

APPM 1340**Exam 3****Fall 2025****Name****Instructor** Richard McNamara**Section** 150

This exam is worth 100 points and has **5 problems**.

Make sure all of your work is written in the blank spaces provided. If your solutions do not fit, there is additional space at the end of the test. Be sure to **make a note** indicating the page number where the work is continued or it will **not** be graded.

Show all work and simplify your answers. Name any theorem that you use. Answers with no justification will receive no points unless the problem explicitly states otherwise.

Notes, papers, calculators, cell phones, and other electronic devices are not permitted.

L'Hôpital's Rule and dominance of powers arguments can **NOT** be used to evaluate limits on this exam.

End-of-Exam Procedure

1. Go to the designated area to scan and upload your exam to Gradescope.
2. Verify that your exam has been correctly uploaded and all problems have been labeled.
3. Hand the physical copy of your exam to a proctor.
4. Have a proctor swipe your BuffOne card.

1. (18 pts) Determine $\frac{dy}{dx}$ for each of the following. After fully differentiating, do *not* algebraically simplify your answers.

(a) $y = f(x) = \frac{1 + 5x^2}{3x - 1}$

(b) $y = g(x) = \sin^3(x^4 + 1)$

2. (26 pts) Parts (a) and (b) are unrelated.

(a) The position function of Particle P is given by $s(t) = t - \sqrt{2}\sin t$, where $0 \leq t \leq \pi$, s is in meters, and t is in seconds.

i. Find Particle P's velocity function $v(t)$. Include the correct unit of measurement.

ii. Find the distance traveled by Particle P between $t = 0$ and $t = \pi$ seconds. Fully simplify your answer and include the correct unit of measurement.

- (b) The velocity function of Particle Q is given by $v(t) = 2t^{1/2} - t^{3/2}$, where $t > 0$, v is in miles per hour, and t is in hours.
- Find Particle Q's acceleration function $a(t)$. Include the correct unit of measurement.
 - Is the velocity of Particle Q increasing, decreasing, or neither at $t = 1$? Briefly explain your answer.

3. (22 pts) Parts (a) and (b) are unrelated.

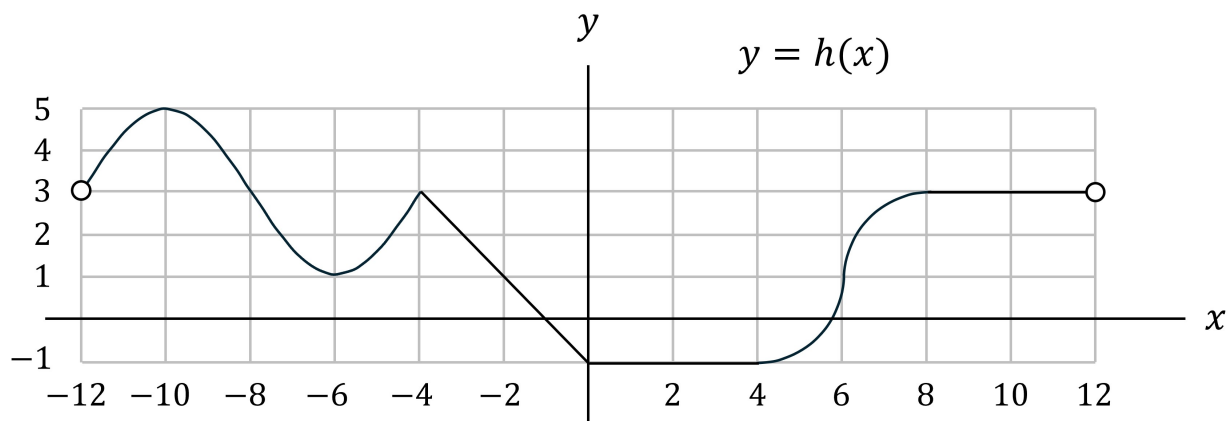
(a) Identify all values of x , if any, at which $y = u(x) = x^{-1} - 2x^{-3}$ has a horizontal tangent. If no horizontal tangents exist, clearly state “none”.

(b) Find the equations of the tangent and normal lines to the curve $y = w(x) = \tan x + 3x^2 - 7x - 1$ at $x = 0$. If there are no tangent and normal lines at that location, clearly state “none”.

4. (21 pts) Parts (a) and (b) are unrelated.

- (a) Determine $p'(x)$ for the function $p(x) = x^2 - x + 1$ by using the *definition of derivative*. You must obtain $p'(x)$ by evaluating the appropriate *limit*.

(b) The following is the graph of a function $h(x)$ on the domain $(-12, 12)$.



Answer the following, where $h'(x)$ is the derivative function of the function $h(x)$ graphed above.

- What is the value of $h'(-10)$?
- What is the value of $h'(-2)$?
- On what subintervals of $(-12, 12)$, if any, is the value of $h'(x)$ negative? If no such subintervals exist, clearly state "none".
- At what values of x on the interval $(-12, 12)$, if any, is $h(x)$ not differentiable? If no such x values exist, clearly state "none".

5. (13 pts) Find the equation of each horizontal asymptote of $y = \frac{(x+2)(3x-5)}{(4-x)(2x+3)}$, if any exist. If no horizontal asymptotes exist, clearly state “none”.

Support your answer by evaluating the appropriate limit(s). (*Reminder: You may not use L'Hôpital's Rule or dominance of powers arguments to evaluate limits on this exam.*)

END OF EXAM

Your Initials _____

ADDITIONAL BLANK SPACE

If you write a solution here, please clearly indicate the problem number.