# 4.4 Worksheet: The Definite Integral

Purpose: One of the best ways to learn math is practice. Often we can't tell what we don't understand until we try to do it. The goal of this worksheet is to give you lots of problems to try. If you get stuck or make mistakes the important thing to do is maintain a growth oriented mindset! This is just practice, and there will be more practice before you are done. Take your time, remember our goals for productive group work, and ask questions!

1. **Computing integrals using area:**

   (a) Below is a graph of the function $f(x)$. Compute $\int_0^2 f(x)\,dx$ and $\int_0^5 f(x)\,dx$.
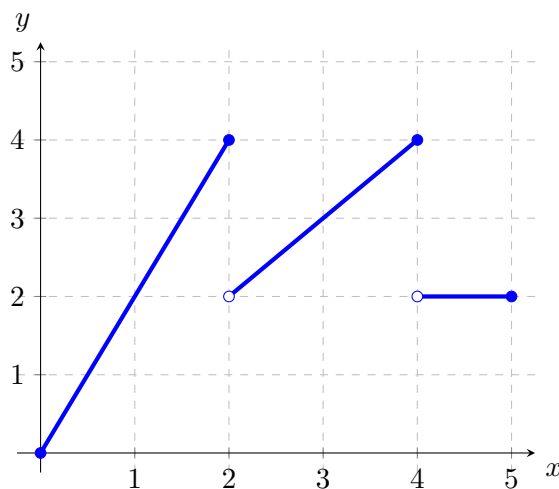

   (b) Consider the function $g(x) = \sqrt{1-(x-2)^2}$. What is the domain of $g(x)$? Sketch the graph of $g(x)$ and use it to compute $\int_1^3 g(x)\,dx$.
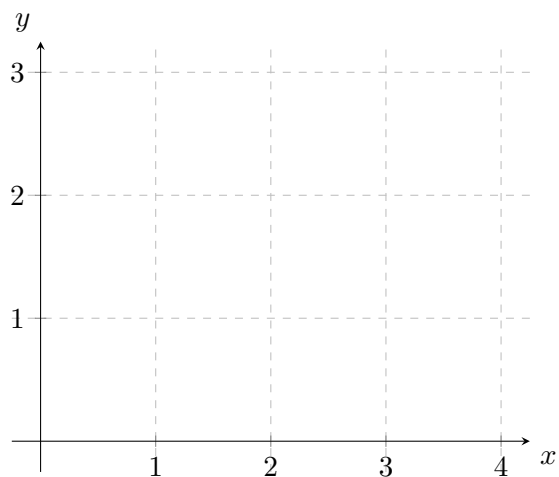
2. **Net change versus total displacement:** The following function keeps track of the velocity of an ant in an ant farm.

$$f(t) = \begin{cases} 2 & \text{if } 0 \le t < 2 \\ 6 - 2t & \text{if } 2 \le t < 4 \\ -6 + t & \text{if } 4 \le t \le 5 \end{cases}$$

How far did the ant walk (this is called total displacement)? How far did the ant end up from where it started (this is called net displacement)?
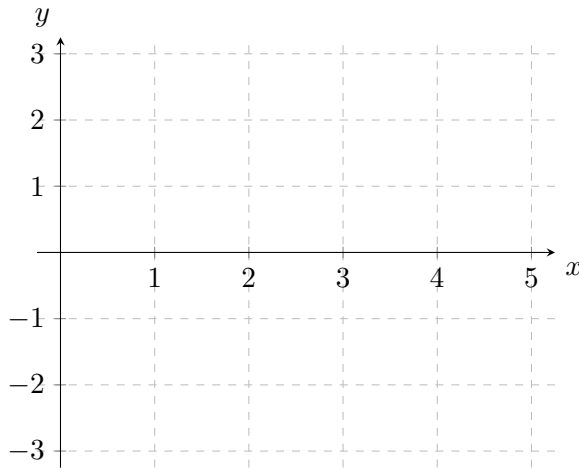
3. **Average velocity:** The velocity of a baseball as a function of time after being released by the pitcher is given by $f(t) = 98 - ln(20t + 1)$. Estimate the average velocity of the baseball in the 0.4 seconds it takes to reach the batter. What is the maximum velocity of the pitch?