1. (6 points) Please circle either T (true) or F (false) for each of the below statements.
   
   a) T F A European put with strike price $K$ has a maximum payoff of $\Lambda(0) = K$.
   
   b) T F For a stock that pays no dividends, the no-arbitrage value $V(t)$ of a forward contract entered into at time $t = 0$ is always zero until the time of delivery $T$, at which time the value is then $V(T) = S(T) - F(0,T)$, where $F(0,T)$ is the agreed upon forward price at time $t = 0$.
   
   c) T F The combination of a long call with strike price $K = $10 and a short call with strike price $K = $20 results in an option portfolio with maximum payoff $10$.

2. (4 points) State the formula for the payoff function $\Lambda(S_T)$ corresponding to a strangle consisting of a put with strike $K_p = 7$ and a call with strike $K_c = 10$. Graph your function on the $S_T$-$\Lambda$ coordinate system. What is $\Lambda(12)$?

   \[ \Lambda(S_T) = \begin{cases} (7 - S_T)^+ \\ + (S_T - 10)^+ \end{cases} \]

   \[ \Lambda(12) = 12-10 = 2. \]

3. (10 total points) A stock is priced at time $t = 0$ is $S_0 = $75 and pays dividends of $1$ at 3 months and $3$ at 8 months. The annual risk free rate is $r = 5\%$, compounded continuously.

   a) (5 points) Find the arbitrage-free forward price $F(0,1)$ for a 1-year forward.

   \[ F(91) = e^{0.05(1)} \left[ 75 - 1e^{-0.05(\frac{1}{4})} - 3e^{-0.05(\frac{3}{8})} \right] \]

   \[ = e^{0.05} (71.1108) \approx 74.7567. \]

   b) (5 points) If the forward price at $F(0,1)$ is $75$, is there an arbitrage opportunity? If not, explain why not. If so, explain, in detail, how much is the arbitrage opportunity and what action you would take at what time to achieve it.

   Yes. Arbitrage Profit is $75 - 74.7567 \approx 0.243299$.

   To achieve this, in $t = 0$, short a forward.
   - Borrow 75, buy asset.

   In $t = 3$ months, receive $1 + interpret in risk-free count
   - $3 +$.

   In $t = 8$ months, receive $75$ for asset. Repay 75 e^{0.05} loan.

   Withdraw dividend investments:

   \[ \text{NET: } 75 + e^{0.05(\frac{3}{4})} + e^{0.05(\frac{3}{8})} - 75e^{0.05} \approx 0.243299 = 75 - F(0,1) \]