Week 1: Questions Taken From Past Midterms

(1) Find the function $F(x)$ such that $F'(x) = x\sqrt{3x+1}$ and $F(0) = 0$.

(2) Express the limit as a definite integral then evaluate:

$$\lim_{n\to\infty} \sum_{k=1}^{n} \frac{\pi}{4n} \tan \frac{k\pi}{4n}$$

(3) An object is tossed into the air at time $t = 0$. At time $t = 1$ seconds the object has reached height 14.7 m. Assuming that there is no air resistance, answer the following questions (recall that the gravitational constant $9.8m/s^2$; give your answers in decimals.

(a) What is the maximal height that the object reaches?

(b) What is the **total distance** that the object flies from time 0 until time $t = 3$?

(4) Use the midpoint rule with $n = 3$ subdivisions to find the approximate value of $\int_0^6 \frac{x^2+5}{x^3+1} dx$. Give your answer to two decimal places.