Vector equation of line

$$\vec{r}(t) = \vec{r_0} + t\vec{v}$$

direction

Initial position

12.5

3 Find vector & parametric equations of line through $(2, 2.4, 3.5)$ and parallel to $3\hat{i} + 2\hat{j} - \hat{k}$

$$\vec{r}_0 = \langle 2, 2.4, 3.5 \rangle$$

$$\vec{v} = \langle 3, 2, -1 \rangle$$

$$\vec{r}(t) = \langle 2, 2.4, 3.5 \rangle + t\langle 3, 2, -1 \rangle$$

$$= \langle \underbrace{2+3t}_{x}, \underbrace{2.4+2t}_{y}, \underbrace{3.5-t}_{z} \rangle$$

Parametric:

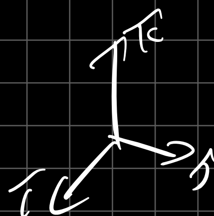
$$x = 2+3t$$

$$y = 2.4+2t$$

$$z = 3.5-t$$

Symmetric: $\dfrac{x-2}{3} = \dfrac{y-2.4}{2} = \dfrac{z-3.5}{-1}$

(10) line through $(2,1,0)$ $\perp$ to $\hat{i}+\hat{j}$ & $\hat{j}+\hat{k}$.



$$\vec{r}_0 = \langle 2,1,0 \rangle$$

$$\vec{v} = (\hat{i}+\hat{j}) \times (\hat{j}+\hat{k}) = \hat{k} - \hat{j} + \hat{i}$$

$$= \hat{i} - \hat{j} + \hat{k}$$

$$= \langle 1, -1, 1 \rangle$$

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

$$= \langle 2+t, 1-t, t \rangle$$

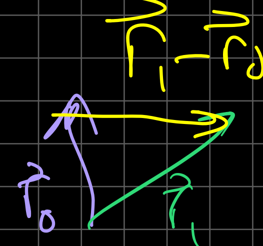
Q: if t is restricted, what happens?

$a \leq t \leq b \rightarrow$ segment.

(17) $(6, -1, 9)$, $(7, 6, 0)$

find vector equation of line segment connecting these points.

$$\vec{r}_0 = \langle 6, -1, 9 \rangle$$



$$\vec{r}_1 = \langle 7, 6, 0 \rangle$$

$$\vec{r}(t) = \vec{r}_0 + t(\vec{r}_1 - \vec{r}_0) \qquad \underline{\underline{0 \leq t \leq 1}}$$

$$= (1-t)\vec{r}_0 + t\vec{r}_1$$

$= \langle 6, -1, 9 \rangle + t\langle 1, 7, -9 \rangle$

$= \langle 6+t, -1+7t, 9-9t \rangle \quad 0 \le t \le 1.$

(24) Find equation of plane through $(5, 3, 5)$ with normal vector $2\hat{i} + \hat{j} - \hat{k}$

point $(x_0, y_0, z_0) \rightarrow \vec{r}_0 = \langle x_0, y_0, z_0 \rangle$ end on plane

$\vec{r} = \langle x, y, z \rangle$

$\vec{r} - \vec{r}_0$ vector in the plane

$\vec{n} = \langle a, b, c \rangle =$ normal vector

$\vec{n} \cdot (\vec{r} - \vec{r}_0) = 0$ Vector eqn of plane

Scalar eqn: $a(x - x_0) + b(y - y_0) + c(z - z_0) = 0$

Standard: $ax + by + cz = d.$

Point: $(5,3,5)$ normal vector $2\hat{i}+\hat{j}-\hat{k}$

$a=2, \; b=1, \; c=-1$

$$2(x-5)+1(y-3)+(-1)(z-5)=0$$

Standard form:

$$2x+y-z=8$$

31 $(0,1,1)$ find plane containing

$(1,0,1)$ these points

$(1,1,0)$

$\vec{u}$ $\vec{v}$

use point

$\vec{u}=\langle 1,-1,0\rangle$

$\vec{v}=\langle 1,0,-1\rangle$

$\vec{u}\times\vec{v}=\langle 1,1,1\rangle$

$a=1$

$b=1$

$c=1$

plane: $1(x-0)+1(y-1)+1(z-1)=0$

$$x+y-1+z-1=0$$

$$x+y+z=2.$$

(40) plane passes through intersection of

$$x - z = 1 \qquad y + 2z = 3$$

&

$\perp$ to $x + y - 2z = 1$

$z = x - 1$

$z = \frac{y-3}{-2}$

- Investigate intersection
- find normal vector. $\langle a, b, c\rangle \cdot \langle 1, 1, -2\rangle = 0$

let $z = t \in \mathbb{R}$

$x = 1 + t$

$y = 3 - 2t$

line. $\vec{r}(t) = \langle 1+t,\ 3-2t,\ t\rangle$

$t = 0$ find $(1, 3, 0)$

$t = 1$ find $(2, 1, 1)$

or any t.

only need 1 pt.

use $(1, 3, 0)$

need our vector! $\langle a,b,c\rangle \cdot \langle 1,1,-2\rangle = 0$

$a+b-2c=0$

need more info!!

Try more later

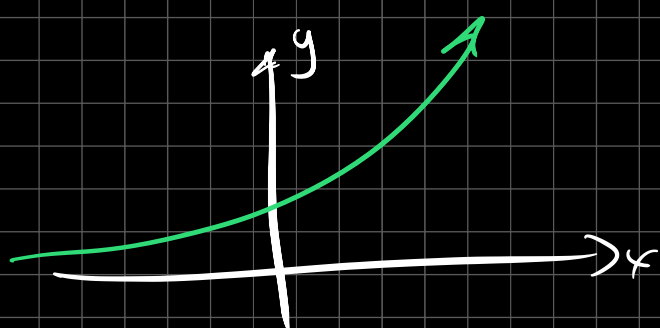
Create discussion board on

Brightspace.

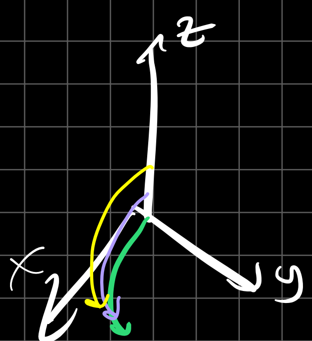
12-6

② $y=e^x$ sketch a graph.

$\mathbb{R}^2$



$\mathbb{R}^3$



(20) $x = y^2 - z^2$

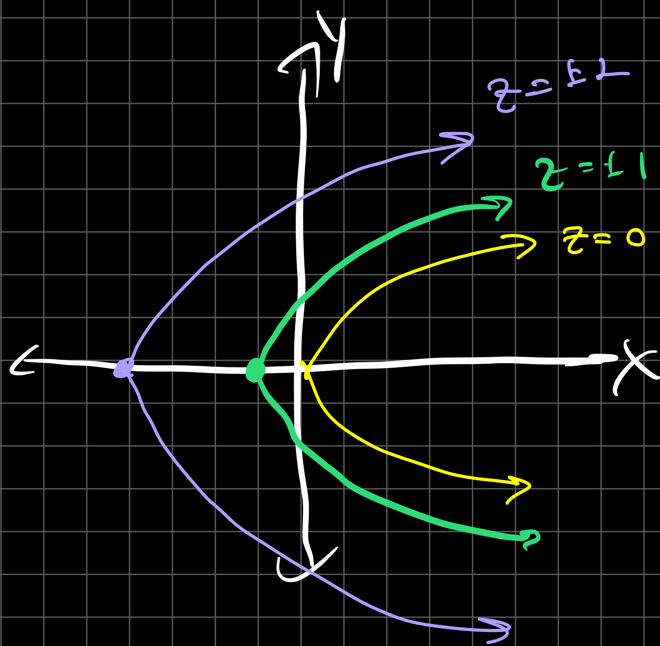
fix z

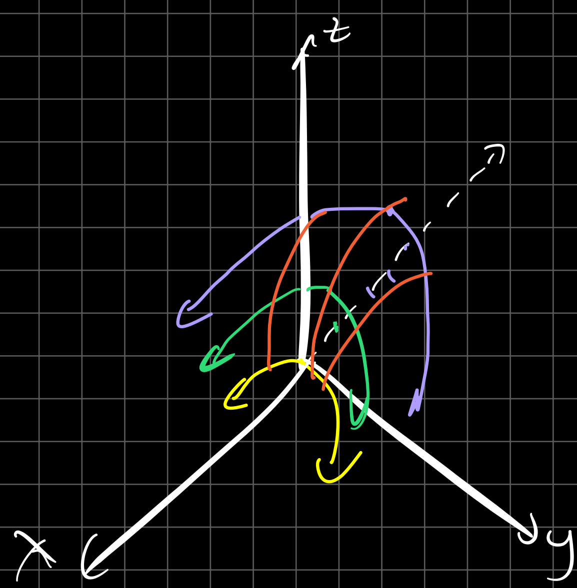
traces in z. (level curves)

$z = 0$ $\qquad x = y^2$

$z = \pm 1$ $\qquad x = y^2 - 1$

$z = \pm 2$ $\qquad x = y^2 - 4$





Traces in y. $\qquad x = y^2 - z^2$

$y = 0$ $\qquad x = -z^2$

$y=1 \quad x = 1-z^2$

$y=2 \quad x = 4-z^2$