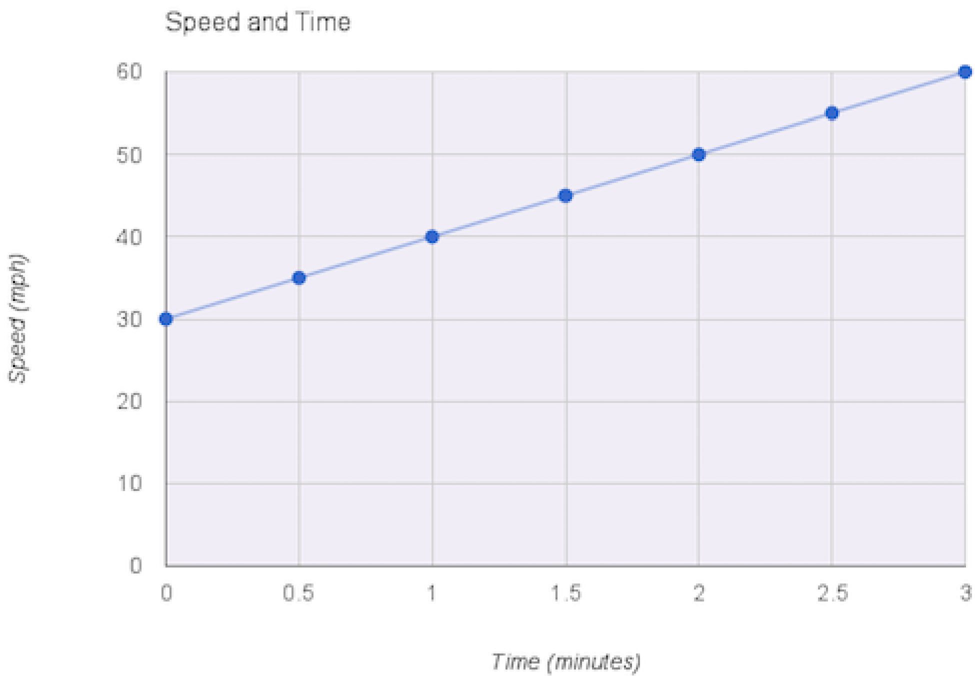
A Sloped Straight Line

Imagine that same car going at 30 miles per hour. We press the accelerator gently, and the car speeds up. We keep it pressed and watch the speed dial on the dashboard and note the speed every 30 seconds. After 30 seconds the car is going at 35 miles per hour. After 1 minute the car is now going at 40 miles per hour. After 90 seconds it's going at 45 miles per hour, and after 2 minutes it's 50 miles per hour. The car keeps speeding up by 10 miles per hour every minute. Here's the same information summarised in a table.

Time (mins)	**Speed (mph)**
0.0	30
0.5	35
1.0	40
1.5	45
2.0	50
2.5	55
3.0	60

Let's visualize this again.



You can see that the speed increases from 30 miles per hour all the way up to 60 miles per hour at a *constant rate*. You can see this is a constant rate because the increments in speed are the same every half a minute and this leads to a straight line for speed. What's the expression for the speed? Well we must have speed 30 at time zero. And after that we add an extra 10 miles per hour every minute. So the expression is as follows.

$$speed = 30 + (10 * time)$$

Or using symbols,

$$s = 30 + 10t$$

You can see the constant 30 in there. And you can also see the (10 * time) which adds the 10 miles per hour for every minute. You'll quickly realize that the 10 is the *gradient* of that line we plotted. Remember the general form of straight lines is $y = ax + b$ where a is the *slope*, or *gradient*. So what's the expression for how speed changes with time? Well, we've already been talking about it, speed increases ten mph every minute.

$$\frac{\delta s}{\delta t} = 10$$

What this is saying, is that there is indeed a dependency between speed and time. This is because $\partial s / \partial t$ is not zero. Remembering that the slope of a straight line $y = ax + b$ is a, we can see “by inspection” that the slope of $s = 30 + 10t$ will be 10. Great work! We’ve covered a lot of the basics of calculus already, and it wasn’t that hard at all. Now let’s hit that accelerator harder!