

Math 1232 Fall 2024  
Single-Variable Calculus 2 Section 11  
Mastery Quiz 3  
Due Monday, September 16

This week's mastery quiz has one topic. Everyone should submit it.

Don't worry if you make a minor error, but try to demonstrate your mastery of the underlying material. 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 this quiz in class on Monday. 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 and recitation section are 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 1: Calculus of Transcendental Functions

**Name:**

**Recitation Section:**

## M1: Calculus of Transcendental Functions

(a) Compute  $\frac{d}{dx} \cos(x)^{\sin(x)}$

**Solution:**

$$\begin{aligned} y &= \cos(x)^{\sin(x)} \\ \ln|y| &= \sin(x) \ln |\cos(x)| \\ y'/y &= \cos(x) \ln |\cos(x)| + \sin(x) \frac{-\sin(x)}{\cos(x)} \\ y' &= \cos(x)^{-\sin(x)} \left( \cos(x) \ln |\cos(x)| - \frac{\sin^2(x)}{\cos(x)} \right) \end{aligned}$$

(b)  $\int \frac{x}{9+x^4} dx =$

**Solution:** We can factor a 9 out to get  $\frac{1}{9} \frac{x}{1+x^4/9}$ . Then we set  $u = x^2/3$ , and  $du = 2x/3 dx$ , and we have

$$\begin{aligned} \int \frac{x}{9+x^4} dx &= \int \frac{1}{9} \frac{x}{1+u^2} \frac{3}{2x} du \\ &= \int \frac{1}{6} \frac{1}{1+u^2} du \\ &= \frac{1}{6} \arctan u + C = \frac{1}{6} \arctan(x^2/3) + C. \end{aligned}$$

(c)  $\int \frac{e^{3y}}{e^{3y}+5} dy =$

**Solution:** Set  $u = e^{3y} + 5$  so  $du = 3e^{3y} dy$ , and we have

$$\int \frac{e^{3y}}{e^{3y}+5} dy = \int \frac{du}{3u} = \frac{1}{3} \ln |u| + C = \frac{1}{3} \ln |e^{3y} + 5| + C.$$