50. (a) Using Table 38-3 and Eq. 38-49 (or, to be more precise, the value given at the end of the problem statement), we find

$$\gamma = \frac{K}{m_p c^2} + 1 = \frac{500 \times 10^3 \,\text{MeV}}{938.3 \,\text{MeV}} + 1 = 533.88 \ .$$

(b) From Eq. 38-8, we obtain

$$\beta = \sqrt{1 - \frac{1}{\gamma^2}} = 0.99999825 \ .$$

The discussion in Sample Problem 38-7 dealing with large γ values may prove helpful for those whose calculators do not yield this answer.

(c) To make use of the precise $m_p c^2$ value given here, we rewrite the expression introduced in problem 46 (as applied to the proton) as follows:

$$r = \frac{\gamma m v}{qB} = \frac{\gamma \left(mc^2\right)\left(\frac{v}{c^2}\right)}{eB} = \frac{\gamma \left(mc^2\right)\beta}{ecB} \ .$$

Therefore, the magnitude of the magnetic field is

$$\begin{aligned} B &= \frac{\gamma \left(mc^2\right)\beta}{ecr} \\ &= \frac{(533.88)(938.3 \,\text{MeV})(0.99999825)}{ec(750 \,\text{m})} \\ &= \frac{667.92 \times 10^6 \,\text{V/m}}{c} \end{aligned}$$

where we note the cancellation of the "e" in MeV with the e in the denominator. After substituting $c = 2.998 \times 10^8$ m/s, we obtain $B = 2.23$ T.