1. The gamma function is defined as \( \Gamma(x) = \int_0^\infty t^{x-1} e^{-t} dt \).
   
a) Find \( \Gamma(1), \Gamma(2), \Gamma(3), \Gamma(4), \) and \( \Gamma(5) \). Is there a pattern?
   
b) Show that \( \Gamma(x + 1) = x \Gamma(x) \) for all \( x > 0 \). [Hint: Integration by Parts is your friend.]

2. a) Use Mathematica or other technology to find an exact value for \( \Gamma(\frac{1}{2}) \).
   
b) Explain how, once you have the value from part a for \( \Gamma(\frac{1}{2}) \), you can find \( \Gamma(\frac{3}{2}) \) and \( \Gamma(-\frac{1}{2}) \) without needing a computer or calculator again.