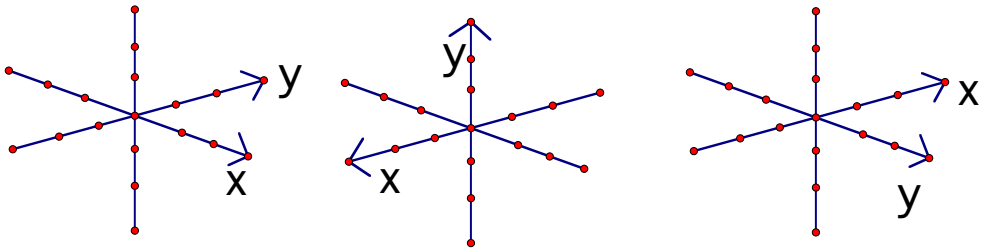
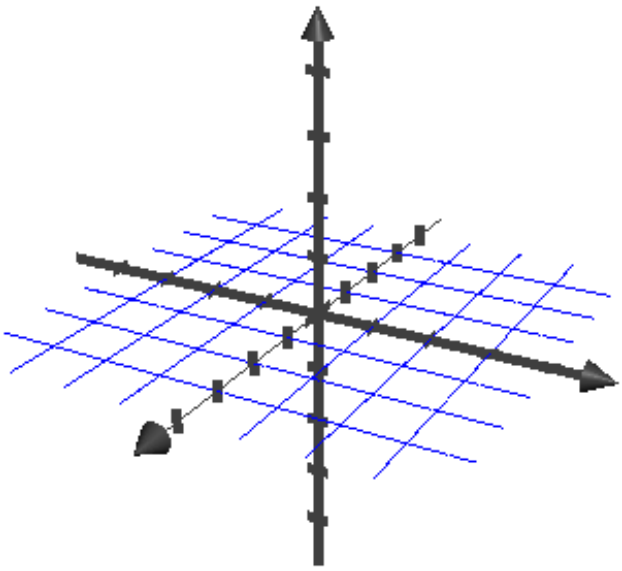
Three-Dimensions

1. We use the convention that the arrows denote the positive side of an axes. For each of the following set of axis below, identify the positive z-axis:



2. If the axes are not labeled, we use the convention that the z-axis moves up and down the page. Use the coordinate axis provided on the right for the following questions:



   (a) Plot the points
   $A = (0, 0, 0)$,
   $B = (1, 2, 3)$, &
   $C = (0, -2, 1)$.

   Note that the points plotted in part (a) cast 'shadows' on the xy-plane. That is, if we drop a perpendicular from a point $P = (a, b, c)$ to the xy-plane, the point $Q = (a, b, 0)$ is the *projection* of P to the xy-plane.

   (b) Find the xy-plane projections for each of the three points you plotted in part (a). Graph the projections and explain why I described these projections as 'shadows'.

   (c) Find the yz-plane projections of the three points you plotted in part (a).

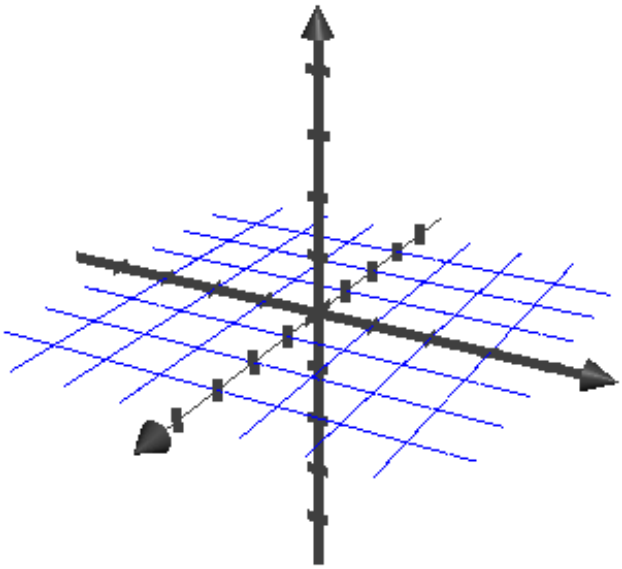
   (d) Find the distance between the point $(0, 0, 0)$ and $(0, -2, 1)$.

   (e) Find the distance between the point $(0, 0, 0)$ and $(1, 2, 3)$.

   (f) Consider the point $P = (a, b, c)$, find the distance between $(0, 0, 0)$ and P. Justify yourself.

Things to do with vectors...

1. Let $A(0,0,0)$, $B(1,2,3)$, & $C(0,-2,1)$.



   (a) Plot the vectors $\overrightarrow{AB}$, $\overrightarrow{AC}$, & $\overrightarrow{AB}+\overrightarrow{AC}$.

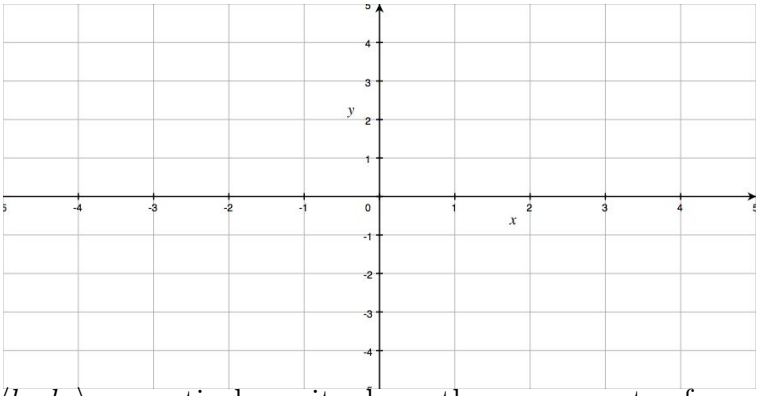
   Notation: vectors $\overrightarrow{v}$ who's initial point is at the origin with their terminal point (a,b,c) have what Stewart calls components, $\langle a,b,c\rangle$.

   (b) Write the components of $\overrightarrow{AB}$ & $\overrightarrow{AC}$.

   (c) If a vector doesn't have an initial point at the origin, we can move (translate) the vector so that its initial point is at the origin.
   Find the components of $\overrightarrow{BA}$ and $\overrightarrow{BC}$.

   (d) In general, write down the components of the vector $\overrightarrow{XY}$ if $X(x_1,y_1,z_1)$ and $Y(x_2,y_2,z_2)$.

2. Let the components of $\overrightarrow{v}$ and $\overrightarrow{w}$ be $\langle 1,2\rangle$ and $\langle 2,-1\rangle$ respectively.



   (a) Draw $\overrightarrow{v}$, $\overrightarrow{w}$, and $\overrightarrow{v}+\overrightarrow{w}$.

   (b) What are the components of $\overrightarrow{v}+\overrightarrow{w}$?

   (c) In general, if the components of $\overrightarrow{a}$ and $\overrightarrow{b}$ are $\langle a_1,a_2\rangle$ and $\langle b_1,b_2\rangle$ respectively, write down the components of $\overrightarrow{a}+\overrightarrow{b}$.

   (d) In general, if the components of $\overrightarrow{a}$ are $\langle a_1,a_2\rangle$, find $|\overrightarrow{a}|$.