**Exercise A.1.** For a given function $f(x)$, the integral $\int\_{a}^{b}f(x)dx$ computed using the formula

$\int\_{a}^{b}f(x)dx ≈h\left[\frac{1}{2}f(x\_{0})+\sum\_{i=1}^{n-1}f(x\_{i})+\frac{1}{2}f(x\_{n})\right]$

is approximated by n trapezoids of equal width h.

Write a Python function that takes any $f$ , $a$ and $b$, and $n$ and returns the approximation.

**Solution:** We write a Python function *trapz.py* with variables corresponding to the notation

| 1 | def trapz(f, a, b, n): |
| --- | --- |
| 2 |  h = float(b-a)/n |
| 3 |  result = 0.5\*f(a) + 0.5\*f(b) # 1st and 3rd term between brackets  |
| 4 |  for i in range(1, n): |
| 5 |  result += f(a + i\*h) # Loop through index i (2nd term) |
| 6 |  result \*= h # Final multiplication |
| 7 |  return result |

The function can be tested as follows

| 1 | >>> from trapz import trapz |
| --- | --- |
| 2 | >>> from math import exp |
| 3 | >>> v = lambda t: 3\*(t\*\*2)\*exp(t\*\*3) |
| 4 | >>> n = 4 |
| 5 | >>> num\_int = trapz(v, 0, 1, n) |
| 6 | >>> num\_int |
| 7 |  1.9227167504675762 |

**Exercise A.2.** ...

**Solution:** ...