# Final Exam Information

The final exam is due in Blackboard by **Saturday, May 16, at 8 am**. You must work individually on the exam.

Each answer on the final has the form of a single number, a single mathematical expression, or a short phrase. The answer itself will be worth **up to** 2 points. Place each final answer in the box at the bottom of the corresponding problem. When giving decimal answers, round your final answer to 5 decimal places. Any intermediate computations should be rounded to more places so that the answer is correct to 5 places.

For full credit, every problem should have supporting work or an explanation. Your work should support your answer. Please don't give work that supports an answer different from the one you provide. The work is worth **up to** 3 points. The supporting work will be scored as follows:

- 0 points - No work or no correct work/explanation
- 1 point - Some correct ideas and work/explanation
- 2 points - The ideas and work/explanation are mostly correct
- 3 points - The ideas, notation, and work/explanation are correct

# Math 132 - Final Exam

Name ____________________________

May 12, 2020

Score ___________

**Show all work to receive full credit**. This test is due no later than May 16 at 8 am.

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1. The region bounded by the graphs of $y = e^x$, $y = 5$, and $x = 0$ is rotated about the $x$-axis to form a solid. Set up the definite integral that gives the volume of the solid. Then use your calculator (or computer) to evaluate the integral.

2. The bounded region between the graph of $f(x) = -x^2 + 3x - 2$ and the $x$-axis is rotated about the line $x = 2$ to form a solid. Set up the definite integral that gives the volume of the solid. Then use your calculator (or computer) to evaluate the integral.

3. A 15-foot chain weighing 4 pounds per foot is lying on the ground. How much work is required to raise one end of the chain to a height of 15 feet so that it is hanging fully extended?

4. A thin plate lies in the 1st quadrant bounded by the graphs of $y = x + 1$, $y = 1$, and $x = 2$. The density of the plate at the point $(x, y)$ is given by $\rho(x) = 2 + \sqrt{x}$. Set up the definite integral that gives the moment about the $x$-axis. Do not evaluate.

5. Integrate: $\displaystyle\int x^5 \ln x \, dx$

6. Given the definite integral $\int_0^3 \frac{x^3}{\sqrt{x^2+9}}\,dx$, carry out the appropriate trigonometric substitution (including the integration bounds), simplify the new integrand, and stop. Do not evaluate.

7. Determine the partial fraction decomposition of $\frac{12-5x-2x^2}{(x+1)(x^2+4)}$.

8. Use the trapezoid rule with five subintervals ($n = 5$) to approximate $\int_0^1 e^{x^2}\,dx$.

9. Explain why the series $\sum_{n=0}^{\infty} 1$ diverges. Do not apply a test, but rather use what it means for a series to converge or diverge.

10. Carefully read the integral test in the class notes. In order to apply the integral test to the series $\sum_{n=0}^{\infty} \frac{1}{n^2 - 3n + 4}$, what improper integral must be evaluated? Do not evaluate.

11. You plan to use the limit comparison test to determine the convergence or divergence of the series $\sum_{n=1}^{\infty} \frac{n^2 - n + 4}{2n^3 + 17n}$. What is a good series to use for your comparison, and will it show convergence or divergence?

12. Give an example of a series that converges conditionally, and name the tests you would use to prove it.

13. Find the radius of convergence of the power series $\sum_{n=0}^{\infty} \frac{(2x-1)^n}{4^n n}$.

14. Find a power series for $f(x) = \frac{1}{1+x} - \frac{1}{1-x}$.

15. Determine the 3rd Maclaurin polynomial for $g(x) = \sqrt{x+1}$. Then use it to approximate $g(0.25)$.

16. Determine the Maclaurin series for $f(x) = e^{x/2}$.

17. Eliminate the parameter $\theta$ to obtain an equation in $x$ and $y$. Describe the graph of the resulting equation.

$$x = 2 - 3\sin\theta, \qquad y = -5 + 3\cos\theta$$

18. The parametric equations $x = \cos t$, $y = \sin t$ describe the unit circle. If we use the area formula for parametric curves to compute the area of the unit circle, we get

$$\int_0^{2\pi} (\sin t)(-\sin t)\, dt = -\pi.$$

Why is the answer negative?

19. Convert the point $(x, y) = (-3, 2)$ to polar coordinates.

20. Set up the definite integral that gives the length of one petal of the rose curve defined by the polar equation $r = 4\sin(2\theta)$. Do not evaluate.