Useful equations and numbers for exam 4

$\mu_o = 4\pi \times 10^{-7} \frac{T \cdot m}{A}$

i. **B**-field of a long current carrying wire: $B = \frac{\mu_o I}{2\pi r}$

ii. **B**-field at the center of a current loop: $B = \frac{\mu_o I}{2r}$

iii. **B**-field inside a solenoid: $B = \mu_o n I$
where n = turns per unit length

iv. force on a charged particle in a magnetic field: $\vec{F}_B = q\vec{v} \times \vec{B}$
$F_B = qv_\perp B = qvB_\perp = qvB\sin\theta$
where θ is the angle between $\vec{v}$ and $\vec{B}$

v. cyclotron motion: $qvB = \frac{mv^2}{r}$, $r = \frac{mv}{qB}$, $f = \frac{qB}{2\pi m}$

vi. magnetic force on a current carrying wire in an external magnetic field:
$\vec{F}_B = \int Id\vec{l} \times \vec{B}$
$\vec{F}_B = Id\vec{l} \times \vec{B}$

vii. Biot-Savart Law: $d\vec{B} = \frac{\mu_o}{4\pi}\frac{Id\vec{l} \times \hat{r}}{r^2}$
$d\vec{B} = \frac{\mu_o}{4\pi}\frac{q\vec{v} \times \hat{r}}{r^2}$

xi. magnetic flux: $\Phi_M = \int_S \vec{B} \cdot d\vec{A}$
$\Phi_m = \vec{B} \bullet \vec{A} = BA\cos\theta$ constant B, A, θ

xii. Faraday's Law of electromagnetic induction: $Emf = \oint \vec{E} \cdot d\vec{l} = -\frac{d\Phi}{dt}$
or magnitude of emf: $|emf| = \left|\frac{d\Phi_m}{dt}\right|$, direction from Lenz's Law

As always, you are free to add some equations on your own to this page. Don't add solved problems, though.