1. (a) The payoff is \((S_T - K) \times 200 = (S_T - 2) \times 200\)
   
   Payoff = -200, -100, 0, 200 respectively for 
   
   \(S_T = 1, 1.5, 2, 3\).

   (b) 

   \(C_{t,T} = S_t e^{-r(T-t)}\)
   
   \[= 1.6 \times e^{(0.04 - 0.06) \times 1} = 1.1583\]

   (c) 

   \[V = e^{-(0.04 \times 1)} (1.5683 - 2) \times 200\]
   
   \[= e^{-0.04} \times 0.5683 \times 200 = -82.95\]

   (d) The market quote is higher than the replication cost \(1.5683\), so we short the contract and buy the replication.

   To generate 1 pound at expiry, we buy \(1 \times e^{-0.06 \times 1}\) pound today, it costs \(1 \times e^{-0.06 \times 1} \times 1.6 = 1.5068\) dollars.

   We borrow 1.5068 dollar today to finance the purchase and save the pound to the bank for growth.

   At expiry, we pay the bank \(1.5068 e^{0.04 \times 1} = 1.5683\) dollar (initial borrow + interest cost), and we receive 1 pound for our saving.

   From the forward short position, we deliver 1 pound and receive $2. The net benefit is \(2 - 1.5683 = 0.4317\) for each contract we sign.
2. (a) It's a European put option.
(b) Strike is $300. Time-to-maturity is 1 year.
(c) \( S_0 = 370, \ F_{0,T} = 370e^{0.04 \times 1} = 385.1 \)

The put option is out of the money.
(d) The intrinsic value is \( \max(0, e^{-r(T-t)}(K-F_{0,T})) = 0 \).

The time value = put option value = $5200.
(e) (i) European call option
(ii) In the money.
(iii) Intrinsic value = \( e^{-r(T-t)}(F_{0,T} - K)^+ \)

\[
= e^{-0.04 \times 1}(385.1 - 300) = 81.7632 \text{ per share}
\]

\[
= 8176.32 \text{ per contract (100 shares)}.
\]

The value = the same as the put at the same strike & maturity.

\[
= 5200 \text{ or } $52 \text{ per share},
\]

Fair price = Intrinsic value + time value

\[
= 81.7632 + 52 = 133.7632 \text{ per share}
\]

13376.32 per contract
(f) The put price will go down.
The call price will increase.
(g) Both call & put prices will go up.
3. (a) Buy put, whose value increases with stock decline & vol increase.

(b) Sell straddle: Volatility going down lowers the value of a straddle (or variance swap).

(c) Long forward, which increases in value with stock, but does not depend on volatility.

4. From the left, Buy 2 call options at $90
   Sell 4 call options at $100
   Buy 2 call options at $110.

Note that the slope is not 1, but 2 from 90-110, & -2 from 100 to 110.