



Center for Academic Resources in Engineering (CARE) Peer Exam Review Session

Math 220/221 — Calculus I

Midterm 6 Worksheet

The problems in this review are designed to help prepare you for your upcoming exam. Questions pertain to material covered in the course and are intended to reflect the topics likely to appear in the exam. Keep in mind that this worksheet was created by CARE tutors, and while it is thorough, it is not comprehensive. In addition to exam review sessions, CARE also hosts regularly scheduled tutoring hours.

Tutors are available to answer questions, review problems, and help you feel prepared for your exam during these times:

Session 1: Apr 24, 4-5:30pm Justin and Bhagya Session 2: Apr 25, 4-5:30pm Cindy and Stef

Can't make it to a session? Here's our schedule by course:

<https://care.engineering.illinois.edu/tutoring-resources/tutoring-schedule-by-course/>

Solutions will be available on our website after the last review session that we host, as well as posted in the Zoom chat 30 minutes prior to the end of the session

Step-by-step login for exam review session:

1. Log into [Queue @ Illinois](#)
2. Click "New Question"
3. Add your NetID and Name
4. Press "Add to Queue"
5. Join the Zoom link in the staff message

Please do not log into the Zoom call without adding yourself to the queue

Good luck with your exam!

1. Evaluate each of the following limits:

(a)

$$\lim_{x \rightarrow \infty} \frac{2 \ln(x)}{\sqrt[3]{x}}$$

(b)

$$\lim_{x \rightarrow 0} \frac{e^{10x} - 1}{5x}$$

(c)

$$\lim_{x \rightarrow \infty} \frac{e^{10x} - 1}{5x}$$

2. Check if the Fundamental Theorem of Calculus applies, then evaluate the given integral if it does.

(a)

$$\frac{d}{dx} \int_{-\pi/2}^x \sin(t) dt, \quad x \in [-\pi, \pi]$$

(b)

$$\frac{d}{dx} \int_{-5}^x \frac{1}{t} dt, \quad x \in [-5, 3]$$

3. Evaluate the following indefinite integral:

$$\int \frac{\sin^2(x)}{\sec(x) \csc^4(x)} dx$$

4. Evaluate the indefinite integral:

$$\int \frac{e^{9x}}{e^{18x} + 1} dx$$

5. At t hours, a population of bacteria is growing at a rate of

$$r(t) = \frac{21e^{t^{1/2}}}{t^{1/2}} \text{ bacteria per hour}$$

Compute the change in population size between times $t = 169$ s and $t = 225$ s. Simplify your answer.

6. Express the definite integral as the limit of Riemann Sums. Do not evaluate the limit.

$$\int_{-3}^5 x^2 e^{\sin(x)} dx$$

NOTE: All problems after part (a) of the following problem may be relevant for the Final Exam, but they are not covered on Exam 6.

7. Let R be the finite region bounded by the graphs of $y = 3\sin(x)$, $y = 6$, and $x = \pi$. Set up, but do not evaluate, definite integrals which represent the following quantities. Integrate with respect to x .
- (a) The area of the region, R .
 - (b) The volume of the solid formed when R is revolved around the line $y = 8$.
 - (c) The volume of the solid formed when R is revolved around the line $x = -2$.
8. Find the average value of the function below on the interval $[1, 9]$. Simplify.

$$f(x) = \frac{8x}{x^2 + 9}$$

9. Some of the values of a polynomial $f(x)$ are shown below in the table. If $g(x) = 8xf'(x^2)$, then find the average value of $g(x)$ on the interval $[0, 2]$. Simplify your answer.

x	$f(x)$
0	3
1	5
2	8
3	13
4	21
5	34
6	55
7	89
8	144
9	233

10. Use a linear approximation to estimate

$$\ln\left(\frac{95}{100}\right)$$

Write your answer as either a simplified fraction or a decimal value.