

Your Name

Your Signature

**Lecture:**  8:30 Contenza  
 9:30 Garfield

**SI:**  Alex  Avni  Jason  
 Ashley  Becca  Matt

Problem	Total Points	Score
1	35	
2	25	
3	15	
4	25	
5	25	
6	10	
7	15	
Total	150	

- You are only allowed to use the attached formula sheet; no other notes are allowed for this exam.
- You may use a calculator, such as a scientific or graphing calculator. You may not use your cellular phone. You are not allowed to share calculators.
- In order to receive partial credit, you must show your work. Be wary of doing computations in your head. Instead, write out your computations on the exam paper.
- Your answers should either be *exact answers* (like  $2\sqrt{2}$ ) or rounded to four digits after the decimal (like 0.1234) in whatever units you're using. Be careful not to round intermediate calculations whenever possible, as you will lose points for errors due to incorrect rounding.
- If you need more room, use the backs of the pages and indicate to the grader that you have done so.
- Raise your hand if you have a question.
- Good luck!

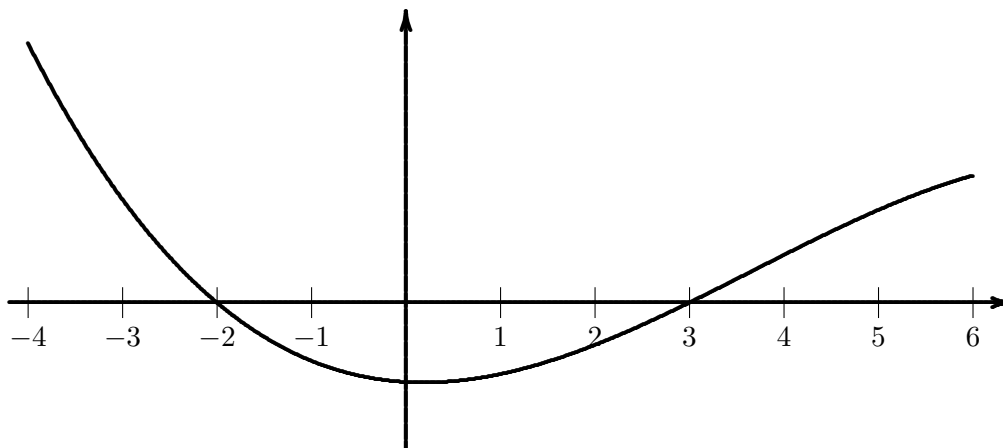
1 (35 points) For each of the following questions, show appropriate work to support your answers.

(a) (12 points) Find  $\int \frac{3x^2 + 6}{2x^3 + 12x - 1} dx$ .

(b) (13 points) Find  $\int_0^3 5xe^x dx$ .

(c) (10 points) Find  $\int f(x) dx$ , where  $f'(x) = \sqrt{1+x^2}$ . Your answer should involve  $f(x)$ .  
**Hint:** Use integration by parts.

- 2 (25 points) Let  $f(x)$  be the function shown in the graph below. In each case, determine if the given definite integral is positive, negative, or zero. Explain your reasoning.



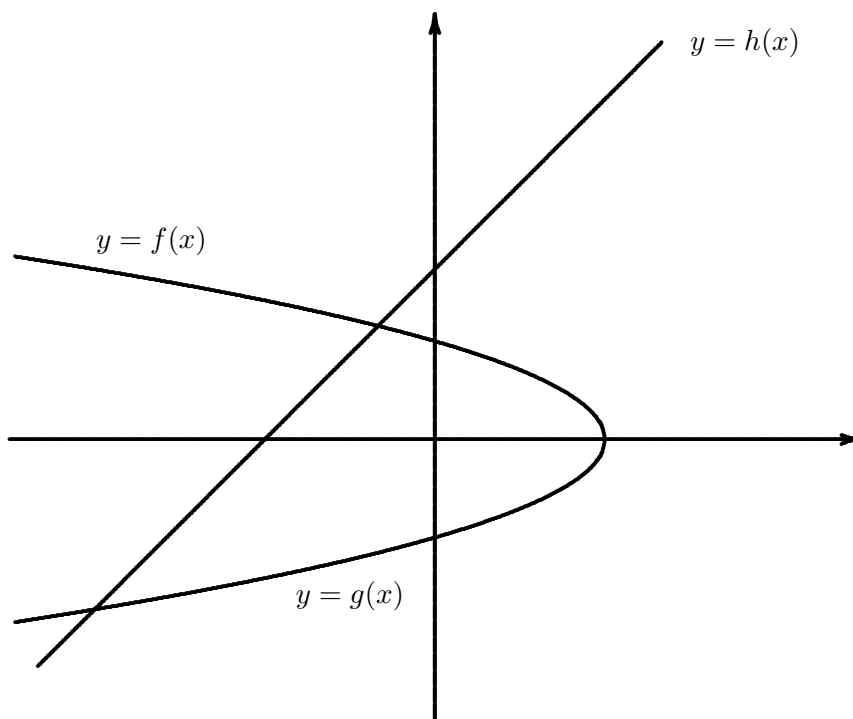
(a) (9 points)  $\int_{-1}^3 f(x) dx$

(b) (9 points)  $\int_2^6 f(x) dx$

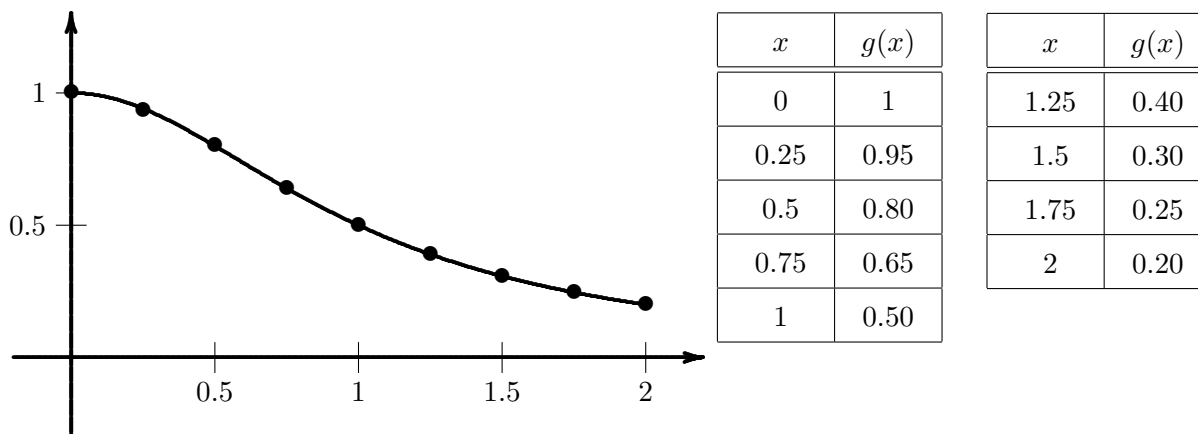
(c) (7 points)  $\int_2^2 f(x) dx$

- 3 (15 points) Suppose that a continuous function  $f(x)$  has average value equal to 3 over the interval  $[-4, 7]$ . Find  $\int_{-4}^7 f(x) dx$ .

- 4 (25 points) Write down an integral (or integrals) that represents the area of the region bounded by the graphs of  $f(x) = \sqrt{3-x}$ ,  $g(x) = -\sqrt{3-x}$ , and  $h(x) = x+3$ . You do not need to evaluate the integral(s)! For your convenience, the graphs of these functions are shown below:

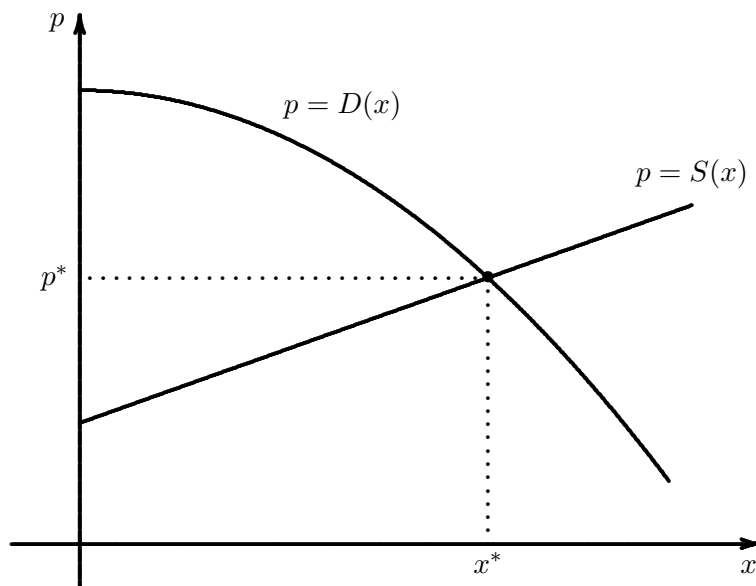


- 5 (25 points) Let  $g(x)$  be the graph shown below. Some specific values of  $g(x)$  are shown in the tables to the right.



- (a) (15 points) Approximate the definite integral  $\int_0^2 g(x) dx$  by partitioning the interval  $[0, 2]$  into four subintervals of equal length and choosing  $u$  as the right endpoint of each subinterval.
- (b) (10 points) Will your estimate be greater than, less than, or equal to the exact area under the curve? Explain how you know this without knowing the actual value of the integral.

- 6 (10 points) The graph below shows the demand curve  $p = D(x)$  and the supply curve  $p = S(x)$  for I♥MATH t-shirts. Clearly shade in the region whose area is the consumer's surplus (CS).



- 7 (15 points) In 2004 the population of Ljubljana (the capital of Slovenia) was 265,000. Census data predicts the population will continue to grow at a rate of  $100 + t^{2/3}$  people per year, where  $t$  represents the number of years elapsed since 2004. Predict the size of Ljubljana's population in 2010.