$$
\begin{aligned}
\mathbf{r_f} &= \mathbf{r_i} + \mathbf{v}(t_f - t_i) \\
\mathbf{v_f} &= \mathbf{v_i} + \mathbf{a}(t_f - t_i) \\
\mathbf{r_f} &= \mathbf{r_i} + \mathbf{v_i}dt + (\mathbf{v_i} + \mathbf{a}dt)dt + (\mathbf{v_i} + 2\mathbf{a}dt)dt + (\mathbf{v_i} + 3\mathbf{a}dt)dt + \\
&\quad (\mathbf{v_i} + 4\mathbf{a}dt)dt + \\
&\quad (\mathbf{v_i} + 5\mathbf{a}dt)dt + \\
&\quad (\mathbf{v_i} + 6\mathbf{a}dt)dt
\end{aligned}
$$