

Math 212 Mock Test 1

Quarantine, day 58.

Name: _____

Note that both sides of each page may have printed material.

If you could read the directions
before asking me a question



Instructions:

1. Read the instructions.
2. Panic!!! Kidding, don't panic! I repeat, **do NOT panic!**
3. Complete all problems in the actual test. Bonus problems are, of course, optional, and will only be counted if all other problems are attempted.
4. **You have 90 minutes to complete the test.**
5. Show ALL your work to receive full credit. You will get 0 credit for simply writing down the answers (unless it's a case of fill in the blank or state a definition, etc.)
6. Write neatly so that I am able to follow your sequence of steps and box, or otherwise indicate, your answers. Solutions with no indicated answer or several contradictory answers will be considered incorrect.
7. Read through the exam and complete the problems that are easy (for you) first!
8. You are NOT allowed to use notes, calculators, or other aids—including, but not limited to, divine intervention/inspiration, the internet, telepathy, knowledge osmosis, the smart kid that may be sitting beside you or that friend you might be thinking of texting.
9. In fact, **cell phones should be out of sight! If you are caught with a cellphone you will be asked to leave the exam and you'll be given a zero. That goes for smart watches too!**
10. Use the correct notation and write what you mean! x^2 and $x2$ are not the same thing, for example, and I will grade accordingly.

Other than that, have fun and good luck!

Corona virus: *exists*

The guy from the math
problem buying 369 rolls
of toilet paper:



1. Compute the following integrals (5 points each):

(a) $\int \tan^3 \theta \sec^3 \theta \, d\theta$

(b) $\int_0^{\pi/2} t^2 \cos t \, dt$

(c) $\int \frac{x^3 - 1}{x^3 + x} dx$

2. Approximate the integral below using 4 subintervals and:

$$\int_{-1}^1 (x^2 + 1) dx$$

(a) The Simpson's rule (5 points):

(b) Compare your estimate with the exact value of the integral. (5 points)

3. For each of the integrals below determine, with justification, whether they converge or diverge. If convergent, say what they converge to (10 points each)

$$(a) \int_2^{\infty} \frac{2}{x^2 - x} dx$$

$$(b) \int_1^{\infty} \frac{1}{\sqrt{x^5 + 2}} dx$$

4. (5 points each) For each of the following series, state, with justification, whether the series converges absolutely, conditionally, or diverges.

$$(a) \sum_{n=1}^{\infty} \frac{(-1)^n n}{3n^2 + n + 1}$$

$$(b) \sum_{n=2}^{\infty} \frac{2^n + 5}{3^n}$$

$$(c) \sum_{n=1}^{\infty} \frac{\cos(n^2)}{n \sqrt{n}}$$

5. (10 points) Find the radius of convergence and the interval of convergence of $\sum_{n=0}^{\infty} \frac{(-1)^n (x-3)^n}{2^n}$

6. (a) (5 points) Use a known power series to find a power series for
 $f(x) = \sin x^2$

- (b) (10 points) Using your answer above, find $\int_0^1 \sin x^2 dx$ with an error less than 0.01.

- (c) (5 points) Justify that your answer above has the desired accuracy.

7. (10 points) Suppose $f(x) = \sqrt{x}$. Find the third degree Taylor polynomial of $f(x)$ centered at $x = 1$.

(The actual test will have bonus problems in this section—to have a good shot at them, aim to finish the test 10 to 15 minutes early.)

