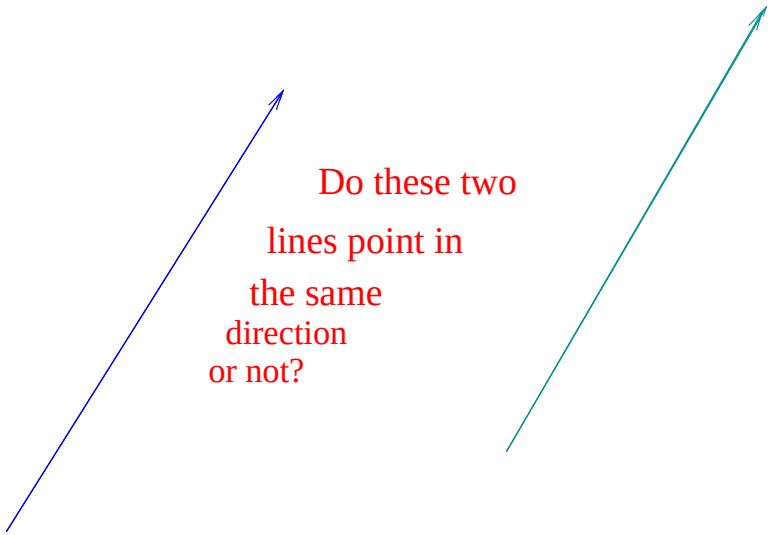
MOTIVATION FOR USING ANGLES, ANGULAR MEASURE, AND COORDINATE AXES TO HELP IN SPECIFYING DIRECTIONS IN THE PLANE

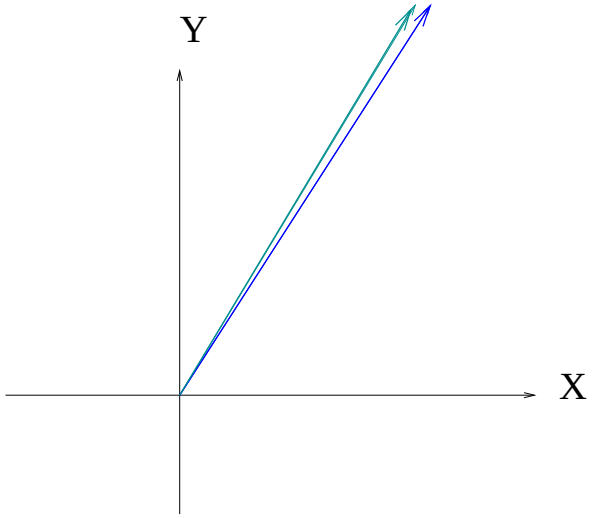
While we can draw an arrow on the blackboard in order to tell someone else what direction on the plane of the blackboard we are talking about (we might call this the "geometric" description of the direction in question), it can be useful to assign numbers to directions as an alternate way of specifying what direction we mean. (This can be especially useful if we want to specify the direction, say, to someone else who isn't in the same room, and so can't see the arrow we have drawn).

FIG. 1:



- Look at the two lines in Figure 1 above and try to see if you can tell whether or not they point in the same direction.
- It's (by design) not very easy to tell whether they point in exactly the same direction or only in close, but not quite identical directions, because they are separated by too much space.

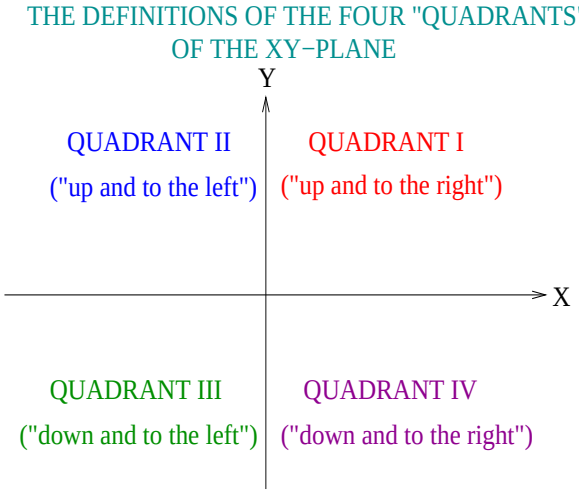
FIG. 2:



PUTTING THE TAILS OF THE TWO LINES TOGETHER AT THE ORIGIN
OF A COORDINATE SYSTEM MAKES IT A LOT EASIER TO TELL!

- However, if we take the two lines and move them (without changing the directions they point in) until their tails are in the same place, as in the second figure, it becomes incredibly easy to see that they point in similar, but not identical directions.
- The discussion above illustrates why it is conventional to characterize directions in the plane using lines *all of which have their tails at the same place*. This place can be taken to be the origin of a rectangular coordinate system, corresponding to the coordinates, x and y you are used to using in high school.

FIG. 3:



- The use of the $x-y$ coordinate system (for the reasons discussed above) makes it also natural to describe directions in the plane in a qualitative geometrical manner by specifying which of the four "quadrants" into which the x and y axes subdivide the plane the given direction points in. By convention the four quadrants are named as indicated in the figure above, with the numbering starting from the upper right quadrant and increasing as one goes counterclockwise:

- *Quadrant I* (QI, or *the first quadrant*) thus corresponds to directions up and to the right, *Quadrant II* (QII, or *the second quadrant*) to directions up and to the left, *Quadrant III* (QIII, or *the third quadrant*) to directions down and to the left, and *Quadrant IV* (QIV, or *the fourth quadrant*) to directions down and to the right.