

Your Name

Signature (you agree to complete honestly)

Student ID #

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Start Time

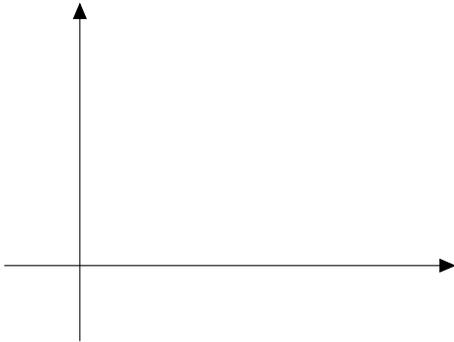
End Time

Page	Total Points	Score
2	22	
3	24	
4	20	
5	17	
6	17	
Total	100	

- You will have 60 minutes to complete the exam.
- This test is closed book and you may not use a calculator.
- You may use one side of a single piece of paper (8 1/2 in. x 11 in.) of handwritten notes.
- In order to receive full credit (or partial credit in the case of incorrect solutions), you must **show your work**. Please write out your computations on the exam paper.
- Simplify all obvious expressions.
- **PLACE A BOX AROUND**  **YOUR FINAL ANSWER** to each question where appropriate.

1. (12 points) Consider the region bounded by  $y = x$  and  $y = x^3$  for  $0 \leq x \leq 2$ .

(a) (2 points) Sketch the region bounded by the curves. Clearly label each curve and label any important points.

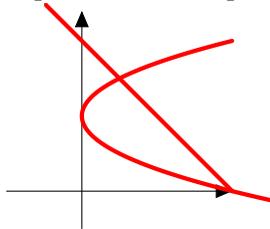


(b) (10 points) Find the area of this region.

2. (10 points) The base of a solid is a circle with radius 2 centered at the origin. Cross sections perpendicular to the  $x$ -axis are rectangles whose heights are twice the length of their base. Find the volume of this solid.

3. (24 points) Consider the region bounded by  $y = 4 - x$ ,  $x = (y - 2)^2$ , which is graphed below. Set up, but do not solve, an integral that finds the volume of this region when it is rotated about each of the following axes. **You do NOT need to simplify the integrand.** State the method that you are using. A sketch of the region has been provided for you.

- (a) (4 points) Find the points of intersection of  $y = 4 - x$  and  $x = (y - 2)^2$ .



- (b) (5 points)  $x$ -axis

- (c) (5 points)  $y$ -axis

- (d) (5 points)  $x = -3$

- (e) (5 points)  $y = 6$

4. (10 points) The temperature in a certain city (in °F)  $t$  hours after 12 PM (noon) was modeled by the function

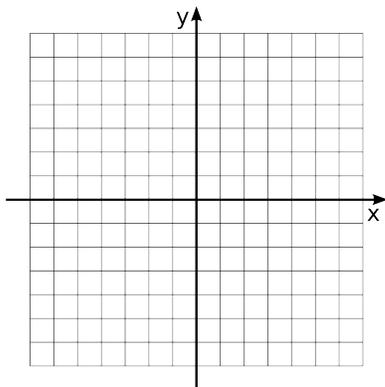
$$T(t) = 3 \cos\left(\frac{\pi t}{12}\right) + 5.$$

Use this equation to find the average temperature during the period from 12 PM to 6 PM. Give an exact answer with proper units AND then, using  $\pi \approx 3$  give a rough estimate of what the average temperature is to the nearest whole number.

5. (10 points) A spring has a natural length of 10 cm. If an 20-N force is required to stretch the spring to a length of 20 cm, how much work is required to stretch the spring an additional 20 cm? Give your answer with proper units.

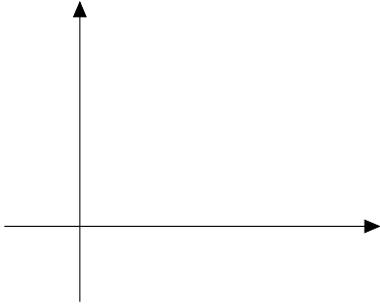
6. (10 points) Find the exact length of the curve  $y = 2 - 4x^{3/2}$  for  $0 \leq x \leq 2$ .

7. (7 points) Set up, simplify, but do not solve an integral describing the surface area obtained by rotating the region  $y = \sqrt{9 - x^2}$  between  $x = 0$  and  $x = 3$  about the  $y$ -axis. Begin by sketching the curve.



8. (17 points) Consider the region bounded by  $y = \sin(2x)$  and  $y = 0$  on the interval  $[0, \pi/4]$ .

(a) (7 points) Sketch curves on the interval, shade the region, and then find the area bounded by the curves.



(b) (10 points) Find the center of mass (also known as the centroid) of this region.