**Last Time: Work Integral**

The **line integral of** a 2D **vector field** along a curve C given by is defined as

That integral gives the ***work*** necessary *to move a particle through the field along the path C.*

**Note:**For a 3D vector field over a curve C given by we define, similarly,

Of course we have that and for the 3D vector field

**Example:** Find , where (i) is a line from (-5,-3) to (0,2) and for (ii) is given by , also from (-5,-3) to (0,2)

Consider the following vector field together with the paths , , and . Determine the signs (pos, neg, or zero) for the following work integrals. Then, as HW, confirm your answer by working out the three integrals, given that



Next we have tied everything together by looking at the work done through *conservative* vector fields

**Fundamental Theorem of Line Integration**

If is a *conservative* vector field with potential function , and is a curve from to , then:

Thus, if a vector field is *conservative*, we have *two* ways to find the work integral :

1. you can use the *definition* of the line integral (as long as the path is explicitly given), or
2. you could *find the potential function* and then compute the difference

Sometimes one is easier, sometimes the other.

**Example**: Find the following work integrals, using whichever method seems easier.

1. where , some curve from to
2. where , upper half circle to
3. where is the V-shaped curve from to to