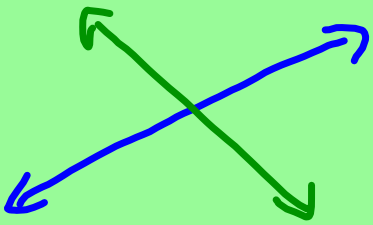
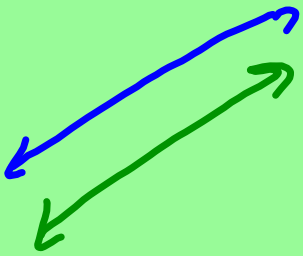
Lesson 5: Intersecting 2 Lines in 3-Space & Intersecting a Line and a Plane.

Example 0: Sketch all the possibilities when 2 lines pass in 3-space. {4}



Two lines meet in a single point.

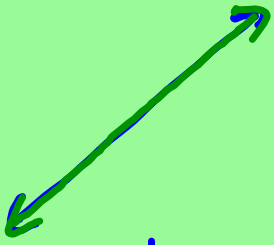
The point is the solution.



The line are parallel and never meet.

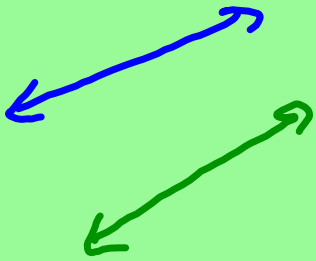
There is no solution.

The system is inconsistent



The line are parallel and coincident.

The whole line is the solution.



*Skew case

Two lines that passs over one another, but do not touch.

There is no solution; this system inconsistent.

* Any two variables will match, but the third will not.

Ex 1: Solve (and classify) the intersection of the following pairs of lines.

a) $\vec{r}_1 = (8,-4,1) + t(5,7,3)$

$\vec{r}_2 = (1,0,-2) + s(1,6,1)$

✓ Lines not parallel

$x = 8 + 5t \quad x = 1 + s$

$y = -4 + 7t \quad y = 0 + 6s$

$8 + 5t = 1 + s \Rightarrow 5t - s = -7$ (×6)

$-4 + 7t = 6s \Rightarrow 7t - 6s = 4$

$30t - 6s = -42$

$-23t = 46$

$t = -2$

$8 + 5(-2) = 1 + s$

$-3 = s$

Check "z"

$z = 1 + 3t$

$= 1 + 3(-2) = -5$

$z = -2 + s$

$= -2 + (-3) = -5$

∴ The two line intersect in a point

$(x, y, z) = (-2, 18, -5)$

Ex 1: Solve (and classify) the intersection of the following pairs of lines.

b) $\vec{r}_1 = (2,0,-1) + t(1,-2,2)$

$$\begin{cases} x = -3s \\ y = 6s + 5 \\ z = 4 - 6s \end{cases}$$

$\vec{d}_2 = \langle -3, 6, -6 \rangle$ (×-3) ∴ They are parallel.

See if $(2,0,-1)$ lies on Line 2.

$2 = -3s \Rightarrow s = -\frac{2}{3}$

$0 = 6s + 5 \Rightarrow s = -\frac{5}{6}$

$-1 = 4 - 6s \Rightarrow s = \frac{5}{6}$

} not equal

∴ The system is inconsistent and there is no solution.

The lines are parallel but not coincident.

Ex 1: Solve (and classify) the intersection of the following pairs of lines.

c) $\vec{r}_1 = (4,2,0) + t(-1,2,3)$

$\vec{r}_2 = (-1,2,1) + s(-2,-1,1)$

* Not parallel

$4 - t = -1 - 2s \Rightarrow -t + 2s = -5$ (x2)

$2 + 2t = 2 - s \Rightarrow 2t + s = 0$

$+ \quad -2t + 4s = -10$

$5s = -10$

$s = -2$

$4 - t = -1 - 2(-2)$

$t = 1$

Check "2"

$z = 0 + 3t \Rightarrow 3$

$z = 1 + s \Rightarrow -1$

∴ Lines are skewed

* There is no solution.

Example 2: Create a pair of 3-D lines that satisfy the remaining case.

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Lesson 5 - PART B

Example 0: Sketch all the possibilities when a line and a plane are intersected. {3}

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Example 1: Solve for the intersection of the line and plane.

$$\pi_1 : 4x - 2y + 2z - 5 = 0$$

a)
$$l_1 : \begin{cases} x = 2 - 3t \\ y = -3 + t \\ z = 1 - 2t \end{cases}$$

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Example 2: Solve for the intersection of the line and plane.

$$\vec{r}_1 = (0,2,0) + t(1,1,-1)$$

b) $\pi_1 : 2x + y + 3z = -4$

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Example 3: Create an example of a line and plane that meet the third criteria.

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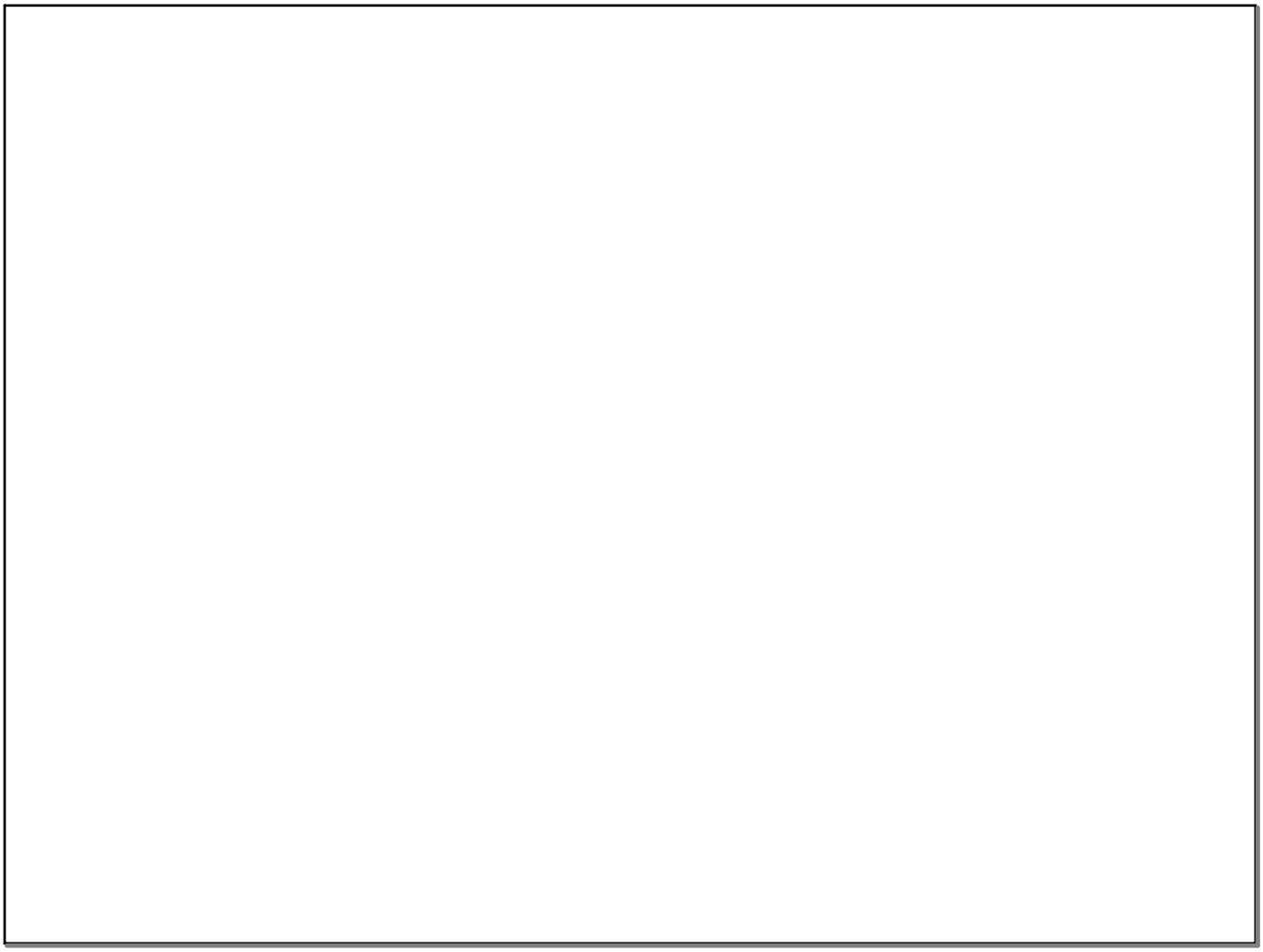

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