Name: _____   TA's Name: _____

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

1. (24 points) **Do only 3 of the following integrals (No calculators are allowed on this problem).**

   (a) $\int \dfrac{\cos x}{\sqrt{\sin x + 1}}\,dx$

   (b) $\int \dfrac{1}{x \ln x}\,dx$

   (c) $\int x^2 \sqrt{4 + x}\,dx$

   (d) $\int \dfrac{x}{1 + (x^2 + 1)^2}\,dx$

(Continue on Next Page ...)

2. (9 points) Let R be bounded by the circle $x^2 + y^2 = 4$, the line $y = x$, and the x-axis. Set up an integral **(but don't evaluate)** for its area. (Make sure to include a sketch for the setup.)

3. (16 points, 8 points each) Let R be the region enclosed by $y = 2x$, $y = 2$, $x = 0$.
   (a) Find **(but don't evaluate)** an integral whose value gives the volume of the solid obtained by revolving the region R about the horizontal line $y = -1$, **using the method of shells.**

   (b) Find **(but don't evaluate)** an integral whose value gives the volume of the solid obtained by revolving the region R about the vertical line $x = 1$, **using the method of washers.**

4. (12 points) A solid concrete column in the shape of a cylinder of radius 1 meter and height 20 meeter is to be build from the ground up. If the wet concrete weighs 500 kilograms per cubic meeter. Find the minimum amount of work needed to build the column.

5. (12 points) The graph of a function $y = f(x)$ is given below.
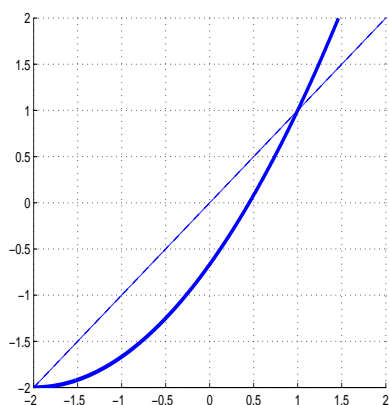
(a) Explain why the function is invertible.

(b) State the domain of the inverse function $y = f^{-1}(x)$.

(c) It is given the derivative $f'(1) = 2$. Find an equation for the tangent line to the inverse function f^{-1} at the point $f(1)$.

(d) Sketch the graph of the inverse function $y = f^{-1}(x)$ on the same graph above.

6. (12 points) An underwater observatory window has the shape of an isosceles triangle of height 2 feet and base length 2 feet, which (i.e. the base) is 10 feet below the surface. Write down **but do not evaluate** an integral whose value is the force that is required to hold the window in place against the water.
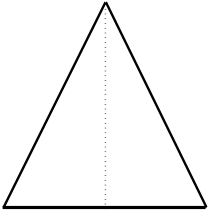
7. (15 points, 5 points each) Find the exact values or formula, and calculator values are not allowed.

    (a) Find the value of $\sin^{-1}(\sin(\frac{3\pi}{2}))$.

    (b) Find the value of $\cos(\sin^{-1}(-0.25))$.

    (c) Simplify $\cos(\tan^{-1}(x))$. Show all the works.

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2 Bonus Points: According to the Chinese calendar, 2005 is the year of (a) pig, (b) dragon, (c) cat, (d) none of the above.   (... *The End*)