1. Find the average value of the function \( f(x) = \int_x^1 \cos t^2 \, dt \) on the interval \([0, 1]\).

2. Evaluate \( \int_0^1 \int_0^1 e^{\max(x^2, y^2)} \, dx \, dy \), where \( \max(x^2, y^2) \) means the larger of the numbers \( x^2 \) and \( y^2 \).

3. Without doing any calculations:
   
   (a) Let \( R \) be the square defined by \(-1 \leq x \leq 1, -1 \leq y \leq 1\). Is the sign of \( \int \int_R x^4 \, dA \) is positive, negative, or zero?

   (b) What is the value of \( \frac{1}{\pi} \int \int_S 1 + x \, dA \), where \( S \) is the unit disk centred at the origin?

4. Find \( \int \int_D 3 \, dA \) where \( D \) is the circular region in the \( xy \)-plane with centre \( C(10, -50) \) and radius 2. What if the centre is at \( C(-1, 15) \)?

5. Find the area in the \( xy \)-plane between the curves \( y = x \) and \( y = 2x^2 - x \). Think about this both as a double integral and a single integral and why they are really the same thing.

6. Find the volume of the solid \( T \) that lies below the paraboloid \( z = x^2 + y^2 \) and above the triangle \( R \) in the \( xy \)-plane that has vertices \((0, 0, 0), (1, 1, 0), \) and \((2, 0, 0)\).

7. Describe the solid bounded by the graphs \( y = x^2, z = y, y = 4 \) and \( z = 0 \) and then find its volume.

8. Find the volume of the solid bounded by the two paraboloids \( z = x^2 + 2y^2 \) and \( z = 12 - 2x^2 - y^2 \). (There is a picture of this solid on page 962 of your textbook.)

**Warm-Up for next Tuesday**

Use double integration in polar coordinate to find the area bounded by the cardioid \( r = 1 + \cos \theta \).