

Name _____ DUE DATE: _____

Directions:

- Read each problem carefully and use your knowledge of calculus to determine your answer.
- In order to receive FULL CREDIT you must either SHOW ALL WORK or EXPLAIN how you got your answer!! PLEASE NOTE: A multiple choice answer alone without any work will only receive half credit.

1) Suppose that $f(x) = \begin{cases} 2x & \text{for } x \leq 1 \\ 3x^2 - 1 & \text{for } x > 1 \end{cases}$

Then $\int_0^2 f(x) dx =$

- A. 7
- B. 6
- C. 5
- D. 2
- E. 1

2) Find the area of the region bounded by the graphs at $y = \frac{x^3 + 2}{x}$, $y = 0$, $x = 1$, and $x = e$.

- A. $\frac{e^2}{2} - \frac{4}{e} - \frac{9}{2}$
- B. $\frac{9}{2} - \frac{e^2}{2} - \frac{4}{e}$
- C. $2\sqrt{e^9} + \frac{4}{e} - \frac{38}{9}$
- D. $\frac{-5 - e^3}{3}$
- E. $\frac{e^3 + 5}{3}$

3) Given $\frac{dy}{dx} = \frac{xy}{2}$. Let $f(x)$ be the particular solution to the given differential equation with initial condition $f(0) = 3$. Use Euler's method starting at $x = 0$, with a step size of 0.1, to approximate $f(0.2)$.

4) Given $\lim_{x \rightarrow 3^+} f(x) = 2$, which of the following **MUST** be true?

- A. $f(3)$ exists
- B. $f(x)$ is continuous at $x = 3$
- C. $f(3) = 2$
- D. $\lim_{x \rightarrow 3^-} f(x) = 2$
- E. None of these must be true.

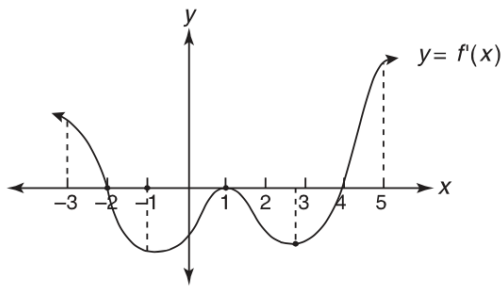
5) $\int \frac{dx}{x^2 - x - 2} =$

- A. $-\frac{1}{3} \ln \left| \frac{x+1}{x-2} \right| + C$
- B. $\ln \left| \frac{x-1}{x+2} \right|^3 + C$
- C. $-\frac{1}{x} - \ln|x| - \frac{x}{2} + C$
- D. $\frac{1}{3} - \ln \left| \frac{x-1}{x+2} \right| + C$
- E. $\ln \left| \frac{x-2}{x+1} \right|^3 + C$

6) What is $\lim_{h \rightarrow 0} \frac{e^{x+h} - e^x}{h}$?

- A. 0
- B. $\ln x$
- C. x
- D. e^x
- E. 1

7)



Above is the graph of $f(x)$. On what interval (5) is the graph of $f(x)$ concave upwards?

- A. $-3 < x < 1$ and $1 < x < 3$
- B. $-2 < x < 1$ and $1 < x < 4$
- C. $-1 < x < 3$
- D. $-1 < x < 1$ and $3 < x < 5$
- E. $-3 < x < 1$

8) If $F(x) = \int_1^x \sqrt{t^2 - t} dt$, then $F'(3) =$

- A. 6
- B. 5
- C. $\sqrt{6}$
- D. $\sqrt{5}$
- E. $\sqrt{3}$

9) $\int_4^7 \frac{1}{(x-3)^2} dx =$

A. $\frac{1}{27}$

B. $\frac{3}{4}$

C. $\frac{1}{9}$

D. $\ln 4 - \ln 3$

E. $\ln 16 - \ln 9$

10) Find the average value of $y = x^3 \sqrt{x^4 - 1}$ on the interval $[1,3]$.

A. $216\sqrt{5}$

B. $\frac{216\sqrt{5}}{3}$

C. $80\sqrt{5}$

D. $\frac{80\sqrt{5}}{3}$

E. $\frac{640\sqrt{5}}{27}$

- 11) Given two functions f and g defined by $f(x) = \tan x$ and $g(x) = \sqrt{2} \cos x$.
- (a) Find the coordinates of the point of intersection of the graphs of f and g in the interval $0 < x < \frac{\pi}{2}$.
- (b) Find the area of the region enclosed by the y -axis and the graphs of f and g .

- 12) The line $x = c$ where $c > 0$ intersects the cubic $y = 2x^3 + 3x^2 - 9$ at point P and the parabola $y = 4x^2 + 4x + 5$ at point Q .
- (a) If a line tangent to the cubic at point P is parallel to the line tangent to the parabola at point Q , find the value of c where $c > 0$.
- (b) Write the equations of the two tangent lines described in (a).