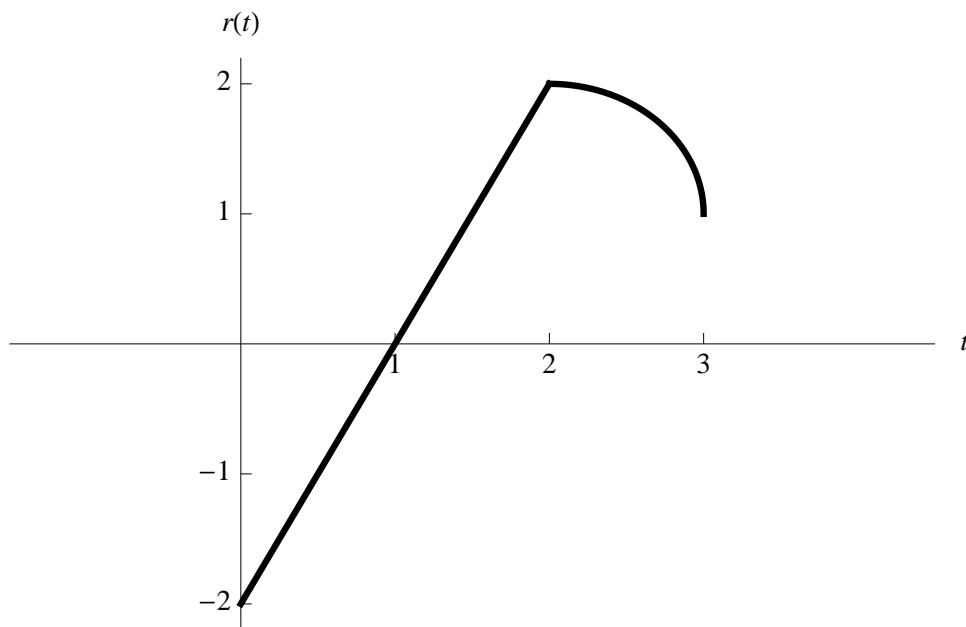


3. [12 points] Shown below is a graph of a function  $r(t)$ . The graph consists of a straight line between  $t = 0$  and  $t = 2$  and a quarter circle between  $t = 2$  and  $t = 3$ .



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

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