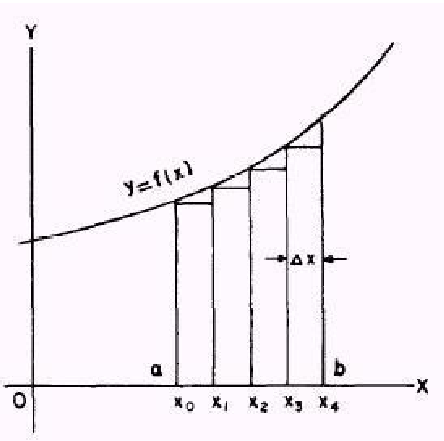
Common Instructions

1) Model all mathematical functions as C functions
2) You can use programs from previous labs or from lecture notes

(20 Marks)
Q1 Define an operation **sqn** as follows:
Take a number and calculate the sum of the squares of its digits.
Create a function that performs this operation on a number k times.
It is a mathematical fact that starting from any arbitary positive integer n, if we keep on applying the above operation, we shall eventually get either 1 or 89.
For example
sqn(17) = 50, sqn(50) = 25, sqn(25) = 29, sqn(29) = 85, sqn(85) = 89
Hence, if you did the operation k=5 times, you would have got 89.
Verify that after 5 repetitions on 17, you get 89.

(30 Marks)
Q2 Recall Week 3 optional problem. A perfect number is a positive integer that is the sum of its proper positive divisors, that is, the sum of the positive divisors excluding the number itself.
The first perfect number is 6, because 1, 2, and 3 are its proper positive divisors, and 1 + 2 + 3 = 6.
The next perfect number is 28 = 1 + 2 + 4 + 7 + 14.
Write a function which returns 1 if a given number is a Perfect number, and 0 otherwise. Use this function to find the smallest Perfect number, greater than a given number N. You may use other helper functions.
Using these functions, create another function to generate the first M perfect numbers.

(50 Marks)
Q3 Assume that you are given a curve as follows:
f(x) = -1 if x <= -1
x^3 if -1< x < 1
x^2-x+1 if 1 <= x
In order to find the area bounded by the (continuous) curve and the x-axis, we find the approximation by summing the area of infinitesimally thin vertical strips as
shown below:



Area of strips.

Create a function to approximate the area bounded by the above curve and the x-axis using strips of width Δx (parameter to the function) in the range [a,b] where a and b are *integral* values to be entered by the user.

Verify whether the following equality (approximately) holds true

Area[a,b] + Area[b,c] = Area [a, c]

Where Area[x,y] is the area of the curve in the range [x,y].

Also, note the difference in areas with different width of strips.