

Midterm

You have 135 minutes to complete all three sections on this exam. Note that if there are two problems on a single page, you only have to solve one of them. Show all of your work, label your answers clearly, and do not use a calculator.

Problem 1 Find the volume of the solid described: The base of the solid is the disk $x^2 + y^2 \leq 4$. The cross-sections are planes perpendicular to the y -axis between $y = -2$ and $y = 2$ are isosceles right triangles with one leg in the disk.

OR

Problem 1 A cylindrical hold of radius 3 is bored through the center of a sphere of radius 6 (see the figure, where $a = 3$). Find the volume of the remaining solid.

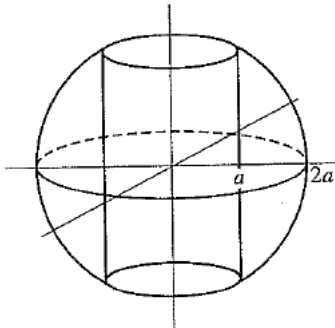


FIGURE 13

Problem 2 Find the length of the curve given by $y = \frac{1}{3}(x^2 + 2)^{3/2}$ from $y = 1$ to $y = 6$.

OR

Problem 2 Find the area of the surface generated by revolving the curve $y = \sqrt{x+1}$ from $1 \leq x \leq 5$ about the x -axis.

Problem 3 It takes a force of 22050 lb to compress a coil spring assembly on a New York City Transit Authority subway car from its free height of 8 in to its fully compressed height of 5 in. Answer the following:

a *What is the assembly's force constant?*

b *How much work does it take to compress the assembly the first inch?*

c *How much work does it take to compress the assembly the second inch?*

Problem 4 Solve the differential equation $\frac{dy}{dx} = 6y^2x$ given that $y(1) = 1/25$.

Problem 5 Evaluate the integral

$$\int x^2 \log(x) dx$$

OR

Problem 5 Evaluate the integral

$$\int 4x \cos(2 - 3x) dx$$

Problem 6 Evaluate the integral

$$\int \sec^3(x) dx$$

OR

Problem 6 Evaluate the integral

$$\int \cos^4(x) \sin^2(x) dx$$

Problem 7 Evaluate the integral

$$\int \frac{\sqrt{x^2 + 16}}{x^4} dx$$

OR

Problem 7 Evaluate the integral

$$\int \sqrt{1 - 7x^2} dx$$

Problem 8 Evaluate the integral

$$\int \frac{2x + 1}{(x + 1)(x - 2)^2} dx$$

OR

Problem 8 Evaluate the integral

$$\int \frac{1}{(x + 1)(x^2 + 49)} dx$$

Problem 9 If the integral

$$\int_1^{\infty} \frac{1}{\sec^2(x)x^2} dx$$

converges, give proof by comparison. If it diverges, then prove that by comparison.

OR

Problem 9 If the integral

$$\int_1^{\infty} \frac{1}{e^x + 1} dx$$

converges, give proof by comparison. If it diverges, then prove that by comparison.