

Fundamental Problem

Generate a table of values for $f(x)$ on $x \in [a, b]$ given the spacing of the x values

- This forms a key component to many scientific computing problems

x	$f(x)$
0	0
0.1	0.01
0.2	0.04
0.3	0.09
0.4	0.16
0.5	0.25
0.6	0.36
0.7	0.49
0.8	0.64
0.9	0.81
1.0	1.00

$f(x) = x^2$ for $x \in [0, 1]$ with the x 's spaced 0.1 apart

} 11 points in the table

- normally we would specify the number of values in the table rather than the spacing (easier to do)

- Table spacing

$$h = \frac{b - a}{n}$$

- here, n is the number of "gaps" or intervals in the table.

- The number of points in the table will be $n + 1$.

- The hard part is generating the x values (or coordinates). The function values just go along for the ride.

- one way to do this

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$$n = 10$$

$$a = 0$$

$$b = 1$$

$$h = (b - a) / n$$

$$x = a$$

$$y = \boxed{x \times x \times 2}$$

WRITE (x, x) x, y

DO i = 2, n+1

$$x = x + h$$

$$y = \boxed{x \times x \times 2}$$

WRITE (x, x) x, y

ENDDO

} $x=0$
 $y=0$ start table up

—————→ get next x value
—————→ get new y value

i	x	y
2	$0 + 0.1 = 0.1$	0.01
3	$0.1 + 0.1 = 0.2$	0.04
4	$0.2 + 0.1 = 0.3$	0.09
5	$0.3 + 0.1 = 0.4$	0.16
6	$0.4 + 0.1 = 0.5$	0.25
7	$0.5 + 0.1 = 0.6$	0.36
8	$0.6 + 0.1 = 0.7$	0.49
9	$0.7 + 0.1 = 0.8$	0.64
10	$0.8 + 0.1 = 0.9$	0.81
11	$0.9 + 0.1 = 1.0$	1.00

With this framework only the first 3 lines and the functions in the boxes need to be changed if the table changes

(ie, tabulate $y = \sin(x)$ for $x \in [-\pi/2, \pi/2]$ using 51 points)
 $a = -\pi/2$, $b = \pi/2$, $n = 50$