**Wind Chill** The formula that gives the wind chill factor for a 60°F temperature and a wind with velocity $V$ in miles per hour is

$$W = \begin{cases} 
60 & \text{if } 0 \leq V < 4 \\
0.644V - 9.518\sqrt{V} + 76.495 & \text{if } 4 \leq V \leq 55.9 \\
41 & \text{if } V > 55.9 
\end{cases}$$

Before we get started answering the questions, let’s notice how the wind chill function $W$ is defined on three intervals. The part of the function that you use will depend on the velocity of the wind, $V$.

For example, if the wind speed is at least 0 and less than 4, we’ll use the first piece of the function:

$$W = \begin{cases} 
60 & \text{if } 0 \leq V < 4 \\
0.644V - 9.518\sqrt{V} + 76.495 & \text{if } 4 \leq V \leq 55.9 \\
41 & \text{if } V > 55.9 
\end{cases}$$

Likewise, if the wind speed is at least 4 and at most 55.9, we’ll use the second piece of the function:

$$W = \begin{cases} 
60 & \text{if } 0 \leq V < 4 \\
0.644V - 9.518\sqrt{V} + 76.495 & \text{if } 4 \leq V \leq 55.9 \\
41 & \text{if } V > 55.9 
\end{cases}$$

And last, if the wind speed is greater then 55.9, we’ll use the third piece of the function:

$$W = \begin{cases} 
60 & \text{if } 0 \leq V < 4 \\
0.644V - 9.518\sqrt{V} + 76.495 & \text{if } 4 \leq V \leq 55.9 \\
41 & \text{if } V > 55.9 
\end{cases}$$

**a.** Find the wind chill factor for the 60°F temperature if the wind is 20 mph.

We’re asked about the value of $W$ when $V = 20$ so our first step is to find the piece of $W$ that corresponds to 20. Since 20 falls between 4 and 55.9 we’ll use the function $W = 0.644V - 9.518\sqrt{V} + 76.495$ and substitute $V = 20$ to find $W$.

$$W = 0.644V - 9.518\sqrt{V} + 76.495$$

$$= 0.644(20) - 9.518\sqrt{20} + 76.495$$

$$= 46.81$$

The wind chill factor for a 60°F temperature when the wind is blowing 20 mph is 47°F.

**b.** Find the wind chill factor for the 60°F temperature if the wind is 65 mph.

In this question we’re asked about the value of $W$ when $V = 65$. The third piece of the function is defined for all values of $V$ that are greater than 55.9. Since 65 > 59.9, we see that $W = 41$.

The wind chill factor for a 60°F temperature when the wind is blowing 65 mph is 41°F.

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1Harshbarger/Yocco, College Algebra In Context, 5e, p. 210, #48.
c. *Graph the function for* \( 0 \leq V \leq 80 \).

I graphed \( W \) in three pieces so you can clearly see how the function is defined in the given intervals.

\[
\begin{align*}
\text{If } 0 \leq V < 40, & \quad y = 40 - 0.64V \\
\text{If } 40 \leq V \leq 55.9, & \quad y = 41 - 0.64V \\
\text{If } V \geq 55.9, & \quad y = 41 - 2V \\
\end{align*}
\]

\( d. \) *What are the domain and range of the function graphed in part (c)?*

The domain is all values of \( V \) that are defined. In this example, it doesn’t make sense for the wind to blow in negative miles per hour and part (c) limits us to a wind velocity of 80. This gives us a domain of \( 0 \leq V \leq 80 \).

The range are the values of \( W \) that are generated by the values of the domain. The range is \( 41 \leq W \leq 60 \).