QUESTION

If a particle P has position $\mathbf{r}$ and its acceleration at time t is given by $\dfrac{d^2\mathbf{r}}{dt^2} = -g\mathbf{k}$, where g is a constant, find the general form for the particle's position at time t.

ANSWER

$\dfrac{d^2\mathbf{r}}{dt^2} = -g\mathbf{k}$, $\dfrac{d\mathbf{r}}{dt} = -gt\mathbf{k} + \mathbf{c}_1$, $\mathbf{r} = -\dfrac{gt^2}{2}\mathbf{k} + t\mathbf{c}_1 + \mathbf{c}_2$, where $\mathbf{c}_1$ and $\mathbf{c}_2$ are constant vectors.