

1 (30 points) Evaluate the following indefinite integrals (10 points each):

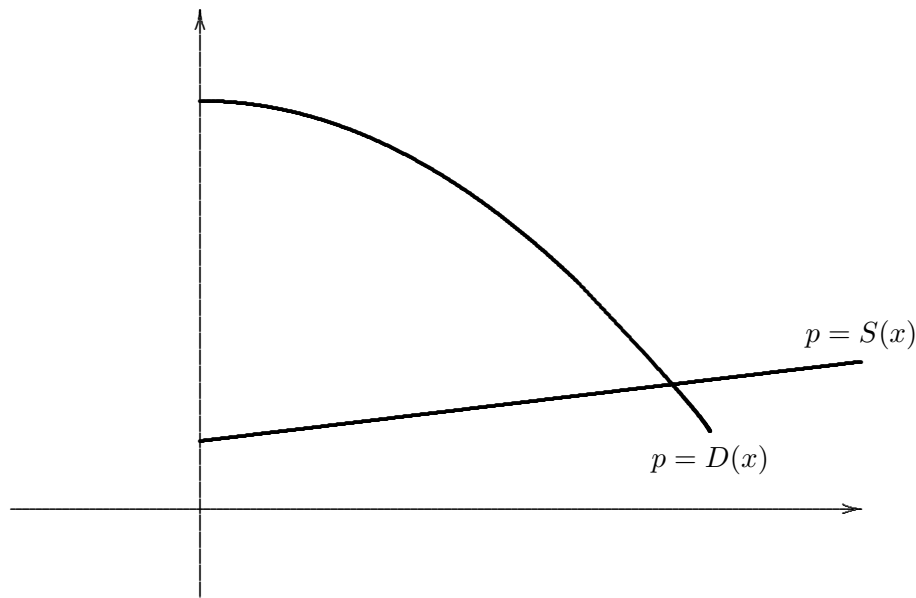
(a)  $\int x \sin(5x) dx$

(b)  $\int x e^{3x^2} dx$

(c)  $\int 3x^2 e^x dx$

2 (12 points)

(a) (4 points) The following picture shows a demand curve  $p = D(x)$  and a supply curve  $p = S(x)$ . Shade in the area on this graph that represents the Producer's Surplus (PS).



(b) (8 points) If  $p = D(x) = 18 - 2x^2$  and  $p = S(x) = x + 3$ , calculate the Consumer's Surplus (CS). (Note that these are the functions graphed in part (a), but this is **not** what you shaded in part (a).)

3 (15 points) The depreciation rate of a new car obeys the equation

$$V'(t) = \frac{-12,000}{(3t + 2)^2}, \quad 0 \leq t \leq 5$$

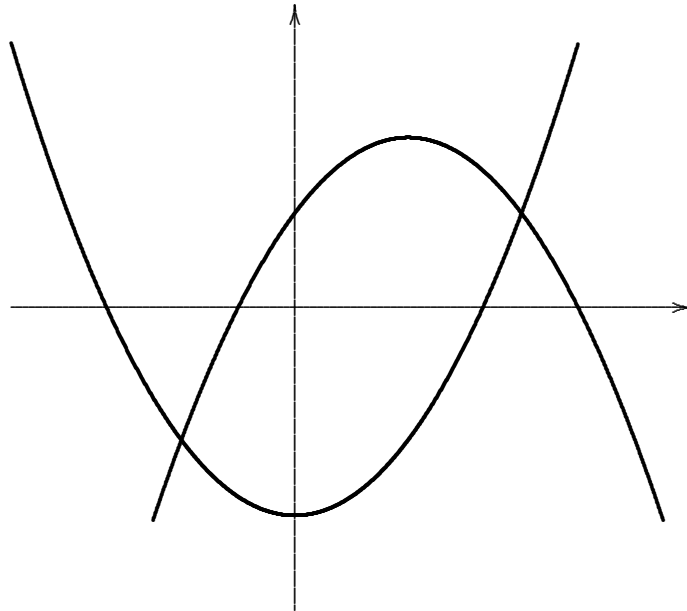
where  $V$  is the value of the car  $t$  years after it was purchased. If the car cost \$18,000 new, what is its value after 3 years?

4 (15 points) Suppose the population of a town is projected to be  $P(t) = 7000e^{0.04t}$  people, where  $t$  is measured in years from today. Find the average population in this city over the next ten years. If you round, then please round your answer to the nearest person.

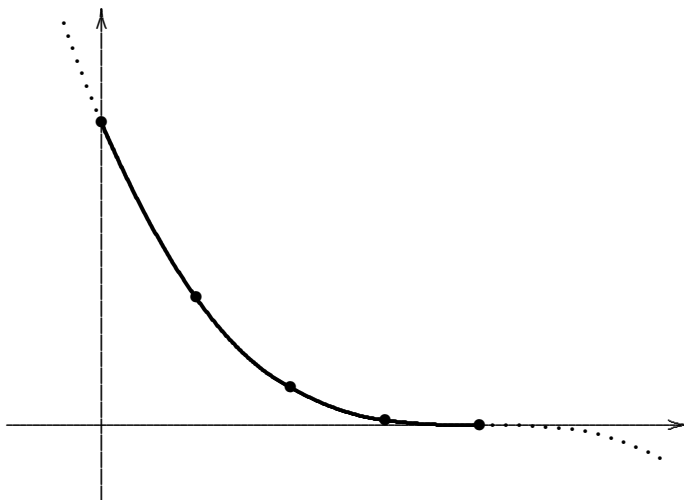
5 (15 points) Find the area between the graphs of the functions

$$y = 5 + 4x - x^2 \quad \text{and} \quad y = x^2 - 11.$$

For your convenience, the graphs of these functions are shown below:



6 (13 points) Below is the graph of a curve  $y = f(x)$ . We would like to estimate the area under this curve in the first quadrant (from  $x = 0$  to  $x = 4$ ). Unfortunately, we do not know the equation of this curve, but only the values shown in the table below (and as dots on the graph):



$x$	$f(x)$
0	16
1	7
2	2
3	$\frac{1}{2}$
4	0

- (a) (10 points) Approximate the area under  $y = f(x)$  from  $x = 0$  to  $x = 4$  by partitioning  $[0, 4]$  into four subintervals of equal length and choosing  $u$  as the left endpoint of each subinterval.
- (b) (3 points) Is your estimate in part (a) is too high or too low? Explain your reasoning.