TEXAS A&M UNIVERSITY
Math Learning Center

Math 152 - Spring 2024
Final Exam Review
"Hands On Grades Up"
Wednesday, May 1 , 4-6 PM
ILCB 229

PLEASE SCAN THE QR CODE BELOW

We will begin at 4PM. A problem will be displayed on the table monitors. Collaborate with your table on how to solve each problem. If you have a question, raise your hand. At the end of a predetermined number of minutes, the solutions will be displayed on the wall monitors. Feel free to take a picture of the solution, as the solutions are not posted. Be sure you write clearly in the free response questions, and justify each step with well written mathematics to avoid losing partial credit!

In order for us to cover as much content as possible, many of the questions will focus on the *set up*. In addition, since exam 3 was just a few weeks ago, we will focus more on Exam 1 and Exam 2 material, as well as Chapter 10 material.

Problem 1. Find the sum of the series: $\sum_{n=0}^{\infty} \frac{(-1)^n + 3^{n+1}}{2^{2n}}$.

Problem 2. Explain why the integral is improper. Evaluate it, or explain why it diverges.

$$\int_1^2 \frac{x^2}{x^2-4}\,dx$$

Problem 3. The base of a solid is the region bounded by the curve $y = 9 - x^2$ and the x-axis. Cross sections perpendicular to the y-axis are rectangles with height equal to twice the base. Set up but do not evaluate an integral that gives volume of the solid.

Problem 4. A 300 foot rope that weighs 100 pounds hangs over the edge of a building. At the end of the rope, there is a bag of cement that weighs 65 pounds. How much work is done in pulling the rope and cement to the top of the building?

Problem 5. Find the area of the region R bounded by graph of $y = \sin^3 x$, the x axis, from $x = 0$ to $x = \dfrac{\pi}{2}$.

Problem 6. Find the area of the region that is bounded by $r = 2\cos\theta$, $0 \leq \theta \leq \dfrac{\pi}{6}$.

Problem 7. Evaluate $\int_0^{\pi} \cos^2(2x) \sin^2(2x)\, dx$

Problem 8. The region bounded by $x = y^2$ and $x = 9$ is revolved around the line $x = 9$. Set up an integral that gives the resulting volume using

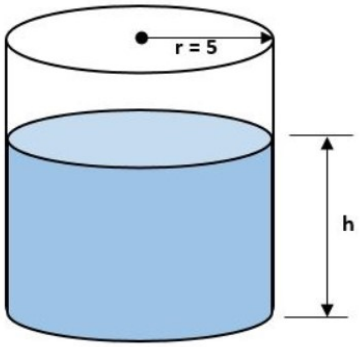
a.) The method of disks. Do not evaluate the integral.

b.) The method of shells. Do not evaluate the integral.

Problem 9. A spring has a natural length of 1 foot. The force done in holding the spring to 2 feet is 75 pounds. What is the spring constant? How much work is done in stretching it from 3 feet to 4 feet?

Problem 10. Find the length of the curve $y = t^2$, $x = t^3$, $0 \leq t \leq 1$.

Problem 11. Consider the tank in the shape of cylinder of radius 5 feet and height of 8 feet. If the tank is initially full water to a height of $h = 3$ feet, find the work done in pumping the water to the top of the tank. Use $\rho g = 62.5$ pounds per cubic foot for the weight density of water.



Problem 12. Find the integral that gives area of the surface obtained by rotating the curve $x = t\sqrt{t}$, $y = t^2$, $0 \leq t \leq 1$,

a.) About the y-axis. Do not evaluate the integral.

b.) About the x-axis. Do not evaluate the integral.

Problem 13. Determine whether the improper integral converges or diverges: $\displaystyle\int_2^\infty \frac{1}{x + e^{4x}}\, dx.$

Problem 14. Consider $\sum_{n=1}^{\infty} a_n$. If the n^{th} partial sum of the series is $s_n = e^{(2+n)^{-1}} + 4$,

a.) Find the sum of the series.

b.) Find a_6.

Error Estimates

Problem 15. Estimate the error in using the sum of the first 10 terms to approximate $\sum_{n=1}^{\infty} \frac{(-2)^n}{n!}$.

Problem 16. Estimate the error in using the sum of the first 5 terms to approximate $\sum_{n=1}^{\infty} \frac{1}{n^4}$.

Problem 17. Write a Maclaurin series for the function $f(x)$ given that $f'(x) = x^3 \arctan(x^5)$.

Problem 18. Find $\int x^9 e^{x^5}\, dx$

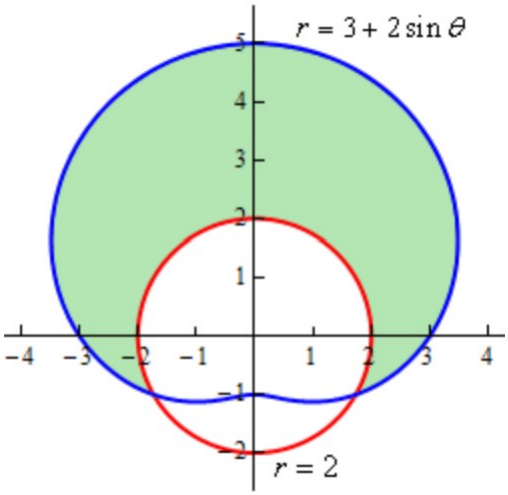
Problem 19. $\int \tan^3 x \sec^5 x \, dx$

Problem 20. Determine whether $\sum \dfrac{(-1)^n \ln(n+1)}{n+1}$ converges conditionally, converges absolutely, or diverges. Name the test used.

Problem 21. Sketch the graph of $x = 2\cos(2\theta)$ and $y = 8\sin(2\theta)$, $0 \leq \theta \leq \dfrac{\pi}{2}$ and include the direction of the curve.

Problem 22. Find $\displaystyle\int \frac{2x+8}{(x-1)(x^2+4)}\,dx$

Problem 23. Set up but do not evaluate an integral that calculates the area of the shaded region.



Problem 24. Find $\displaystyle\int_{\sqrt{2}/2}^{1} \frac{1}{x^2\sqrt{4x^2-1}}\,dx$

Problem 25. Find $\displaystyle\int_1^e \frac{\ln x}{x^2}\,dx$

Problem 26. Find the Taylor Series for $f(x) = \dfrac{1}{x^3}$ at $a = 2$.

Problem 27. Find the sum of the series $\sum_{n=2}^{\infty} \frac{(-1)^n 3^{n+1}}{n!}$.

Problem 28. Write a Maclaurin series for the function $f(x) = \dfrac{x^3}{(1-4x)^2}$.

Problem 29. Expand the Macuaurin series of $\sin(x^2)$ to degree 10. Then, use this 10th degree Maclaurin polynomial to approximate $\displaystyle\int_0^1 \sin(x^2)\,dx$.

Problem 30. Find the second degree Taylor Polynomial for $f(x) = e^x$ at $x = 1$ and use it to approximate $\sqrt{e}$