

Final exam: Study guide

General information

The final exam will be held in the regular classroom (Badgley 146) from 8 AM to 9:30 AM on Wednesday, December 14, 2022. It is a closed book exam. A single sided, handwritten, 3" x 5" note card is allowed. A scientific calculator is allowed. Graphing/programmable/transmittable calculators are not allowed.

The exam has a *mandatory* section and a *bonus* section. The mandatory section has 8 multiple choice questions and 3 free response questions, constituting 25% of the total course credit (as written in the syllabus). The bonus section has 8 multiple choice questions, constituting a bonus of 8% of the total course credit.

The mandatory problems cover Section 2.5 - 3.6 of the textbook. The bonus problems may ask you anything from the beginning of the course.

Review

You should review the homework problems, worksheet problems, read examples in the lectures and textbook. It is always a good idea to study for the exam with someone. The types of problems you may be asked on the exam include:

- Find derivatives of a function using the chain rule.
- Perform implicit differentiation.
- Find a linear approximation of a function.
- Find differentials.
- Find critical numbers, local minimum/maximum, global minimum/maximum of a function.
- Use Second Derivative test to classify critical numbers.
- Use Rolle's theorem and Mean Value Theorem to show existence/uniqueness of roots or to show inequalities.
- Graph a function using Calculus.
- Use Newton's method to approximate roots.

Additional problems to practice

1) Calculate y' .

(a) $y = \left(x + \frac{1}{x^2}\right)^{\sqrt{2}}$

(b) $y = x^2 \sin(\pi x)$

(c) $y = \frac{\cos(x^2-1)}{x^2+1}$

(d) $xy^4 + x^2y = x + 3y$

2) The circumference of a sphere was measured to be 84 cm with a possible error of 0.5 cm.

- (a) Use differentials to estimate the maximum error in the calculated surface area. What are the possible absolute and relative errors?

- (b) Use differentials to estimate the maximum error in the calculated volume. What are the possible absolute and relative errors?

3) Let

$$f(x) = \frac{x - 1}{x^2 - x + 1}$$

- (a) Determine the domain of the function.
- (b) Determine the x -intercept(s) and y -intercept.
- (c) Determine the vertical and horizontal asymptotes if any exist.
- (d) Determine all the critical numbers of the given function.
- (e) Draw a fluctuation chart of the function.
- (f) Sketch the graph of the function based on the above information.
- 4) Find the maximum and minimum values of the function in Problem 3 on the interval $[-3, 3]$.
- 5) Let $f(x) = x - \sin x$, where $x \in [0, 4\pi]$.
- (a) Find all the critical numbers of f on the interval $[0, 4\pi]$.
- (b) Use Second Derivative test to classify the critical numbers found in Part a.
- (c) Find the intervals of concavity and the inflection points.
- 6) Use Newton's method to find the largest root of $x^4 - 2$ with allowable error 0.0001.