  $\frac{\sqrt{2}}{\pi}$       (F) None of These

8. (6 points) Let  $R(t) = 2t + 1$  be the rate at which moss grows on a rock (measured in  $in^2/s$ .) Use 2 equal subintervals and left endpoints to estimate the amount of moss (measure in  $in^2$ ) that grows from  $t = 1$  to  $t = 7$ .

(A) 12      (B) 24      (C) 36      (D) 44      (E) 72      (F) 90

9. (6 points) If  $f(x) = \int_0^{g(x)} \sqrt{4 + t^3} dt$  and  $g(x) = \int_1^{e^{2x}} \ln(t + 1) dt$ , find  $f'(0)$ .

(A) 0      (B)  $2 \ln(2)$       (C)  $4 \ln(2)$       (D)  $6 \ln(2)$       (E)  $8 \ln(2)$       (F)  $12 \ln(2)$       (G) None of These

10. (6 points) Find  $\int_0^3 (|1 - x^2| + x^2) dx$ .

(A) 0      (B)  $\frac{16}{3}$       (C)  $\frac{34}{3}$       (D)  $\frac{49}{3}$       (E)  $\frac{58}{3}$       (F)  $\frac{65}{3}$

11. (6 points) Find  $\int_0^3 (x-1)e^{(x-1)^2} dx$ .

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

12. (6 points)  $\int_0^1 \frac{3x}{\sqrt{3x+1}} dx$

- (A)  $\frac{8}{9}$       (B)  $\frac{2}{3}$       (C)  $\frac{6}{11}$       (D)  $\frac{3}{4}$       (E)  $\frac{\sqrt{2}}{4}$       (F)  $\frac{1}{2}$

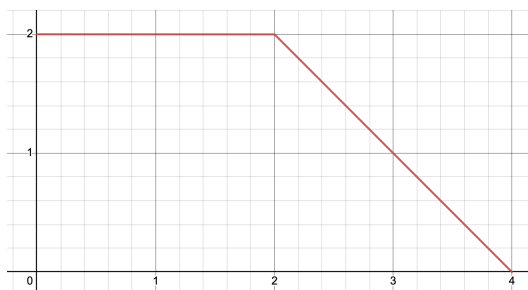
13. (6 points) Find the area bounded by  $y = x^3 - x$  and the x-axis.

- (A) 0      (B)  $\frac{1}{8}$       (C)  $\frac{1}{3}$       (D)  $\frac{1}{2}$       (E)  $\frac{3}{4}$       (F) 1

14. (4 points): True or False: The function  $f(x) = x^4 + 3x$  has an inflection point at  $x = 0$ .

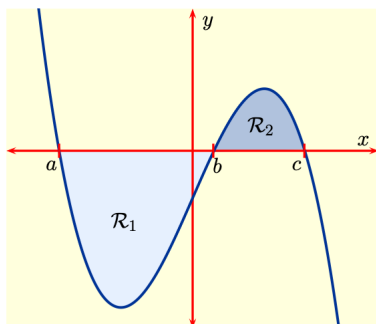
15. (4 points): True or False:  $\int_{-2}^1 \left( \frac{1}{x^2} \right) dx = -\frac{1}{2}$ .

16. (4 points): Let  $G(x) = \int_0^x f(t) dt$ , where  $f(t)$  is the function below.



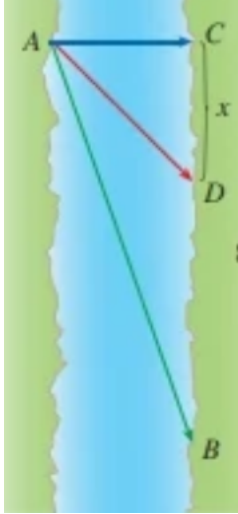
True or False: The value  $G'(2)$  does **not** exist.

17. (4 points): Let  $f$  be the function below:



True or False: The area of the two regions equals  $\left| \int_a^c f(x) dx \right|$ .

18. (10 points) A person needs to get from point  $A$  to point  $B$  (See the image below). The distance from  $A$  to  $C$  is 2 km and the distance from  $C$  to  $B$  is 8 km. The person will first swim across the river to point  $D$  at a rate of 2 km/hr and then run to  $B$  at a rate of 6 km/hr. What is the length of  $x$  that gets this person to point  $B$  the fastest?



19. (6 points) Free Response: Find  $\int \frac{1}{9+x^2} dx$ .



Multiple Choice (6 points each):

1)

2)

3)

4)

5)

6)

7)

8)

9)

10)

11)

12)

13)

True or False (4 points each):

14)

15)

16)

17)

