



INSTITUTE OF ACTUARIAL
& QUANTITATIVE STUDIES

Subject:

Financial
Engineering

Chapter:

UNIT I

Category:

Practice
Questions

1. **Subject CT8 April 2009 Question 1**

Describe what is meant by an arbitrage opportunity.

2. **Subject CT8 September 2008 Question 6**

Consider an asset S paying a dividend at a constant instantaneous rate of d , a forward contract with maturity T written on S and a constant, instantaneous (continuously compounded) risk-free rate of r .

Derive the price at time t of the forward contract, using the no-arbitrage principle.

3. **Subject CT8 September 2012 Question 2**

A non-dividend-paying stock has a current price of $S_0 = 400 p$. Over each of the next three years its price could increase by 20% (so $S_{t+1} = 1.2S_t$), or decrease by 20% (so $S_{t+1} = S_t / 1.2$). The continuously compounded risk-free rate is 6% p.a. The stock price move in each year is independent of the move in other years.

A non-standard derivative pays off $\sqrt{S_3}$ after three years, provided that at some point over three years the stock price has moved up in one year and then immediately down in the following year. Otherwise, the derivative pays zero.

Calculate the current price of the non-standard derivative.

4. **Subject CT8 September 2014 Question 5**

Let S be the price of a non-dividend paying share, and let r be the continuously compounded risk-free rate.

(i) Derive the forward price at time zero for the forward contract on S with maturity T .

Assume that, at time zero, the share price is 500, and that the forward contract has maturity two years. The share pays a dividend of 5% of the share price every six months with the next dividend due in two months, and the continuously compounded risk-free rate is 3% p.a.

(ii) Determine the forward price for this contract.

(iii) Comment on whether the high dividend yield relative to the risk-free rate offers an arbitrage opportunity.

5. Subject CM2 A September 2019 Question 4

Consider a put option p_t on a dividend-paying share with strike price K and maturity at time T . The current time is t and the risk-free rate of interest is r per annum. The share has current price S_t , volatility σ and dividend yield δ .

(i) Write down the impact on the option price of each of the following changes:

- (a) An increase in the share price S_t .
- (b) An increase in the strike price K .
- (c) A decrease in time to expiry $(T-t)$.
- (d) A decrease in the dividend yield q .
- (e) A reduction in the risk-free rate r .
- (f) An increase in the volatility σ .

(ii) Explain which of the changes in (i) move the price of a call option in the same direction as the price of a put option.

6. Subject CM2 A April 2019 Question 6

Consider a share with price S_t at time t . The continuously-compounded risk-free rate is r per annum.

- (i) Show that the fair price of a forward contract on S_t maturing at time T is $K = S_0 e^{rT}$.

A share S_0 is currently worth £12. The continuously-compounded risk-free rate is 5% per annum.

- (ii) Calculate the fair price of a forward contract written on the share at time $t = 0$ with expiry at time $t = 5$.

An investor takes a long position in the forward contract at time 0. At time 1 the share price has fallen to £10.

- (iii) Calculate the value to the investor of the forward contract at time $t = 1$.

At time $t = 2$ the share unexpectedly pays a one-off dividend.

- (iv) Explain, with reasons, how the forward price might change as a result of the one-off dividend.