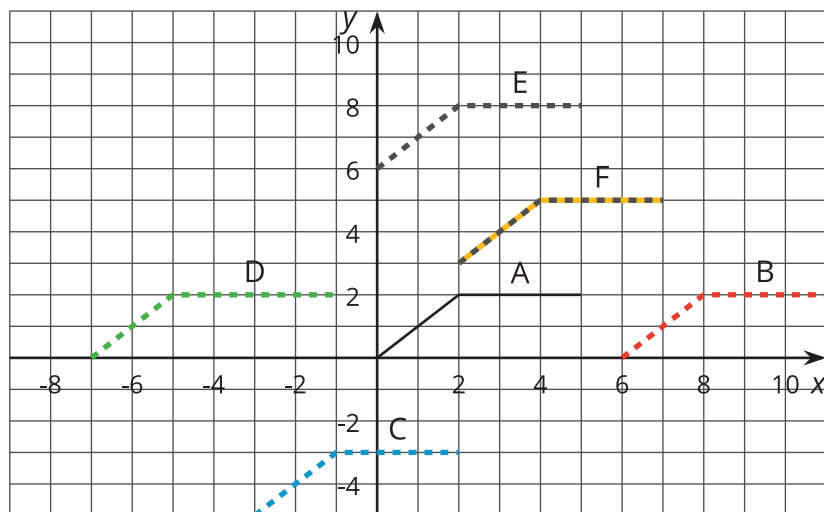


More Movement

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

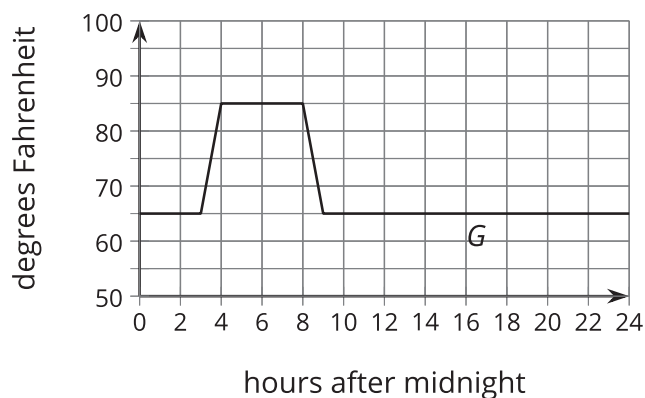
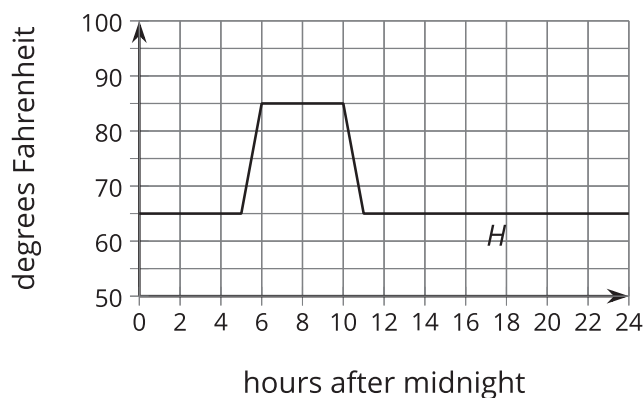
3.1 Moving a Graph

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

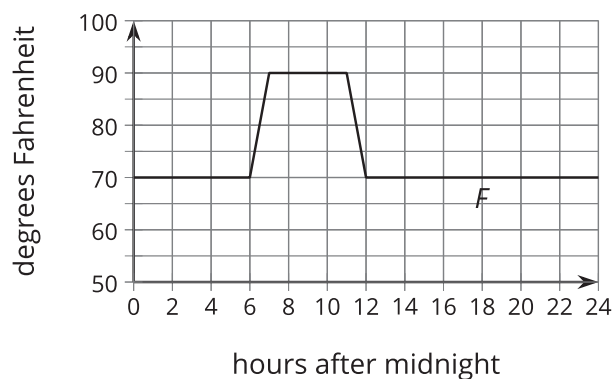


3.2 New Hours for the Kitchen

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?

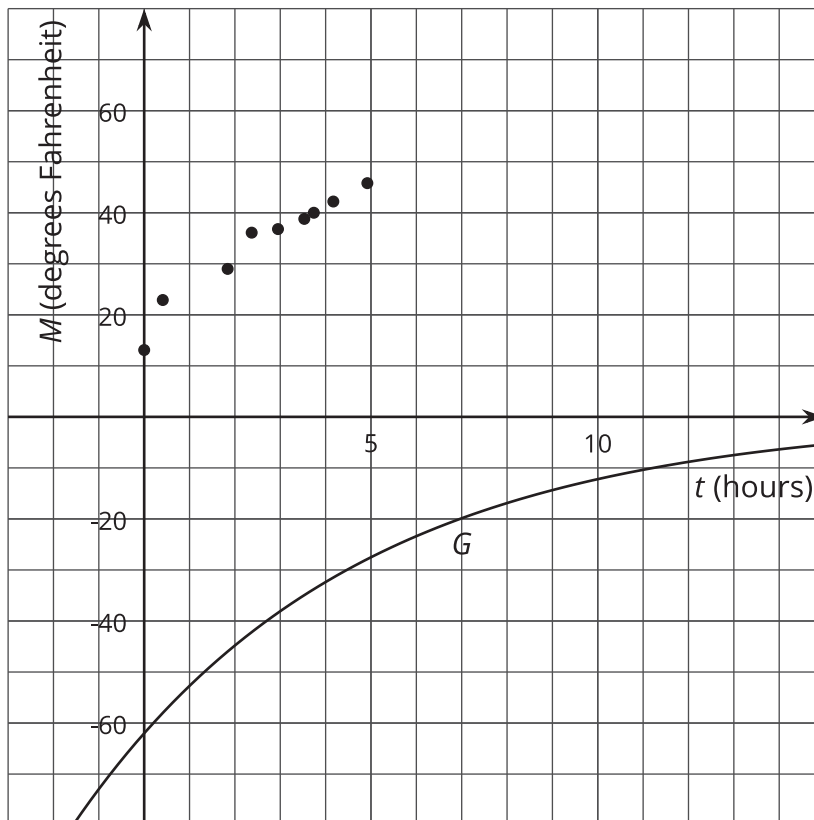


3. Write an expression for F in terms of the original baking schedule, H .

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.

- Without graphing, describe how Jada and Noah each transformed the graph of G to make their new functions to fit the data.
- Use technology to graph the data, J and N , on the same axes.
- 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.

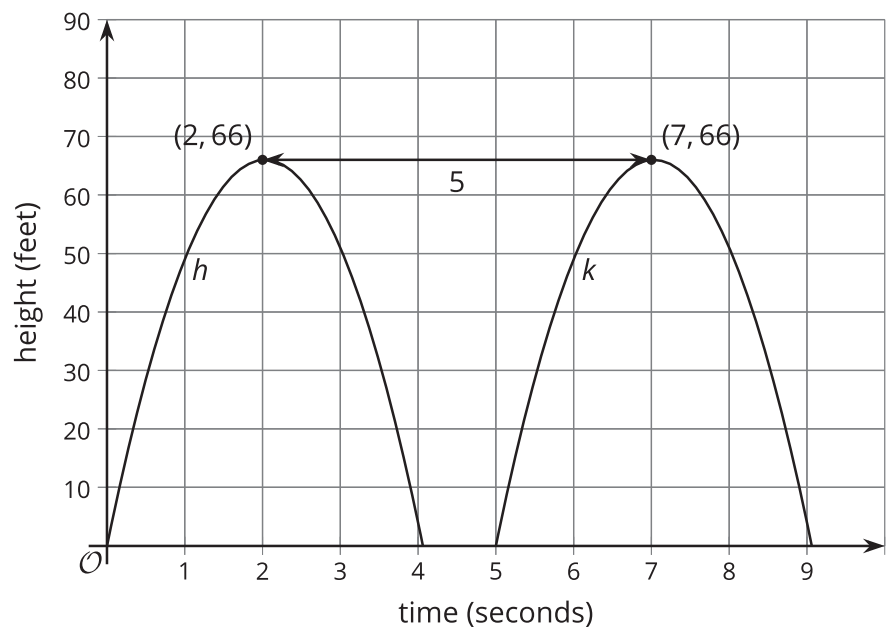
1. How well does Elena's model fit the data?
2. Is Elena's idea to exclude the first data point a good one? Explain your reasoning.

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 look 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.