Name: __________________________

“We’re still pioneers, we barely begun. Our greatest accomplishments cannot be behind us, cause our destiny lies above us.” - Cooper, Interstellar

ANNOUNCEMENT: Quiz #10 on sections 4.2, 5.5, 6.1 will be given out during the first 15 mins of class on Thursday.

1. Evaluate the following definite integral.

a) \( \int_0^1 \frac{6x + 3}{x^2 + x + 5} \, dx \)

b) \( \int_0^{\pi/2} \frac{\cos x}{e^{\sin x}} \, dx \)

c) \( \int_0^{\pi/3} \tan^3 x \sec^2 x \, dx \)

d) \( \int x^5 \sqrt{1 - x^2} \, dx \)
2. Explain carefully why $f(x) = x^7 + 5x^3 + 2x - 20$ cannot have two real roots.

3. Set up, but do not evaluate, one or more integrals which represent the area of the finite region bounded by the curves $y = x - 1$ and $x = 7 - y^2$. 
4. Consider the finite region bounded by the curves $x = \frac{1}{2}y^2$ and $y = x^2$. In the following manner set up, but do not evaluate, definite integrals which represent the area of this region.

1. Integrate with respect to $x$.

2. Integrate with respect to $y$. (The integrands in parts (a) and (b) should be different.)

5. The area of the region bounded by the graphs of $y = x^3$ and $y = x$ cannot be found by the single integral $\int_{-1}^{1} x^3 - x \, dx$. Explain why this is so. Use symmetry to write a single integral that does represent the area.
CHALLENGE: I’ll discuss this in detail on Thursday.

6. Let $R$ be the region bounded by the $x$-axis and the graph of $y = e^{-x}$ on the interval $[1, 3]$. Set up, but do not evaluate, definite integrals which represent the given quantities. Use proper notation.

a) The volume of the solid obtained when $R$ is revolved around the line $y = 2$.

b) The volume of the solid with base $R$ for which the cross-sections perpendicular to the $x$-axis are squares.