3. [12 points] Shown below is a graph of a function $r(t)$. The graph consists of a straight line between $t = 0$ and $t = 2$ and a quarter circle between $t = 2$ and $t = 3$.

Calculate the following using the graph and the properties of integrals.

a. [4 points] $-3 \int_0^3 (2 + r(t)) \, dt$.

Solution: We compute

$$-3 \int_0^3 (2 + r(t)) \, dt = -6 \int_0^3 1 \, dt - 3 \int_0^3 r(t) \, dt = -18 - 3(1 + \pi/4) = -21 - 3\pi/4.$$ 

b. [4 points] $\int_{1/2}^{3/2} r'(t) \, dt$.

Solution: By the fundamental theorem of calculus,

$$\int_{1/2}^{3/2} r'(t) \, dt = r(3/2) - r(1/2) = 1 - (-1) = 2.$$ 

c. [4 points] The average value of $r$ on the interval $[1, 3]$.

Solution: The average value of $r$ on the interval $[1, 3]$ is

$$\frac{1}{3 - 1} \int_1^3 r(t) \, dt = \frac{1}{2} \left( 1 + 1 + \pi/4 \right) = 1 + \pi/8.$$