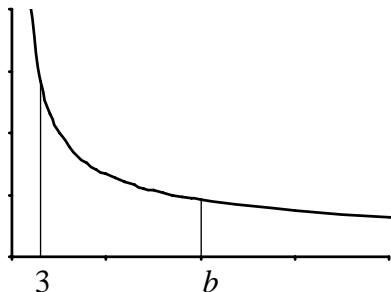


### EXAMPLE

**Step 1:** Use the Fundamental Theorem to find the finite area below  $f(x) = \frac{1}{\sqrt{x-1}}$  over the interval  $[3, b]$ .



$$\int_3^b \frac{1}{\sqrt{x-1}} dx = 2\sqrt{x-1} \Big|_3^b = 2\sqrt{b-1} - 2\sqrt{2}$$

**Step 2:** Determine what happens to the area as  $b \rightarrow \infty$ .

$b$	area
4	0.63567449
40	9.66156887
400	37.12154159
4000	123.64686691
40000	397.16657284
400000	1262.08105580
4000000	3997.17107288

$$\lim_{b \rightarrow \infty} (2\sqrt{b-1} - 2\sqrt{2}) = \infty$$

**Conclusion:** We say that the improper integral  $\int_3^{\infty} \frac{1}{\sqrt{x-1}} dx$  diverges. There is an infinite amount of area under the graph.

---

### Practice:

Use the Fundamental Theorem to find the finite area below  $f(x) = \frac{1}{1.02^x}$  over the interval  $[0, b]$ .

Determine what happens to the area as  $b \rightarrow \infty$ .

State a conclusion.