22.2 HW – ~~31~~, ~~32~~, ~~33~~, ~~35a~~, ~~37~~, ~~39~~, 50, 51

31) a) left
b) ⊗
c) up
d) no force
e) right
f) down

32) a) left
b) ⊙
c) up

33) a) ⊗
b) left
c) ⊙

35) a) $|\vec{F}| = IlB\sin\phi$

$F = (1000\,A)(100\,m)(5.00\times10^{-5}\,T)\sin30^\circ$

$\boxed{F = 2.50\,N}$

37) $F = IlB$

$B = \frac{F}{Il} = \frac{2.16\,N}{(30.0\,A)(0.04\,m)} = \boxed{1.80\,T}$

39) a) $F = IlB\sin\phi$

$\sin\phi = \frac{F}{IlB}$

$\sin\phi = 0.5$

$\boxed{\phi = 30.0^\circ}$

b) $F = IlB\sin\phi$

$= (8)(0.5)(1.2)\sin90^\circ$

$\boxed{F = 4.80\,N}$

50) a) $F = \frac{l\mu_0 I^2}{2\pi r} = \frac{(50)(4\pi\times10^{-7})(800)^2}{2\pi(0.750)} = 8.533333333335$

$= \boxed{8.53\,N}$

$\mu_0 = 4\pi\times10^{-7}\ Tm/A$

the force is repulsive because the currents are in opposite directions (DC power & neutral wires)

b) The force is repulsive so there is never a risk that the two wires will touch and short circuit

51) a) $F = IlB\sin\phi$

$\frac{F}{l} = IB\sin\phi$

$\frac{F}{l} = I\left(\frac{\mu_0 I}{2\pi r}\right) = \frac{I^2\mu_0}{2\pi r} = \frac{I^2\cdot4\pi\times10^{-7}}{2\pi r} = \frac{I^2\cdot(2\times10^{-7})}{r}$

$\frac{F}{l} = \frac{2I^2\times10^{-7}}{r}$

$\sqrt{\frac{F\cdot r}{l\cdot2\times10^{-7}}} = \sqrt{I^2}$

$I = \sqrt{\frac{0.225(0.02)}{2\times10^{-7}}} = \boxed{50\,A}$

b) repulsive