b)

$$\left(\frac{1-r}{1+r}\right)' = \frac{(1+r)(-1) - (1-r)\cdot 1}{(1+r)^2} = -\frac{2}{(1+r)^2}$$

$$\Rightarrow \frac{d}{dB_0}\mu_0 = -\frac{2}{(1+r)^2}\cdot\left[\frac{d}{dB_0} r\right]\cdot\frac{n\hbar\gamma}{2}$$

$$= -\frac{2}{\Big(1+\underbrace{e^{-\frac{\Delta E}{k_B T}}}_{=e^{\xi B_0}}\Big)^2}\cdot\frac{n\hbar\gamma}{2}\cdot \xi\cdot\underbrace{e^{\xi B_0}}_{=r} =: (*)$$

Taylor:

$$T_1\mu(\underset{B_{0_0}=0}{0}, B_0) = \underbrace{\mu_0(0)}_{\frac{1-1}{1+1}\,\dots\,=0 \text{ as } e^{\xi\cdot 0}=1} + \left(\frac{d}{dB_0}\mu_0\Big|_{B_0=0}\right)\cdot(B_0-0)$$

$$\overset{(*)}{=} -\frac{2}{(1+1)^2}\cdot\frac{n\hbar\gamma}{2}\cdot\underbrace{\left(-\frac{\hbar\gamma}{k_BT}\right)}_{\xi}\cdot r\cdot B_0$$

$$= \left(-\frac{1}{2}\xi\cdot r B_0\right)\cdot\frac{n\hbar\gamma}{2}$$ ⇝ linear in B_0 ✓

$\overset{(1)}{\Rightarrow}$ suffices to compare $\frac{1-r}{1+r}$ and $\left(-\frac{1}{2}\xi\cdot r B_0\right)$ for comparison of accuracy.

$$\frac{1-r}{1+r} = \frac{1-e^{\xi B_0}}{1+e^{\xi B_0}}$$

@ T = 310 K:

B_0 \ $f()$	$\frac{1-e^{\xi B_0}}{1+e^{\xi B_0}}$	$-\frac{1}{2}\xi\cdot r B_0 = -\frac{1}{2}\xi\cdot e^{\xi B_0} B_0$
1T	~~3,29299~~ $3{,}292904\cdot 10^{-6}$	$3{,}292882\cdot 10^{-6}$ (error only in ~~...~~ smaller decimals)
3T	$9{,}878711\cdot 10^{-6}$	$2{,}963555\cdot 10^{-5}$ ⇝ ratio ≈ 3