MAT1110 > OBLIG > 1 > 1.py > ...

```python
import numpy as np

#a)
v_1 = np.array([1, 1, 1])
v_2 = np.array([1, 1, -2])
v_3 = np.array([1, -1, 0])

if np.dot(v_1, v_2) & np.dot(v_1,v_3) & np.dot(v_2,v_3) ==0:
    print("Alle vinkelene er vinkelrette på hvrandre")

"""
Terminal> Python.exe> 1.py
Alle vinkelene er vinkelrette på hvrandre
"""
```

1 b)

$A e_1 = v_1$

$$\begin{bmatrix} a & b & c \\ d & e & f \\ g & h & i \end{bmatrix} \cdot \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix} \rightarrow$$

$$\Downarrow$$

$$\begin{bmatrix} a \\ d \\ g \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$$

$A e_2 = v_2$

$$\begin{bmatrix} 1 & b & c \\ 1 & e & f \\ 1 & h & i \end{bmatrix} \cdot \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \\ -2 \end{bmatrix}$$

$$\Downarrow$$

$$\begin{bmatrix} b \\ e \\ h \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \\ -2 \end{bmatrix}$$

$$\begin{bmatrix} 1 & 1 & c \\ 1 & 1 & f \\ 1 & -2 & i \end{bmatrix} \cdot \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} = \begin{bmatrix} 1 \\ -1 \\ 0 \end{bmatrix}$$

$$\begin{bmatrix} c \\ f \\ i \end{bmatrix} = \begin{bmatrix} 1 \\ -1 \\ 0 \end{bmatrix}$$

$$A = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & -1 \\ 1 & -2 & 0 \end{bmatrix}$$

$$A \cdot a = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & -1 \\ 1 & -2 & 0 \end{bmatrix} \cdot \begin{bmatrix} a_1 \\ a_2 \\ a_3 \end{bmatrix} = \underline{\underline{\begin{bmatrix} a_1 + a_2 + a_3 \\ a_1 + a_2 - a_3 \\ a_1 - 2a_2 \end{bmatrix}}}$$

Sjekk: $a_1 v_1 + a_2 v_2 + a_3 v_3 =$

$$\rightarrow \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix} a_1 + \begin{bmatrix} 1 \\ 1 \\ -2 \end{bmatrix} a_2 + a_3 \begin{bmatrix} 1 \\ -1 \\ 0 \end{bmatrix} = \underline{\underline{\begin{bmatrix} a_1 + a_2 + a_3 \\ a_1 + a_2 - a_3 \\ a_1 - 2a_2 \end{bmatrix}}}$$

```
#c)
A = np.transpose(np.array([v_1,v_2,v_3]))
B = np.linalg.inv(A)

print(np.dot(B,v_1))
print(np.dot(B,v_2))
print(np.dot(B,v_3))

"""
Terminal> Python.exe> 1.py
[1. 0. 0.]
[1.11022302e-16 1.00000000e+00 0.00000000e+00]
[0. 0. 1.]
"""
```

② a) $\underbrace{\begin{pmatrix} 2/3 & 1/6 & 1/6 \\ 1/6 & 2/3 & 1/6 \\ 1/6 & 1/6 & 2/3 \end{pmatrix}}_{C} \cdot \underbrace{\begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix}}_{V_1} = \begin{pmatrix} \frac{6}{6} \\ \frac{6}{6} \\ \frac{6}{6} \end{pmatrix} = \underbrace{1}_{\lambda} \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix}$ $\underline{\underline{\lambda = 1}}$ egenverdien til V_1 er 1

$\begin{pmatrix} 2/3 & 1/6 & 1/6 \\ 1/6 & 2/3 & 1/6 \\ 1/6 & 1/6 & 2/3 \end{pmatrix} \cdot \begin{pmatrix} 1 \\ 1 \\ -2 \end{pmatrix} = \begin{pmatrix} 1/2 \\ 1/2 \\ -6/6 \end{pmatrix} = \begin{pmatrix} 1/2 \\ 1/2 \\ -1 \end{pmatrix} = \underbrace{\frac{1}{2}}_{\lambda} \begin{pmatrix} 1 \\ 1 \\ -2 \end{pmatrix}$ $\underline{\underline{\lambda = \frac{1}{2}}}$ λ til $V_2 \to \frac{1}{2}$

$\begin{pmatrix} 2/3 & 1/6 & 1/6 \\ 1/6 & 2/3 & 1/6 \\ 1/6 & 1/6 & 2/3 \end{pmatrix} \cdot \begin{pmatrix} 1 \\ -1 \\ 0 \end{pmatrix} = \begin{pmatrix} \frac{1}{2} \\ -1/2 \\ 0 \end{pmatrix} \underbrace{\frac{1}{2}}_{\lambda} \begin{pmatrix} 1 \\ -1 \\ 0 \end{pmatrix}$ $\underline{\underline{\lambda = \frac{1}{2}}}$ λ til $V_3 \to \frac{1}{2}$

b) $A \cdot \vec{a} = \vec{b}$ $\vec{b} = \begin{pmatrix} 3 \\ 7 \\ 2 \end{pmatrix}$

~~først vil jeg finne a ved å~~ først uttrykke b ved v_j som vi vet
$a_1\vec{V_1} + a_2\vec{V_2} + a_3\vec{V_3} = \vec{b}$

$$\begin{aligned} x + y + z &= 3 \\ x + y - z &= 7 \\ x - 2y &= 2 \end{aligned} \iff \begin{pmatrix} 1 & 1 & 1 & 3 \\ 1 & 1 & -1 & 7 \\ 1 & -2 & 0 & 2 \end{pmatrix} \overset{I-II,\ I-III}{\sim} \begin{pmatrix} 1 & 1 & 1 & 3 \\ 0 & 0 & -2 & 4 \\ 0 & -3 & -1 & -1 \end{pmatrix} \overset{III \leftrightarrow II}{\sim}$$

$$\sim \begin{pmatrix} 1 & 1 & 1 & 3 \\ 0 & -3 & -1 & -1 \\ 0 & 0 & -2 & 4 \end{pmatrix}$$

$z = -2$ $\quad -3y + 2 = -1 \to -3y = -3 \to y = 1$ $\quad x + 1 - 2 = 3 \quad \underline{x = 4}$

$b = 4\vec{V_1} + \vec{V_2} - 2\vec{V_3}$ så $\vec{a} = [4, 1, -2]$, ka $= b$ er det riktigste

Så må jeg finne C^n der $\boxed{\lim_{n\to\infty}}$

$CV_1 = V_1 \qquad C^nV_1 = V_1$

$CV_2 = V_2\frac{1}{2} \qquad C^nV_2 = (\frac{1}{2})^n V_2 = 0$

$CV_3 = V_3\frac{1}{2} \qquad C^nV_3 = (\frac{1}{2})^n V_3 = 0$

$$\begin{aligned} C^n b &= C^n(4\vec{V_1} + \vec{V_2} - 2\vec{V_3}) \\ &= 4C^n\vec{V_1} + C^n\vec{V_2} - 2C^n\vec{V_3} \\ &= 4\vec{V_1} + 0 - 0 \\ &= 4\begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix} = \underline{\underline{\begin{bmatrix} 4 \\ 4 \\ 4 \end{bmatrix}}} \end{aligned}$$

MAT1110 > OBLIG > 1 > 3a.py > ...

```python
import numpy as np
import matplotlib.pyplot as plt

#tidsintervallet
t = np.linspace(0, np.pi, 150)

#funksjonen
def r(t):
    x = np.cos(t)
    y = np.sin(t)
    z = 4*np.sin(4*t)**2
    return x, y, z
x, y, z = r(t)

#plotter
fig = plt.figure()
axis = fig.add_subplot(111, projection="3d")
axis.plot(x, y, z)
axis.set_xlabel("x-akse")
axis.set_ylabel("y-akse")
axis.set_zlabel("z-akse")
plt.show()


"""
Terminal> Python.exe> 1.py
"""
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3 b) $\vec{F}(x,y,z) = (5x^4 + 2xy^3 - yze^{xyz},\ 3x^2y^2 - xze^{xyz},\ \cancel{z} - xye^{xyz})$

1 $\begin{cases} \frac{\partial F_1}{\partial y} = 6xy^2 - yxz^2e^{xyz} - ze^{xyz} \\ \frac{\partial F_2}{\partial x} = 6xy^2 - yxz^2e^{xyz} - ze^{xyz} \end{cases}$

3 $\begin{cases} \frac{\partial F_2}{\partial z} = -x^2yze^{xyz} - ye^{xyz} \\ \frac{\partial F_3}{\partial y} = -x^2yze^{xyz} - ye^{xyz} \end{cases}$

2 $\begin{cases} \frac{\partial F_1}{\partial z} = -xy^2ze^{xyz} - ye^{xyz} \\ \frac{\partial F_3}{\partial x} = -xy^2ze^{xyz} - ye^{xyz} \end{cases}$

$\vec{r}(t) = (\cos t, \sin t, 4\sin^2 4t) \quad t \in [0,\pi]$

$\vec{r}(\pi) = (-1,0,0)$

$\vec{r}(0) = (1,0,0)$

$\nabla\phi = F(x,y,z) = \left(\frac{\partial\phi}{\partial x}, \frac{\partial\phi}{\partial y}, \frac{\partial\phi}{\partial z}\right)$

$\int_{\mathcal{C}} \vec{F}\cdot d\vec{r} = \int_{\mathcal{C}} \nabla\phi\, dr = \phi(\vec{r}(b)) - \phi(\vec{r}(a)) = \phi(-1,0,0) - \phi(1,0,0) =$

$\frac{\partial\phi}{\partial x} = 5x^4 + 2xy^3 - yze^{xyz} \xrightarrow{\int dx} x^5 + x^2y^3 - e^{xyz} + A(y,z)$

$\frac{\partial\phi}{\partial y} = 3x^2y^2 - xze^{xyz} \xrightarrow{\int dy} x^2y^3 - e^{xyz} + B(x,z)$

$\frac{\partial\phi}{\partial z} = -xye^{xyz} \xrightarrow{\int dz} -e^{xyz} + C(x,y)$

$\phi = x^5 + x^2y^3 - e^{xyz} \longrightarrow ((-1)^5 + (-1)^2(0) - e^0) - ((1)^5 + (1)(0) - e^0)$

$-2 \quad -(0) \quad = \underline{\underline{-2}}$