

**MA205 - Integral Calculus**  
**Lesson 19: Vector Functions II**

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Mechanics Based Problems

1. Find the position vector of a particle that has the given acceleration and the specified initial velocity and position. Then use Mathematica to graph the path of the particle.

(a)  $\mathbf{a}(t) = \mathbf{i} + 2\mathbf{j} + 2t\mathbf{k}$ ,  $\mathbf{v}(0) = \mathbf{0}$ ,  $\mathbf{r}(0) = \mathbf{i} + \mathbf{k}$

(b)  $\mathbf{a}(t) = t\mathbf{i} + t^2\mathbf{j} + \cos 2t\mathbf{k}$ ,  $\mathbf{v}(0) = \mathbf{i} + \mathbf{k}$ ,  $\mathbf{r}(0) = \mathbf{j}$



3. A force with magnitude 20 N acts directly upward from the  $xy$ -plane on an object with mass 4 kg. The object starts at the origin with initial velocity  $\mathbf{v}(0) = \mathbf{i} - \mathbf{j}$ . Find its position function and its speed at time  $t$ .