1. Use Mathematica to evaluate the integrals
   a) $\int \sin 3x \cos 5x \, dx$  
b) $\int \sin 3x \cos 4x \, dx$  
c) $\int \sin 3x \cos 7x \, dx$

Conjecture a general formula for $\int \sin ax \cos bx \, dx$ (don’t prove it, just spot the pattern).

2. Consider the solid formed by rotating the region under $y = 1/x$ from $x = 1$ to $x = b$ around the $x$-axis. What is the volume of this solid when $b = 10$? When $b = 100$? When $b = 1000$?

3. Evaluate $\int x \arctan x \, dx$.

4. Find the volume of the ellipse with equation $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$. 