University of California, San Diego
Department of Mathematics

Instructions

1. **Write your *Name*, *PID*, *Section*, and *Exam Version* on the front of your Blue Book.**
2. **No calculators or other electronic devices are allowed during this exam.**
3. **You may use one page of notes, but no books or other assistance during this exam.**
4. **Read each question carefully, and answer each question completely.**
5. **Write your solutions clearly in your Blue Book.**
   (a) **Carefully indicate the number and letter of each question and question part.**
   (b) **Present your answers in the same order they appear in the exam.**
   (c) **Start each problem on a new page.**
6. **Show all of your work. No credit will be given for unsupported answers, even if correct.**
7. **Turn in your exam paper with your Blue Book.**

DO NOT TURN OVER UNTIL INSTRUCTED TO DO SO

Question Zero:

0. (1 point) Carefully read and complete the instructions at the top of this exam sheet and any additional instructions written on the chalkboard during the exam.

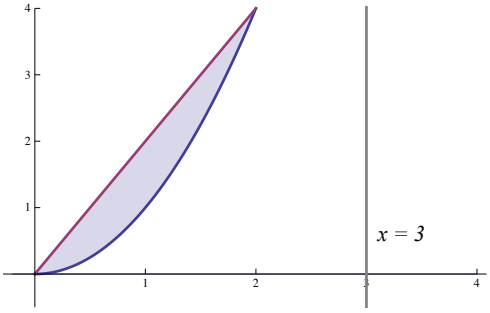
(This exam is worth 35 points.)

1. (10 points) Compute the following indefinite integrals.

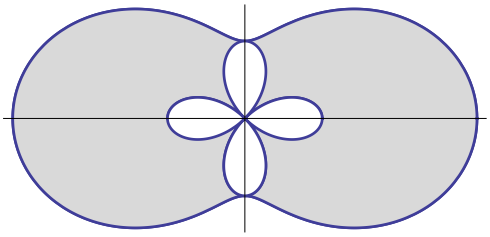
   (a) $\int e^{2x}\cos(5x)\,dx$

   (b) $\int \frac{\ln(4+\sqrt{x})}{\sqrt{x}}\,dx$

2. (8 points) The shaded region is enclosed by the curves $y = x^2$ and $y = 2x$. Compute the volume of the solid object obtained by rotating the shaded region about the axis $x = 3$.



3. (8 points) Compute the area of the shaded region, where the "outside" curve is the graph of $r = 2 + \cos(2\theta)$ and the "inside" curve is the graph of $r = \cos(2\theta)$.



4. (8 points) Your town is infected with a parasitic fungus that is slowly turning people into mushrooms. You have discovered a cure in the form of a bacteria, but you need to mass produce it. Let the number of bacterial cells you have on day t be given by $P(t)$ and assume $P(0) = 0$. If the growth rate of the bacterial colony is given by $\frac{dP}{dt} = 2te^{t^2}$ million cells per day and if you need to grow 99 million cells, how many days are needed to produce the cure? That is, what is the value of T so that $P(T) = 99$?