

Final Exam Information

The final exam is due by email no later than **Thursday, December 17, at 11:59 pm**. You must work individually on the exam.

For each problem, the answer itself will be worth **up to** 2 points. Place each final answer in the box at the bottom of the corresponding problem.

For full credit, every problem must have supporting work or an explanation. Your work should support your answer. Please don't give work that supports an answer different from the one you provide. The work is worth **up to** 3 points. The supporting work will be scored as follows:

- 0 points - No work or no correct work/explanation
- 1 point - Some correct ideas and work/explanation
- 2 points - The ideas and work/explanation are mostly correct
- 3 points - The ideas, notation, and work/explanation are complete and correct

Math 131 - Final Exam

December 16, 2020

Name _____

Score _____

Show all work to receive full credit. Carefully read the directions on the preceding page. This test is due no later than December 17 at 11:59 pm.

1. (5 points) Determine the limit. Show analytically (not with a graph or table) how you got your answer.

$$\lim_{x \rightarrow 2} \left(\frac{3x + 5}{x^3 - 4x^2 + 4x} \right)$$

2. (5 points) Determine the limit. Use algebraic techniques (not a graph, table, or L'Hôpital's rule) to show how you got your answer.

$$\lim_{x \rightarrow 1} \left(\frac{7x - 7}{1 - \sqrt{x}} \right)$$

3. (5 points) Yes or No: Is f continuous at $x = 5$? Use the definition of continuity to support your answer.

$$f(x) = \begin{cases} x^2 - x - 8, & x < 5 \\ 12, & x = 5 \\ \frac{3(x - 20) + 9x}{x - 5}, & x > 5 \end{cases}$$

4. (5 points) Let $f(x) = x^2 - 5x$. Write $f'(x)$ in the box, then use the limit definition of derivative to obtain your answer.

5. (5 points) Refer to the table below. Let $h(x) = \frac{3x + p(x)}{q(x)}$ and compute $h'(2)$.

x	0	1	2
$p(x)$	3	1	5
$p'(x)$	-2	-1	-4
$q(x)$	0	4	3
$q'(x)$	8	0	-2

6. (5 points) Refer to the function p described in the table above (see the preceding problem). Let $f(x) = e^{xp(x)}$, and compute $f'(1)$.

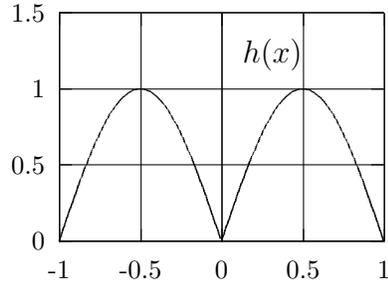
7. (5 points) An object is launched straight upward from the ground with an initial velocity of 47.3 meters per second. What is the maximum height of the object? (Ignore all forces except gravity, and use $g = 9.8$ m/sec².)

8. (5 points) Find an equation of the line tangent to the graph of $xy^2 = x^2 - 2y$ at the point $(2, 1)$.

9. (5 points) Let $g(x) = x^{3x}$. Use logarithmic differentiation to compute $g'(2)$. Round your final answer to the nearest hundredth.

10. (5 points) The graph of f passes through the point $(3, 5)$, and the tangent line at that point has slope -7 . Find the linearization of f at $x = 3$ and use it to approximate $f(2.9)$.

11. (5 points) The function f is defined on the interval $[-1, 1]$. The graph of f is shown below. Use the graph to find the critical points of f . Say why each is a critical point.



12. (5 points) Let $f(x) = \frac{1}{2}x - x^{2/3}$ on $[-1, 4]$. Use calculus to find the absolute extreme values of f .

13. (5 points) Evaluate the limit: $\lim_{x \rightarrow \infty} xe^{-x}$

14. (5 points) The functions $f(x)$ and $f'(x)$ are defined for all x . Furthermore, $f'(x)$ has exactly three zeros: $x = -3$, $x = 5$, and $x = 7$. Use the information below to find the locations (x -values) of all relative extrema.

x	-12	-6	0	6	12
$f'(x)$	3	8	2	1	-5

15. (5 points) Find the inflection points of the graph of $g(x) = 3x^5 + 5x^4 + 2x - 25$.

16. (5 points) Find $f(x)$ if $f'(x) = \frac{2}{\sqrt{1-x^2}}$ and $f(1/2) = \pi$.

17. (5 points) Some values of the function f are given below. Use 4 subintervals of equal length and left endpoints of the subintervals to compute a Riemann sum for f on $[0, 1]$.

x	0.00	0.15	0.25	0.50	0.75	0.90	1.00
$f(x)$	1.00	0.70	0.52	0.13	-0.08	-0.07	0.00

18. (5 points) Evaluate the definite integral. Write your answer in exact form.

$$\int_1^4 \left(\frac{1}{x} + e^x + \sqrt{x} \right) dx$$

19. (5 points) Use a definite integral to find the area of the bounded region between the graph of $y = x^2 - 3x$ and the x -axis. Write your answer in exact form.

20. (5 points) In order to evaluate the following integral, an appropriate u -substitution should be made. Carry out the substitution and write the new integral. Do not evaluate the new integral.

$$\int \frac{\log_7 \sqrt{x}}{\sqrt{x}} dx$$