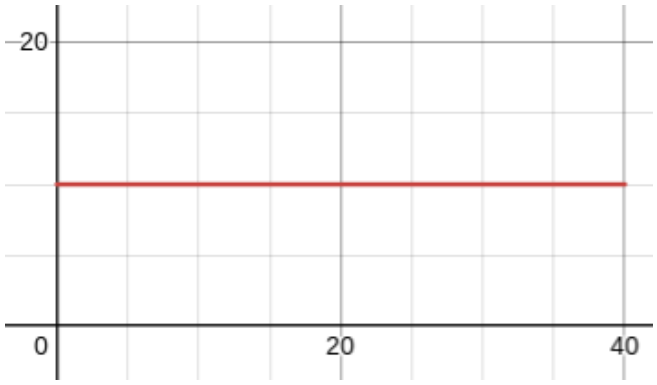
Calculus 1.1 Key Points

Speed and Distance:

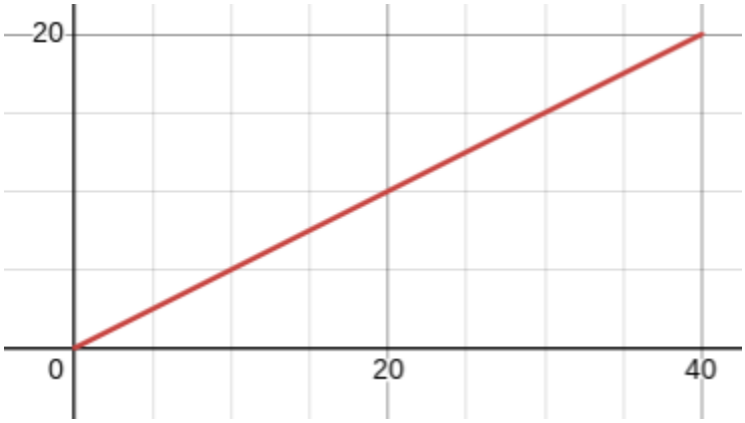
$Distance = Rate \bullet Time$

Suppose the following graph shows the speed of a car (in miles per hour) as a function of time (in hours)



This graph tells us that the car travels at a constant speed of 10 miles per hour for 40 hours. Using our formula above, we know that the car traveled $10 \bullet 40 = 400$ miles

Now, take this graph of distance (in miles) as a function of time (in hours)



This graph tells us that the car travels a total of 20 miles in 40 hours. Rearranging our formula above, we know that the car traveled an average of $20/40 = 0.5$ miles per hour

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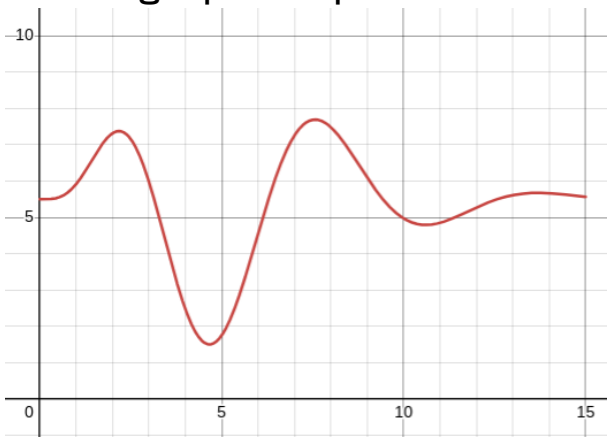
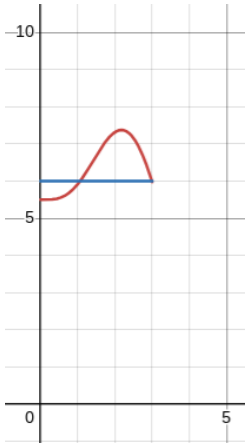
It's easy to take the speed or distance graph and find out the other when the graphs are straight lines. What do we do with curved graphs, like this graph of speed as a function of time?



The key idea is to break it up into smaller parts. For example, if we look at the segment from 0 to 3, we can see that the speed is around 6 miles per hour



Thus, we can approximate that, for the first three hours, the car traveled $6 \bullet 3 = 18$ miles, which relatively close to how far the car actually traveled during that time (19.249 miles). We can repeat this process to solve for how far the car traveled over the entire interval.

Right now, this process is only an approximation, and later on we will use methods to get more accurate answers. But for now, the key takeaway is to understand the connection between speed and distance.