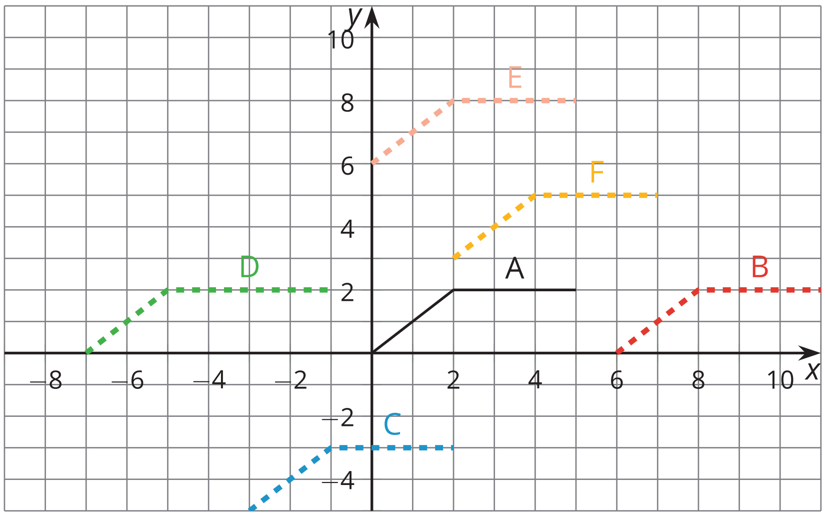
Lesson 3: More Movement

- Let’s translate graphs vertically and horizontally to match situations.

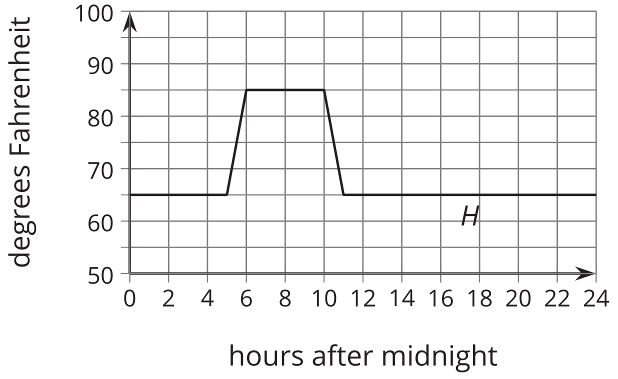
3.1: Moving a Graph

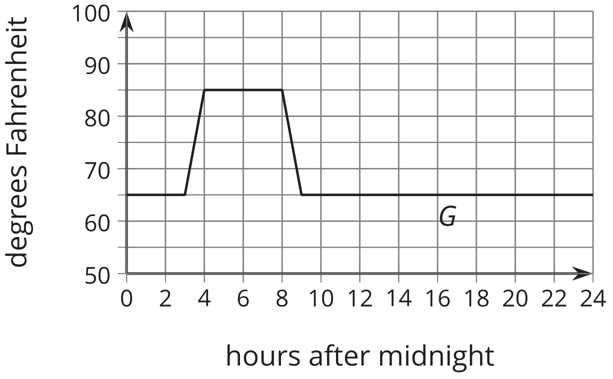
How can we translate the graph of A to match one of the other graphs?



3.2: New Hours for the Kitchen

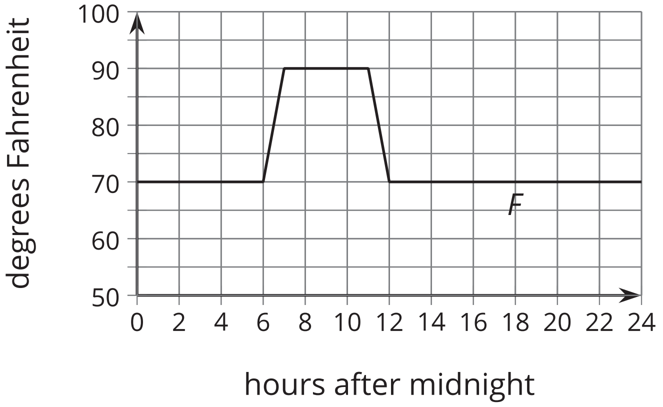
Remember the bakery with the thermostat set to 65°F? At 5:00 a.m., the temperature in the kitchen rises to 85°F due to the ovens and other kitchen equipment being used until they are turned off at 10:00 a.m. When the owner decided to open 2 hours earlier, the baking schedule changed to match.





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?

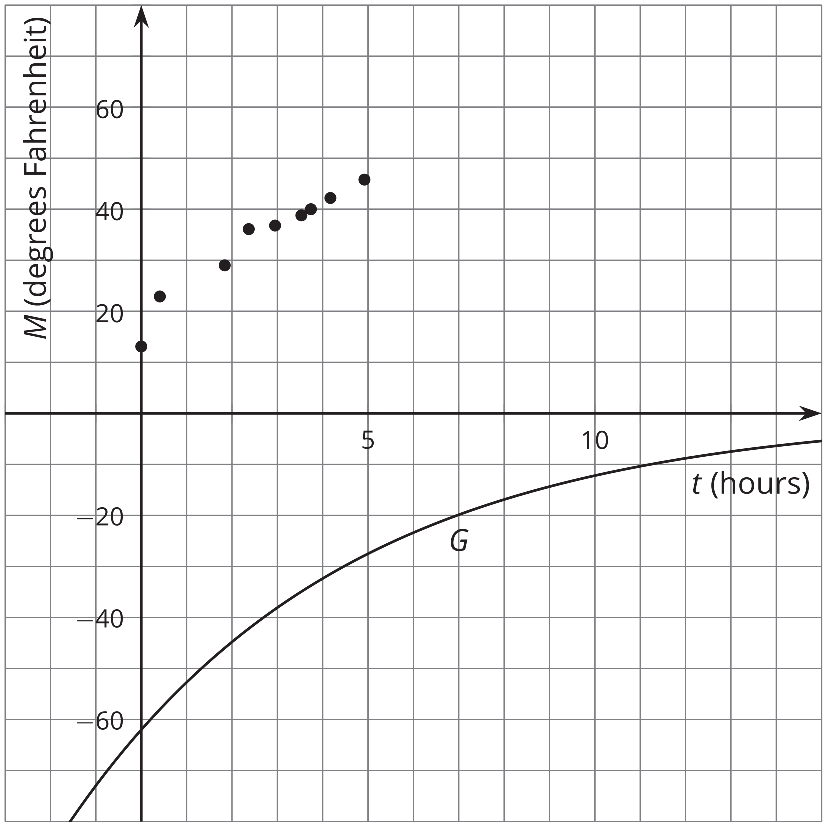


3. Write an expression for F in terms of the original baking schedule, H.

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?

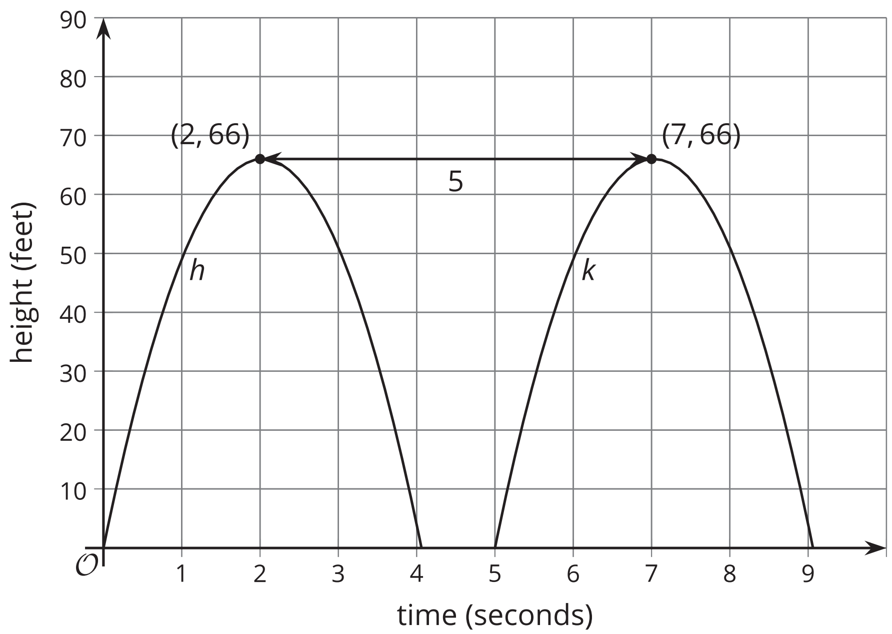
Elena excludes the first data point and chooses a linear model, $E(t) = 21.32 + 5.06t$, to fit the remaining data.

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 g.



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.