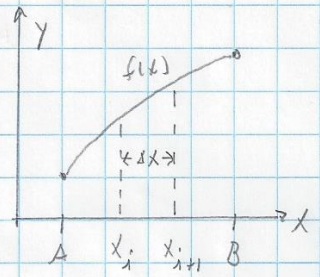
6.5. Trapezoidal Rule Program



As before, break $X \in [A, B]$ into N equal subintervals...

$$\Delta X = \frac{B-A}{N} \qquad X_i = A + (i-1)\Delta X \quad (i = 1, 2, \ldots, N)$$
$$X_{i+1} = X_i + \Delta X$$

$$\text{area} \approx \sum_{i=1}^{N} \frac{1}{2}\left[f(X_i) + f(X_{i+1})\right]\Delta X \qquad (*)$$

prgmTR (Trapezoidal Rule)

```
: ClrHome
: Disp "FROM:"
: Prompt A
: Disp "TO:"
: Prompt B
: Disp "NUMBER"
: Disp "SUBDIVISIONS:"
: Prompt N
: (B-A)/N → C                    ΔX ≡ C
: 0 → S                          S ≡ the integral
: For(I,1,N,1)
: A+(I-1)*C → D                  X_i ≡ D
: D+C → E                        X_{i+1} ≡ E
: S+0.5*(Y1(D)+Y1(E))*C → S      Formula (*)
: End
: Disp S
```

Example. For $\int_0^3 (-x^3 + 6x^2 - 9x + 4)\,dx$ the program gives...

N	area
3	6
10	5.3175
100	5.250675
1000	5.25000675

The exact value is $\int_0^3 (-x^3 + 6x^2 - 9x + 4)\,dx = \left[-\frac{1}{4}x^4 + 2x^3 - \frac{9}{2}x^2 + 4x\right]_0^3 = 5\frac{1}{4} = 5.25$