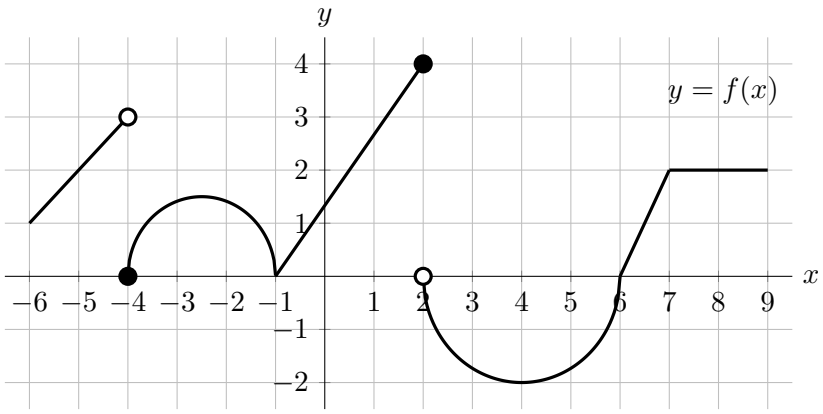
2. [9 points] The graph of $f(x)$ shown below consists of lines and semicircles.



Use the graph above to calculate the answers to the following questions. Give your answers as exact values. You do not need to show work. If any of the answers can't be found with the information given, write "NEI".

a. [3 points] Find the average value of $f(x)$ on $[-4, 2]$.

Solution: $\frac{1}{6}\int_{-4}^{2} f(x)dx = \frac{1}{6}(\frac{1}{2}\pi(1.5)^2 + \frac{1}{2}(4)(3)) = \frac{1}{6}(\frac{9\pi}{8} + 6) = \frac{9\pi}{48} + 1$

b. [2 points] Find the value of $\int_4^9 |f(z)|dz$.

Solution: $\int_4^9 |f(z)|dz = -\int_4^6 f(z)dz + \int_6^9 f(z)dz = \frac{1}{4}\pi(2)^2 + \frac{1}{2}(3+2)(2) = 5 + \pi$

c. [2 points] Find the value of $4 < T \leq 9$ such that $\int_4^T f(x)dx = 0$.

Solution: We need to find a value of T for which

$$\int_4^T f(x)dx = \int_4^6 f(x)dx + \int_6^T f(x)dx = 0.$$

From the graph $\int_4^6 f(x)dx = -\pi$ and $\int_6^T f(x)dx = \frac{1}{2}((T-6)+(T-7))(2) = 2T - 13$.
Solving for T on $2T - 13 = \pi$, we get $T = \frac{\pi + 13}{2}$.

d. [2 points] Find the value of $\int_{-8}^{-7} f(x+2) + 1\, dx$.

Solution:

$$\int_{-8}^{-7} f(x+2) + 1\, dx = \int_{-6}^{-5} f(x) + 1\, dx = \int_{-6}^{-5} f(x)dx + 1 = 1.5 + 1 = 2.5.$$

