

Discovery Exercise for Heaviside and Dirac

We begin with the following function definition.

$$H(x) = \begin{cases} 0 & x < 0 \\ 1 & x \geq 0 \end{cases}$$

In Parts 1–6 graph each given function. You should be able to draw all 6 graphs in under five minutes with no electronic aid.

1. $H(x)$

2. $H(x - 3)$

3. $H(x) - H(x - 3)$

See Check Yourself #68 at felderbooks.com/checkyourself

4. $x^2H(x)$

5. $x^2H(x - 3)$

6. $(x - 3)^2H(x - 3)$

We now define another function:

$$D(x) = \begin{cases} 0 & x < 0 \\ 1/k & 0 \leq x \leq k \\ 0 & x > k \end{cases}$$

7. For $k = 4$ draw a graph of $D(x)$ and calculate $\int_{-\infty}^{\infty} D(x) dx$

8. For $k = 1$ draw a graph of $D(x)$ and calculate $\int_{-\infty}^{\infty} D(x) dx$

9. For $k = 1/3$ draw a graph of $D(x)$ and calculate $\int_{-\infty}^{\infty} D(x) dx$