Basis vectors
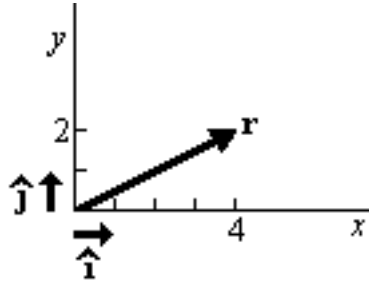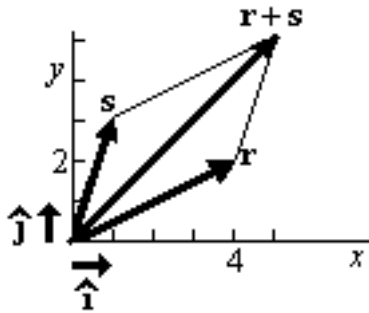
Base vectors:

- Writing an example vector as a combination of the base vectors $\hat{\imath}$ and $\hat{\jmath}$:
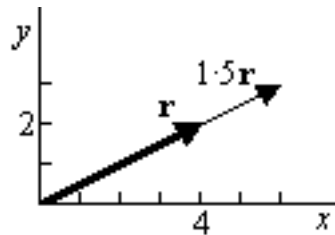

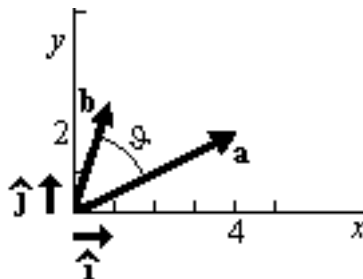$$\vec{r} = 4\hat{\imath} + 2\hat{\jmath}$$

- Addition:

$4\hat{\imath} + 2\hat{\jmath} + 1\hat{\imath} + 3\hat{\jmath} = 5\hat{\imath} + 5\hat{\jmath}.$

- Multiplication by a scalar:

$1.5(4\hat{\imath} + 2\hat{\jmath}) = 6\hat{\imath} + 3\hat{\jmath}.$

- Dot (scalar) product:

$$(a_x\hat{\imath} + a_y\hat{\jmath} + a_z\hat{k} + \ldots) \cdot (b_x\hat{\imath} + b_y\hat{\jmath} + b_z\hat{k} + \ldots) \cdot = a_x b_x + a_y b_y + a_z b_z + \ldots$$

since $\hat{\imath} \cdot \hat{\imath} = 1$, $\hat{\jmath} \cdot \hat{\jmath} = 1$, $\hat{k} \cdot \hat{k} = 1$, and $\hat{\imath} \cdot \hat{\jmath} = 0$, $\hat{\imath} \cdot \hat{k} = 0$, $\hat{\jmath} \cdot \hat{k} = 1$.