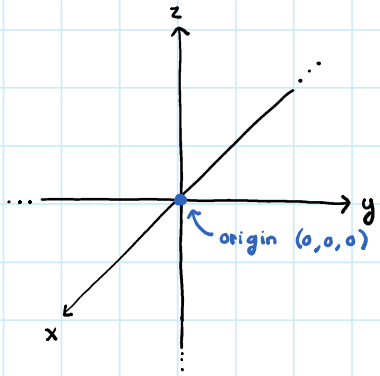
3D Space

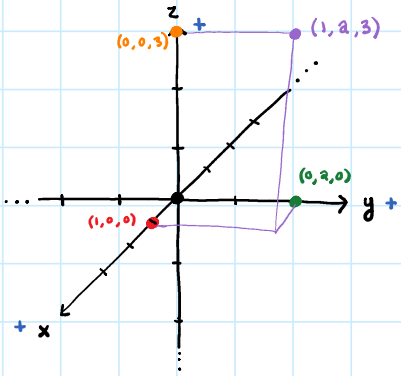
Wednesday, May 3, 2023 8:50 AM

- real 3D space : all triples (x, y, z) / x, y, z are real #'s
- point in 3D space : one specific triple (x, y, z)

ex) $(1, 0, 0)$
x, y, z



ex 1) draw points $(1,0,0)$, $(0,2,0)$, $(0,0,3)$, $(1,2,3)$



* arrow points in + direction *

planes in space are solutions to equations of the form ...

$$ax + by + cz = d$$

a, b, c, d are given #'s

* plane = example of surface
curved lines on plane = curve, not line *

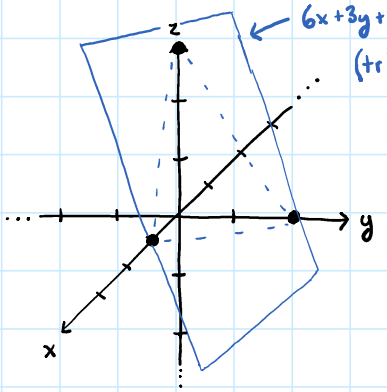
- we call (a, b, c) the perpendicular direction

ex) $6x + 3y + 2z = 6$

ex 2) draw plane $\{6x + 3y + 2z = 6\}$

1) sample points :
$(1, 0, 0)$
$(0, 2, 0)$
$(0, 0, 3)$
$(1, -1, \frac{3}{2})$

2) draw :



* 3 points determine unique plane *

* plane = infinite *

3 ways to describe planes :

1) equation : $ax + by + cz = d$ —sample points→ 2) 3 points in the plane

keep (a,b,c) + sample 1 point → 3) perpendicular direction (a, b, c) + 1 point

sub x,y,z + solve for d

ex 3) consider plane with perpendicular $(7, -1, 2)$ (a, b, c) contain point $(1, 3, 0)$

- give equation : $7x - y + 2z = d$ → use $(1,3,0)$ solves

$7(1) - (3) + 2(0) = d$

$d = 4$

$\boxed{7x - y + 2z = 4}$

- give 3 points

$(1,3,0)$ ✓ given

$(0,0,2)$ ✓

$(0,-4,0)$ ✓

sample : $7x - y + 2z = 4$