1. Find the area between the curves: \( y = \sec^2 x, \ y = 0, \ x = 0 \) and \( x = \pi/4 \).
   a. The integral:

   b. The exact answer:

   c. What is the average value of \( \sec^2 x \) on this interval?

2. Find the area between the curves: \( x = y^3 - y \) and \( x = y^4 - 1 \).
   a. The integral:

   b. The exact answer:

3. The base of an object \( S \) is the area between \( y = 4 - x^2 \) and the \( x \)-axis. Cross-sections perpendicular to the \( x \)-axis are circles. Set up an integral to evaluate the volume of the solid \( S \). (Do not evaluate it.)
4. A swimming pool is 10 m wide, 100 m long and 2 m deep is filled to a depth of 1 m with fresh water (density 1000 kg/m³). Find the hydrostatic force on one end of the pool.

   a. The integral:

   b. An **approximate** answer (e.g., you may use your calculator):

5. Find the volume of the solid obtained by rotating the region bounded by \( y = x^2 + x - 2 \) and \( y = 0 \) about the \( y \)-axis. (10 points)

   The integral (you do not need to evaluate it):

6. Find the volume of the solid obtained by rotating the region bounded by \( y^2 = x \), and \( x = 2y \) about the \( x \)-axis. (10 points)

   The integral (you do not need to evaluate it):
7. A spring has a natural length of 10 cm. A 20-N force is required to stretch it from its natural length to a length of 20 cm.

a. Find the spring constant \( k \).

b. Find exactly how much work is required to stretch the spring from 20 to 40 cm.

8. Find the arc-length of the curve \( y = \frac{2}{3}(x^2-1)^{3/2} \) from \( x = 1 \) to \( x = 3 \).

a. The integral (Hint: the term under the radical should be a perfect square):

b. The exact answer. *(Show your work!)*

10. Find the surface area obtained by rotating the curve \( y = \sqrt{4-x^2} \) (\( 0 \leq x \leq 1 \)) about the \( x \)-axis.

a. Find the derivative \( (dy/dx) \)

b. Set up the integral.