

## Intersections of Lines

### 2 Dimensions

Lines in 2D are either a) parallel or b) intersect.

If the lines are not parallel, then they intersect.

### 3 Dimensions

Lines in 3D are a) parallel or b) intersect or c) skew

$$\mathbf{r}_1 = \begin{pmatrix} x_1 \\ y_1 \\ z_1 \end{pmatrix} = \begin{pmatrix} 1 \\ 0 \\ 1 \end{pmatrix} + \lambda \begin{pmatrix} 2 \\ -3 \\ 1 \end{pmatrix}$$
$$\mathbf{r}_2 = \begin{pmatrix} x_2 \\ y_2 \\ z_2 \end{pmatrix} = \begin{pmatrix} 5 \\ 1 \\ 0 \end{pmatrix} + \mu \begin{pmatrix} 1 \\ 2 \\ -1 \end{pmatrix}$$

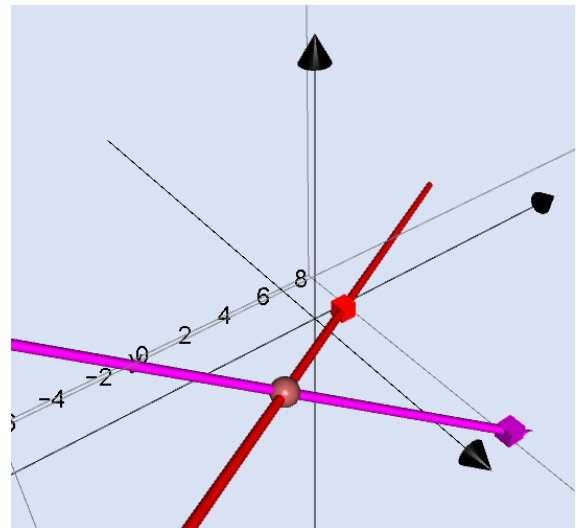
To decide if they intersect, or not, equate x and y equations to solve for  $\lambda$  and  $\mu$

$$x_1 = x_2$$
$$y_1 = y_2$$

If, for these values of  $\lambda$  and  $\mu$

$z_1 = z_2$  then they intersect

$z_1 \neq z_2$  then they do NOT intersect



### Kinematics

Kinematics is just an application of straight lines where the parameter is time. Questions often require us to see if two objects have collided. To collide, they must occupy the **same place** at the **same time**.

There are 2 methods for checking if A and B collide

1. Find the time when the when  $x_A=x_B$ . Find  $y_A$  at this time. Find  $y_B$  at this time. Is  $y_A = y_B$  ?
2. Find time,  $t_1$  when  $x_A=x_B$ . Find time,  $t_2$  when  $y_A=y_B$ . Is  $t_1 = t_2$  ?