

Mathematics 1501 Hour Examination

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Directions: Do all problems. Show your work and justify your answers. Calculators are allowed, but this is a closed book examination. **Put your name and your recitation leader's name on EACH page of your examination.**

1 (54) Calculate each of the following derivatives and integrals.

a. $\int_0^2 x^2(x^3 + 1)^2 dx$

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b. $\int \frac{\sin \sqrt{1+x}}{\sqrt{1+x}} dx$

c. $\int_0^\pi \cos^2 x \sin x dx$

1. (continued) Calculate each of the following derivatives and integrals.

d. $\int_{-\sqrt{\pi}}^{\sqrt{\pi}} x \sin(3x^2) dx$

e. $\int \tan^2 t dt$ [Hint: recall that $\sec^2 x = 1 + \tan^2 x$.]

f. $\frac{d}{dx} \left(\int_0^{3x} \cos 7t dt \right)$

2. (16) Let A be the area of the bounded region enclosed by the parabola $y = (x - 2)^2$ and the line $y = 2x - 1$.

a. Write A as an integral of the form $\int_a^b [f(x) - g(x)] dx$.

b. Compute the value of the area A .

3. (6) Consider the integral $\int_3^5 \sin^2 x dx$. Use the properties of the integral to show that this integral lies between 0 and 2. **Note:** Do **not** compute some approximation on your calculator and claim that this approximation lies between 0 and 2; the directions **require** you to use the properties of the integral.

4. (24) Let R denote the bounded region in the plane which lies between the line $y = 4$ and the parabola $y = (x - 2)^2$. Let S be the solid generated by revolving R around the x -axis.

a. Express the volume of the solid S as an integral.

a. What is the numerical value of the volume of the solid S ?