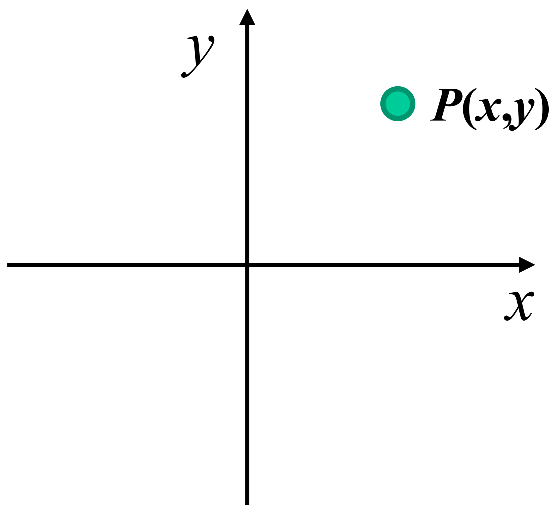
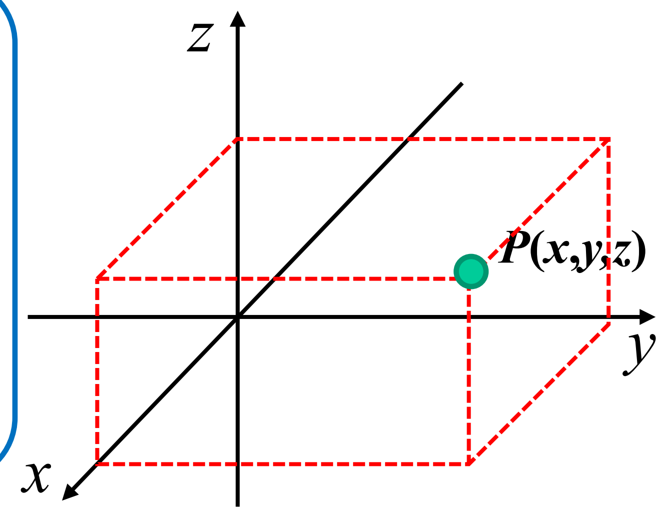
Moving from 2D to 3D

Cartesian plane



Cartesian space

the addition of a rectangular prism with diagonal *OP* can make it easier to visualise the point's location



- two axes (x and y)
- one coordinate plane divided into four quadrants

I: $x>0$, $y>0$
II: $x<0$, $y>0$
III: $x<0$, $y<0$
IV: $x>0$, $y<0$

- points uniquely defined by an ordered pair

- three axes (x, y and z)
- three coordinate planes(yz, xz and xy) divided into eight octants

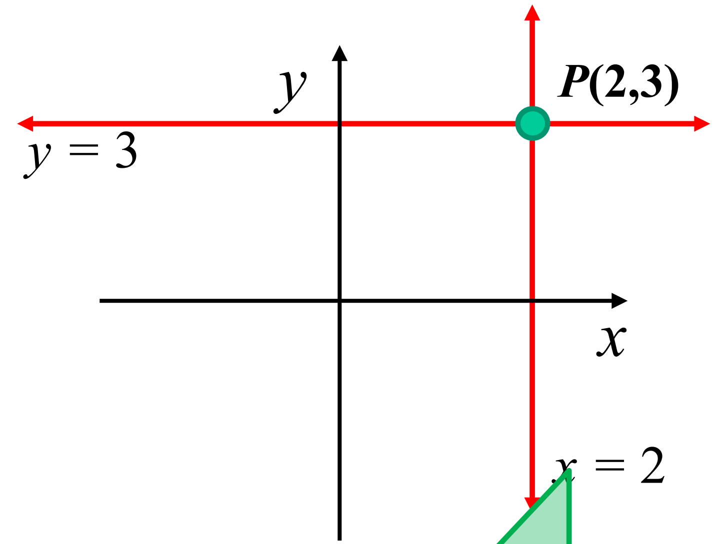
I: $x>0$, $y>0$, $z>0$ **V:** $x>0$, $y>0$, $z<0$
II: $x<0$, $y>0$, $z>0$ **VI:** $x<0$, $y>0$, $z<0$
III: $x<0$, $y<0$, $z>0$ **VII:** $x<0$, $y<0$, $z<0$
IV: $x>0$, $y<0$, $z>0$ **VIII:** $x>0$, $y<0$, $z<0$

- points uniquely defined by an ordered triple

lines parallel to coordinate axes

lines parallel to the x axis ($y = c$)

lines parallel to the y axis ($x = k$)

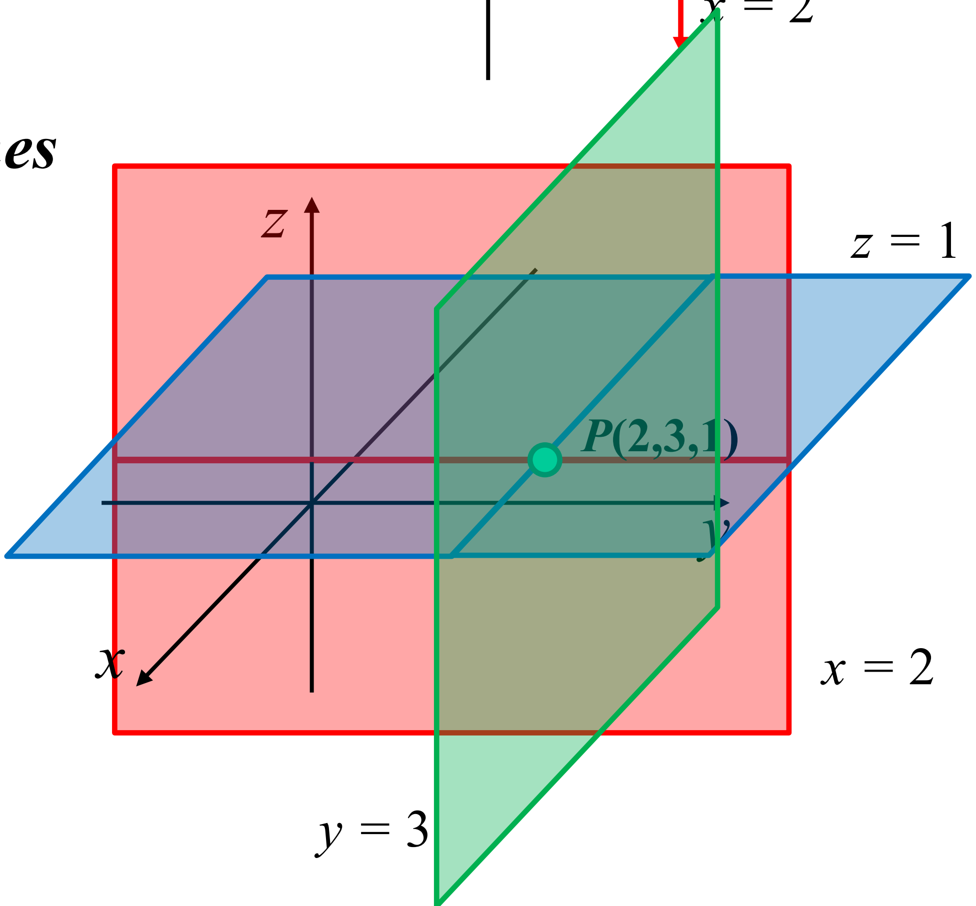


planes parallel to coordinate planes

plane parallel to xy plane ($z = c$)

plane parallel to xz plane ($y = k$)

plane parallel to yz plane ($x = C$)



Distance & Midpoint

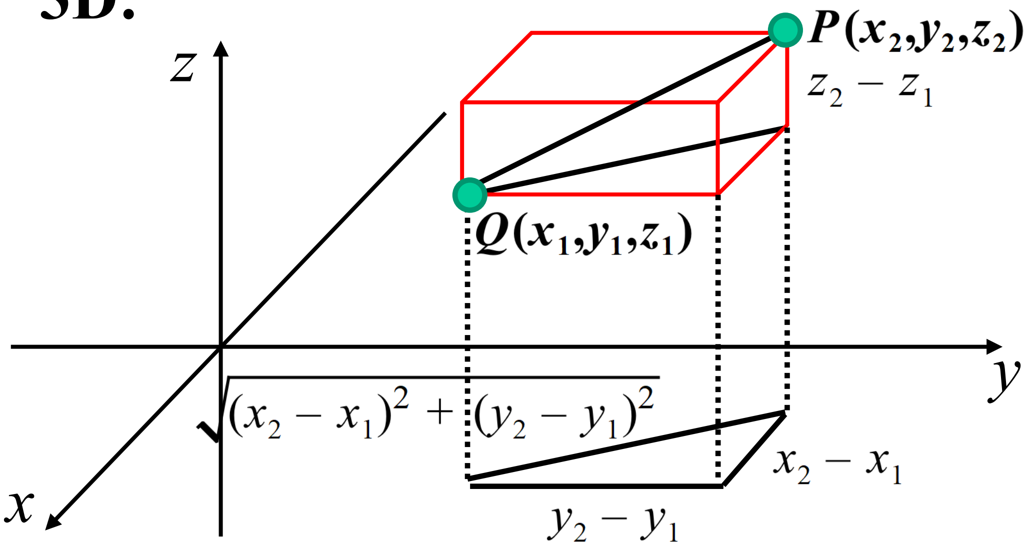
Distance Formula

2D: $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

Midpoint Formula

2D: $M = \left(\dfrac{x_1 + x_2}{2}, \dfrac{y_1 + y_2}{2} \right)$

3D:



$$d = \sqrt{\left(\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}\right)^2 + (z_2 - z_1)^2}$$

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2 + (z_2 - z_1)^2}$$

3D:

$$M = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}, \frac{z_1 + z_2}{2} \right)$$

Exercise 5A;
1, 2, 5, 7, 10, 12, 15, 16