# Math 1231 Summer 2024
# Mastery Quiz 5
# Due Wednesday, July 17

This week's mastery quiz has four topics. Everyone should submit S4 but if you already have a 4/4 on M2, or a 2/2 on S2 or S3 (check Blackboard—grades may have changed after the midterm) you don't need to submit those topics again.

Feel free to consult your notes, but please don't discuss the actual quiz questions with other students in the course.

Remember that you are trying to demonstrate that you understand the concepts involved. For all these problems, justify your answers and explain how you reached them. Do not just write "yes" or "no" or give a single number.

Please turn in this quiz in class on Wednesday. You may print this document out and write on it, or you may submit your work on separate paper; in either case make sure your name is clearly on it. If you absolutely cannot turn it in in person, you can submit it electronically but this should be a last resort.

**Topics on this quiz:**

- Major Topic 2: Computing derivatives
- Secondary Topic 2: Linear approximation
- Secondary Topic 3: Implicit differentiation
- Secondary Topic 4: Related rates

# Name:

Name:

## Major Topic 2: Computing derivatives

(a) Compute $\dfrac{d}{dt}\sqrt[5]{\dfrac{\tan^2(t^2+1)+2}{\sin(2t)-2t}}$

(b) Compute $\dfrac{d}{dx}x^2\sin\left(\sqrt{x^3+x}\right)$

## Secondary Topic 2: Linear approximation

(a) Give a formula for a linear approximation to $f(x)=\sin(x^2-3x)$ near $a=0$.

(b) Give a formula for a linear approximation of $g(x)=\sqrt{x^3+1}$ near the point $a=2$, and use your answer to estimate $g(2.1)$.

## Secondary Topic 3: Implicit differentiation

(a) Find a formula for $y'$ in terms of $x$ and $y$ if $xy^3=\sqrt{x^2+y^2}$.

(b) Find a formula for the second derivative $y''$ in terms of $x$ and $y$ if $\sin(y)=x^2+y$. (Your answer should not contain $y'$.)

## Secondary Topic 4: Related rates

A snowball is melting such that its surface area is decreasing at $1\text{cm}^2/\text{min}$. When the radius is 8cm, how quickly is the radius decreasing? (It might be useful to recall that the surface area of a sphere of radius $r$ is $4\pi r^2$.)