

Name: \_\_\_\_\_

TA's Name: \_\_\_\_\_

**Instructions:** You must show supporting work to receive full and partial credits. No text book, notes, formula sheets allowed.

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**1(15pts)** Use trigonometric substitution to find  $\int \sqrt{a^2 - x^2} dx$ .

**2(10pts)** Find the length of the curve  $y = x^{3/2}$  between  $x = 0$  and  $x = 4$ .

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**3(10pts)** Let  $R$  be the region enclosed by  $y = \sin x$  and  $y = \frac{1}{2} + \frac{6}{10\pi}(x - \frac{5\pi}{6})$  with  $x \geq 0$ . Sketch the region and use the method of shell to set up an integral whose value gives the volume of the solid obtained by revolving the region  $R$  about the  $y$ -axis. **Do not evaluate the integral.**

**4(10pts)** A solid lies between the planes perpendicular to the  $x$ -axis at  $x = -1$  and  $x = 1$ . The cross-sections perpendicular to the  $x$ -axis are circles whose diameters stretch from the curve  $y = -1/\sqrt{1+x^2}$  to  $y = 1/\sqrt{1+x^2}$ . Find the volume of the solid.

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**5(15pts)** It is thought that, at construction, the Great Pyramid of Giza was 481 ft tall and 756 ft wide at its base. It was made of limestones weighing between 131.1 and 162.9 lbs per cubic foot. Find the minimal amount of work needed to build the pyramid, not counting the work to transport the limestones.

**6(15pts)** Find the partial fraction for the rational function  $\frac{x^3 + 6x^2 + 3x + 2}{x^2(x^2 + x + 1)}$ .

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**7(10pts)** Find the solution to this initial value problem of a separable differential equation:

$$\frac{dy}{dx} = x^2\sqrt{y}, \quad y(0) = 4.$$

**8(15pts)** Use the **Limit Comparison Test** to determine whether the improper integral converge: (**Show all work.**)

$$\int_0^{\pi} \frac{1}{\sqrt{x} + \sin x} dx$$

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**2 Bonus Points:** The state bird of Nebraska is (a) The Northern Cardinal , (b) The Blue Jay, (c) The Western Meadowlark, (d) none of the above. (... *The End*)