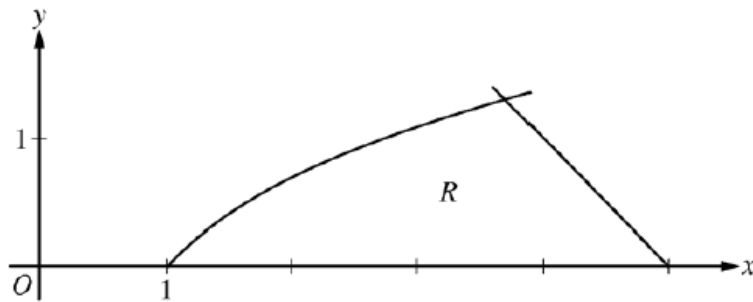
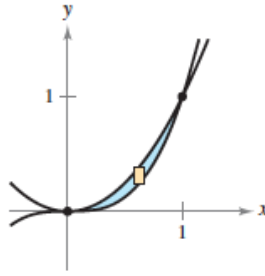


1. A region is enclosed by the graphs of  $y = 3 - x^2$  and the vertical lines  $x = -1$  and  $x = 1$  as show in the figure above.
  - a. Find the area of the enclosed region.
  - b. Find the volume of the solid that is generated by revolving the enclosed region about the  $x$ -axis. **Do not simplify your final answer!**
  - c. Write, but do not evaluate, an integral expression that can be used to find the volume of the solid that is generated by revolving the enclosed region about the line  $y = 4$ .
  - d. The shaded region is the base of a solid. For this solid, cross sections taken perpendicular to the  $x$ -axis are semicircles. Write, but do not evaluate, an integral expression that can be used to find the volume of this solid.

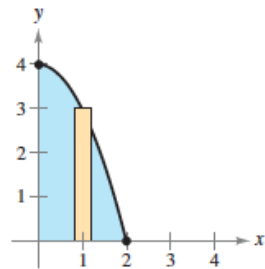
### 2012 AP<sup>®</sup> CALCULUS AB FREE-RESPONSE QUESTIONS



2. Let  $R$  be the region in the first quadrant bounded by the  $x$ -axis and the graphs of  $y = \ln x$  and  $y = 5 - x$ , as shown in the figure above.
  - (a) Find the area of  $R$ .
  - (b) Region  $R$  is the base of a solid. For the solid, each cross section perpendicular to the  $x$ -axis is a square. Write, but do not evaluate, an expression involving one or more integrals that gives the volume of the solid.
  - (c) The horizontal line  $y = k$  divides  $R$  into two regions of equal area. Write, but do not solve, an equation involving one or more integrals whose solution gives the value of  $k$ .



3. A region is enclosed by the graphs of  $y = x^2$  and  $y = x^3$  as shown in the figure above. Find the volume of the solid that is generated by revolving the region about the  $x$ -axis. Simplify your final answer.



4. A region is enclosed by the graphs of  $y = 4 - x^2$ ,  $y = 0$  and  $x = 0$  as show in the figure above.
- Find the area of the enclosed region.
  - Find the volume of the solid that is generated by revolving the enclosed region about the  $x$ -axis. **Do not simplify your final answer!**
  - Write, but do not evaluate, an integral expression that can be used to find the volume of the solid that is generated by revolving the enclosed region about the line  $y = 6$ .
  - The base of a solid is the enclosed region. Write, but do not evaluate, an integral expression that can be used to find the volume of the solid if cross sections taken perpendicular to the  $x$ -axis are isosceles right triangles with on leg across the region.
5. A region is enclosed by the graphs of  $y = \sqrt{x}$ , the  $x$ -axis and the line  $x = 4$ . Write, but do not evaluate, the integral expressions that can be used to find the volume of the solid that is generated by revolving the region about the given line. (You do not need to simplify).
- the  $x$ -axis.
  - the line  $y = -2$ .
  - the  $y$ -axis.
  - the line  $x = 6$ .