

Show all of your work, and be both clear and organized with your presentation. Give exact values only and completely simplify your answers. If you use a calculator, it must be scientific.

1. (15 pts) There is a region bounded on all four sides by the graphs of the following four equations:

$$y = x^3, y = \frac{1}{x^2}, y = 0, \text{ and } x = 2$$

Determine the volume of the solid of revolution obtained upon rotating this region about the line  $x = 3$ . Provide a sketch of the graph of the region that is being revolved.

2. (15 pts) Determine the volume of the solid of revolution that is generated by revolving region bounded by the graphs of  $y = \cosh x$  and  $y = 2$  about the line  $y = -1$ . Provide a sketch of the graph of the region that is being revolved.

3. (24 pts) Evaluate:

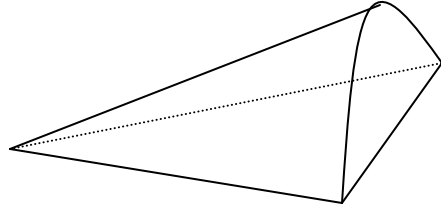
i) 
$$\int \frac{1}{\sqrt{x^2+1} \ln \sqrt{x+\sqrt{x^2+1}}} dx$$

ii) 
$$\int \cot x \cdot \ln^3(\sin^2 x) dx$$

4. (10 pts) Determine the length of the curve  $y = \frac{1}{2} \ln x - \frac{1}{4} x^2$  where  $x \in [1, e]$

5. (12 pts) Determine the area between the graphs of  $y = \sin x$  and  $y = \sin 2x$  over the interval  $\left[0, \frac{\pi}{2}\right]$ . Provide a graph of this region.

6. (12 pts) An isosceles triangle whose height is 8 cm and whose base is 5 cm is the base of a three dimensional solid. Cross sectional slices of this solid are semicircles that are perpendicular to the triangular base and perpendicular to the line of symmetry for that triangle.



7. (12 pts) Determine the average value for the function  $f$  over the interval  $[0, \ln 2]$   
if  $f(x) = e^x \tan e^x$