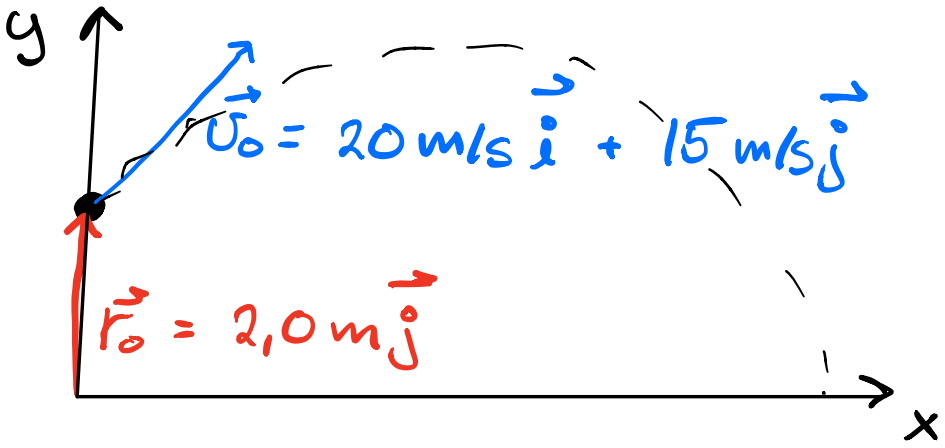
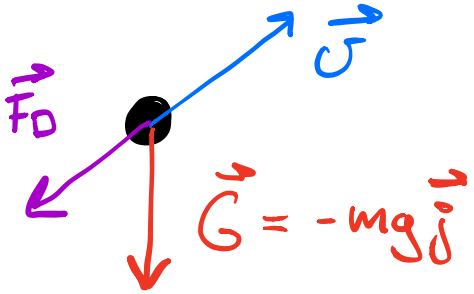
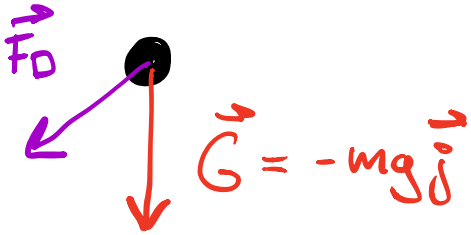
Kast 2D



Luftmotstand:



Frilegemediagram:



$$\vec{G} = -mg\vec{j}$$

$$\vec{F}_D = -D \cdot |\vec{v}| \cdot \vec{v}$$

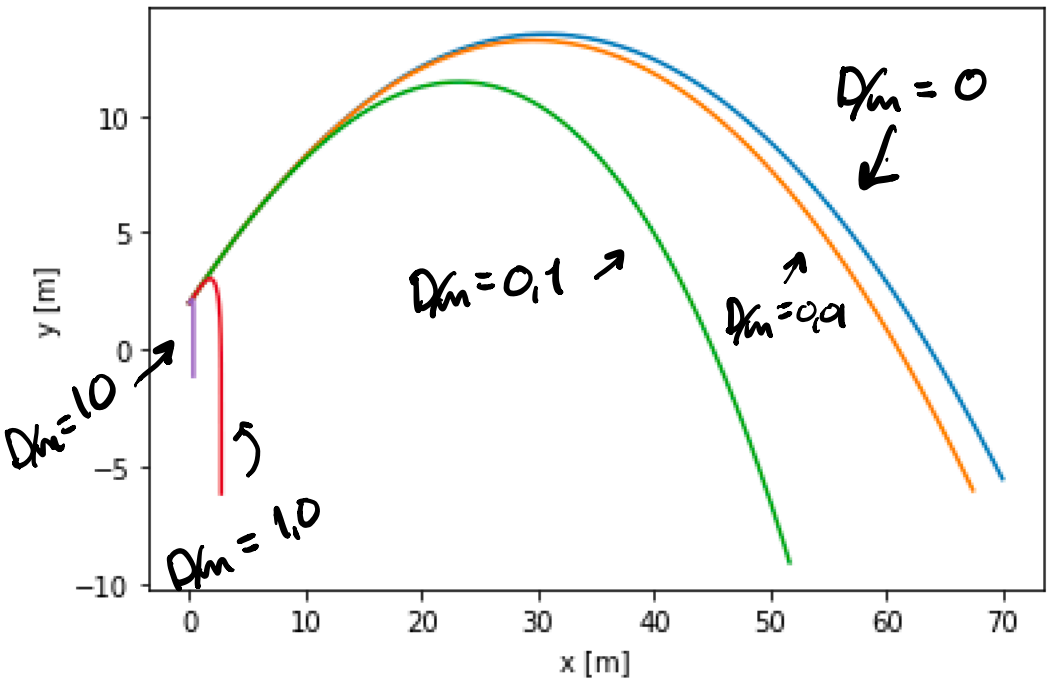
N. 2.100 °

$$\vec{G} + \vec{F}_O = m\vec{a}$$

$$-mg\vec{j} - D\,|\vec{v}|\cdot\vec{v} = m\vec{a} \quad | \cdot \frac{1}{m}$$

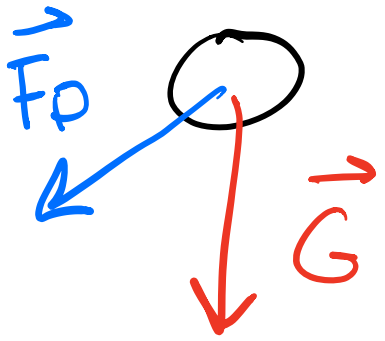
$$-g\vec{j} - \frac{D}{m}\cdot|\vec{v}|\cdot\vec{v} = \vec{a}$$

$-g \cdot$ array([0,1]) norm(v[i,:]) · v[i,:]



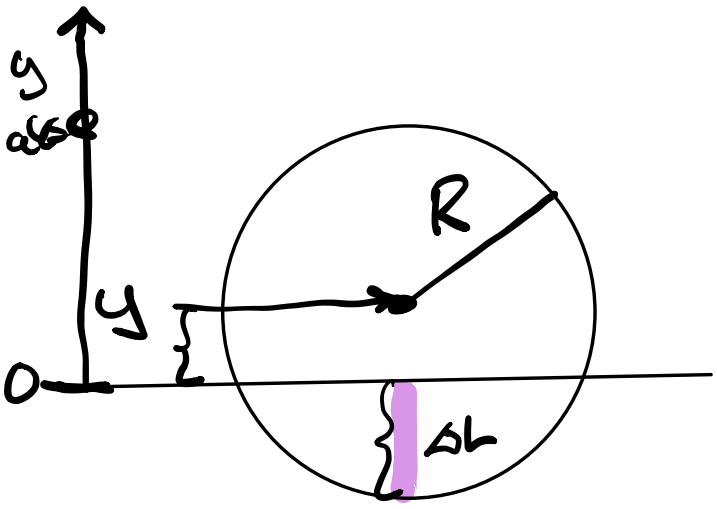
Sprettball

I luften:



Treffer bakken:

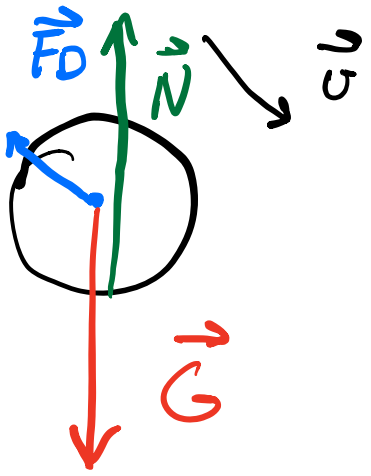
Antar at ballen er ei fjær (Hookes lov)



$$\vec{F}_H = -k \cdot \Delta L$$

k - fjærkonstand N/m

Δl - Lengde på kompresjon



Newtons 2. lov

$$\sum \vec{F} = m\vec{a}$$

$$\vec{G} + \vec{F}_D + \vec{N} = m\vec{a}$$

$$\vec{G} = -mg\,\vec{j}$$

R - radius spretball

$$\vec{F}_D = -D \cdot |\vec{v}| \cdot \vec{v}$$

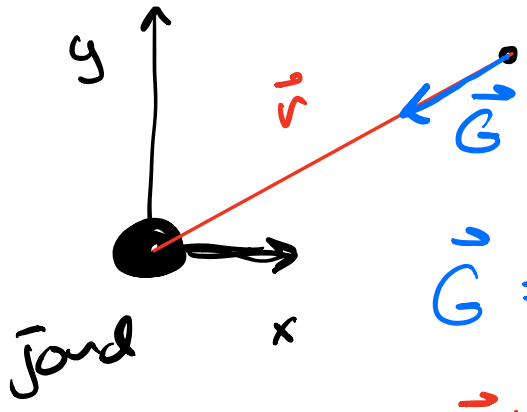
$$\vec{N} = \begin{cases} 0 & \text{nå} \quad y > R \\ -k\,\Delta L\,\vec{j} & \text{nå} \quad y < R \end{cases}$$

$$\Delta L = (R - y)$$

$$\vec{N} = \begin{cases} 0 & \text{nå} \quad y > R \\ -k(R-y) & \text{nå} \quad y < R \end{cases}$$

```
48 # Simulation loop Euler -cromers-metode
49 for i in range(n-1):
50     if (r[i,1]<R):
51         N = k*(R-r[i,1])*array([0,1])
52     else:
53         N = array([0,0])
54     FD = - D*norm(v[i])*v[i]
55     G = -m*g*array([0,1])
56     Fnet = N + FD + G
57     a[i+1] = Fnet/m
58     v[i+1] = v[i] + a[i+1]*dt
59     r[i+1] = r[i] + v[i+1]*dt
60     t[i+1] = t[i] + dt
```

Gravitasjon



$$\vec{G} = -G\frac{M \cdot m}{r^2}\hat{r}$$

$$r = |\vec{r}|$$

$$\hat{r} = \frac{\vec{r}}{|\vec{r}|} = \frac{\vec{r}}{r}$$

$$\vec{G} = -G\frac{M \cdot m}{r^2} \cdot \frac{\vec{r}}{r} = -G\frac{M \cdot m}{r^3}\vec{r}$$

N. 2. lov for Komet

$$\vec{G} = m\vec{a}$$

$$-G\frac{M\,m}{r^3}\vec{r} = m\vec{a} \;\Big|\; \frac{1}{m}$$

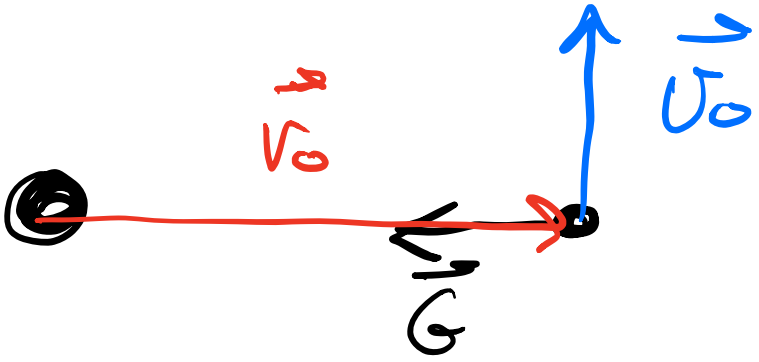
$$\vec{a} = -G\frac{M}{r^3}\vec{r}$$

Kometens posisjon er $\vec{r}$

Initial-verdier

$$\vec{r}(0) = \vec{r}_0 = 2 \cdot 10^{11}\ m\ \vec{i}$$

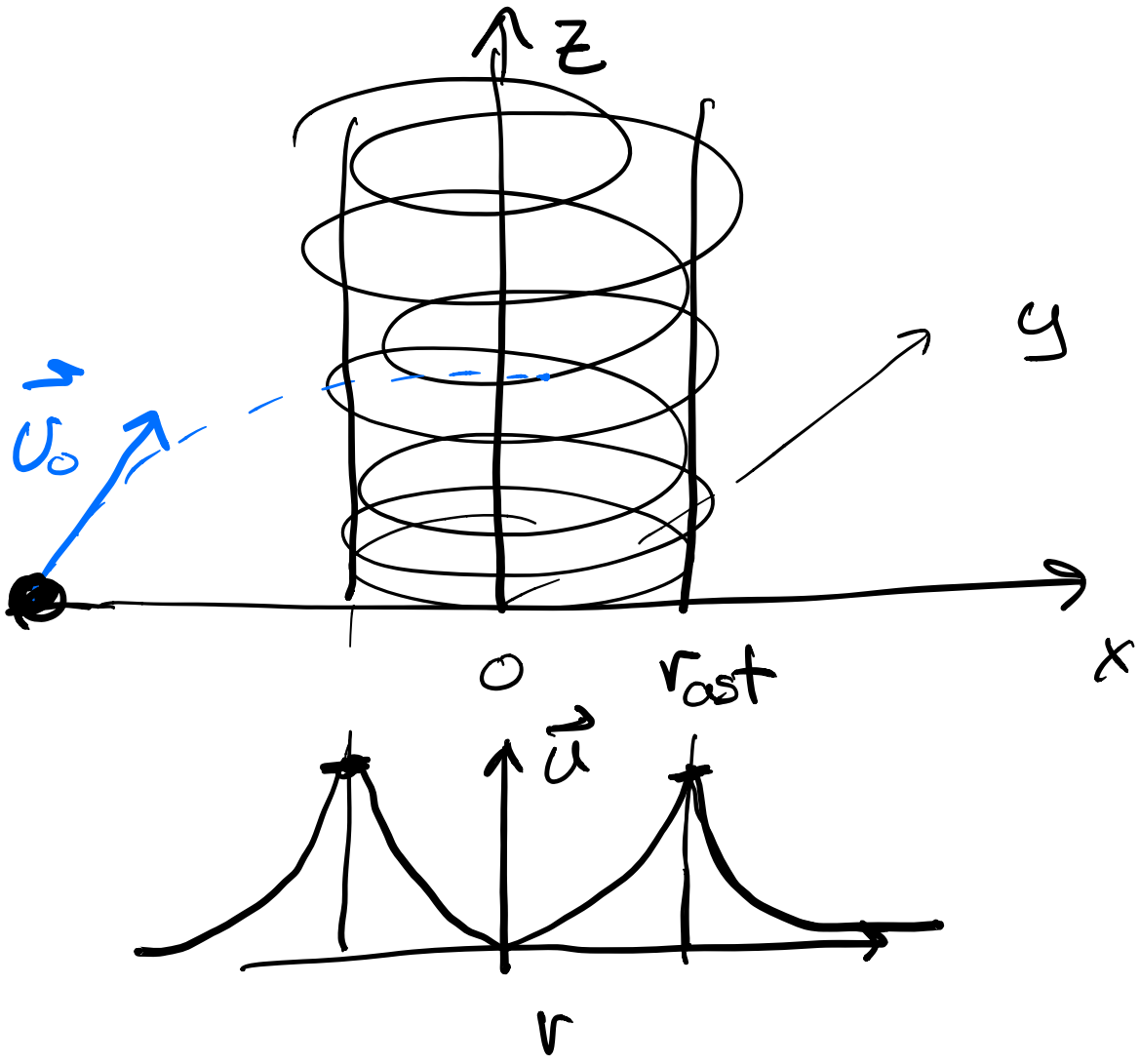
$$\vec{v}(0) = \vec{v}_0 = 5 \cdot 10^{3}\ m/s\ \vec{j}$$



$$G = 6{,}673 \cdot 10^{-11}\ m^3/kgs^2$$

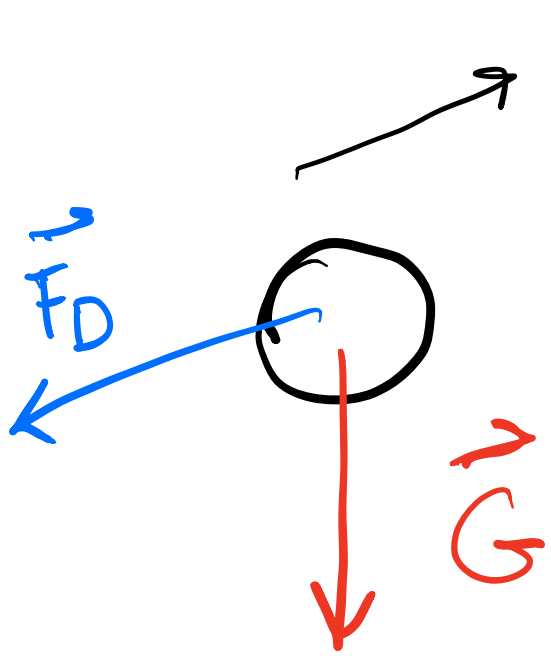
$$M = 1{,}99 \cdot 10^{30}\ kg$$

Probe i tornado



$$\vec{u} = u_0 \cdot \frac{r_{ost}}{r} \hat{u}$$

$$\vec{v}_{rel} = \vec{v} + \vec{u}$$



N. 2. lav

$$\vec{G} + \vec{F}_D = m\vec{a}$$