Parallel Lines :

May Nakoua (Only definition

* Parallel lines in 2D are two lines that never meet regardless the direction !

* Parallel lines in 3D are two lines that never intersect + have the <u>same</u> direction !

* In 3D, if two lines don't intersect but have different directions they're called non-intersecting lines

* The terms of L_1 & L_2 being parallel in 3D

(1) D_1 (directed vector of L_1) & D_2 (directed vector of L_2) have to be a multiple of the other.

$$D_2 = CD_1$$

↓ constant

* if they're equal, they're the same line, so the intersection is the whole line.

(2) They do not intersect !

Question: if L_1: $x = 2 + 3t$, $y = -2t$, $z = 1 + 3t$ } $t \in R$

L_2: $x = 12w$, $y = -8w$, $z = 10 + 12w$ } $w \in R$

Is L_1 parallel to L_2 ?

Find D_1 & D_2

$D_1 = \langle 3, -2, 3 \rangle$

$D_2 = \langle 12, -8, 12 \rangle$

Is $D_2 = c D_1$

$\langle 12, -8, 12 \rangle = c \langle 3, -2, 3 \rangle$

$12 = c3 \Rightarrow c = 4$

$-8 = c(-2) \Rightarrow c = 4$ $\quad D_2 = 4 D_1$

$12 = c.3 \Rightarrow c = 4$ $\quad D_1 = \frac{1}{4} D_2$

step 1) checking if D_2 is a multiple of the other is Done

step 2) checking if they intersect

choose a point from L_1 by giving t a value

say $t = 0$

$x = 2 + (3)(0) = 2$

$y = -2(0) = 0$

$z = 1 + 3(0) = 1$

$\therefore$ point $= (2, 0, 1)$

Check if this point lies on L_2

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$2 = 12w$
$0 = -8w$
$1 = 10 + 12w$

each equation gives a different value of w

$\therefore$ $P(2,0,1)$ doesn't lie on L_2
$\therefore$ No intersection between L_1 & L_2

Perpendicular lines:

In 3D $L_1 \perp L_2$ if only:

(1) $D_1 \cdot D_2 = 0$
(2) They intersect in a point say Q

Question 1) L_1: $x = 2 + 4t$, $y = -4 - 2t$, $z = 1 + t$, $t \in \mathbb{R}$

L_2: $x = 10 - 2w$, $y = -3w$, $z = -2 + 2w$, $w \in \mathbb{R}$

Is $L_1 \perp L_2$?

First, find D_1 & D_2: $D_1 = \langle 4, -2, 1 \rangle$
$D_2 = \langle -2, -3, 2 \rangle$

$D_1 \cdot D_2 = 4 \cdot -2 + -2 \cdot -3 + 1 \cdot 2$
$-8 + 6 + 2 = 0$

$\therefore D_1 \perp D_2 = 0$

Notes not complete.
OUR DEFINITION of PERPENDICULAR, check for 2 things. D_1.D_2 = 0 and they intersect in a point.