Problem Set 4

 # 1: Plot the payoff to the long counterparty of a forward on a nondividend paying stock with contract price \$50. Plot the payoff to the short counterparty of a forward on the same stock with a contract price of \$30. Consider a portfolio consisting of 3 short forward positions with a contract price of \$30 and 3 long positions with a contract price of \$50. Write down the payoff of this portfolio mathematically, and plot this payoff. Write down the value of this portfolio at any time t before the expiration date using a risk free rate of r and denote the expiration date T. Do the same with the roles reversed: 3 short forward positions with a contract price of \$50 together with 3 long positions with a contract price of \$30.

 # 2: Suppose you have a holding of 300 unvested shares in a stock paying no dividends and currently trading at \$150. Suppose the stock vests in 1 year when you intend to sell your entire holding, but until then you want to enter a forward contract to protect yourself from a price drop. What forward position should you take? Now suppose the current risk free rate (continuously compounded) for a 1 year term is 4%. What forward price should you expect to be able to contract for? If a dealer offered you a forward price of \$160, describe the transactions you would take to realize an arbitrage profit. What if you were offered \$152?

 # 3: Suppose you enter into a long position on a 1 year forward contract on a zero coupon bond with a \$5,000 face value maturing in 3 years. The bond is currently trading at \$4,200. What is the forward price? Suppose 6 months later the bond is trading at \$4,250. Has your forward position gained or lost? What if the bond is trading at \$4600? Assume a risk free interest rate of 6% for all times.

 # 4: Derive the forward price for a forward contract on an asset paying a known yield using a cash and carry arbitrage argument. Now that you have the forward price, how would you use it to determine the value of the forward contract?

 # 5: Derive the forward price for a forward on an asset paying an asset holder a known income using a replication argument.

 # 6: Suppose you own a total $100,000 face value of bonds, currently trading at par and maturing in 10 years paying 9% interest, with semiannual coupons. Suppose it is the day after a coupon payment and you now want to enter into a 2 year forward contract for price protection. Suppose the risk free rate is 6% for all terms (flat term structure). What is the forward price for this contract? What position will you take in the contract? Suppose you enter this forward contract. Suppose after the next coupon payment the bond is trading at $98,100. Has your forward position profited or lost money? What if the bond is trading for $102,000?

 # 7: Suppose you are running a US based company needing to make a 15M Euro purchase in 6 months. Suppose the Euro is currently trading for $1.28/Euro. What position would you take in forward contracts to fully protect the payment from price risk? Suppose the risk free interest rate in USD is 5% and in Euro is 2%. What is the forward rate? Suppose a dealer instead offered you a forward rate of $1.29/Euro? Explain in detail the steps you would take to take advantage of this. What if the offer was $1.31?