

MFE/3F Questions Answer Key

Download free full solutions from www.ActuarialBrew.com, or purchase a hard copy from www.actexamdriver.com, or www.actuarialbookstore.com.

Chapter 1 – Put-Call Parity and Replication

1.01	C	Put-Call Parity	1.21	C	Options on Currencies
1.02	B	Put-Call Parity	1.22	B	Exchange Options
1.03	B	Put-Call Parity	1.23	C	Exchange & Currency Options
1.04	C	Put-Call Parity	1.24	A	Put-Call Parity
1.05	D	Put-Call Parity	1.25	D	Early Exercise
1.06	A	Put-Call Parity	1.26	B	Exchange Options
1.07	D	Synthetic Stock	1.27	E	Reverse Conversion
1.08	D	Synthetic T-bills	1.28	E	Min of 2 Assets
1.09	A	Synthetic Stock	1.29	A	Max of 2 Assets
1.10	E	Currency Options	1.30	D	Max of 2 Assets
1.11	A	Currency Options	1.31	B	Max of 2 Assets
1.12	C	Currency Options	1.32	B	Put-Call Parity
1.13	A	Options on Bonds	1.33	A	Put-Call Parity
1.14	E	Options on Bonds	1.34	A	Currency Options
1.15	B	Options on Bonds	1.35	E	Currency Options
1.16	D	Exchange Options	1.36	B	Currency Options
1.17	A	Exchange Options	1.37	D	Currency Options
1.18	D	Exchange Options	1.38	B	Currency Options
1.19	E	Exchange Options	1.39	B	Currency Options
1.20	B	Exchange Options	1.40	C	Currency Options

Chapter 2 – Comparing Options

2.01	E	Bounds on Option Prices	2.12	C	Early Exercise
2.02	C	Diff Strikes & Maturities	2.13	B	Diff Strikes & Maturities
2.03	E	Diff Strikes & Maturities	2.14	E	Bounds on Option Prices
2.04	C	Diff Strikes & Maturities	2.15	C	Propositions 2 and 3
2.05	A	Proposition 2	2.16	A	Option Payoffs
2.06	C	Proposition 3	2.17	D	Diff Strikes & Maturities
2.07	E	Proposition 2	2.18	D	Arbitrage
2.08	D	Proposition 1	2.19	D	Bounds on Option Prices
2.09	C	Proposition 3	2.20	D	Early Exercise of Amer. Call
2.10	A	Bid-Ask Prices	2.21	A	Option Pricing Concepts
2.11	C	Option Pricing Concepts			

Chapter 3 – Binomial Trees: Part I

3.01	C	One-Period Binomial Tree	3.25	D	J-R Binomial Tree
3.02	B	One-Period Binomial Tree	3.26	C	J-R Binomial Tree
3.03	D	Delta	3.27	C	J-R Binomial Tree
3.04	A	Replication	3.28	D	Mult.-Period Binomial Tree
3.05	B	One-Period Binomial Tree	3.29	D	J-R Binomial Tree
3.06	E	Arbitrage	3.30	C	Mult.-Period. Binomial Tree
3.07	C	Delta	3.31	A	J-R Binomial Tree
3.08	D	Risk-Neutral Pricing	3.32	B	Put-Call Parity
3.09	D	Replication	3.33	A	J-R Binomial Tree
3.10	D	Expected Return	3.34	C	Replication
3.11	E	Risk-Neutral Probability	3.35	D	J-R and CRR Binomial Trees
3.12	C	Expected Return	3.36	B	Alternative Binomial Trees
3.13	E	Arbitrage	3.37	B	Arbitrage
3.14	A	Expected Return	3.38	B	Realistic Probability
3.15	B	One-Period Binomial Tree	3.39	D	Risk-Neutral Probability
3.16	B	Realistic Probability	3.40	D	Replication
3.17	C	Expected Return	3.41	B	One-Period Binomial Tree
3.18	D	Expected Return	3.42	C	Replication
3.19	D	Expected Return	3.43	D	Replication
3.20	C	CRR Binomial Tree	3.44	E	Replication
3.21	A	CRR Binomial Tree	3.45	E	Replication
3.22	B	CRR Binomial Tree	3.46	A	Delta
3.23	A	CRR Binomial Tree	3.47	A	Replication
3.24	B	CRR Binomial Tree	3.48	B	Arbitrage in the Binomial Model

Chapter 4 – Binomials Trees: Part II

4.01	C	State Prices	4.11	A	Three-Period Binomial Tree
4.02	B	Two-Period Binomial Tree	4.12	C	Three-Period Binomial Tree
4.03	D	Two-Period Binomial Tree	4.13	C	Three-Period Binomial Tree
4.04	B	Expected Return	4.14	C	Three-Period Binomial Tree
4.05	B	Two-Period Binomial Tree	4.15	B	Three-Period Binomial Tree
4.06	C	Expected Return	4.16	B	Four-Period Binomial Tree
4.07	D	Two-Period Binomial Tree	4.17	E	Three-Period Binomial Tree
4.08	E	Expected Return	4.18	D	Three-Period Binomial Tree
4.09	B	Three-Period Binomial Tree	4.19	C	Option on a Stock Index
4.10	A	Three-Period Binomial Tree	4.20	A	Option on a Stock Index

Download free full solutions from www.ActuarialBrew.com or purchase a printed copy.

Chapter 4 – Binomial Trees: Part II, continued

4.21	C	Utility Values & State Prices	4.39	E	Two-Period Binomial Model
4.22	A	Option on a Stock Index	4.40	E	3-Period Bin. Model: Currency
4.23	E	Utility Values & State Prices	4.41	D	Greeks in J-R Binomial Model
4.24	E	Options on Currencies	4.42	D	State Prices
4.25	E	Utility Values & State Prices	4.43	E	Utility Values & State Prices
4.26	E	Options on Currencies	4.44	B	Utility Values & State Prices
4.27	D	Utility Values & State Prices	4.45	E	Greeks in Binomial Model
4.28	D	Options on Currencies	4.46	B	Greeks in Binomial Model
4.29	A	Utility Values & State Prices	4.47	B	Greeks in Binomial Model
4.30	E	Options on Currencies	4.48	E	Three-Period Binomial Tree
4.31	D	Utility Values & State Prices	4.49	A	Greeks in Binomial Model
4.32	A	Options on Currencies	4.50	A	Three-Period Binomial Tree
4.33	A	Utility Values & State Prices	4.51	A	Options on Futures Contracts
4.34	D	Options on Futures Contracts	4.52	C	Options on Futures Contracts
4.35	C	Utility Values & State Prices	4.53	C	American Put Option
4.36	A	Options on Futures Contracts	4.54	A	American Call Option
4.37	B	Utility Values & State Prices	4.55	E	American Put Option
4.38	A	Options on Futures Contracts	4.56	C	Theta in the Binomial Model

Chapter 5 – Lognormally Distributed Prices

5.01	C	The Lognormal Distribution	5.16	A	Median of Future Stock Price
5.02	C	Converting to Std. Normal RV	5.17	C	One Standard Deviation Move
5.03	A	Sums of Normal RVs	5.18	B	One Standard Deviation Move
5.04	D	Median Stock Price	5.19	C	Two Standard Deviation Move
5.05	A	Expected Value	5.20	D	Two Standard Deviation Move
5.06	B	Stock Price Probabilities	5.21	E	Effect Inc. Time Until Maturity
5.07	E	Conditional Expectation	5.22	A	Compare Stock & Risk-free Bond
5.08	E	Effect Inc. Time Til Maturity	5.23	D	Conditional, Partial Expectation
5.09	D	Confidence Intervals	5.24	E	Conditional, Partial Expectation
5.10	C	Prob. That Stock Price $> K$	5.25	B	Partial Expectations
5.11	C	Exp. Value Future Stock Price	5.26	B	Conditional Expectation
5.12	A	Median of Future Stock Price	5.27	C	Partial Expectation
5.13	B	Prob. of Future Stock Price	5.28	A	Conditional, Partial Expectation
5.14	B	Median of Future Stock Price	5.29	D	The Lognormal Distribution
5.15	E	Prob. That Stock Price $< K$	5.30	E	The Normal Distribution

Download free full solutions from www.ActuarialBrew.com or purchase a printed copy.

Chapter 5 – Lognormally Distributed Prices, continued

5.31	B	Prob. of Future Stock Price	5.34	A	Covariance of S_t and S_T
5.32	D	Conditional Expectation	5.35	B	Covariance of S_t and S_T
5.33	B	Confidence Intervals			

Chapter 6 – Histograms and Normal Probability Plots

6.01	D	Order Statistics	6.04	C	The Black-Scholes Model
6.02	A	Quantiles	6.05	A	Quantiles
6.03	E	Quantiles			

Chapter 7 – The Black-Scholes Formula

7.01	D	Black-Scholes Call Price	7.17	C	Options on Currencies
7.02	B	Black-Scholes Put Price	7.18	A	Options on Currencies
7.03	A	Black-Scholes, Prepaid Forward	7.19	D	Options on Futures Contracts
7.04	B	Options on Currencies	7.20	C	Black-Scholes Put Price
7.05	C	Options on Currencies	7.21	A	Black-Scholes Call Price
7.06	C	Options on Currencies	7.22	C	Black-Scholes Formula
7.07	C	Options on Futures	7.23	D	Black-Scholes, Prepaid Forward
7.08	B	Options on Futures	7.24	D	Black-Scholes, Prepaid Forward
7.09	B	Options on Futures	7.25	E	Currency Options, Black-Scholes
7.10	A	Options on Futures	7.26	B	Options on Currencies
7.11	D	Options on Currencies	7.27	E	Options on Currencies
7.12	A	Holding Period Profit	7.28	D	Options on Futures
7.13	D	Black-Scholes Call Price	7.29	D	Options on Futures
7.14	B	Black-Scholes Put Price	7.30	A	Holding Period Profit
7.15	E	Black-Scholes, Prepaid Forward	7.31	B	Black-Scholes Formula
7.16	D	Calendar Spread	7.32	D	Black-Scholes Formula

Chapter 8 – The Greeks and Other Measures

8.01	B	Greek Measures for Portfolios	8.10	C	Elasticity
8.02	E	Delta	8.11	B	Option Elasticity
8.03	C	Delta	8.12	D	Elasticity of a Portfolio
8.04	B	Elasticity	8.13	B	Risk Premium of a Portfolio
8.05	E	Greek Measures for Portfolios	8.14	E	Sharpe Ratio
8.06	E	Greek Measures for Portfolios	8.15	A	General
8.07	B	Elasticity	8.16	B	Greek Measures for Portfolios
8.08	E	Elasticity	8.17	C	Greek Measures for Portfolios
8.09	A	Sharpe Ratio	8.18	A	Black-Scholes and Delta

Download free full solutions from www.ActuarialBrew.com or purchase a printed copy.

Chapter 8 – The Greeks and Other Measures, cont'd

8.19	C	Option Volatility	8.25	D	Theta
8.20	C	Portfolio Delta & Elasticity	8.26	A	Option Volatility
8.21	D	Delta	8.27	E	Option Volatility
8.22	D	Elasticity	8.28	B	Elasticity and Risk Premium
8.23	C	Elasticity	8.29	E	Convex Positions
8.24	A	Call Option Delta			

Chapter 9 – Delta-Hedging

9.01	A	Delta-Hedging	9.27	C	Delta-Gamma Hedging
9.02	C	Market-Maker Profit	9.28	E	Delta-Gamma Hedging
9.03	E	Market-Maker Profit	9.29	B	Delta-Gamma Hedging
9.04	A	Delta-Hedging	9.30	A	Delta-Rho Hedging
9.05	B	Market-Maker Profit	9.31	E	Delta-Rho Hedging
9.06	C	Market-Maker Profit	9.32	C	Delta-Gamma-Rho Hedging
9.07	E	Market-Maker Profit	9.33	A	Delta-Gamma-Vega Hedging
9.08	D	Delta	9.34	A	Delta-Gamma-Rho-Vega Hedging
9.09	A	Market-Maker Profit	9.35	E	Delta-Gamma-Rho-Vega Hedging
9.10	D	Delta Approximation	9.36	C	Delta Hedging & B-S Eqn.
9.11	D	Delta-Gamma Approximation	9.37	E	Static Option Replication
9.12	C	Delta-Gamma-Theta Approx.	9.38	A	Delta-Hedging
9.13	B	Market-Maker Profit	9.39	A	Delta-Hedging
9.14	B	Market-Maker Profit	9.40	C	Delta-Gamma Hedging
9.15	D	Market-Maker Profit	9.41	B	Delta-Hedging
9.16	B	Black-Scholes Equation	9.42	B	Market-Maker Profit
9.17	E	Black-Scholes Equation	9.43	E	Frequency of Re-Hedging
9.18	B	Black-Scholes Equation	9.44	D	Frequency of Re-Hedging
9.19	B	Frequency of Re-Hedging	9.45	D	Delta-Gamma Hedging
9.20	D	Frequency of Re-Hedging	9.46	B	Frequency of Re-Hedging
9.21	D	Frequency of Re-Hedging	9.47	A	Market-Maker Profit
9.22	B	Frequency of Re-Hedging	9.48	D	Market-Maker Profit
9.23	D	Frequency of Re-Hedging	9.49	C	Market-Maker Profit
9.24	B	Frequency of Re-Hedging	9.50	C	Market-Maker Profit
9.25	D	Delta-Gamma Hedging	9.51	C	Delta-Gamma Approximation
9.26	A	Delta-Gamma Hedging	9.52	B	Delta-Gamma Hedging

Download free full solutions from www.ActuarialBrew.com or purchase a printed copy.

Chapter 10 – Exotic Options: Part I

10.01	B	Asian Options	10.22	B	Gap Options
10.02	C	Asian Options	10.23	C	Gap Options
10.03	A	Delta of Asian Option	10.24	C	Gap Options
10.04	B	Barrier Options	10.25	D	Gap Options
10.05	E	Asian Options	10.26	C	Gap Options
10.06	D	Asian Options	10.27	E	Asian Options
10.07	E	Barrier Options	10.28	A	Compound Options
10.08	C	Barrier Options	10.29	B	Asian Options
10.09	E	Barrier Options	10.30	C	Barrier Options
10.10	D	Barrier Options	10.31	B	Gap Options
10.11	A	Barrier Options	10.32	E	Asian Options
10.12	A	Barrier Options	10.33	C	Compound Options
10.13	A	Compound Options	10.34	A	Compound Options
10.14	C	Compound Options	10.35	C	Path-Dependent Options
10.15	B	Compound Options	10.36	C	Gap Options
10.16	D	Compound Options	10.37	C	Barrier Options
10.17	B	Compound Options	10.38	C	Barrier Options
10.18	B	Compound Options	10.39	A	Am. Call on Div. Paying Stock
10.19	D	Gap Options	10.40	B	Barrier Options
10.20	C	Gap Options	10.41	A	Asian Options
10.21	A	Gap Options	10.42	C	Gap Put-Call Parity

Chapter 11 – Exotic Options: Part II

11.01	E	Exchange Options	11.15	D	Forward Start Option
11.02	C	Exchange Options	11.16	A	Forward Start Option
11.03	E	Exchange Options	11.17	A	Forward Start Option
11.04	A	Exchange Options	11.18	E	Forward Start Option
11.05	E	Exchange Options	11.19	C	Chooser Options
11.06	B	Exchange Options	11.20	E	Chooser Options and Delta
11.07	C	Exchange Options	11.21	D	Chooser Options
11.08	D	Exchange Options	11.22	B	Exchange Options
11.09	D	Exchange Options	11.23	D	Forward Start Options
11.10	A	Barrier Options	11.24	C	Forward Start Options
11.11	D	Gap Options	11.25	A	Exchange Options
11.12	D	Chooser Options	11.26	D	Exchange Options
11.13	D	Chooser Options	11.27	E	Exchange Options
11.14	A	Forward Start Option	11.28	A	Cash Call Options

Download free full solutions from www.ActuarialBrew.com or purchase a printed copy.

Chapter 11 – Exotic Options: Part II, continued

11.29	D	Asset Call Options	11.38	C	Asset-or-Nothing Options
11.30	B	All-or-Nothing Options	11.39	B	Cash-or-Nothing Call Option
11.31	B	All-or-Nothing Options	11.40	A	Cash-or-Nothing Call Option
11.32	B	All-or-Nothing Options	11.41	D	Cash-or-Nothing Call Option
11.33	A	All-or-Nothing Options	11.42	C	Cash-or-Nothing Call Option
11.34	B	All-or-Nothing Options	11.43	C	Early Asset-or-Nothing Put
11.35	A	All-or-Nothing Options	11.44	B	Delta-Hedging Gap Call Options
11.36	C	Collect-on-Delivery Call	11.45	D	Asset-or-Nothing Power Option
11.37	D	Collect-on-Delivery Call	11.46	B	Asset-or-Nothing Call Option

Chapter 12 – Monte Carlo Simulation

12.01	C	Std. Dev. of Monte Carlo Est.	12.16	C	MC Valuation European Put
12.02	B	Std. Dev. of Monte Carlo Est.	12.17	D	MC Valuation Asian Put
12.03	D	Forward Price, Monte Carlo Val.	12.18	D	Control Variate Valn
12.04	B	MC Valuation in Binomial Model	12.19	E	Control Variate Valn
12.05	A	MC Valuation in Binomial Model	12.20	C	Variance & Control Variate
12.06	A	Sum of Uniformly Dist'ed RVs	12.21	E	Variance & Control Variate
12.07	A	Sum of Uniformly Dist'ed RVs	12.22	B	Antithetic Variate Method
12.08	E	Inverse Cum. Normal Dist.	12.23	C	Control Variate Method
12.09	B	Inverse Cumulative Normal Dist.	12.24	D	Stratified Sampling
12.10	E	Sequence of Stock Prices	12.25	B	Stratified Sampling
12.11	A	Geometric Avg. Strike Call	12.26	E	Normal RV's as Quantiles
12.12	C	Asian Call Options	12.27	E	Stratified Sampling Method
12.13	A	Std. Dev. of Monte Carlo Est.	12.28	C	Control Variate Method
12.14	C	Std. Dev. of Monte Carlo Est.	12.29	B	Control Variate Method
12.15	E	Std. Dev. of Monte Carlo Est.	12.30	E	Variance of Control Variate Est.

Chapter 13 – Volatility

13.01	C	Exercise Boundaries	13.07	B	Est'ed Parameters of Lognormal
13.02	E	Exercise Boundaries	13.08	E	Annualized Expected Return
13.03	E	Estimating Volatility	13.09	C	Volatility Skew
13.04	D	Estimating Volatility	13.10	E	Historical Volatility
13.05	D	Estimated Standard Deviation	13.11	D	Implied Volatility
13.06	D	Est'ed Lognormal Parameters			

Download free full solutions from www.ActuarialBrew.com or purchase a printed copy.

Chapter 14 – Brownian Motion

14.01	E	Diffusion Process	14.26	A	Multiplication Rules
14.02	B	Multiplication Rules	14.27	E	Multiplication Rules
14.03	A	Prepaid Forward Price of \$1	14.28	E	Product Rule - Stochastic Diff Eq
14.04	A	Geo. Brownian Equivalencies	14.29	E	Geo. Brownian Equivalencies
14.05	E	Geo. Brownian Equivalencies	14.30	A	Geo. Brownian Equivalencies
14.06	D	Geo. Brownian Equivalencies	14.31	C	Geo. Brownian Equivalencies
14.07	B	Geo. Brownian Equivalencies	14.32	E	Geo. Brownian Equivalencies
14.08	E	Geo. Brownian Equivalencies	14.33	B	Geo. Brownian Equivalencies
14.09	D	Ornstein-Uhlenbeck Process	14.34	E	Geometric Brownian Motion
14.10	A	Geo. Brownian Equivalencies	14.35	C	Geometric Brownian Motion
14.11	A	Black-Scholes Framework	14.36	B	Geo. Brownian Equivalencies
14.12	C	Brownian Motion Properties	14.37	E	Geo. Brownian Equivalencies
14.13	E	Probability	14.38	D	Multiplication Rules
14.14	C	Geo. Brownian Equivalencies	14.39	E	Synthetic Risk-Free Asset
14.15	A	Geo. Brownian Equivalencies	14.40	C	Geometric Brownian Motion
14.16	A	Stochastic Differential Eq.	14.41	D	Black-Scholes Formula
14.17	D	Geom. BM & Mutual Funds	14.42	A	Volatility of Prepaid Forward
14.18	E	Probability	14.43	B	Volatility of Prepaid Forward
14.19	D	Probability	14.44	C	Forward Exchange Contract
14.20	A	Ornstein-Uhlenbeck Process	14.45	D	Ornstein-Uhlenbeck Process
14.21	E	Ornstein-Uhlenbeck Process	14.46	B	Portfolio Returns
14.22	E	Correlation Coefficient	14.47	A	Standard Brownian Motion
14.23	E	Geom. BM & Mutual Funds	14.48	A	Geometric Brownian Motion
14.24	B	Geom. BM & Mutual Funds	14.49	C	Pure Brownian Motion
14.25	D	Geom. BM & Mutual Funds			

Chapter 15 – The Sharpe Ratio & Itô's Lemma

15.01	C	Sharpe Ratio	15.08	D	Market Price of Risk
15.02	D	Confidence Intervals	15.09	B	Sharpe Ratio
15.03	D	Sharpe Ratio & Arbitrage	15.10	C	Valuing a Claim on S^a
15.04	E	Sharpe Ratio & Arbitrage	15.11	E	Delta and S^a
15.05	B	Sharpe Ratio	15.12	E	Power Option
15.06	C	Sharpe Ratio & Arbitrage	15.13	A	Valuing a Claim on S^a
15.07	A	Market Price of Risk	15.14	A	Risk-Neutral Process

Download free full solutions from www.ActuarialBrew.com or purchase a printed copy.

Chapter 15 – The Sharpe Ratio & Itô's Lemma, cont'd

15.15	E	Itô's Lemma	15.42	D	Market Price of Risk
15.16	B	Itô's Lemma	15.43	B	Market Price of Risk
15.17	D	Geo. BM Equivalencies & SR	15.44	D	Drift & Itô's Lemma
15.18	A	Itô's Lemma	15.45	B	Itô's Lemma & O-U Process
15.19	E	Risk-Neutral Process	15.46	E	Itô's Lemma
15.20	C	Risk-Neutral Process	15.47	C	Valuing a Claim on S^a
15.21	B	R-N Process & Sharpe Ratio	15.48	B	Sharpe Ratio
15.22	E	Itô's Lemma	15.49	C	Sharpe Ratio
15.23	B	Risk-Neutral Process	15.50	B	Sharpe Ratio
15.24	C	Market Price of Risk	15.51	E	Claim on S^a
15.25	C	Valuing a Claim on S^a	15.52	D	Claim on S^a
15.26	B	Valuing a Claim on S^a	15.53	B	Claim on S^a
15.27	B	Valuing a Claim on S^a	15.54	B	Market Price of Risk
15.28	A	Valuing a Claim on S^a	15.55	E	Market Price of Risk
15.29	D	Valuing a Claim on S^a	15.56	C	Arbitrage
15.30	D	Valuing a Claim on S^a	15.57	C	Itô's Lemma
15.31	E	Valuing a Claim on S^a	15.58	A	Quadratic Variation
15.32	A	Prepaid Forward Price of S^a	15.59	D	Claim on S^a
15.33	E	Risk-Neutral Process	15.60	A	Market Price of Risk
15.34	C	Valuing a Claim on S^a	15.61	B	Market Price of Risk
15.35	D	Power Option	15.62	A	Risk-Neutral Pricing
15.36	E	Market Price of Risk	15.63	B	Gap Power Option
15.37	E	Market Price of Risk			
15.38	B	Itô's Lemma			
15.39	B	Itô's Lemma			
15.40	D	Valuing a Claim on S^a			
15.41	D	Valuing a Claim on S^a			

Chapter 16 – The Black-Scholes Equation

16.01	A	Black-Scholes Equation	16.06	E	Black-Scholes Equation
16.02	D	Black-Scholes Equation	16.07	D	Sharpe Ratio
16.03	D	B-S Eqn & Exp Option Return	16.08	B	Sharpe Ratio
16.04	B	Black-Scholes Equation	16.09	E	Sharpe Ratio
16.05	E	Black-Scholes Equation			

Chapter 17 – The Black Model for Options on Bonds

17.01	C	Forward Prices	17.03	B	Black Model
17.02	C	Black Model	17.04	D	Black Model

Download free full solutions from www.ActuarialBrew.com or purchase a printed copy.

Chapter 17 – The Black Model for Options on Bonds

17.05	C	Black Model	17.09	C	Black Model
17.06	E	Floorlet in Black Model	17.10	A	Black Model
17.07	E	Forward Rate Agreements	17.11	E	Black Model
17.08	D	Black Formula			

Chapter 18 – Binomial Short Rate Models

18.01	C	Binomial Interest Rate Model	18.13	D	BDT Model
18.02	A	Binomial Interest Rate Model	18.14	D	Binomial Interest Rate Model
18.03	B	Binomial Interest Rate Model	18.15	E	BDT Model
18.04	C	Binomial Interest Rate Model	18.16	A	BDT Model
18.05	B	BDT Model	18.17	C	CIR Model
18.06	B	BDT Model	18.18	D	Interest Rate Cap
18.07	C	BDT Model	18.19	E	BDT Model
18.08	A	BDT Model	18.20	D	BDT Model
18.09	B	BDT Model	18.21	A	Risk-Neutral Probability
18.10	D	BDT Model	18.22	B	Caplet in BDT Model
18.11	A	BDT Model	18.23	D	Binomial Interest Rate Model
18.12	B	BDT Model	18.24	B	BDT Model

Chapter 19 – Continuous-Time Models of Interest Rates

19.01	A	Duration-Hedging	19.19	A	Risk-Neutral Int. Rate Models
19.02	C	Delta-Hedging	19.20	A	Delta-Gamma-Theta Approx.
19.03	E	Rendleman-Bartter Model	19.21	E	CIR Model
19.04	C	Vasicek Model	19.22	C	Vasicek Model
19.05	D	Vasicek & Forward Int. Rates	19.23	D	Interest Rate Derivative
19.06	B	Rendleman-Bartter Model	19.24	E	Interest Rate Derivative
19.07	A	CIR Model	19.25	E	CIR Model
19.08	A	Risk-Neutral Vasicek Model	19.26	C	Delta-Gamma Approx. Bonds
19.09	D	Vasicek Model	19.27	D	Theta in CIR Model
19.10	E	Cont's-Time Int. Rate Models	19.28	C	CIR Model
19.11	E	Duration-Hedging	19.29	A	Vasicek Model
19.12	C	Risk-Neutral Vasicek Model	19.30	C	Risk-Neutral Vasicek Model
19.13	D	Risk-Neutral CIR Model	19.31	B	Risk-Neutral Vasicek Model
19.14	A	Delta-Gamma Approximation	19.32	C	Risk-Neutral Vasicek Model
19.15	A	Delta-Gamma Approximation	19.33	E	CIR Model
19.16	B	Vasicek Model	19.34	C	Vasicek Model
19.17	B	Vasicek Model	19.35	A	Rendleman-Bartter Model
19.18	C	Vasicek Model	19.36	D	CIR Model

Download free full solutions from www.ActuarialBrew.com or purchase a printed copy.

MFE/3F Table Provided by the SOA

The printed normal distribution table should only be used if you don't have access to the online normal distribution calculator. We recommend using the online normal distribution calculator when working exam-style questions. The printed normal distribution table is provided in case internet access is not available.

Unless otherwise stated in the question, assume:

- The market is frictionless. There are no taxes, transaction costs, bid/ask spreads, or restrictions on short sales. All securities are perfectly divisible. Trading does not affect prices. Information is available to all investors simultaneously. Every investor acts rationally and there are no arbitrage opportunities.
- The risk-free interest rate is constant.
- The notation is the same as used in *Derivatives Markets*, by Robert L. McDonald.

When using the normal distribution calculator, values should be entered with five decimal places. Use all five decimal places from the result in subsequent calculations.

In *Derivatives Markets*, $\Pr(Z < x)$ is written as $N(x)$.

The standard normal density function is:

$$f_Z(x) = N'(x) = \frac{1}{\sqrt{2\pi}} e^{-\frac{1}{2}x^2} = \frac{e^{-x^2/2}}{\sqrt{2 \times 3.14159}} = \frac{e^{-x^2/2}}{\sqrt{2.50663}}, \quad -\infty < x < \infty.$$

Let Y be a lognormal random variable. Assume that $\ln(Y)$ has mean m and standard deviation v . Then, the density function of Y is:

$$f_Y(x) = \frac{1}{xv\sqrt{2\pi}} e^{-\frac{1}{2}\left(\frac{\ln(x)-m}{v}\right)^2}, \quad x > 0$$

The distribution function of Y is:

$$F_Y(x) = N\left(\frac{\ln(x)-m}{v}\right), \quad x > 0$$

Also, $E\left[Y^k\right] = e^{\left(km + \frac{1}{2}k^2v^2\right)}$

which is the same as the moment-generating function of the random variable $\ln(Y)$ evaluated at the value k .

Printed Normal Distribution Table

Entries represent the area under the standardized normal distribution from $-\infty$ to z , $\Pr(Z < z)$.

The value of z to the first decimal is given in the left column. The second decimal place is given in the top row.

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990
3.1	0.9990	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9993	0.9993
3.2	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995
3.3	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9997
3.4	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9998
3.5	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998
3.6	0.9998	0.9998	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999
3.7	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999
3.8	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999
3.9	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Values of z for selected values of $\Pr(Z < z)$							
z	0.8420	1.0360	1.2820	1.6450	1.9600	2.3260	2.5760
$\Pr(Z < z)$	0.8000	0.8500	0.9000	0.9500	0.9750	0.9900	0.9950