1. Use finite approximation to estimate the area under the graph of $f(x) = 4 - x^2$ between $x = -2$ and $x = 2$ using the follow rules (6 points)

   a. a lower sum with two rectangles of equal width.

   b. an upper sum with two rectangles of equal width.

2. Evaluate the sums of $\sum_{k=1}^{6}(k^2 - 5)$. (4 points)

3. Find the norm of the partition $P = \{-2, -1.6, -0.5, 0, 0.8, 1\}$. (5 points).

4. Find the average value of $f(t) = (t - 1)^2$ over $[0, 3]$.(5 points)

5. What values of a and b minimize the value of $\int_a^b (x^4 - 2x^2)\, dx$. (10 points)

6. Show that the value of $\int_0^1 \sqrt{x + 8}\, dx$ lies between $2\sqrt{2}$ and 3. (5 points)

7. Evaluate $\int_{\frac{\pi}{4}}^{\frac{3\pi}{4}} \csc\theta \cot\theta\, d\theta$. (8 points)

8. Find dy/dx where $y = (\int_0^x (t^3 + 1)^{10} dt)^3$. (10 points)

9. Find the area of the shaded region in Fig.1. (10 points)

10. Evaluate $\int \frac{\sec z \tan z}{\sqrt{\sec z}}\, dz$. (8 points)

11. Evaluate $\int \frac{x}{(x^2-4)^3}\, dx$. (10 points)

12. Find the area of the shaded region in Fig.2. (10 points)

13. Find the area of the propeller-shaped region enclosed by the curve $x - y^3 = 0$ and the line $x - y = 0$. (10 points)
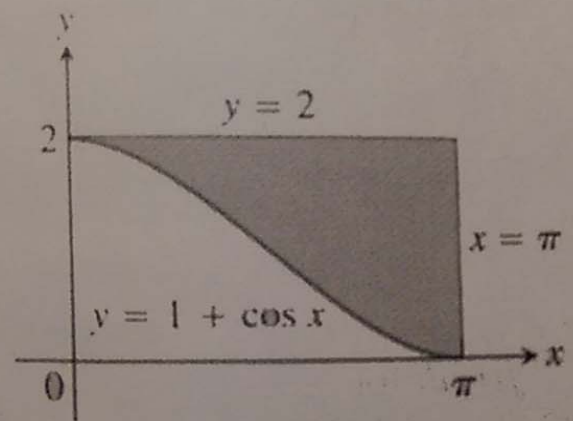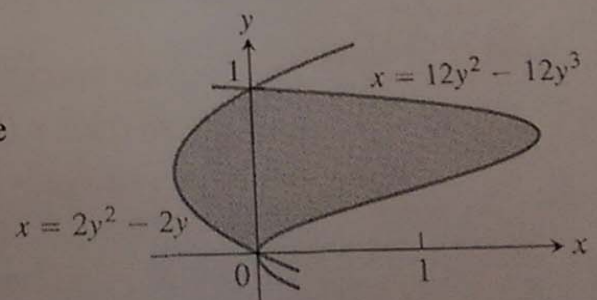

Fig.1

Fig.2