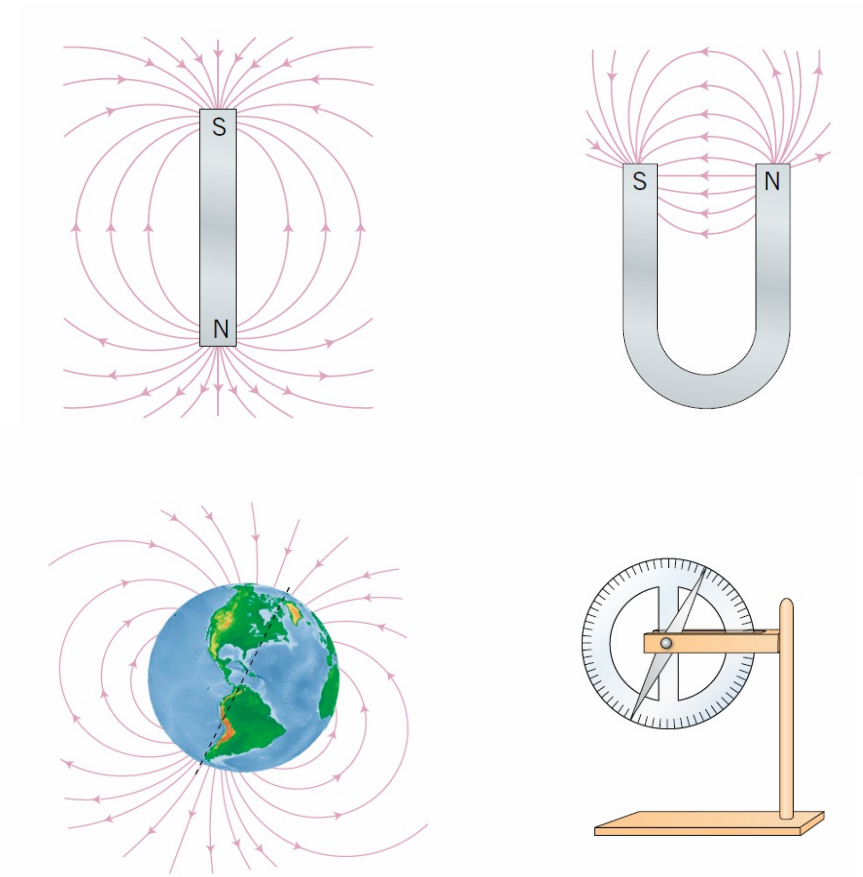
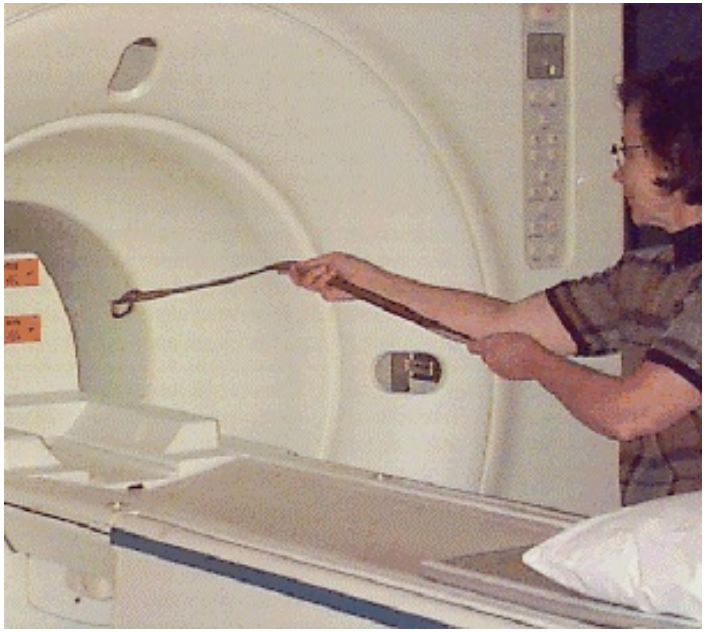
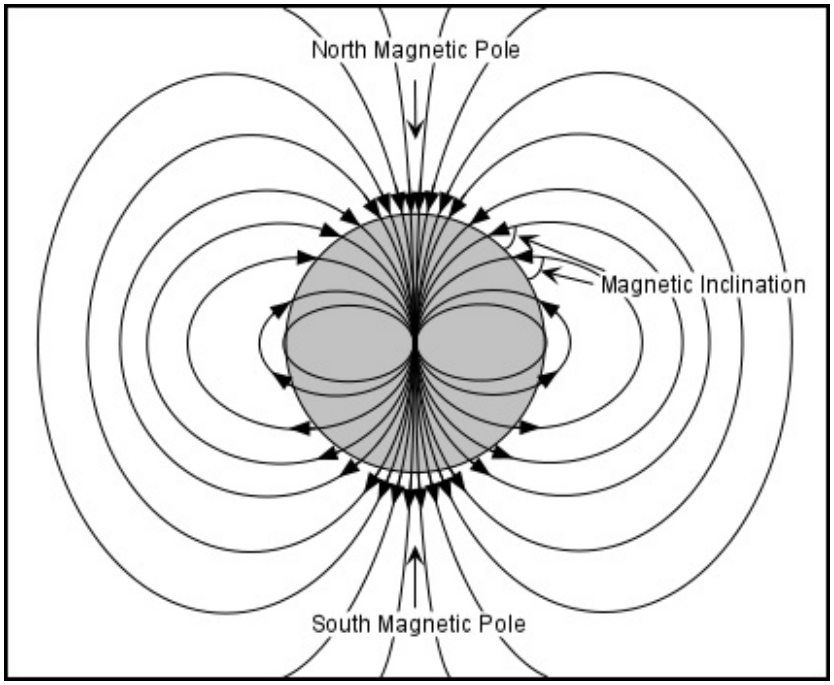
Kapittel 23:
Magnetisk felt

Magnetisk felt



Magnetisk feltstyrke



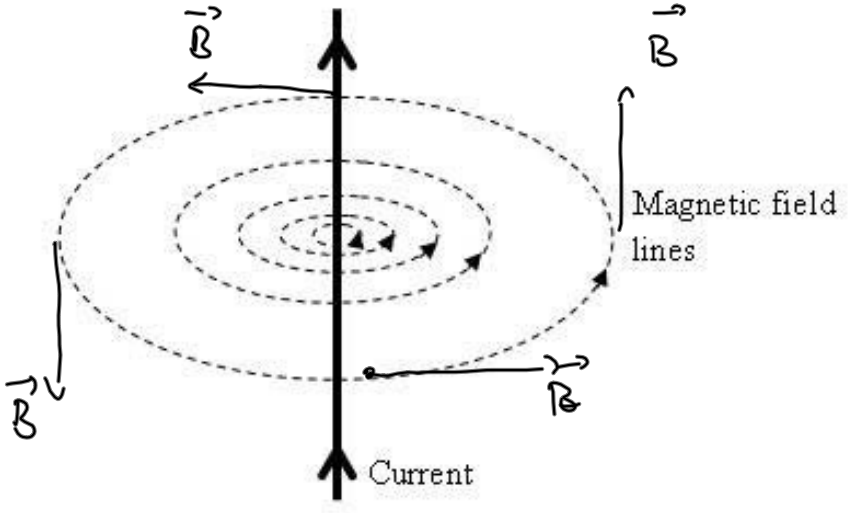


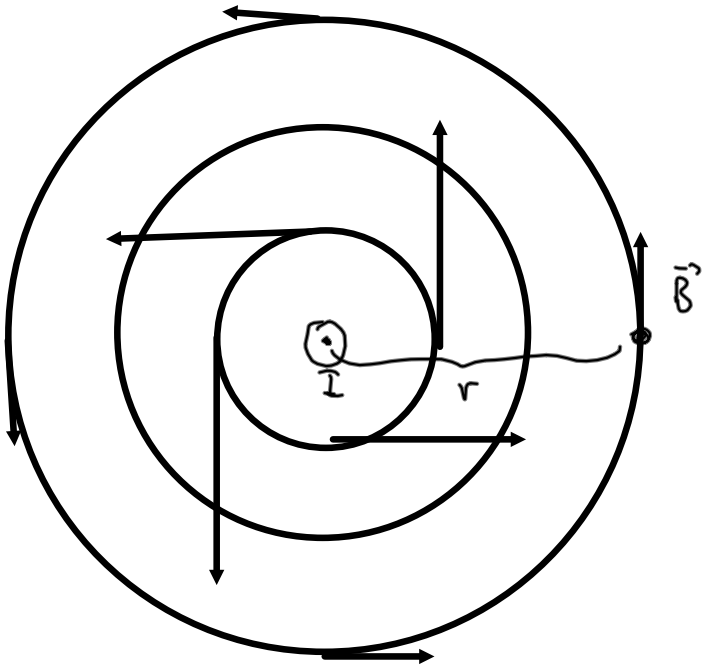
MRI: 1-3 T

Jorda: 0,000025 - 0,000065 T

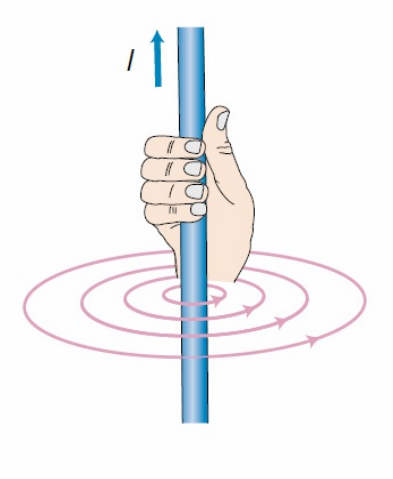
Smallest value in a magnetically shielded room	10^-14 Tesla
Interstellar space	10^-10 Tesla
Earth's magnetic field	0.00005 Tesla
Small bar magnet	0.01 Tesla
Within a sunspot	0.15 Tesla
Small NIB magnet	0.2 Tesla
Big electromagnet	1.5 Tesla
Strong lab magnet	10 Tesla
Surface of neutron star	100,000,000 Tesla
Magstar	100,000,000,000 Tesla

Magnetisk felt rundt en strømførende leder





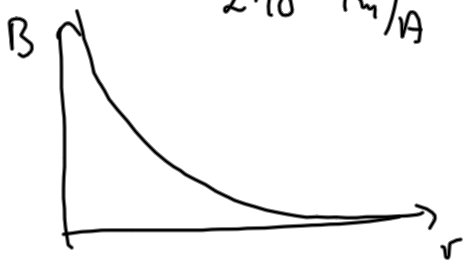
Høyrehåndsregel 1

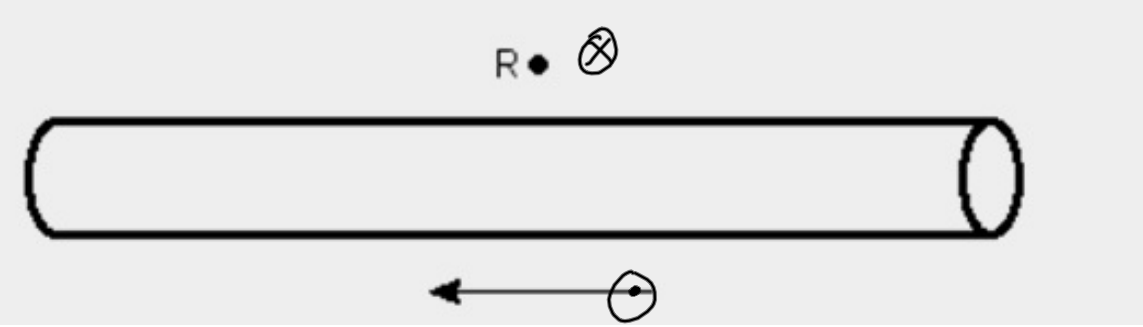


$B = k_m \frac{I}{r}$

k_m: $2 \cdot 10^{-7}\ Tm/A$

(Coulomb: $E = k_e \frac{Q}{r^2}$)





I en ledning går det strøm i den retninga som pilen viser. Hvilken retning har magnetfeltet rundt ledningen i punktet R?

A →

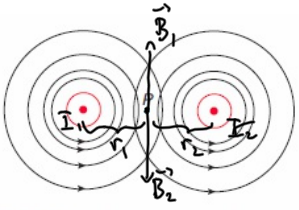
B ←

C ↑

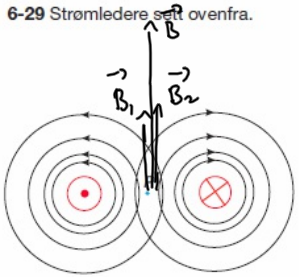
D ↓

E ⊙

F ⊗



6-29 Strømledere sett ovenfra.



6-30 Strømledere sett ovenfra.

Hva blir feltstyrken midt mellom lederne dersom strømmen er 6,0 A og avstanden mellom dem er 5,0 cm?

$I_1 = I_2 = 6{,}0\,A = I$

$r_1 = r_2 = 2{,}5\,cm = r$

$B_1 = k_m \frac{I_1}{r_1}$

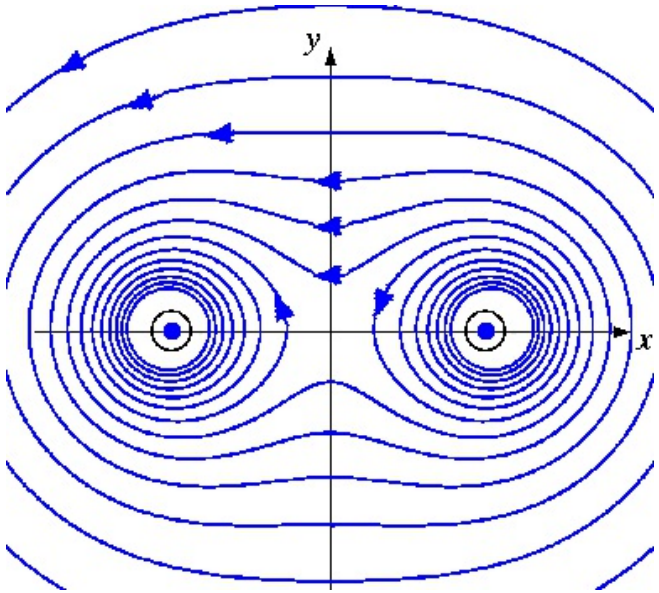
$B_2 = k_m \frac{I_2}{r_2}$

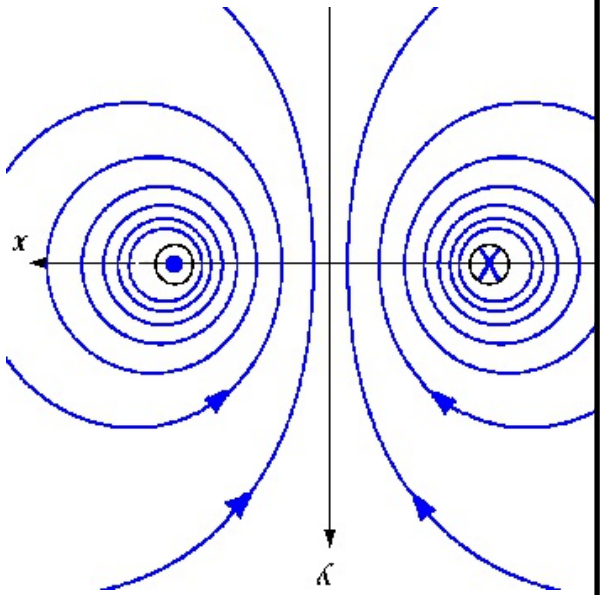
$|B_1| = |B_2|$

$\vec{B} = \vec{B}_1 + \vec{B}_2 = 0$

$\vec{B} = \vec{B}_1 + \vec{B}_2$

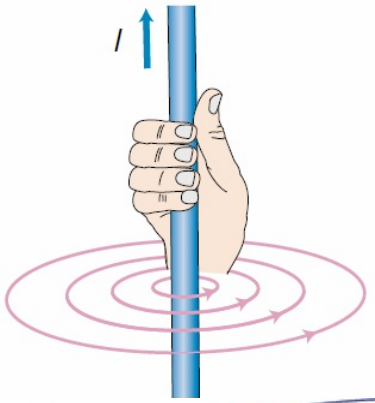
$B = |\vec{B}| = 2 k_m \frac{I}{r} = 2 \cdot 2 \cdot 10^{-7}\,Tm/A \cdot \frac{6{,}0\,A}{2{,}5 \cdot 10^{-2}\,m} = 4{,}8 \cdot 10^{-5}\,T$

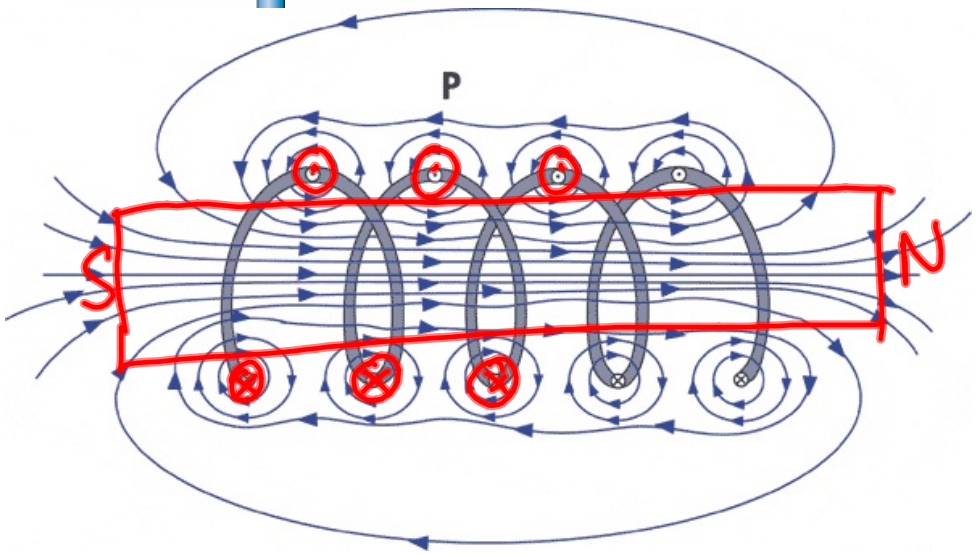




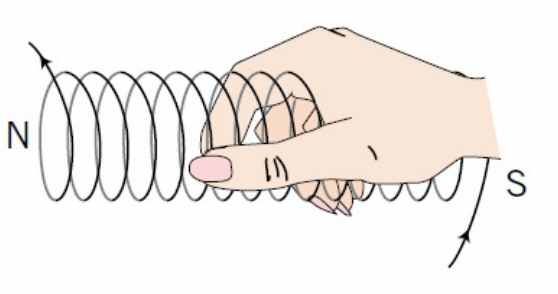
Magnetisk felt rundt en strømførende leder

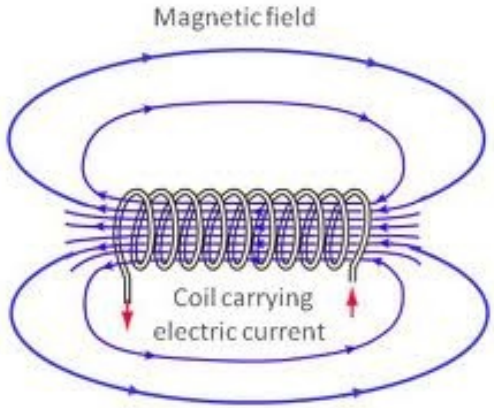
Høyrehåndsregel 1





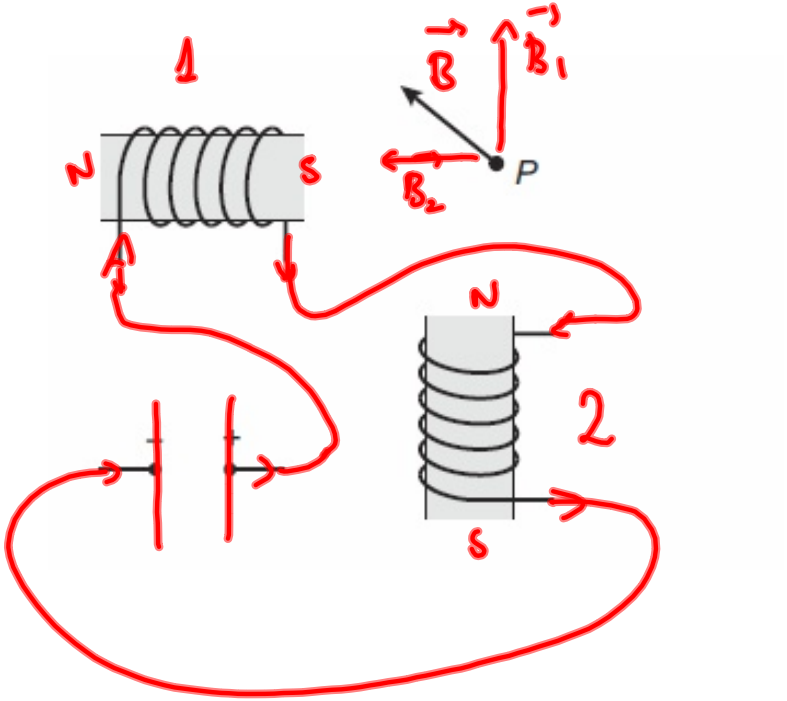
Høyrehåndsregel 2



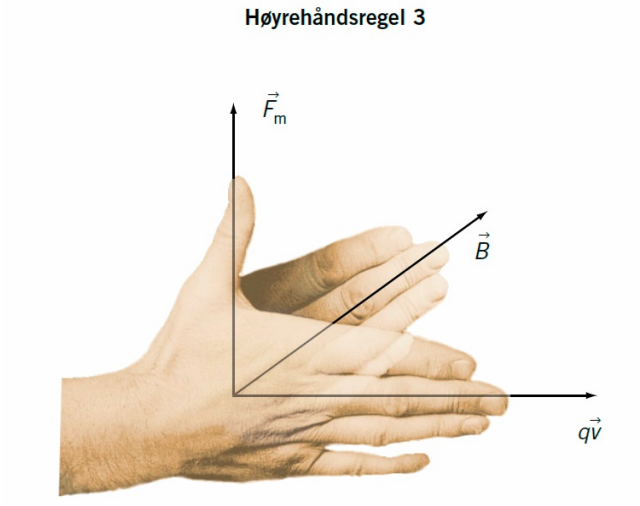


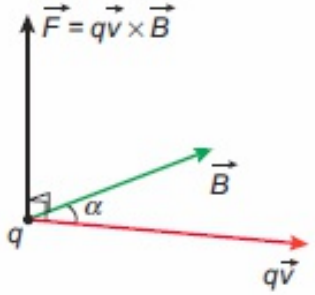
Spolene på figuren skal kobles i serie.

Kan du fullføre koblingene slik at magnetfeltet i punktet P får retning som vist på figuren?



Kraft på ladet partikkel i magnetfelt





(El: $\vec{F} = q\vec{E}$)

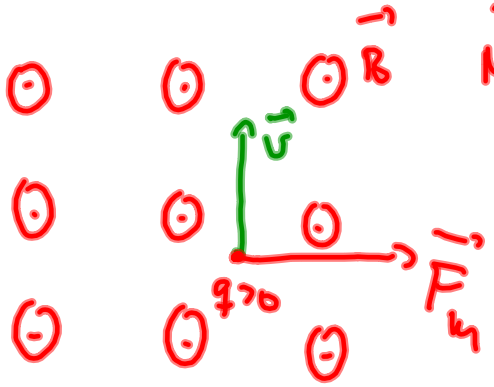
$\vec{F} = q\vec{v} \times \vec{B}$

$F = qvB \sin\alpha$

$v = 0$: $F = 0$

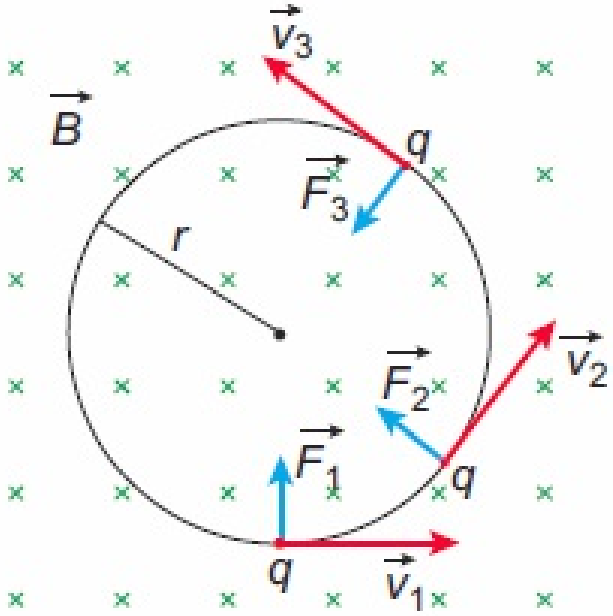
$\vec{v} \parallel \vec{B}$: $\alpha = 0$, $\sin\alpha = 0$

$F = 0$



$\vec{v} \perp \vec{B}$ $\alpha = 90°$ $\sin\alpha = 1$

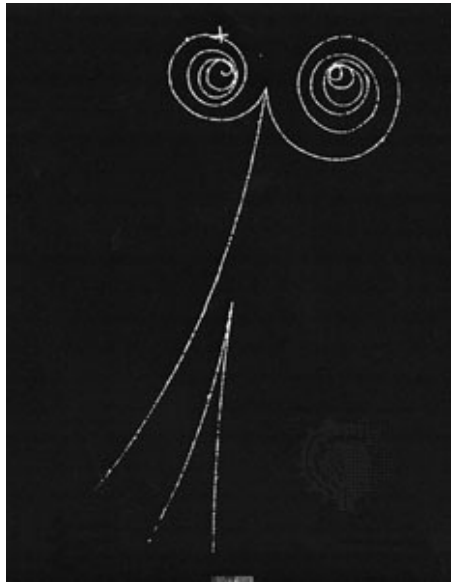
$F = qvB$



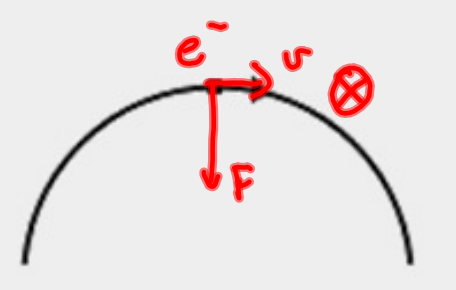
$$F = m\frac{v^2}{r} = F_m = qvB$$

$$m\frac{v}{r} = qB$$

$$r = \frac{mv}{qB}$$



$\vec{F} = q\,v\,B$



Figuren viser litt av banen til et elektron som er i bevegelse i et homogent magnetfelt. Banen ligger i papirplanet. Hvilken retning har magnetfeltet?