1) A penguin is moving at velocity \( v(t) = \frac{1}{t+1} \) meters per hour for \( t=0 \) to \( t=2 \) hours. Use \( \Delta t = 0.5 \) to and left-hand Riemann sums to estimate the distance that the penguin travels during these 2 hours.

2) Find the area between the curves \( y=x^{1/2} \) and \( y=x^{1/3} \) for \( 0 \leq x \leq 1 \).

3) Suppose \( f(x) \) has the graph below. Sketch 2 functions \( F(x) \) such that \( F'(x)=f(x) \). In one case let \( F(0)=0 \) and in the other let \( F(0)=1 \).

4) Find the general antiderivative of the following functions:
   a) \( f(x) = x^2 + 1 \)  
   b) \( \sin(x)+\cos(x) \)  
   c) \( \sqrt{x-3} \)

5) Compute \( \int_{1}^{3} \frac{4}{x^5} \, dx \).

5) The rate of increase of a population of bacteria is given by the formula \( P'(t) = 6e^{0.6t} \) million per hour, at hour \( t \). Suppose \( P(0) = 0.5 \) billion. Find the population when \( t \) is 1 hour.

6) An object is thrown vertically upward with a speed of 10 m/sec from a height of 2 m. Find the highest point it reaches and when it reaches the ground. The acceleration of gravity is -9.8 m/sec^2.

7) Find \( \frac{d}{dx} \left( \int_{t}^{2} e^{-r^2} \, dr \right) \).

8) State the 2 fundamental theorems of calculus.