Show all your work on the exam paper, legibly and in detail, to receive full credit. The use of a calculator or any other electronic device is prohibited. You may only use techniques discussed to date in class. You must **simplify all answers** unless you are explicitly instructed not to.

1. (16 pts) Find the area enclosed by the region bounded by the curves \( y = \frac{2}{1 + x^2} \), \( y = x \) and \( x = 0 \). Hint: The graphs intersect at \( x = 1 \).
2. (16 points) Give an integral or integrals that represent(s) the area enclosed by the curves $y = x$, $y = 9x$, and $y = 6 - x$. Do NOT evaluate the integral(s).
3. (10 points) Give an integral that represents the volume of the solid that results when the region in the first quadrant enclosed by the curves $y = 10 - x^2$, $y = 6$, and $x = 0$ is revolved about the $x$-axis. Do NOT evaluate the integral.

4. (8 points) Give an integral that represents the volume of the solid that results when the region in the first quadrant enclosed by the curves $y = 10 - x^2$, $y = 6$, and $x = 0$ is revolved about the $y$-axis. Do NOT evaluate the integral.
5. (6 points) Give an integral that represents the volume of the solid that results when the
region enclosed by the curves \( y = \sqrt{x}, y = 0, \) and \( x = 9 \) is revolved about the line \( x = 9. \)
Do not evaluate the integral.

6. (12 points) Evaluate the integral.

\[ \int_{0}^{\ln 3} xe^{3x} dx \]
7. (16 points) Evaluate the integral.

\[ \int \sin \left( \ln x \right) \, dx \]
8. (10 points) Give an integral that represents the arc length of the curve $y = \tan x$ from $x = 0$ to $x = \frac{\pi}{4}$. Do NOT evaluate the integral.

9. (6 points) Give an integral that represents the arc length of the parametric curve $x = e^{t'}, y = e^{2t'}$ from $t = 0$ to $t = 2$. Do NOT evaluate the integral.
10. (5 points) Bonus Problem

Evaluate the integral.

\[ \int x^5 e^{x^3} \, dx \]