

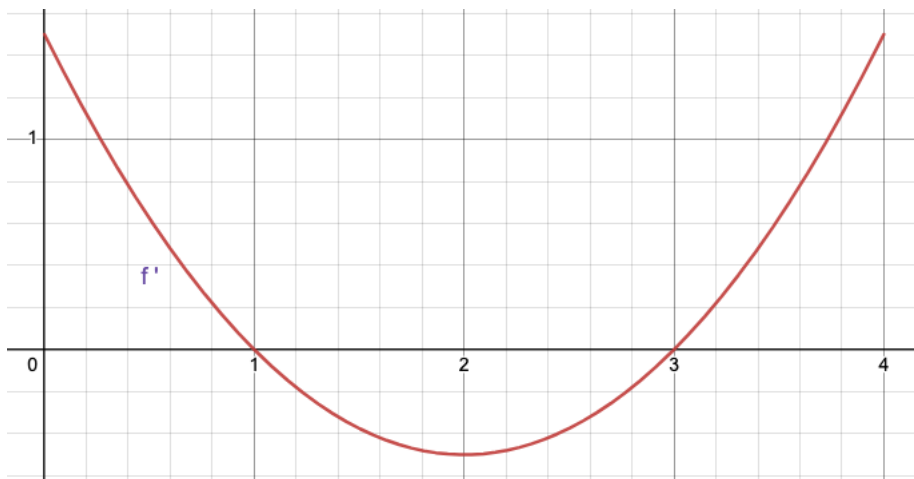
Instructions:

- 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

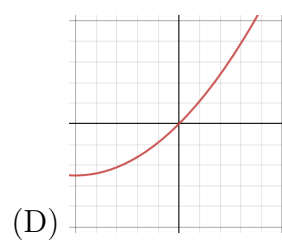
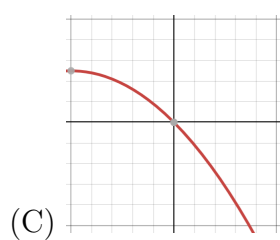
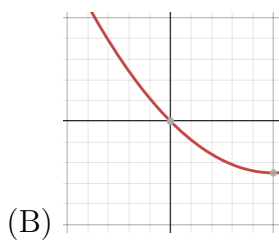
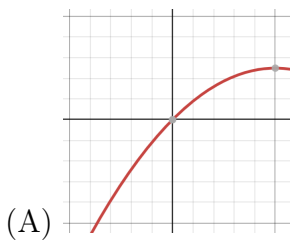
3. (6 points) Find $\lim_{x \rightarrow 0} \left(\frac{e^{2x} + e^{-2x} - 2}{e^{2x} - 2x - 1} \right)$.

- (A) 0 (B) $\frac{1}{2}$ (C) 2 (D) $\frac{3}{2}$ (E) 1 (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) $\frac{1}{2}$ (C) 4 (D) $\frac{1}{4}$ (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) $\frac{\sqrt{2}}{2}$ (E) $\frac{\sqrt{3}}{3}$ (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) 44 (C) 24 (D) 36 (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) $8 \ln(2)$ (C) $6 \ln(2)$ (D) $4 \ln(2)$ (E) $2 \ln(2)$ (F) $12 \ln(2)$ (G) None of These

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

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

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

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

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

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

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 $x = 0$.

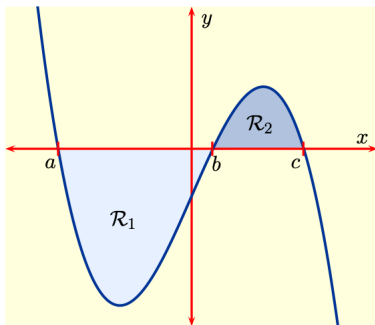
15. (4 points): True or False: $\int_{-2}^1 \left(\frac{1}{x^2} \right) dx = -\frac{1}{2}$.

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



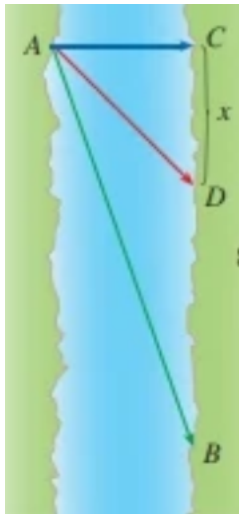
True or False: The value $G'(2)$ does **not** exist.

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 1 km and the distance from C to B is 4 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 $\int \frac{1}{4+x^2} dx$.

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)

