Math 151 - Week#06 **Name (Print)** _____
Spring 2021 - MT#1 review **RedID** _____
Week#6 **Section # /TA** _____

---

1. Find the area of the region bounded by the curves. Plot the curves and find their intersections.

$$y = \sin x,\ y = \cos x,\ x = 0,\ x = \pi/2.$$

2. Find the average value of $g(t) = \dfrac{t}{\sqrt{3+t^2}}$ on the interval $[1, 3]$.

3. Set up an integral (SLICES) for the volume obtained by rotating the region bounded by

$$y = e^{-x^2},\ y = 0,\ x = -1,\ x = 1$$

   (a) about the x-axis [plot region and a typical slice]

   (b) about $y = -1$ [plot region and a typical slice]

4. Set up an integral (SLICES) for the volume obtained by rotating the region bounded by

$$y = x^2,\ x^2 + y^2 = 1,\ y \geq 0$$

(a) about the x-axis [plot region and a typical slice]

(b) about the y-axis [plot region and a typical slice]

5. Set up an integral (SHELLS) for the volume obtained by rotating the region bounded by

$$x = \sqrt{\sin y},\ 0 \leq y \leq \pi,\ x = 0$$

(a) about the x-axis [plot region and a typical washer]

(b) about $y = 4$ [plot region and a typical washer]

6. Evaluate the integral $\int_0^2 y \sinh(\alpha y)\, dy =$

7. Evaluate the integral $\int \sin^3\theta \cos^4\theta\, d\theta =$

8. Evaluate the integral $\int_0^{\pi/2} \sin^2 x \cos^2 x\, dx =$

9. Evaluate the integral $\int \frac{1}{x^2 - a^2} dx$, where $a \neq 0$.

10. Evaluate the integral $\int \frac{2x^2 - x + 4}{x^3 + 4x} dx$.

11. Using trig sub, rewrite as a trigonmetric integral in θ (do NOT compute the integral):

$$\int_0^{3\sqrt{3}/2} \frac{x^3}{(4x^2+9)^{3/2}}\,dx =$$

12. Using trig sub, rewrite as a trigonmetric integral in θ (do NOT compute the integral):

$$\int \frac{x}{\sqrt{3-2x-x^2}}\,dx =$$

13. Find the work exerted by lifting a leaky bucket from the ground to the top of a building that is 100 m tall. The bucket begins with 40 liters of water (1 liter of water = 1 Kg) and leaks at rate of 100 milliliters per second. [Force = mg and consider, for simplicity, that $g = 10$].

    a) Assuming that the bucket is pulled up at a constant rate of 5 meters per second, compute the mass of the bucket as a function of distance from the floor. Compute the total work done when pulling the bucket all the way to the top of the building.

    b) Do the same for when the bucket is pulled at a rate of 1 meters per second.
    Which situation will require more work and why?