Answers to growth homework.

1. A. Use the formula $g=\log(N_t/N_0)/0.3$ and you get g=17.7. So there must be 17.7 (or 18 rounded) generations to go from 500 to 10^8 CFU. Since the doubling time is 20 min (0.33 hour), you get 18g x 0.33h/g = 5.9 h (or 6 h, rounded), so you would have to come in at 5:00 pm + 6 h = 11:00 pm.

2. A. Same formula: $g=\log(48{,}000/3{,}000)/0.3 = 4.0$;
5 h/4.0 g = 1.25 h/g or 75 min/g.

B. Growth rate is the inverse of the generation (doubling) time and is usually denoted by the greek letter Mu (μ). So the growth rate = 0.8/h or 0.013/min.

3. Now we are going to use $N_t=N_0 \times 2^g$. First, we have to calculate the number of generations (g) for each strain. The wild-type clone's growth rate is 1.5g/h, so in 10 h there are 15 generations. For the mutant clone the normal growth rate is 3g/h, so in 10 h there are 30 generations.

For the wild-type clone, $N_0=1000$, so at 10 h, $N_{10}=1000 \times 2^{15} = 3.3\times10^7$ CFU.
For the mutant, $N_0=1$, so at 10 h, $N_{10}=1 \times 2^{30} = 1.1\times10^9$ CFU.

So the ratio of wild-type to mutant clones is $3.3\times10^7/1.1\times10^9=0.03$,
or about 1 in 33. Not very good!

4. Use $g=\log(N_t/N_0)/0.3$. $g=\log(10^{28}/10^{-12})/0.3 = \log10^{40}/0.3 = 40/0.3 = 133$.
Since each generation is 0.5 hours, it would take 133g x 0.5 hours = 67 hours or roughly 2.8 days.