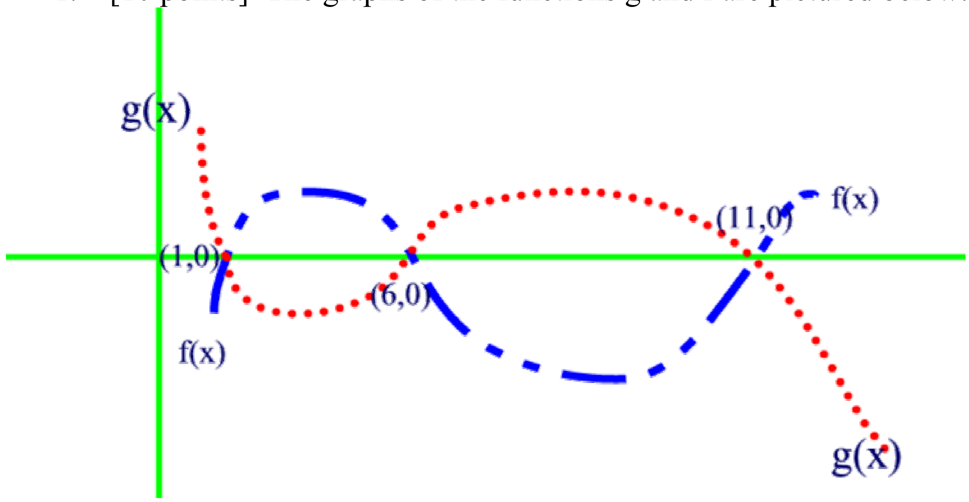
1. [10 points] The graphs of the functions g and f are pictured below:



$$\int_1^6 f(x)dx = 3, \quad \int_6^{11} f(x)dx = -7, \quad \text{and} \int_1^{11} g(x)dx = 10$$

The area bounded by f and g is 30.

   a. Find $\int_1^6 g(x)dx$ and $\int_6^{11} g(x)dx$
   b. Find the area bounded by f(x) and the x axis.
2. [9 points] Find the area of the region bounded $y = -x^2 + 8x - 11$ and $y = 2x - 6$.
3. [9 points] Find k so that

$$1 = \int_0^{\infty} ke^{-4t}dt$$

4. [9 points] Let C be the curve described by $x(t) = 2 + 2\cos t$ and $y(t) = 4 + 4\sin^2 t$ for $0 \le t \le \pi$.
   a. Find (dy/dx).
   b. Find the x and y of the point where C has a horizontal tangent line.
   c. Find an equation of the line tangent to C at (3, 7).
5. [16 points] Let C be the curve described by $x(t) = 1 - 2\cos^2 t$ and $y = 3\sin^2 t$ for $0 \le t \le \pi$.
   a. Draw a graph of C with a window: $-2 \le x \le 4$ and $-1 \le y \le 4$.
   b. Eliminate the parameter t. That is, find an equation that describes C with only variables x and y.
   c. A particle travels along C from time 0 to time π. Find the distance that that particle travels, i.e. e., the arc length of C from $t = 0$ to $t = \pi$.
   d. Find the distance from the initial point (x(0),y(0)) to the terminal point $((x(\pi), y(\pi))$, i.e. e. the displacement of the particle.
6. [9 points] Find the area inside of $r = 2$ and to the right of $r = \sec\theta$.
7. [12 points] Find a power series that represents:
   a. $\dfrac{2x}{1+x^2}$
   b. $\ln\left(1+x^2\right)$.

[Hint: $\sum_{n=0}^{\infty}(-1)^n x^{2n} = \frac{1}{1+x^2}$]

8. [4 points] State the Maclaurin series for
   a. e^x
   b. cos x

9. [6 points] Let $F(x) = \int_0^x \sin(t^3)dt$. Find the Maclaurin series of $\frac{d(F(x))}{dx}$

   [Hint: $\sin z = \sum_{k=0}^{\infty} (-1)^k \frac{z^{2k+1}}{(2k+1)!}$]

10. [8 points] If $f^{(n)}(0) = \left(\frac{2}{3}\right)^n (n!)$
    a. Find the Maclaurin series of f(x)
    b. Find the radius of convergence.

11. [10 points]
    a. Using the Taylor's polynomial (with a = 0) for the sin x with a 5^{th} degree term compute an approximation of sin .2.
    b. Using Taylor's inequality find an upper bound for your answer in 11 a.