Kinematics

Rectangular

$$\hat{x} \times \hat{y} = \hat{z}$$

$$\vec{r} = x\hat{x} + y\hat{y} + z\hat{z}$$
$$\vec{v} = \dot{x}\hat{x} + \dot{y}\hat{y} + \dot{z}\hat{z}$$
$$\vec{a} = \ddot{x}\hat{x} + \ddot{y}\hat{y} + \ddot{z}\hat{z}$$

Plane Polar

$$\vec{r} = r\hat{r}$$
$$\vec{v} = \dot{r}\hat{r} + r\dot{\theta}\hat{\theta}$$
$$\vec{a} = (\ddot{r} - r\dot{\theta}^2)\hat{r} + (r\ddot{\theta} + 2\dot{r}\dot{\theta})\hat{\theta}$$

Cylindrical

$$\hat{r} \times \hat{\phi} = \hat{z}$$
$$\vec{r} = r\hat{r} + z\hat{z}$$
$$\vec{v} = \dot{r}\hat{r} + r\dot{\phi}\hat{\phi} + \dot{z}\hat{z}$$
$$\vec{a} = (\ddot{r} - r\dot{\phi}^2)\hat{r} + (r\ddot{\phi} + 2\dot{r}\dot{\phi})\hat{\phi} + \ddot{z}\hat{z}$$

Spherical

$$\hat{r} \times \hat{\theta} = \hat{\phi}$$
$$\vec{r} = r\hat{r}$$
$$\vec{v} = \dot{r}\hat{r} + r\dot{\phi}\sin(\theta)\hat{\phi} + r\dot{\theta}\hat{\theta}$$
$$\vec{a} = (\ddot{r} - r\dot{\phi}^2\sin^2(\theta) - r\dot{\theta}^2)\hat{r} + (r\ddot{\theta} + 2\dot{r}\dot{\theta} - r\dot{\phi}^2\sin(\theta)\cos(\theta))\hat{\theta} + (r\ddot{\phi}\sin(\theta) + 2\dot{r}\dot{\phi}\sin(\theta) + 2r\dot{\theta}\dot{\phi}\cos(\theta))\hat{\phi}$$