real 3D space: all triples \((x, y, z)\) \(x, y, z\) are real \(\mathbb{R}\)’s

point in 3D space: one specific triple \((x, y, z)\)

ex) \((1, 0, 0)\)

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

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

\[ax + by + cz = d\]

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

ex) \(6x + 3y + 2z = 6\)

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

1) sample points:

\((1, 0, 0)\)
\((0, 0, 0)\)
\((0, 0, 1)\)
\((1, -1, \frac{3}{2})\)

3 ways to describe planes:

1) equation: \(ax + by + cz = d\)  \(\text{sample points}\)

2) 3 points in the plane

3) perpendicular direction \((a, b, c) + 1\) point

* arrow points in + direction *

* plane = example of surface

* curved lines on plane: curve, not line *

* 3 points determine unique plane *

* plane = infinite *

* triangle within plane *
ex 3) consider plane with perpendicular (7, -1, 2) contain point (1, 3, 0)

* give equation: \( 7x - y + 2z = d \) 
  use \((1, 3, 0)\) solves
  \[7(1) - (3) + 2(0) = d\]
  \[d = 4\]
  \[7x - y + 2z = 4\]

* give 3 points
  
  \((1, 3, 0)\) given
  sample: \(7x - y + 2z = 4\)
  
  \((0, 0, 2)\)
  
  \((0, -4, 0)\)