

# The Math of EV3Dprinter

by Thomas Madeya



## Circles are polygons with many points

Wikipedia: *polygons = chain of straight line segments*



...



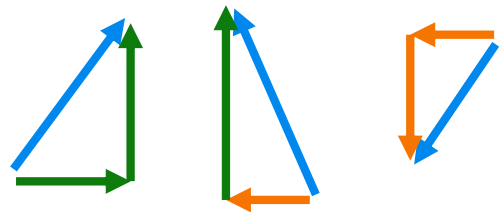
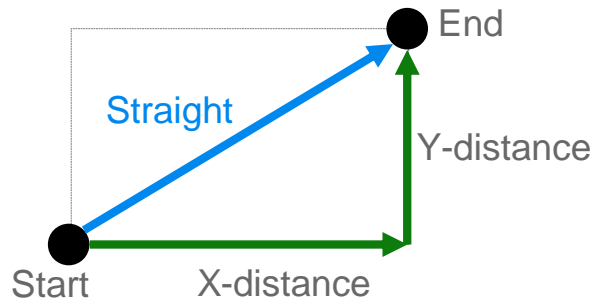
### Two main questions:

Q1: How to plot a straight line?

Q2: How to calculate start/end points for each line?

# Q1 How to Plot a Straight Line?

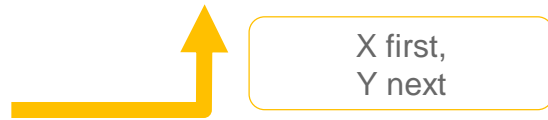
## Straight lines



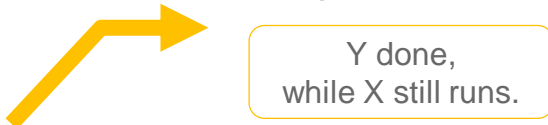
**For EV3:**  
distance = motor degrees

## Options to drive the motors

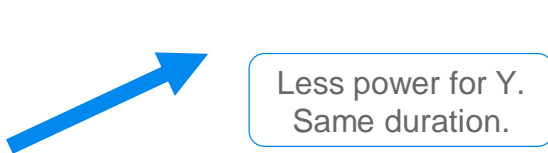
In sequence



Parallel – same power



Parallel – adjusted power



## Calculating the Power

distance = power \* time  
*or*  
time = distance / power

time = x-dist / x-power  
time = y-dist / y-power

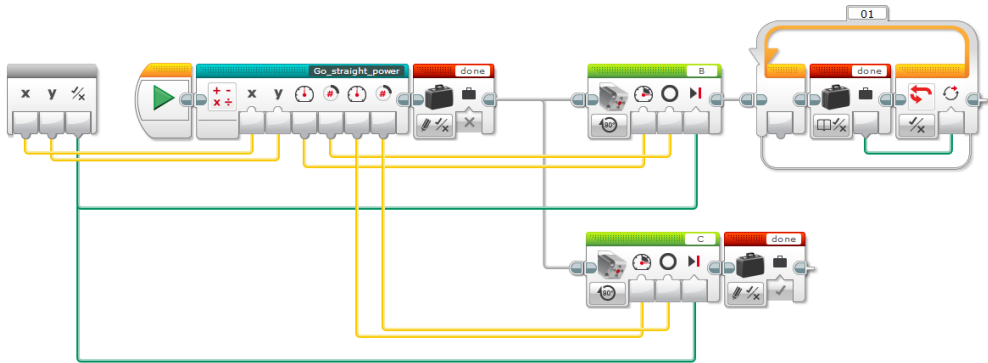
$x\text{-dist} / x\text{-power} = y\text{-dist} / y\text{-power}$

$y\text{-power} = y\text{-dist} / x\text{-dist} * x\text{-power}$

# A1: How to Plot a Straight Line!

1. Calculate x-distance and y-distance
2. Identify longer distance
3. Give "base" power to longer distance motor
4. Calculate reduced power for shorter distance motor
5. Run both motors in parallel

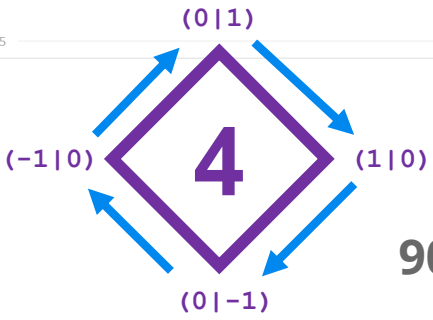
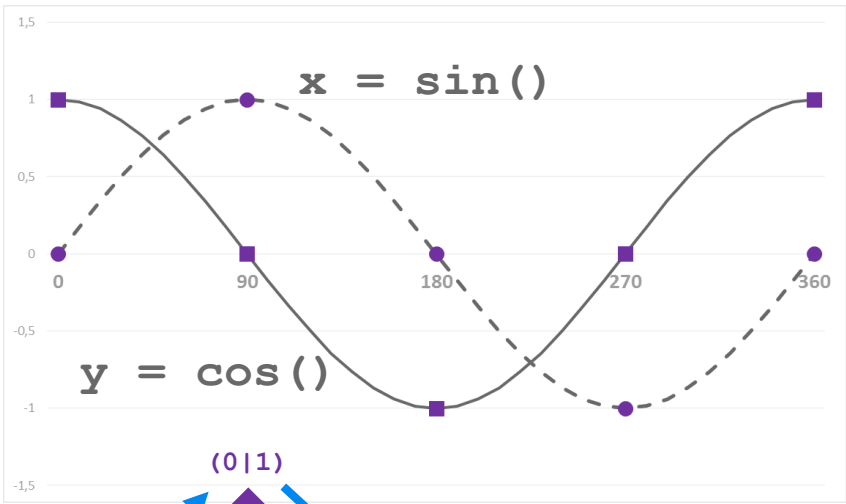
Go\_straight





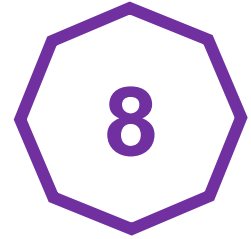
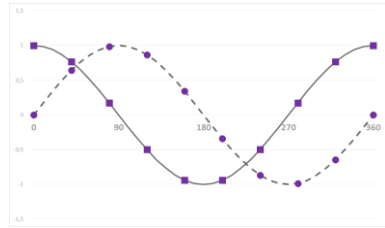
# Q2: How to Calculate Start/End Points?

## Trigonometry is the key

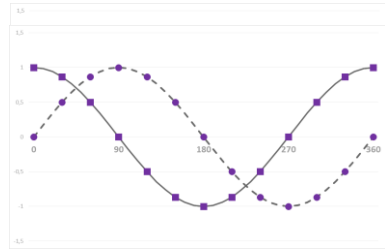


90 degree steps

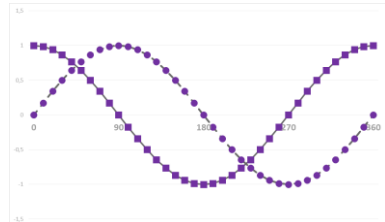
## Low degree = more lines



45 degrees



30 degrees



10 degrees

# A2: How to Calculate Start/End Points!

1. Decide on
  - the "resolution" = degrees per step
  - the "scaling" = radius of the circle
2. In a loop use `sin()` and `cos()` to call `Go_straight` for each step

## Circle

