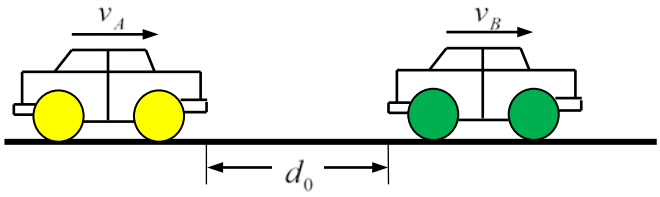
1-6. Two cars *A* and *B* are traveling in the same direction with an initial distance $d_0 = 100$ m. If car *B* travels with a normally distributed speed $v_B \sim N(20, 2^2)$ m/s, while car *A* travels with an initial speed $v_A = 30$ m/s and then decelerate at $a_A = 5$ m/s^2. What's the probability that distance between the two cars is greater than 150 m when car *A* stops?



For car *A*

$$v = v_0 + at$$

$$0 = v_A - a_A t$$

$$t = \frac{v_A}{a_A}$$

$$v^2 = v_0^2 + 2a(s - s_0)$$

$$0 = v_A^2 - 2a_A s_A$$

$$s_A = \frac{v_A^2}{2a_A}$$

For car *B*

$$s_B = v_B t = \frac{v_B v_A}{a_A}$$

The distance between the two cars when car *A* stops

$$d = s_B - s_A + d_0 = \frac{v_B v_A}{a_A} - \frac{v_A^2}{2a_A} + d_0$$

$$\mu_d = \frac{\mu_{v_B} v_A}{a_A} - \frac{v_A^2}{2a_A} + d_0 = 130 \text{ m/s}$$

$$\sigma_d = \frac{v_A}{a_A}\sigma_{v_B} = 12 \text{ m/s}$$

The probability that *d* is greater than 150 m

$$
\begin{aligned}
p(d > 150) &= 1 - p(d < 150) \\
&= 1 - \Phi\left(\frac{150 - \mu_d}{\sigma_d}\right) \\
&= 0.048
\end{aligned}
$$