Your Name

Your Signature

Student ID #

Quiz Section

Professor's Name

TA's Name

- Turn off and stow away all cell phones, watches, pagers, music players, and other similar devices.
- This exam is closed book. You may use one $8.5'' \times 11''$ sheet of handwritten notes (both sides OK). Do not share notes. You can use only a Texas Instruments TI-30X IIS calculator.
- In order to receive credit, you must **show all of your work**. If you do not indicate the way in which you solved a problem, or if the work shown is incorrect or incomplete, you may get little or no credit for it, even if your answer is correct.
- You may use directly the integral formulas # 1-18 in the table from section 7.5 of your textbook (posted on the departmental math 125 website), without deriving them. **Show your work in evaluating any other integrals, even if they are on your note sheet**.
- Place $\boxed{\text{a box around your answer}}$ to each question. Unless otherwise instructed, simplify your answers, but leave them in exact form (for example $\frac{\pi}{3}$ or $5\sqrt{3}$).
- All exam pages are double-sided except for this cover page and the last page. You may use the blank sides for extra room if needed but if you want us to grade these spare pages clearly **indicate in the problem area** that your work is on the back of the cover page or on the blank sides of the last page.
- This exam has 9 problems on 9 pages. When the exam starts, make sure that your exam is complete.

Question	Points	Score
1	14	
2	14	
3	10	
4	10	
5	10	

Question	Points	Score
6	12	
7	10	
8	10	
9	10	
Total	100	

1. (14 points) Evaluate the following indefinite integrals. Show work and box your answers.

   (a) $\displaystyle\int \frac{x^2+1}{x^2-2x-3}\,dx$

   (b) $\displaystyle\int y^2\,(\ln y)^2\,dy$

2. (14 points) Evaluate the following integrals. Simplify but leave your answers in exact form.

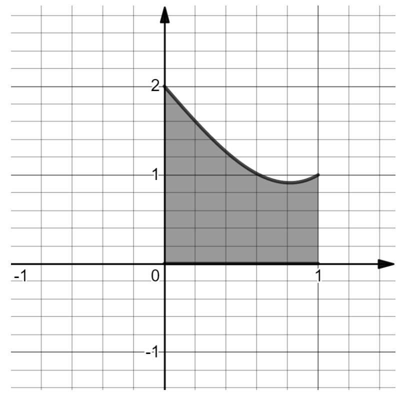
   (a) $\int_0^4 e^{\sqrt{2t+1}}\,dt$

   (b) $\int_0^{\pi} \sin^3\theta \cos^2\theta \, d\theta$

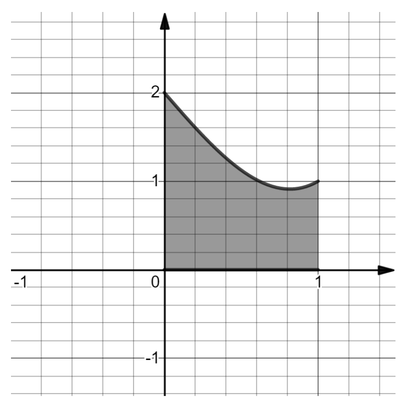
3. (10 points) Consider the area bounded by the curves:

$$y = x^3 - 2x + 2, \qquad x = 0, \qquad x = 1, \qquad \text{and } y = 0.$$

(a) Set up (do not evaluate) an integral equal to the volume swept out by rotating this area about the y-axis.



(b) Set up (do not evaluate) an integral equal to the volume swept out by roating this area around the horizontal line $y = 2$.



4. (10 points) A particle moves along a line, with acceleration at t seconds given by:

$$a(t) = \frac{1}{2\sqrt{t}}$$

where the acceleration is measured in $\mathrm{m}/\mathrm{sec}^2$. The particle has velocity $v(0) = -2$ m/sec at time $t = 0$ seconds. Find the total distance traveled by the particle during the time interval $0 \le t \le 9$ seconds.

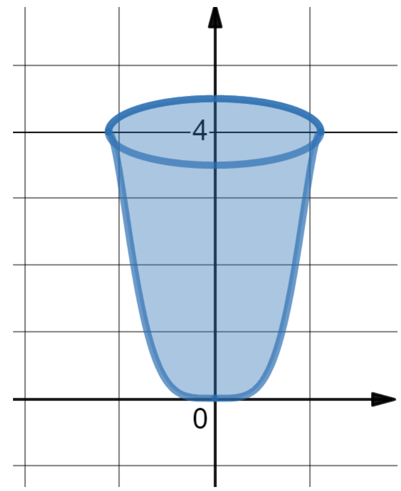
5. (10 points) Determine whether the integral $\displaystyle\int_0^\infty \frac{1}{(x^2+2x+2)^{3/2}}\,dx$ is convergent or divergent. If it converges, evaluate it.

6. The portion of the graph of

$$x = \left(\arcsin\left(\frac{y}{4}\right)\right)^{(1/4)} \qquad \text{between } y = 0 \text{ and } y = 4 \text{ meters}$$

is rotated around the y-axis to form a container with depth of 4 meters, as shown. The container is filled with water. The density of water is 1000 $\mathrm{kg/m^3}$ and the gravitational acceleration is 9.8 $\mathrm{m/sec^2}$.

(a) (8 points) Find an integral that gives the work required to pump all the water out over the side. **Do <u>not</u> attempt to evaluate the integral – just set it up.**



(b) (4 points) Estimate the value of the integral from part (a) using Simpson's Rule with $n = 4$ subintervals. Show work and round your answer to the nearest Joule.

7. (10 points) A hot cube of metal is removed from an oven and left to stand in a cold room. The cube is losing heat in such a way that the rate of change of its temperature is proportional to the difference between the temperature of the metal and the temperature of the room.

   Suppose that the room has a constant temperature of 47° F. Initially the cube's temperature is 443° F. Ten minutes after being removed from the oven, the cube's temperature is 380° F.

   What will the cube's temperature be 20 minutes after being removed from the oven? Round your answer to two decimal digits.

8. (10 points) Consider the region in the first quadrant bounded by:

$$y = x^k, \qquad x = 1, \qquad \text{and the } x\text{-axis,}$$

where $k > 0$ is some fixed positive number.

If the center of mass of this region lies on the line $y = 0.26$, what is the value of k?

9. (10 points) Find the solution to the differential equation

$$\frac{dy}{dx} = \frac{\ln x}{xy}$$

that satisfies the initial condition $y(1) = 2$. Give your solution in explicit form, $y = f(x)$.