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

Math 231E — Engineering Calculus

Midterm 3 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: Nov. 15, 2-3:20pm Norita and Yash

Session 2: Nov. 16, 3-4:20pm Grace and Sushrut

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

https://care.grainger.illinois.edu/tutoring/schedule-by-subject

Solutions will be available on our website after the last review session that we host.

Step-by-step login for exam review session:

1. Log into Queue @ Illinois: https://queue.illinois.edu/q/queue/844
2. Click "New Question"
3. Add your NetID and Name
4. Press "Add to Queue"

Please be sure to follow the above steps to add yourself to the Queue.

Good luck with your exam!

1. Test the following improper integral for convergence. If it converges, find the value

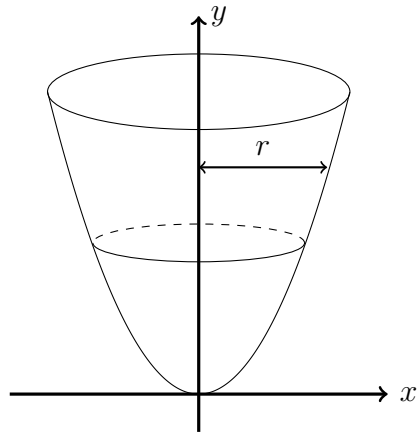
$$\int_0^\infty e^{-\frac{4}{3}y} dy$$

(a) Diverges
(b) Converges, value is $-\frac{3}{4}$
(c) Converges, value is $\frac{4}{3}$
(d) Converges, value is $\frac{3}{4}$
(e) None of the above

2. Which of the following integrals best represents the length of the curve $y = \cos(x)$ between $x = 0$ and $x = 1$?

(a) $\int_0^1 \sqrt{1 + \cos^2(x)} dx$
(b) $\int_0^1 \sqrt{1 + \sin^2(x)} dx$
(c) $\int_0^1 x\sqrt{1 + \cos^2(x)} dx$
(d) $\int_0^1 x \sin(x)$
(e) $\int_0^1 x\sqrt{1 + \sin^2(x)} dx$

3. The figure below represents the calculation of the volume of solid of revolution. Which of the following integrals most closely represents the calculation of the volume as represented in the figure?



(a) $\int_0^1 \pi y^2 dx$

(b) $\int_0^1 \pi x^2 dy$

(c) $\int_0^1 2\pi xy dx$

(d) $\int_0^1 2\pi xy dy$

(e) None of the above

4. Compute the arc length of the function $y = 1 + 2x^{\frac{3}{2}}$ between $x = 0$ and $x = 1$

(a) $\frac{14}{9}$

(b) $\frac{10}{9}$

(c) $\frac{2}{9}\sqrt{10}$

(d) $\frac{2}{27}(10\sqrt{10} + 1)$

(e) None of the above

5. For which value of C does the following series converge?

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

(a) It does not converge for any value of C.
(b) $\frac{1}{2}$
(c) 1
(d) $\frac{1}{3}$
(e) 0

6. If $a_n = 3 + \frac{\ln(n)^6}{\sqrt{n}}$, then the sequence a_n:

(a) Converges to 3.
(b) Diverges to infinity.
(c) Diverges, but not to infinity.
(d) Converges to 6.
(e) Converges to 4.

7. Determine if the series converges of diverges.

8. Determine if the following integral converges or diverges

$$\int_1^{\infty}\frac{x^3+12x-2}{x^6+5x^5+3x^2-1}dx$$

9. Which of the following expressions best represents the volume of the solid of revolution found by rotating the area between the curve $y = 1 + x^2 - 2x^4$ and the x-axis for x on the interval (0,1) around the y-axis?

(a) $2\pi \int_0^1 x\sqrt{1 + (2x - 8x^3)^2}dx$

(b) $2\pi \int_0^1 \sqrt{1 + (2x - 8x^3)^2}dx$

(c) $2\pi \int_0^1 (x + x^3 - 2x^5)dx$

(d) $2\pi \int_0^1 (1 + x^2 - 2x^4)dx$

(e) $2\pi \int_0^1 y\sqrt{1 + (2x - 8x^3)^2}dx$

10. Determine the type of integral (proper, improper, type I, or type II), and point(s) that make the integral fall under that classification.

$$\int_2^3 \frac{\sin(x)}{x^2 - 3x + 2}dx$$

(a) Type I

(b) Proper

(c) Type II - integrand undefined at $x = 2$

(d) Type II - integrand undefined at $x = 2$ and $x = 3$

(e) Type II - integrand undefined at $x = 3$

11. Determine which of the following is true about the series:

$$\sum_{n=0}^{\infty} \frac{(-1)^n}{n^2}$$

(a) Not enough information to make a determination

(b) The series converges to $\frac{2}{5}$

(c) The series diverges

(d) The series converges absolutely

(e) The series converges only conditionally

12. Find the sum of the geometric series:

$$12 + 12\left(\frac{7}{19}\right) + 12\left(\frac{7}{19}\right)^2 + 12\left(\frac{7}{19}\right)^3 ...$$

(a) 20
(b) 8
(c) 19
(d) 14
(e) $\frac{7}{19}$

13. Find the sum of the series:

$$\sum_{n=0}^{\infty} \frac{\cos^n(x)}{3^n}$$

(a) $\frac{3}{3-\cos(x)}$
(b) $\frac{1}{3-\cos(x)}$
(c) $\frac{2}{3-\cos(x)}$
(d) $\frac{3}{3-\sin(x)}$
(e) $\frac{1}{3-\sin(x)}$

14. Determine the value of the series, if it converges:

$$\sum_{n=1}^{\infty} \frac{5^{n+2}}{6^n}$$

(a) 64
(b) The series diverges
(c) 2
(d) 125
(e) 25

15. Does the series converge or diverge?

$$\sum_{n=1}^{\infty} e^{\frac{3}{n}}$$