Saint Mary's University
Department of Mathematics
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Math 1251: Calculus for Life Sciences II

Midterm Test

February 28, 2018

Instructor: J. Irving

Instructions:

- *No electronic devices, or aids of any kind, are permitted.*
- *There are 4 pages plus this cover page. Check that your test paper is complete.*
- *There are a total of 60 points. The value of each question is indicated in the margin.*
- *Answer in the spaces provided, using backs of pages for additional space if necessary.*
- *Show all your work. Insufficient justification will result in a loss of points.*

Page	**Maximum**	**Your Score**
1	19	
2	13	
3	12	
4	16	
Total	**60**	

1. Compute:

[7] (a) $\displaystyle\int \left(1 - \frac{x}{2} + \frac{3}{x} - 4x^4 + \frac{5}{\sqrt[3]{x}} - e^{6x} + \sin 7x\right) dx$

[4] (b) $\displaystyle\int_0^1 t^2(1 - \sqrt{t})\, dt$

[8] 2. Find the area of the region bounded between the curves $y = x + 1$ and $y = x^2 - x - 2$. Your solution should include an appropriately labelled sketch of the region.

[4] 3. Approximate $\int_1^3 \sqrt{1+x}\,dx$ by a Riemann sum with $N = 4$ subintervals, using right-endpoints.

Do not evaluate the sum!

4. Give expressions in terms of definite integrals for the following.

Do not evaluate your integrals!

[3] (a) The distance travelled over the first 10 seconds by a particle moving in a straight line whose velocity after t seconds is $1 - e^{-t}$ m/s.

[3] (b) The volume of the solid obtained by revolving the portion of the curve $y = \ln x$ between $x = 1$ and $x = e$ around the x-axis.

[3] (c) The average value of the function $f(x) = \sqrt{1+x^2}$ over the interval $[1, 4]$.

[4] 5. Compute $\dfrac{\partial}{\partial x}\, xy^2 \sin(yx^3)$.

[8] 6. Find all critical points of $f(x, y) = 10 - x^2 + 2xy - 3y^2 - 4x + 16y$ and use the second derivative test to classify them as maxima, minima, or neither. **Clearly explain your reasoning.**

7. Compute:

[5] (a) $\displaystyle\int_0^1 \frac{x^3}{(1+3x^4)^2}\,dx$

[5] (b) $\displaystyle\int xe^{2x}\,dx$

[6] 8. The region R of the (x, y)-plane is shaded in the sketch below. Find the volume of the solid over R that is bounded above by $f(x, y) = 1 - 2x^2y$.