

Show absolutely all of your work, completely simplify your answers, and give exact values only. Be both clear and organized with your presentation.

1. (15 pts) Determine the area bounded by the graphs of the equations given below. Provide a sketch of the region whose area you seek.

$$y = \frac{2x^2 - 3}{1 + x^2} \quad \text{and} \quad y = \frac{1}{2}$$

2. (15 pts) Consider the region bounded by the graphs of the following equations:

$$y = \sqrt{x+1}, y = \frac{1}{x+1}, \text{ and } x = 1$$

Determine the volume of the solid of revolution obtained upon revolving this region about the line $x = -2$ using the cylindrical shell method.

3. (15 pts) Consider the region bounded by the graphs of the following equations:

$$y = \sqrt{x+1}, y = \frac{1}{x+1}, \text{ and } x = 1$$

Determine the volume of the solid of revolution obtained upon revolving this region about the line $x = -2$ using the washer method.

4. (15 pts) the velocity of a particle moving along a straight line is given by $v(t) = 3t^2 - 4t + 1$ where $s(0) = 2$ and s is the position function.

i) What is the position of this particle after 2 seconds?

ii) Determine the distance travelled over the time interval $[0, 2]$

5. (25 pts) Evaluate each of the following integrals:

i)
$$\int \frac{x^2 - 2x + 3}{\sqrt{x+1}} dx$$

ii)
$$\int_1^{\sqrt{3}} \frac{\tan^{-1} \frac{1}{x}}{x^2 + 1} dx$$

iii)
$$\int \frac{\ln^2 x^3}{x} dx$$

