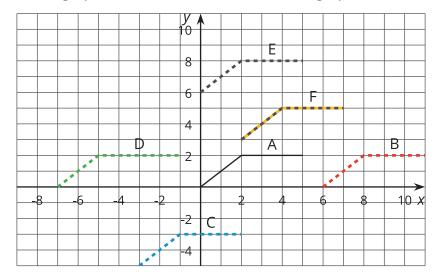
More Movement

Let's translate graphs vertically and horizontally to match situations.



Moving a Graph

How can we translate the graph of A to match one of the other graphs?

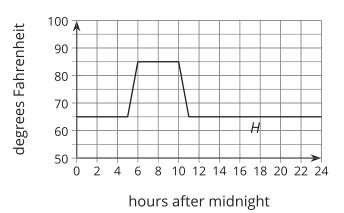


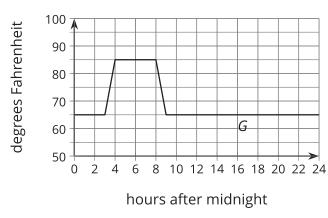


3.2

New Hours for the Kitchen

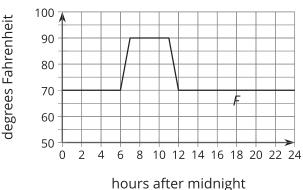
Remember the bakery with the thermostat set to $65^{\circ}F$? At 5:00 a.m., the temperature in the kitchen rises to $85^{\circ}F$ due to the ovens and other kitchen equipment being used until they are turned off at 10:00 a.m. When the owner decided to open 2 hours earlier, the baking schedule changed to match.





1. Andre thinks, "When the bakery starts baking 2 hours earlier, that means I need to subtract 2 from x and that G(x) = H(x-2)." How could you help Andre understand the error in his thinking?

2. The graph of F shows the temperatures after a change to the thermostat settings. What did the owner do?

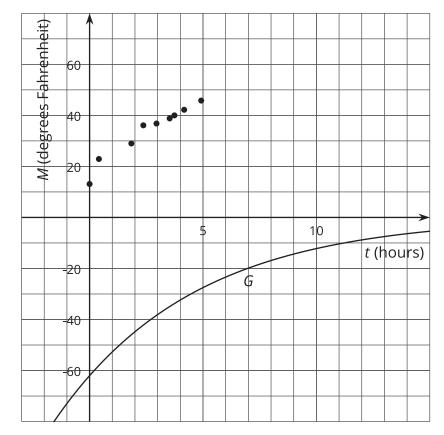


3. Write an expression for F in terms of the original baking schedule, H.

3.3 Thawing Meat

A piece of meat is taken out of the freezer to thaw. The data points show its temperature M, in degrees Fahrenheit, t hours after it was taken out. The graph M = G(t), where $G(t) = -62(0.85)^t$, models the shape of the data but is in the wrong position.

t	M
0	13.1
0.41	22.9
1.84	29
2.37	36.1
2.95	36.8
3.53	38.8
3.74	40
4.17	42.2
4.92	45.8



Jada thinks changing the equation to $J(t) = -62(0.85)^t + 75.1$ makes a good model for the data. Noah thinks $N(t) = -62(0.85)^{(t+1)} + 68$ is better.

1. Without graphing, describe how Jada and Noah each transformed the graph of G to make their new functions to fit the data.

- 2. Use technology to graph the data, J and N, on the same axes.
- 3. Whose function do you think best fits the data? Be prepared to explain your reasoning.



Are you ready for more?

Elena excludes the first data point and chooses a linear model, E(t) = 21.32 + 5.06t, to fit the remaining data.

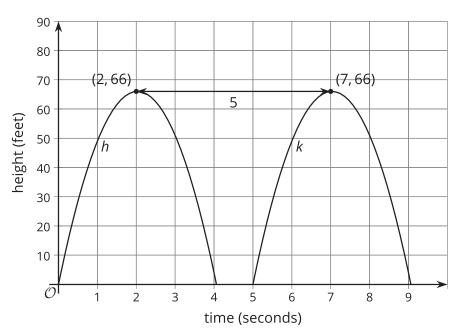
- 1. How well does Elena's model fit the data?
- 2. Is Elena's idea to exclude the first data point a good one? Explain your reasoning.

Lesson 3 Summary

Remember the pumpkin catapult? The function h gives the height h(t), in feet, of the pumpkin above the ground t seconds after launch.

Now suppose k represents the height k(t), in feet, of the pumpkin if it were launched 5 seconds later. If we graph k and h on the same axes they looks identical, but the graph of k is translated 5 units to the right of the graph of h.

Since we know the pumpkin's height k(t) at time t is the same as the height h(t) of the original pumpkin at time t-5, we can write k in terms of h as k(t) = h(t-5).



Suppose there was a third function, j, where j(t) = h(t+4). Even without graphing j, we know that the graph reaches a maximum height of 66 feet. To evaluate j(t), we evaluate h at the input t+4, which is zero when t=-4. So the graph of j is translated 4 seconds to the left of the graph of h. This means that j(t) is the height, in feet, of a pumpkin launched from the catapult 4 seconds earlier.

