

Position at time $t = 4$.

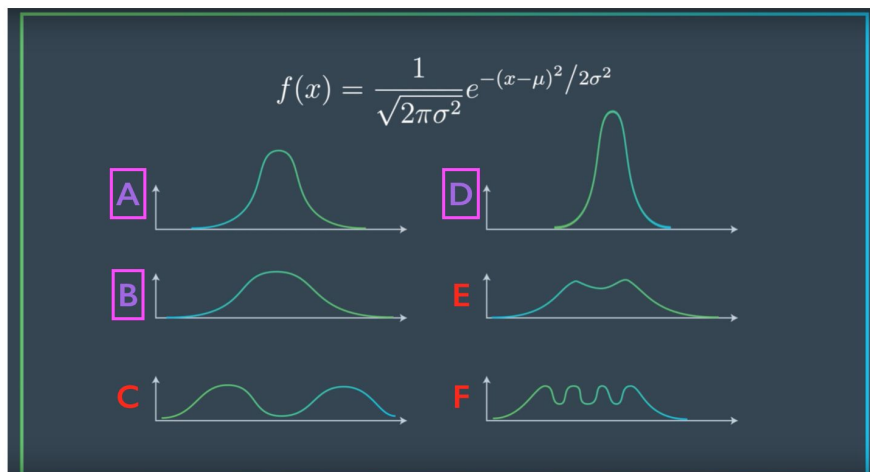
Inferring Velocity

From the earlier positions, we can infer the velocity (indicated by the pink arrow in the image) of the object; the velocity appears to be u and to the left by a fairly consistent amount between each time step.

Assuming no drastic change in velocity occurs, we predict that at time $t = 4$, the object will be on this same trajectory, at point B.

Kalman Filter

A Kalman filter gives us a mathematical way to infer velocity from only a set of measured locations. In this lesson, we'll learn how to create a 1D Kalman filter that takes in positions, like those shown above, takes into account uncertainty, and estimates where future locations might be and the velocity of an object!



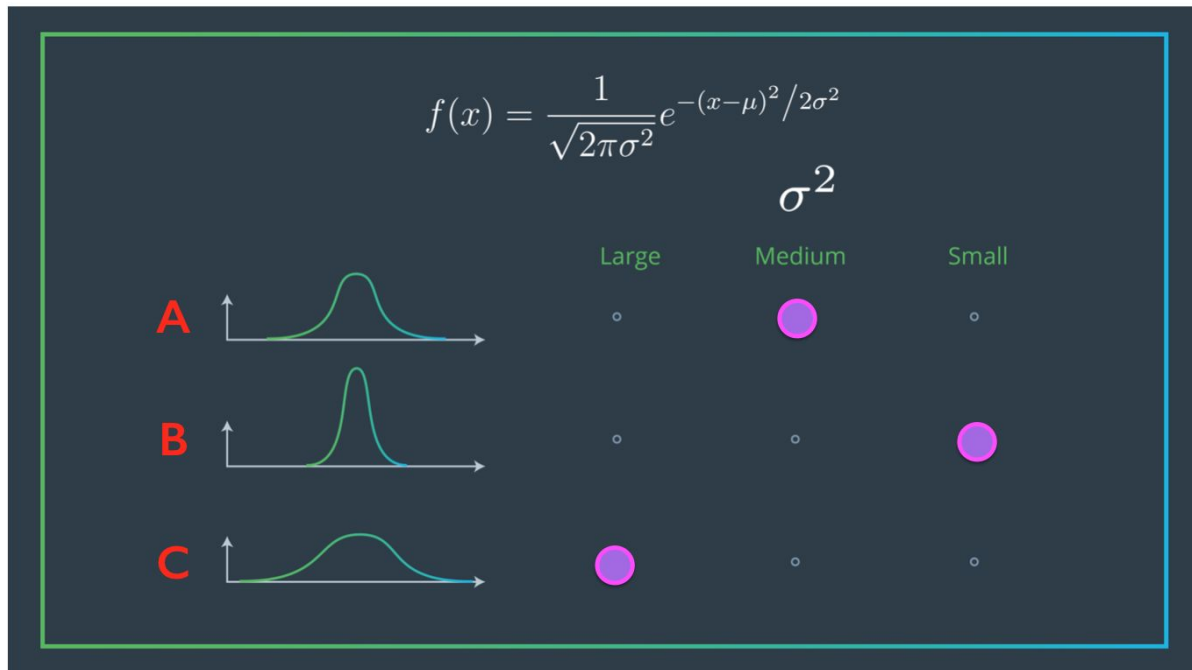
All Gaussians.

Gaussian Characteristics

Gaussians are exponential function characterized by a given **mean**, which defines the location of the peak of a Gaussian curve, and a **variance** which defines the width/spread of the curve. All Gaussians are:

- **symmetrical**
- they have **one peak**, which is also referred to as a "unimodal" distribution, and * they have an exponential drop off on either side of that peak

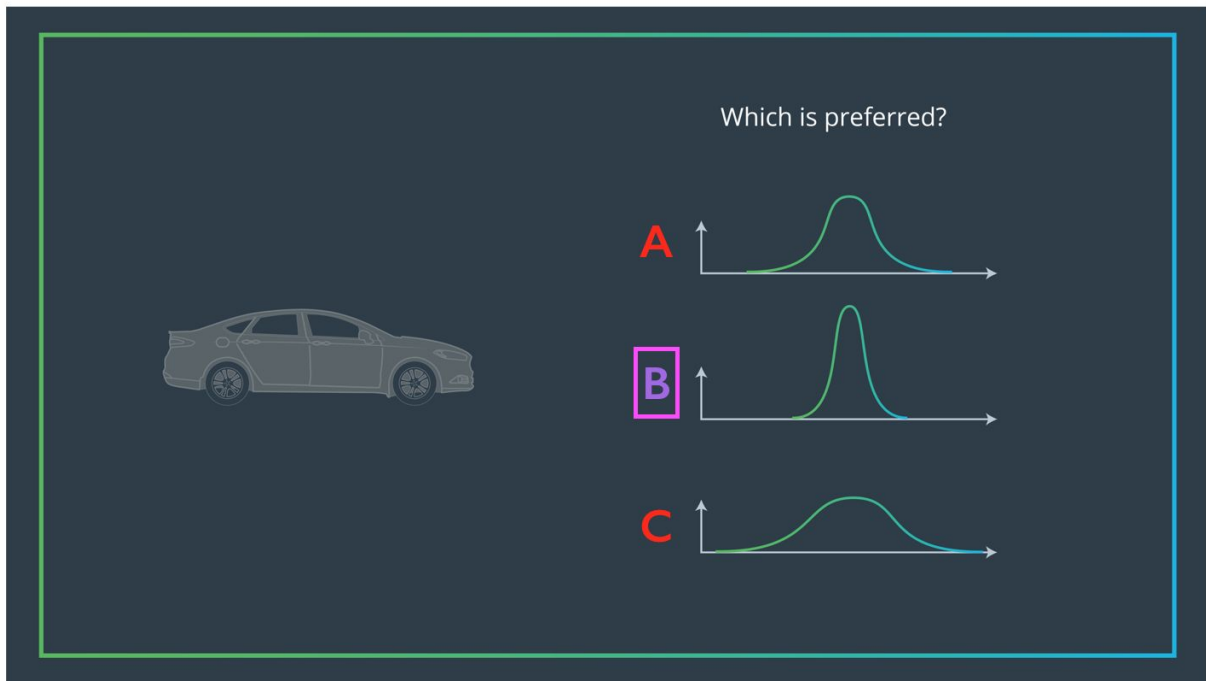
Options C, E, and F all have multiple peaks and so are *not* Gaussians.



Variance

The variance is a measure of Gaussian spread; the smallest spread is Gaussian B, the largest is Gaussian A. You may also notice that larger variances correspond to shorter Gaussians.

Variance is also a measure of certainty; if you are trying to find something like the location of a car with the *most* certainty, you'll want a Gaussian whose mean is the location of the car and with the smallest uncertainty/spread. As seen in the answer, below.



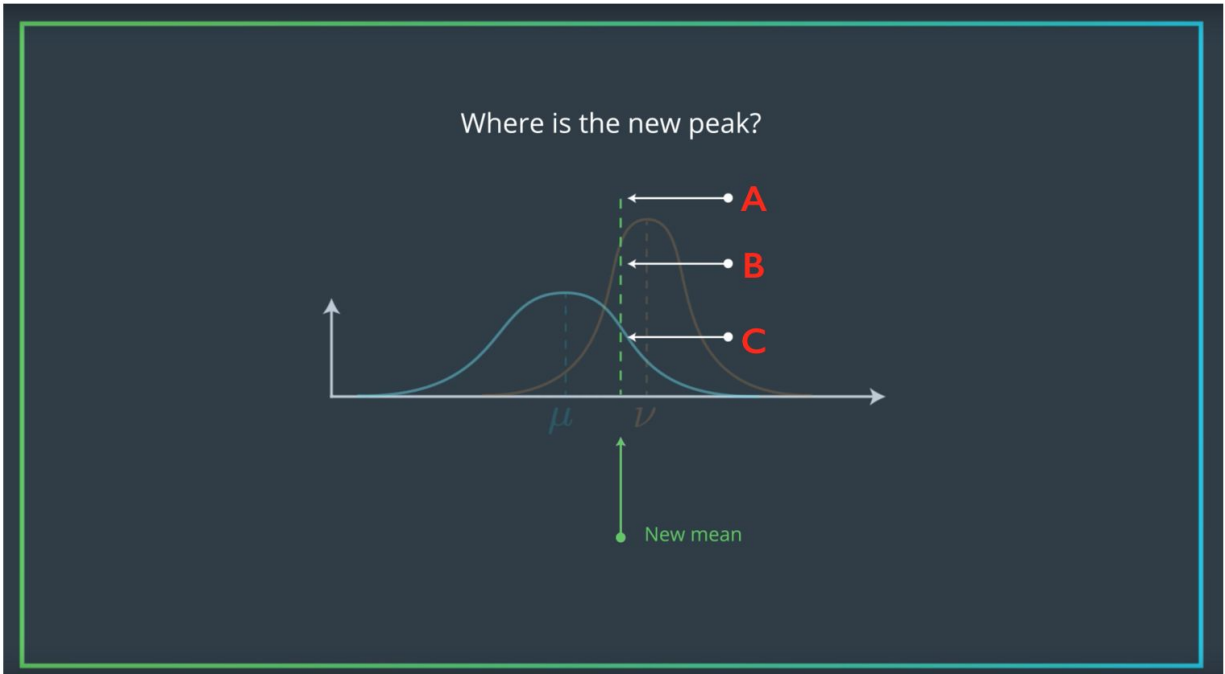
Smaller variance = more certain measurement.



QUIZ QUESTION

After combining the two Gaussians above, where will the new mean be?
Choose one of the four options pictured above.

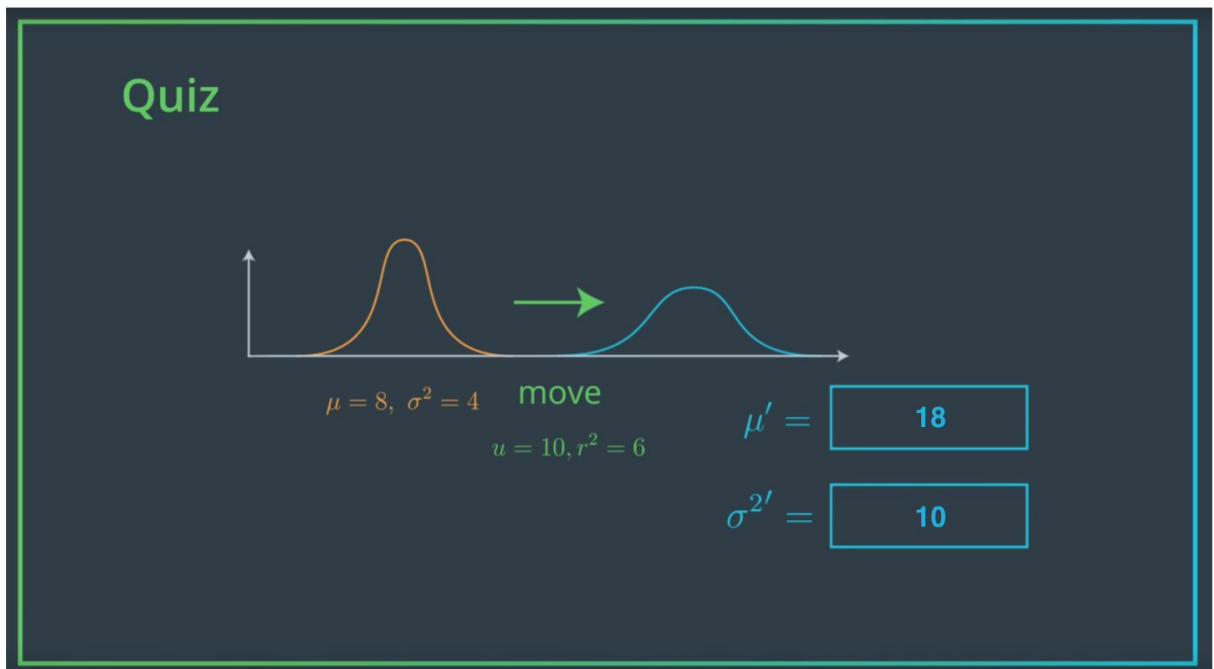
Ans: C



QUIZ QUESTION

For the newly created Gaussian, given the new mean, how tall do you think the new peak will be? Recall that the height of a Gaussian is related to its variance term and "certainty."

Ans: Surprisingly the resulting gaussian is more certain than the two prior. The answer is A.



Motion Update

A motion update is just an addition between parameters; the new mean will be the old mean + the motion mean; same with the new variance!