

Planar Transformations of Graphs

x goes inside a function. y comes out.

$$\begin{array}{c} x \\ \downarrow \\ y \leftarrow f(\quad) \rightarrow y \end{array}$$

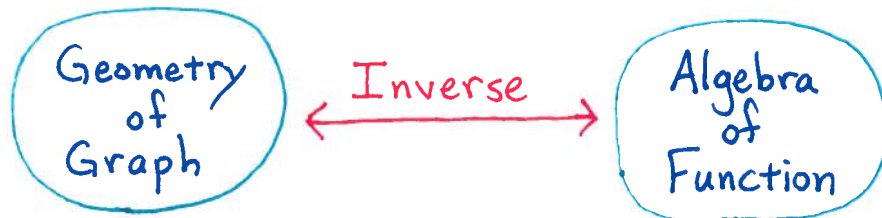
Change in x happens "inside" the function

Difference between $f(x)$ and $f(x+c)$, $f(cx)$, $f(-x)$ is a change in x .

Change in y happens "outside" the function

Difference between $f(x)$ and $f(x)+c$, $cf(x)$, $-f(x)$ is a change in y .

Change in x :



Change in y :



Equations in One Variable

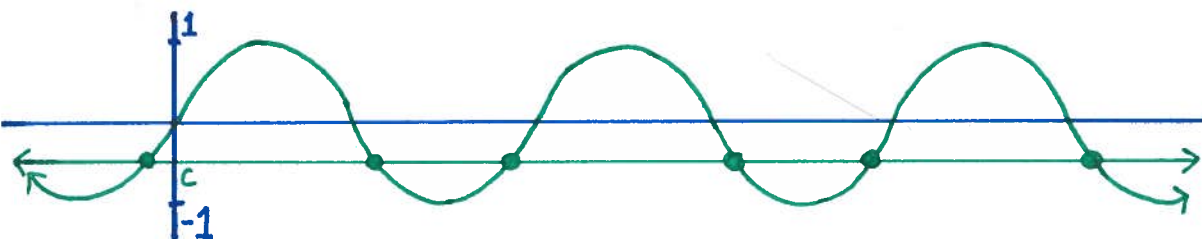
Dividing by a function

We can divide by a function, but only when it's not zero. When it is zero is another matter.

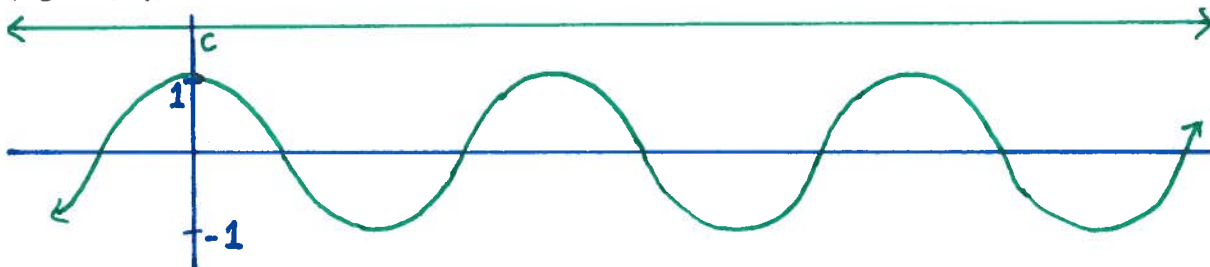
$$h(x)f(x) = h(x)g(x) \begin{cases} \rightarrow f(x) = g(x) \\ \rightarrow h(x) = 0 \end{cases}$$

Solutions of trigonometric equations

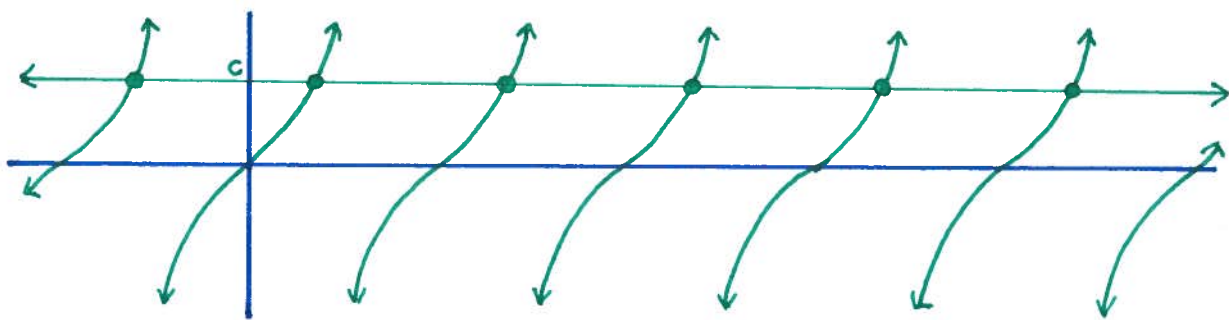
(o) $\sin(x) = c$ and $\cos(x) = c$ have infinitely many solutions if $c \in [-1, 1]$.



(o) $\sin(x) = c$ and $\cos(x) = c$ have no solutions if $c \notin [-1, 1]$.



(o) $\tan(x) = c$ has infinitely many solutions.



Conics

Ellipses, hyperbolas, and parabolas are the nondegenerate conics.

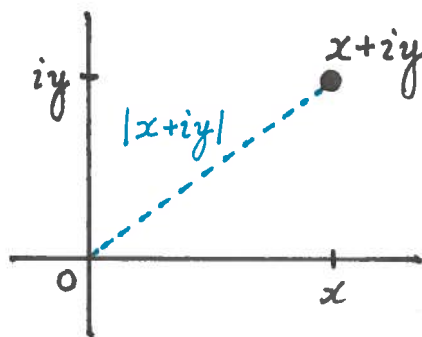
Complex Numbers

(•) $(a+ib) + (c+id) = (a+c) + i(b+d)$

(•) To find $(a+ib)(c+id)$, use the distributive law and that $i^2 = -1$.

Norms

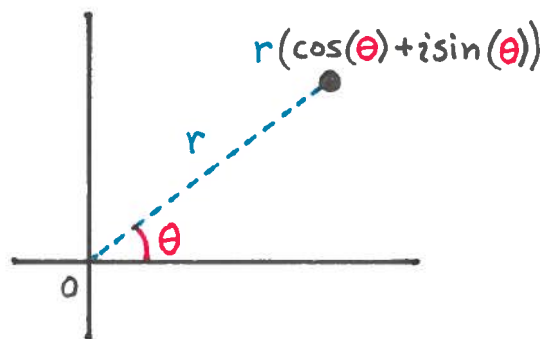
$$|x+iy| = \sqrt{x^2+y^2}$$



Polar Coordinates

$$r(\cos(\theta) + i\sin(\theta))$$

↑ norm ↑ angle

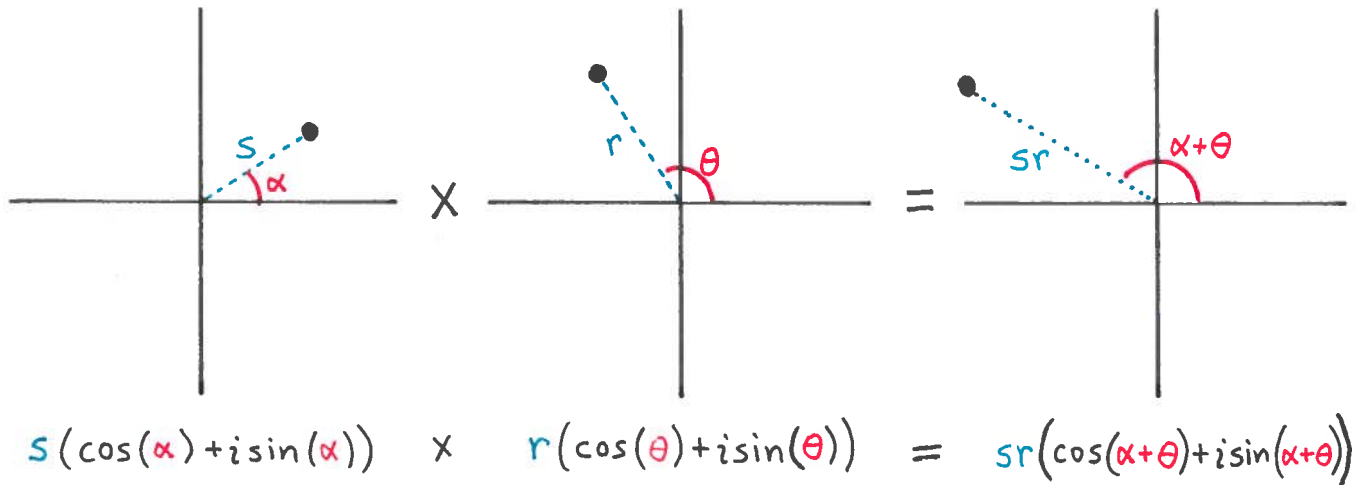


Cartesian vs. Polar Coordinates

$$x+iy = |x+iy| \left(\frac{x}{|x+iy|} + i \frac{y}{|x+iy|} \right)$$

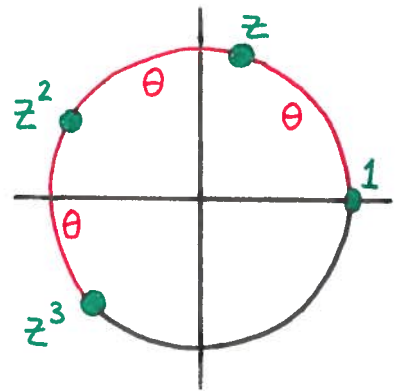
Multiplication in polar coordinates

multiply norms and add angles.



Powers of numbers on the unit circle

To find the n-th power, add the angle n-times.



Common complex numbers on the unit circle

