5pts.  
1: You invest $1000 in an account yielding 8% compounded continuously. When will the account reach $1500?

\[ A = Pe^{rt} \text{ formula for continuous compounding} \]

\[
\frac{1500}{1000} = e^{0.08t} \\
1.5 = e^{0.08t} \\
\ln(1.5) = 0.08t \\
t = \frac{\ln(1.5)}{0.08} = 5.07 \text{ years} 
\]

7pts.  
2: Show that the geometric sum \( S = a + ar + ar^2 + \cdots + ar^{n-1} \) satisfies \( S = \frac{a-ar^n}{1-r} \).

\[
\frac{-rS}{(1-r)} = a + ar + ar^2 + \cdots + ar^{n-1} + ar^n \\
S = \frac{a-ar^n}{1-r} 
\]

8pts.  
3: You want to start saving for a house. You decide that you will wait until you can save $30,000 for a down payment. You put $600 per month into an account yielding 6% compounded monthly. How long will it take to have enough for a down payment?

\[
30000 = 600 \left(1 + \frac{0.06}{12}\right)^n + 600 \left(1 + \frac{0.06}{12}\right)^{n-1} + \cdots + 600 \left(1 + \frac{0.06}{12}\right) \\
30000 = \frac{600 \left(1 + \frac{0.06}{12}\right) - \left(1 + \frac{0.06}{12}\right)^{n+1}}{\frac{0.06}{12}} \\
30000 = \frac{600 \left(1 + \frac{0.06}{12}\right)}{1 - \left(1 + \frac{0.06}{12}\right)^n} \\
30000 = \frac{600 \left(1 + \frac{0.06}{12}\right)}{1 - \left(1 + \frac{0.06}{12}\right)^n} \\
30000 \left(1 + \frac{0.06}{12}\right) = 1 \left(1 + \frac{0.06}{12}\right)^n \\
-2487562 = 1 - (1.005)^n \\
\log(1.005) = 0.045 \\
n = \frac{\log(1.2487562)}{\log(1.005)} = 44.5 \text{ months}