Hi All! I will have music playing in the background at least until 10am so that people can test their speakers.

Hey, if you hate my music you might want to turn off the volume until then. :)

If you need to play with the controls the menu next to “Start Video” has a option “Video Settings…” and then then there is an “Audio” tab where you can test speakers/microphone

When you come into the meeting your microphone should by default be mute

You may communicate by

1. the chat
2. signals of yes/no/faster/slower/thumbs up/thumbs down/etc.
3. you may unmute your microphone (but remember to mute again when you finish speaking)

4. I think that there is an option to annotate the screen (see if you can find the controls and draw on the screen)

Plan for today:

(1) finish with equivalence relations (one more example from complex numbers)

(2) summation notation

We will start with an an example from the list of equivalence relations on complex numbers: (a) prove it is an equivalence relation

(b) identify the equivalence classes

The following are examples of equivalence relations on the complex numbers

$$R_1 = \{(x, x) : x \in \mathbb{C}\}$$

$$R_2 = \{(x, y) : Re(x) = Re(y), x, y \in \mathbb{C}\}$$

$$R_3 = \{(x, y) : Im(x) = Im(y), x, y \in \mathbb{C}\}$$

$$R_4 = \{(x, y) : |x| = |y|, x, y \in \mathbb{C}\}$$

$$R_5 = \{(x, y) : ax = y \text{ for some } a > 0, a \in \mathbb{R}, x, y \in \mathbb{C}\}$$

$$R_6 = \{(x, y) : ax = y \text{ for some } a \neq 0, a \in \mathbb{R}, x, y \in \mathbb{C}\}$$

if x = a+bi where a and b are real
then Re(x) = a and Im(x) = b

Step 1: show that the following relation on complex numbers is an equivalence relation

$$R_6 = \{(x, y) : ax = y \text{ for some } a \neq 0, a \in \mathbb{R}, x, y \in \mathbb{C}\}$$

R6 is reflexive because if x is not 0, then 1*x=x where a=1 not equal to 0 so (x,x) in R6
0*a = 0 for any a not equal to 0 so (0,0) is in R6 also

if (x,y) in R6, then a*x = y for some a not equal to 0
if we let b=1/a, then
x = y/a = (1/a)*y = b*y
b*y = x for some b not equal to 0
so (y,x) in R6 and R6 is symmetric

if (x,y) and (y, z) are in R6, then there is a1 and a2 both not equal to 0
such that a1*x = y and a2*y = z
a2*y = a2*(a1*x) = z
if I let a3 = a1*a2 then a3 is not equal to 0
and a3*x = a2*a1*x = z
that implies that (x,z) in R6
therefore R6 is transitive

Therefore R6 is an equivalence relation

Step 2: identify the equivalence classes (next page)

Step 2: identify the equivalence classes

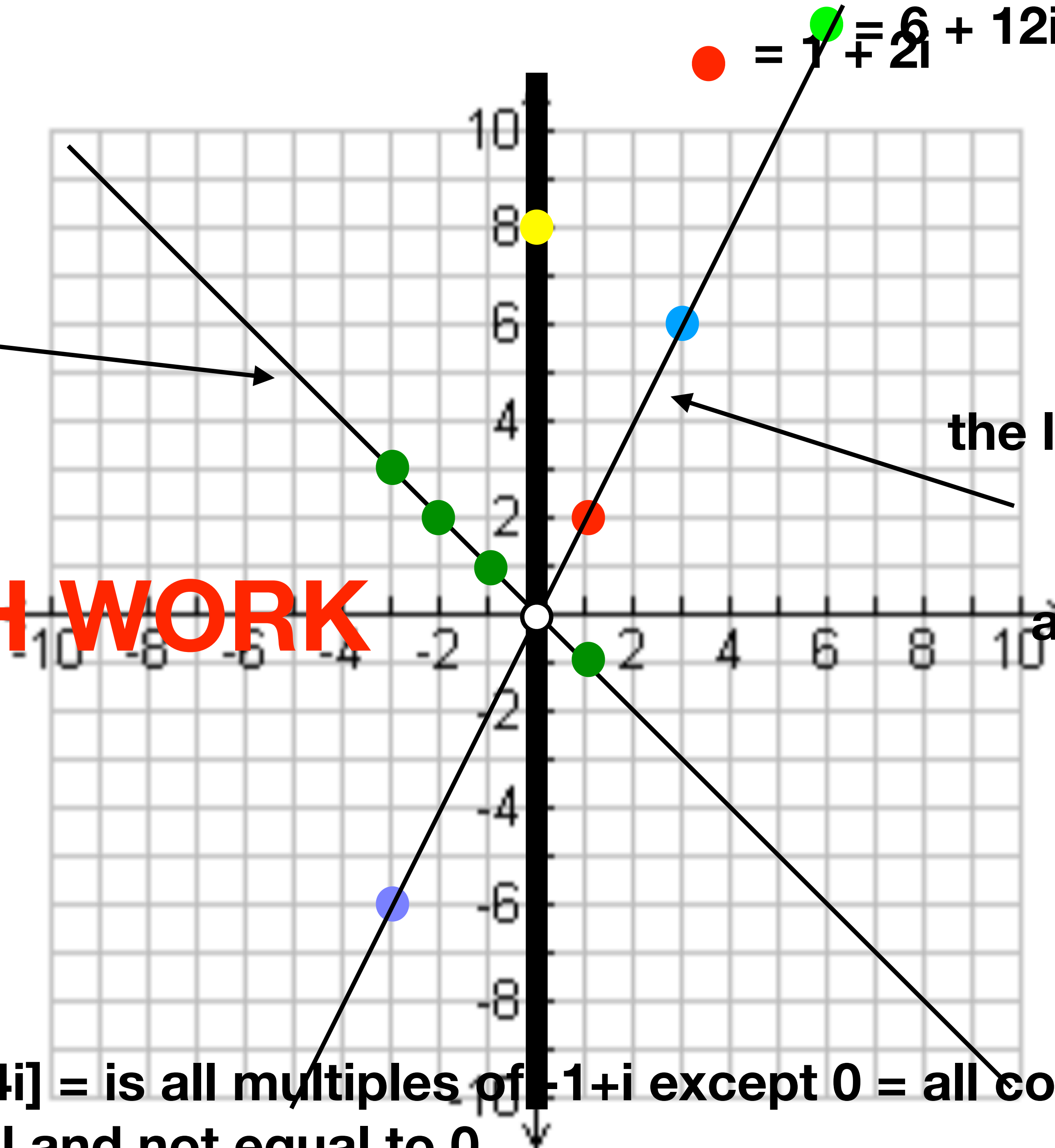
= 3 + 6i

= -3 -6i

= 6 + 12i

= 1 + 2i

slope = -1 = rise/run
y-intercept = 0



SCRATCH WORK

= -3 + 3i

the line which passes throug
1+2i is a line with
slope = rise/run = 2/1
and y-intercept = origin

[-3+3i] = [-1+i] = [-4+4i] = is all multiples of -1+i except 0 = all complex numbers of the form x-xi with “x” real and not equal to 0

[1+2i] = is all multiples of 1+2i except 0

1+2i is in [3+6i]

(1+2i, 3+6i) in R6 because 3*(1+2i) = 3+6i shows that 3+6i in [1+2i]

(3+6i,1+2i) in R6 because R6 is symmetric (or because 1/3*(3+6i) = 1+2i)

$$R_6 = \{(x,y) : ax = y \text{ for some } a \neq 0, a \in \mathbb{R}, x, y \in \mathbb{C}\}$$

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Fact 1: The equivalence classes are all the lines which pass through the origin of the complex plane and don't include the origin itself.

Proof: let z = x+yi where x and y are real be a complex number
The equivalence class of [z] are all the points of the form a*z
for some a not equal to 0. These are the complex numbers ax + ay i = az
these are the points which are on a line with slope = ay/ax = y/x
and y-intercept equal to the origin (that is these are the points which lie on a slope with constant slope y/x).

if x=0, then z= yi and the equivalance class [z] = [yi] = this is the vertical line passing through the origin with a hole at the origin.

Fact 2:

There is one more class [0] which consists only of the origin.

Anatomy of a summation

upper limit of the summation
r is an integer (usually r>= the first value of the index of the sum)
there should be something here if the sum is finite

summand

last term of the sum

$$\sum_{i=1}^{r} a_i = a_1 + a_2 + \cdots + a_r$$

first term of the sum

ellipsis

Greek letter Sigma

lower limit of the summation
i is the index summation

an infinite sum is often called a “series”