

You have 100 minutes to finish the exam. Please show all your work for full credits.

1. Set up the integral for the volume of the solid. **Do not evaluate the integral.**
 - (a) (6 points) The base of the solid is the region bounded between the curve $y = x^3$ and the y -axis from $y = 1$ to $y = 2$. The cross sections taken perpendicular to the y -axis are **squares**.

 - (b) (8 points) The solid is generated when the region enclosed by $y = x^2$ and $y = 2x$ is revolved about $y = 5$. You must use the **disk/washer** method.

 - (c) (8 points) The solid is generated when the region enclosed by $y = \sqrt{x}$, $y = 4$ and $x = 0$ is revolved about $x = -3$. You must use the **cylindrical shell** method.

2. (6 points) Write out the form of the partial fraction decomposition for $\frac{5}{(x^2 - 4)(x^2 + 1)^2}$. (Do not find the numerical values of the coefficients)

3. Evaluate the integral.

(a) (8 points) $\int x^2 \cos x \, dx$

(b) (8 points) $\int \tan^2 x \sec^4 x \, dx$

(c) (8 points) $\int \tan^{-1} x \, dx$

(d) (10 points) $\int \sqrt{9 - x^2} dx$

(e) (10 points) $\int \frac{2x + 1}{x^3 + x} dx$

4. (10 points) Find the exact arc length of the curve $y = \frac{1}{3}(x^2 + 2)^{3/2}$ from $x = 0$ to 1.
5. (8 points) A spring exerts a force of 6N when it is stretched from its natural length of 3 m to a length of 5 m. Find the work required to stretch the spring from its natural length to a length of 7 m.
6. (10 points) The cylindrical tank shown in the figure is filled with a liquid weighing 70 lb/ft³. Find the work required to pump all the liquid to a level 2 ft above the top of the tank. **Set up the integral but do not evaluate it.**