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 **a TI-30X IIS calculator only.**
- 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 any of 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 $5\sqrt{3}$).
- If you need more room, use the backs of the pages and indicate that you have done so.
- This exam has 10 questions on 9 pages, plus this cover sheet. Once the exam starts, check that you have a complete exam!

Question	Points	Score
1	14	
2	12	
3	10	
4	10	
5	10	

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

1. Evaluate the following integrals. Show your work, and box your final answer.

   (a) (7 points) $\int \sin^3(4y)\cos^7(4y)\,dy$

   (b) (7 points) $\int \frac{6x^2}{x^2-3x+2}dx$

2. (a) (6 points) Evaluate the integral: $\int \sin(\sqrt{x})dx$. Show your work, and box your final answer.

(b) (6 points) Does the improper integral $\int_0^\infty \frac{1}{\sqrt{2+x^2}}dx$ converge or diverge? Fully justify your answer.

3. The questions on this page are all short answers. No need to justify, except for the very last one.

(a) Circle the correct equality or inequality signs:

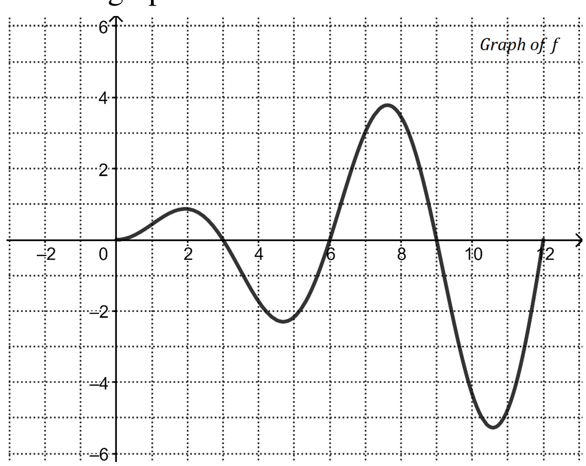
i. (2 points) $\displaystyle\int_{\pi}^{2\pi} \frac{\sin(x)}{x} dx \qquad > \qquad = \qquad < \qquad 0.$

ii. (2 points) $\displaystyle\int_{\pi}^{\pi} \frac{\sin(x)}{x} dx \qquad > \qquad = \qquad < \qquad 0.$

(b) The rest of the questions below both refer to a function $g(x)$, which is defined for $0 \le x \le 12$ as:

$$g(x) = \int_0^x f(t)dt,$$

where $f(t)$ is the function whose graph is shown.



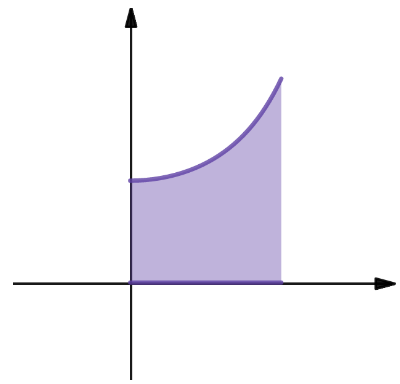
i. (2 points) At what value of x in the interval $[0,12]$ does $g(x)$ reach its absolute maximum?

ii. (4 points) Let $h(x) = g(3x^2 - 5)$. Determine $h'(2)$.

4. (10 points) Find the x-coordinate for the center of mass of a thin plate with constant density that occupies the region:

$$0 \leq x \leq \pi/4, \qquad 0 \leq y \leq 2\sec^2(x).$$

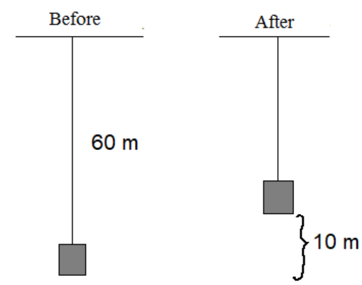
Give your answer $\bar{x}$ as an exact number.



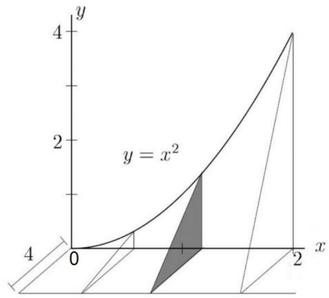
5. (10 points) A 1000-kg elevator is suspended by a 60 m cable that weighs 5 kg/m.

   Compute the work, in Joules, required to raise the elevator from the basement to the third floor, a distance of 10 m.

   Recall that $g = 9.8$ m/s^2.

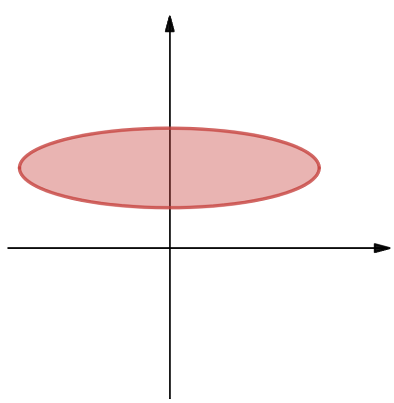


6. (6 points) Compute the volume of the solid shown below. The solid has right triangular cross sections perpendicular to the x-axis, for $0 \leq x \leq 2$.



7. (8 points) SET UP only (do not compute) an integral equal to the volume of the solid obtained by rotating about the x-axis the region inside the ellipse:

$$\frac{x^2}{4} + (y-2)^2 = 1.$$



8. (10 points) Find the solution of the differential equation

$$y' + \frac{x}{y-1} = 0$$

that satisfies the initial condition $y(0) = -1$. Give your solution in explicit form, as $y = f(x)$.

9. The change in a population $P = P(t)$ is modeled by the differential equation:

$$\frac{dP}{dt} = 2P\left(1 - \frac{P}{5000}\right)$$

Being a population, you may assume the values of P to be non-negative.

(a) (4 points) For what values of P does the population decrease? Justify.

(b) (6 points) Which of the following functions are solutions for the given differential equation? Circle all that apply and justify your answer by SHOWING YOUR WORK.

i. $P(t) = 2000$

ii. $P(t) = 5000e^{2t}$

iii. $P(t) = \dfrac{1000}{1+e^{-2t}}$

iv. None of the above

10. (a) (4 points) Set up an integral equal to the arc length of the logarithmic curve

$$y = \ln x, \text{ from } (1,0) \text{ to } (2, \ln 2).$$

(b) (6 points) Evaluate the arc length integral from part (a).
(Hint: integration by parts may help in a later step)