

Exam #1

February 6, 2019

Name _____

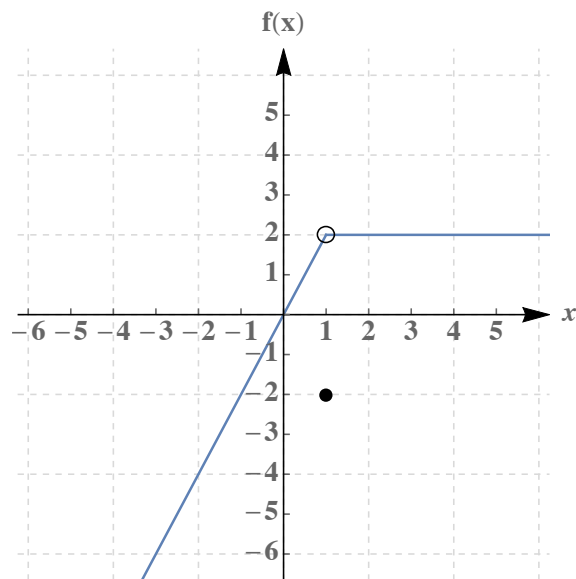
- You will be told when to begin the work and when to terminate work on the examination. You must stop when instructed. Points may be deducted in case of violations.
- Please show your work to support your answers that require calculations. Correct but unsupported answers may not be given full credit.
- The use of a cell phone or other electronic communication devices during the examination is not allowed. The exam will be canceled and a grade of "0" will be assigned to anyone who opens a cell phone during the examination or if one is found on their seat or hand.

No calculators are allowed!

Honor Code: On my honor, I have neither received nor given any aid during this examination.

Signature: _____

1. (5 points) Is the function displayed below continuous everywhere? Give reasons for your answers.



2. (5 points) Find both one-sided limits at $x = 3$ and determine if the function is continuous at $x = 3$. Support your answer.

$$f(x) = \begin{cases} 2x - 1 & \text{if } x < 3 \\ x^2 & \text{if } x > 3 \end{cases}$$

3. (5 points each) Evaluate the following limits algebraically, if they exist:

a) $\lim_{x \rightarrow 1} \frac{\sqrt{x} - 1}{x - 1}$

b) $\lim_{x \rightarrow 7} \frac{x^2 - 49}{x + 7}$

c) $\lim_{x \rightarrow \infty} \frac{x^3 - 2x + 8}{x^3 + x^2 - 1}$

d) $\lim_{x \rightarrow -\infty} \frac{-4}{x}$

4. (5 points) Is the limit of a function the same as its derivative? If yes, describe why, and if no, describe the difference between them.

5. (5 points) Find the derivative of the function using the **definition of derivative**. [You will get no credit for using the power rule for differentiation.]

$$f(x) = \sqrt{x}$$

6. (5 points) Find the points (x -coordinates are enough) where the tangent line to the function below is horizontal. $f(x) = x^3(5 + x^2)$

7. (5 points each) Differentiate the following function and simplify the derivative

(a) $f(x) = 4x^3 + 3x + \frac{\sqrt{x}}{3x} + \frac{2}{\sqrt{x}}$

(b) $f(t) = \frac{5t - 4t^3}{t^2}$

(c) $f(x) = (1 - x)(3 + x)$

8. (5 points) State the product rule for derivatives, i.e., write the formula for $(f(x) \cdot g(x))'$

9. (10 points each) Find the first and second derivative of the function and simplify your answer

(a) $f(x) = 4 - 3x + x^2$

(b) $g(t) = \frac{t^2 + 2}{t^2}$

(c) $h(x) = \sqrt{x} - \frac{1}{x^2} - x + 3$

10. (5 points) Experiments show that a human brain is continuously developing. The number of new neural connections in millions are approximated by the function below, where t is the time in years since birth

$$n(t) = 20480 + \sqrt{t} - \frac{t^2}{3}$$

Find $n'(t)$. At what rate is the number of new neural connections changing after 9th year? Is it increasing or decreasing?

11. (0 pts) How many hours in total did you study for this exam?

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14+

12. (0 pts) Do you think that you could studied better? Why? Yes No