

Errata and updates for ASM Exam MFE/3F (Seventh Edition) sorted by page

Note: Change practice exam 1:16, 1:18, 1:21, 4:7, 7:4, 7:11, 7:22, 9:17, 10:22, 12:23 as indicated below. None of the choices for 5:3, 7:6, 10:4, and 12:11 are correct.

[3/5/2011] The information in the section “The normal distribution table” only applies to paper-and-pencil sites. For students taking the exam under CBT, replace that section with the following:

Formulas in this course use the normal distribution. Most students will be taking this exam at a Prometric site. Prometric provides a standard normal distribution calculator. See http://www.prometric.com/SOA/MFE3F_calculator.htm to see how this works. The calculator provides values of the cumulative normal distribution function and its inverse to 5 decimal places.

In addition, you will be given a formula sheet. See http://www.prometric.com/SOA/MFE3F_calculator.htm for this sheet. It provides the standard normal density function, the lognormal density function, and moments of the lognormal distribution.

This edition of the manual was written before the Prometric calculator was introduced, and therefore uses the former rounding rules of the SOA, as listed in the section of the manual these paragraphs are replacing.

[7/8/2010] On page 8, at the end of the first sentence (after “put”), add “both of them at-the-money ($K = S_0$).”

[11/22/2009] On page 10, in the second bullet, change “exercise” to “exercises”.

[11/22/2009] On page 24, in the solution to Quiz 1-3, on the first displayed line, change e^{-rt} to e^{-rT} .

[11/22/2009] On pages 29–30, in all displayed equations, the last argument of P and C should be $T - t$ instead of T . This affects ten T 's, seven on page 29 and three on page 30.

[8/9/2010] On page 37, on the first line of the third bullet for the answer to Example 2D, change $S_1 = 45 - k$ to $S_1 = 40 + k$.

[11/23/2010] On page 39, on the last line of the page, $S_t > K$ should be $S_t > K_1$.

[11/22/2009] On page 63, one line above “Solutions”, change MFE/3F-3 to MFE/3F-S09:3.

[11/22/2009] On page 56, 3 lines from the end of the answer, change ds to dS .

[11/4/2010] On page 70, in the solution to exercise 3.27, on the 12th line, p_1 and p_2 should be p_1^* and p_2^* .

[1/6/2010] On page 74, on the line below the table, change “ending call” to “ending put”.

[11/22/2009] On page 79, 3 lines above Example 4E, replace $e^{(r-\delta)h}$ with $Se^{(r-\delta)h}$.

[11/22/2009] On page 96, in the caption of Figure 4.11, change Binary to Binomial.

[11/22/2009] On page 96, in the solution to exercise 4.19, the fourth word should be “is”.

[12/14/2009] On page 119, on the sixth line of the “Lognormal tree” paragraph, change σh to $\sigma\sqrt{h}$.

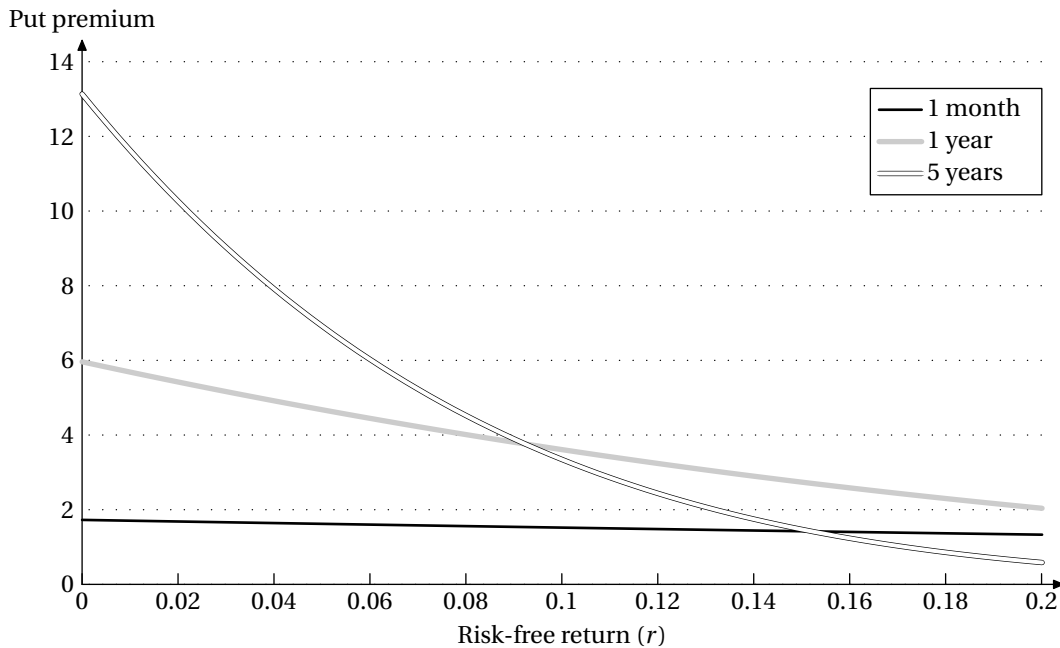
[2/15/2010] On page 132, in Table 7.1, four lines from the bottom, change $-m$ to $+m$.

[12/10/2009] On page 138, in equation (7.6), d_2 should be $-d_2$.

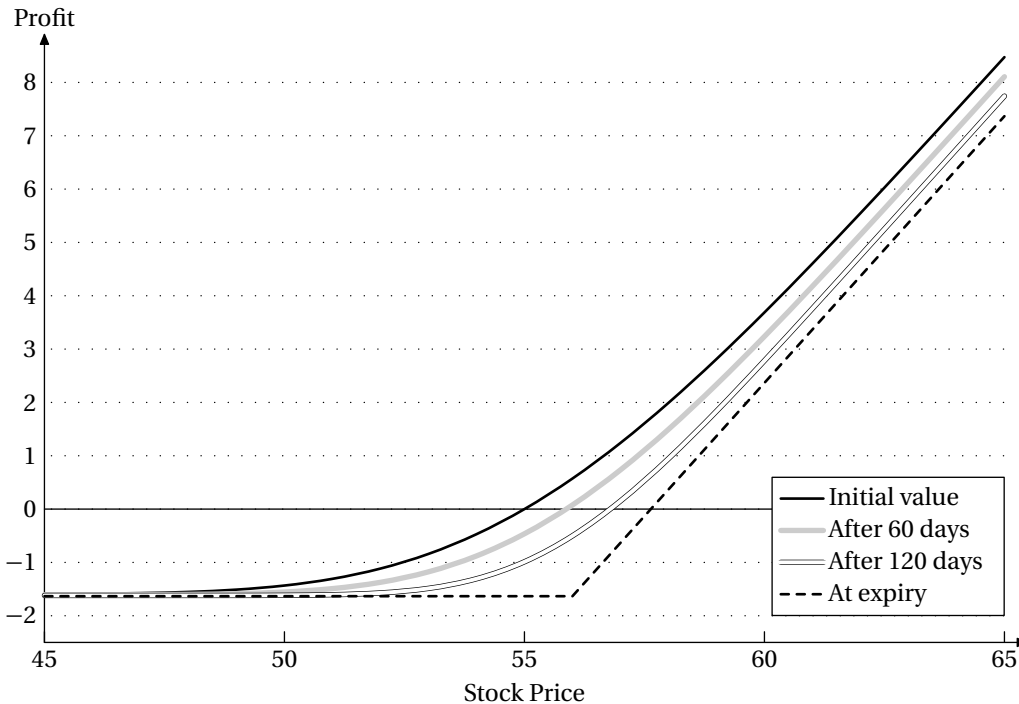
[3/11/2010] On page 138, in item 2 under “One who owns a European call option”, change “Receipt of K ” to “Receipt of the stock”.

[1/29/2010] On page 138, 2 lines above Example 7C, change S to S_0 .

- [4/24/2011] On page 140, in equation (7.5), put a hat on d_2 : $N(-\hat{d}_2)$.
- [2/18/2011] On page 145, the solution to exercise 7.11 uses equation (7.5) (not (7.4)) and the solution to exercise 7.12 uses equation (7.8) (not (7.7)).
- [12/14/2009] On page 150, on the last line, replace “stock prices” with “stock returns”.
- [3/15/2011] On page 154, exercise 8.2 is identical to exercise 6.11.
- [12/14/2009] On page 182, on the second line (in Ke^{-rt}) and third line (in $Se^{-\delta t}$), change t to T .
- [12/5/2009] On page 189, in Figure 10.14, the vertical scale should be multiplied by 40. The correct figure is



- [1/23/2010] On page 203, although the solution given to exercise 10.19 is mechanically correct, the information given is impossible, since delta for a put option should decrease, not increase, as an option is more in-the-money.
- [3/8/2011] On page 206, in the solution to exercise 10.11, on the first line change “calculate” to “calculating”. On the fourth displayed line, change $2(N - 0.1)$ to $2N(-0.1)$; also change the $N(0.1)$ in the denominator to $N(-0.1)$.
- [12/5/2009] On page 214, Figure 11.2 is incorrect. The correct figure is



- [5/15/2011] On page 221, in the displayed formula, change the summation index from i to t .
- [8/13/2010] On page 225, in the solution to exercise 11.2, on the fifth line, remove the minus sign from -0.10 .
- [3/26/2011] On page 233, 2 lines above Example 12B, change 4.1474 to 4.1874.
- [12/14/2009] On page 245, in exercise 12.11, on the third line, change “next” to “net”.
- [12/14/2009] On page 250, in the solution to exercise 12.3, on the third line from the end, change “ x long” to “ $-x$ long”.
- [12/14/2009] On page 253, in the solution to exercise 12.13, on the fifth line, change 46.60 to 44.60.
- [12/14/2009] On page 253, in the solution to exercise 12.14, on the first line, put a period after 1.66.
- [12/14/2009] On page 253, in the solution to exercise 12.18, on the second line, replace 0.09 with 0.0915.
- [12/14/2009] On page 259, two lines below the second displayed equation, add the word “on” after “based”.
- [12/14/2009] On page 262, on the line after the first display, change $\ln S(0)$ to $3\ln S(0)$.
- [12/14/2009] On page 270, on the last line of the page, change S_t to S_{t_1} .
- [12/14/2009] On page 282, in the solution to exercise 13.12, on the third and fourth lines (once apiece), remove the negative sign from -0.00865 .
- [12/14/2009] On page 289, on the fifth line of Section 14.1, change t to T .
- [12/14/2009] On page 289, in the paragraph numbered 3, on the second line, replace “is” with “when”.
- [12/14/2009] On page 294, on the 3rd line, add a period after “strike price”.
- [4/29/2011] On page 298, on the first displayed line, $Se^{-\delta t}$ should be $Se^{-\delta T}$.
- [9/21/2010] On page 299, 2 lines above Section 14.3, change 0.031628 to 0.033737.

- [2/5/2010] On page 299, on the 1st and 2nd lines of Section 14.3, interchange “call” and “put”: “. . . you may give (for a put option) or receive (for a call option). . .”.
- [5/4/2011] On page 301, on the fifth line of Example 14G, delete “at-the-money” and add “with strike price 50” after “put options”.
- [4/14/2010] On page 304, in Table 14.1, in the formulas for exchange options, in the four exponents, add T after δ_S or δ_Q .
- [12/14/2009] On page 306, in exercise 14.8, delete “midrule” from the second line of the table and instead put a line under the first line of the table so that it looks like this:

Date	Price
Feb. 1	52
Feb. 2	66
Feb. 3	58
Feb. 4	47

- [12/14/2009] On page 312, in the solution to exercise 14.1, replace the last line with

The price of the option is $e^{-0.03} (10(0.4801) + 20(0.9616)) = \boxed{23.323}$.

- [10/21/2010] On page 312, in the solution to exercise 14.2, the first $<$ on the payment lines for 10 and 20 should be \leq .

- [12/14/2009] On page 328, on the second line, replace “distribution” with “sample mean”.

- [12/13/2009] On page 330, on the third line of the answer to Example 15H, delete the first left parenthesis in the numerator.

- [12/15/2009] On page 332, in Table 15.1, replace the last line with

$$\beta = \frac{\text{Cov}(X, Y)}{\text{Var}(Y)} = \frac{\sum x_i y_i - n \bar{X} \bar{Y}}{\sum y_i^2 - n \bar{Y}^2}$$

- [3/15/2010] On page 332, in the unnumbered table, replace the first column’s numbers with 0.1292, 0.4522, 0.5596, and 0.9032.

- [2/11/2010] On page 334, in exercise 15.5, add the words “nondividend paying” before “stock” on the first line.

- [12/13/2009] On page 337, in exercise 15.16, on the last line, replace “call” with “put”.

- [12/14/2009] On page 338, in exercise 15.17(ii), delete the word “bar”.

- [12/14/2009] On page 339, in the solution to exercise 15.1, on the last line, change $\frac{1}{1}.2138$ to $(1.2138$.

- [12/15/2009] On page 344, the solution to exercise 15.16 is incorrect. The correct solution is

First we calculate β . In Example 15H, we derived the following formula for β , with Y the control variate:

$$\beta = \frac{\sum x_i y_i - n \bar{X} \bar{Y}}{\sum y_i^2 - n \bar{Y}^2}$$

substituting our data, with x_i the simulated price of the put option and y_i the simulated price of the call option (the control variate),

$$\sum x_i = 5.11$$

$$\sum y_i = 7.89$$

$$\sum y_i^2 = 26.3133 \qquad \sum x_i y_i = 2.873$$

$$\beta = \frac{2.873 - (5.11)(7.89)/5}{26.3133 - 7.89^2/5} = -0.374423$$

$$X^* = \frac{5.11}{5} - 0.374423 \left(3.85 - \frac{7.89}{5} \right) = \boxed{0.171}$$

[8/23/2010] On page 345, in the solution to exercise 15.21, in the header of the table in the last column, change $S_2 - 200$ to $S_2 - 110$.

[12/14/2009] On page 345, the solution to exercise 15.22 has several errors. The correct solution is

The lognormal parameters are $m = 0.05 - 0.5(0.3^2) = 0.005$ and $v = 0.3$. The first number 0.56 goes to the first stratum: $0.25(0.56) = 0.14$, and $N^{-1}(0.14) = -1.08$, so the resulting stock price is $50e^{0.005 - 1.08(0.3)} = 36.344$, and the option pays $40 - 36.344 = 3.656$. The second number 0.32 goes to the second stratum: $0.25 + 0.25(0.32) = 0.33$, and $N^{-1}(0.33) = -0.44$, so the resulting stock price is $50e^{0.005 - 0.44(0.3)} = 44.04$ and the option doesn't pay. Clearly the option doesn't pay for numbers in the third and fourth strata, for which $N^{-1}(x) > 0$, so the resulting put option price is $e^{-0.05}(3.656/4) = \boxed{0.869}$.

[3/3/2010] On page 346, in the solution to exercise 15.23, on the top line of the table, 3rd column, change Z to Z_i . Also, on the first line under the heading of the third column, change 0.2667 to 0.0267. However, the table does not use the SOA rounding rules to compute the second column. The following table uses the rounding rules:

u_i	Z_i	$n_i = (0.10)(2) + (0.2\sqrt{2})Z_i$	e^{n_i}
0.27	-0.61	0.0275	1.0278
0.73	0.61	0.3725	1.4514
0.83	0.95	0.4687	1.5979
0.17	-0.95	-0.0687	0.9336
0.15	-1.04	-0.0942	0.9101
0.85	1.04	0.4942	1.6391

The final answer is then 1.26001 instead of 1.26007.

[12/30/2009] On page 349, last line of page, note that $X(t)$ has a scaled and shifted binomial distribution. $0.5(X(t) + t)$ is binomial with the indicated parameters.

[2/11/2010] On page 350, on the first line of Quiz 16-1, add at the end of the first sentence "with time measured in days".

[3/16/2011] On page 351, in Section 16.1.2, on the line below equation (*), change $X(t)$ to $X(t)/X(0)$.

[12/30/2009] On page 352, change "in" to "is" on the 2nd line and $X(t)$ to $X(t)/X(0)$ on the 6th line.

[12/30/2009] On page 353, 7 lines from the bottom, change α to μ .

[12/30/2009] On page 356, 3 lines from the bottom, $C(50, 40, 1)$ should be $C(40, 50, 1)$.

[9/13/2010] On page 368, on the third line of the second paragraph of Section 17.2, change "lend" to "borrow".

[12/30/2009] On page 371, in Table 17.1, 3 lines from the end, change "an" to "and".

[12/30/2009] On page 378, on the 2nd displayed line of the answer to Example 17L, change the third expression $0.15 + 0.3 - 0.060.25$ to $\frac{0.15 + 0.03 - 0.06}{0.25}$.

[3/29/2010] On page 391, on the second line from the end of exercise 17.25, change $\sigma dZ(t)$ to $\nu dZ(t)$. (In other words, this σ is not the same as the σ on the previous line.)

[10/21/2010] On page 391, in exercise 17.26, on the second to last line, change $r dt$ to $a dt$.

[12/13/2009] On page 394, in exercise 17.41, change dt to ds and $dZ(t)$ to $dZ(s)$.

[8/26/2010] On page 395, in the solution to exercise 17.4, on the second line, change $\frac{dZ(t)}{dt}$ to $\frac{dX(t)}{dt}$.

[12/30/2009] On page 396, in the solution to exercise 17.8, on the second line of (iii), in the last expression, delete d in the numerator.

[12/18/2009] On page 398, the solution to exercise 17.14 is incorrect. The correct solution is

Let's back out r and σ from (i), (ii) and (iii). The logarithm of $S(1)/S(0)$ has a normal distribution with parameters $m = r - \delta - 0.5\sigma^2$ and $\nu = \sigma$. The 50th percentile of a standard normal is 0 and the 80th percentile is 0.842.

From (ii):

$$m = \ln \frac{59.40}{60} = -0.010$$

$$r - \delta - 0.5\nu^2 = -0.010$$

From (iii),

$$m + 0.842\nu = \ln \frac{90.50}{60} = 0.411005$$

$$\nu = \frac{0.411005 - (-0.010)}{0.842} = 0.50$$

$$r - \delta - 0.5(0.50^2) = -0.010$$

$$r - 0.06 - 0.125 = -0.010$$

$$r = 0.175$$

We can now calculate α , the rate of return on the stock, from the Sharpe ratio.

$$\phi = 0.3 = \frac{\alpha - 0.175}{0.5}$$

$$\alpha = (0.3)(0.5) + 0.175 = 0.325$$

Then $\alpha - \delta = 0.265$, and the expected value of $S(2)$ is $60e^{2(\alpha-\delta)} = 60e^{0.53} = \boxed{101.94}$.

[3/21/2011] On page 398, in the solution to exercise 17.13, five lines from the end, a 5 is missing from the right-hand side, which should be $5rS^3e^{\gamma t}$.

[12/30/2009] On page 401, the solution to exercise 17.26 is incorrect. The correct solution is

The Sharpe ratio is $(0.18 - 0.04)/0.25 = 0.56$. Then $d\tilde{Z}(t) = 0.56dt + dZ(t)$, so it's an arithmetic Brownian motion with drift 0.56 and volatility 1. The mean of the $\tilde{Z}(2)$ is $2(0.56) = 1.12$ and the variance is 2, so

$$\Pr(\tilde{Z}(2) > 0) = 1 - N\left(\frac{-1.12}{\sqrt{2}}\right) = N(0.79) = \boxed{0.7852}$$

[12/30/2009] On page 402, in the solution to exercise 17.28, add "dt" after the first ϕ .

[4/1/2011] On page 405, in the solution to exercise 17.38, on the second line, $\text{Var}(S - Q)$ should be $\text{Var}(\ln S - \ln Q)$. Also, the final answer to exercise 17.38 should be 0.2852 instead of 0.286.

[12/30/2009] On page 412, 2 lines above Quiz 18-4, add “for” between “nodes” and “one”.

[12/28/2009] On page 415, in Quiz 18-5, change 3-year to 4-year.

[5/15/2011] On page 416, one line before Subsection 18.2.2, change “they could” to “that could”.

[3/29/2010] On page 421, in exercise 18.10, the tree is not a Black-Derman-Toy tree.

[3/29/2010] On page 425, in the solution to exercise 18.8, change σ to σ_1 in the first two displayed lines.

[12/28/2009] On page 429, in the solution to Quiz 18-5, change “2-year” to “3-year” twice (first line, second line).

[2/25/2010] On page 439, three lines above Example 20A, the sign of N is incorrect. Replace the phrase starting with is $-N$ through the parenthetical sentence with

is $N = -t_1 P(0, t_1) / t_2 P(0, t_2)$. (In other words, N is the number of bonds to buy; it is negative, so you should sell bonds.)

[4/29/2010] On page 439, the last two lines of the table in the answer to Example 20A should be

Loan	$0.904838e^{0.05/365} = 0.904962$	0.904962
Total	0.000218	0.000214

[12/30/2009] On page 441, on the first line of the fourth paragraph, add “to” between “leads” and “an”.

[5/5/2010] On page 441, one line below equation (20.7), put “d”'s before the two Z 's:

$$\text{Here, } d\tilde{Z}(t) = dZ(t) - \phi(r, t)dt.$$

[12/30/2009] On page 442, on the line after the 4th displayed equation, a slash is missing: $P_r(t, t, T) = -q(r, t, T)P(r, t, T) / \sigma(r)$.

[12/25/2009] On page 447, on the third line of Quiz 20-3, the interest rate risk premium is -0.05 (not 0.05). In general, the interest rate process has a negative risk premium.

[4/6/2010] On page 454, on the second line of the answer to Example 20I, change $e^{0.1(4)}$ to $e^{-0.1(4)}$.

[10/26/2010] On page 456, on the first line of Section 20.4, change “page” to “section”.

[4/24/2010] On page 457, change equation (20.20) to

$$P(r + \epsilon, h, T) - P(r, 0, T) = \Delta\epsilon + 0.5\Gamma\epsilon^2 + \theta h$$

[10/21/2010] On page 463, in the list of additional released exam questions, change Sample:16 to Sample:14.

[10/30/2010] On page 476, on the first line of the third paragraph, change 11 to 12.

[4/27/2010] On page 480, in question 16, on the last line, change “an-the-money” to “an at-the-money”.

[3/31/2010] On page 481, replace question 18 with

The time- t price of a stock is $S(t)$. A claim on a stock pays $C(t) = \sqrt{S(t)}$. $S(t)$ follows geometric Brownian motion with rate of appreciation 0.10 and volatility 0.2.

The Itô process followed by C is of the form

$$dC(t) = aC(t)dt + bC(t)dZ(t)$$

Determine a .

(A) 0.040 (B) 0.045 (C) 0.050 (D) 0.055 (E) 0.060

[3/31/2010] On page 481, in question 21, replace choices (C), (D), and (E) with 0.68, 0.70, 0.72 respectively.

[3/31/2010] On page 484, on the first line of question 6, change “write” to “writes”.

[2/26/2010] On page 503, change the last line of question 7 to “Calculate $\alpha(2, 4)$.”

[3/16/2010] On page 526, in question 4(iii), change 38.70 to 35.73.

[4/21/2010] On page 526, in question 6, change the last displayed line to

$$\frac{dx(t)}{x(t)} = \alpha dt + \beta dZ(t)$$

[4/14/2010] On page 528, in question 11, add after (vi):

(vii) The strike prices of the compound options are all the same.

[4/14/2010] On page 531, in question 22, add at the end of the first sentence “based on forward prices”.

[5/7/2010] On page 534, in question 4(i), add “ dt ” after $0.4(0.06 - r(t))$.

[5/11/2010] On page 542, in question 4(i), change $S(t)$ to $S(0)$.

[4/20/2010] On page 546, in question 17, add at the end of (iii): “Dividends are not incorporated in the index.”

[4/22/2010] On page 555, in question 22, add the words “nondividend-paying” before “stock” on lines 1 and 5.

[4/8/2011] On page 561, in question 15, delete the first sentence. This derivative security could not exist under the Black-Scholes framework with constant σ unless $\sigma = 0$.

[4/5/2011] On page 562, in question 17, on the seventh line, add the words “the variance of” before “control variate”.

[4/27/2010] On page 572, in question 23, on the fourth line, change “put” to “call”.

[3/31/2010] On page 581, replace the solution to question 18 with

The process for S is

$$dS = 0.10S dt + 0.2S dZ$$

Using Itô’s lemma,

$$\begin{aligned} dC &= C_S dS + \frac{1}{2} C_{SS} (dS)^2 + C_t dt \\ &= \frac{0.10S}{2\sqrt{S}} dt - \left(\frac{1}{2}\right) \left(\frac{0.2^2 S^2}{(2)(2)S^{3/2}}\right) dt + \frac{0.2S}{2\sqrt{S}} dZ \\ &= \left(0.05\sqrt{S} - \frac{0.04}{8}\sqrt{S}\right) dt + 0.1\sqrt{S} dZ \\ &= (0.05 - 0.005)C dt + 0.1C dZ \end{aligned}$$

The constant multiple of the drift term is therefore $0.05 - 0.005 = \boxed{0.045}$. **(B)**

An alternative and easier method is to log the process and then exponentiate it back. In $C = 0.5 \ln S$, and

$$\begin{aligned} d \ln S(t) &= (0.10 - 0.5(0.2^2)) dt + 0.2 dZ(t) = 0.08 dt + 0.2 dZ(t) \\ d \ln C(t) &= 0.04 dt + 0.1 dZ(t) \\ \frac{dC(t)}{C(t)} &= (0.04 + 0.5(0.1)^2) dt + 0.1 dZ(t) = 0.045 dt + 0.1 dZ(t) \end{aligned}$$

Change the answer choice in the table on page 577 accordingly.

- [3/31/2010] On page 583, in the solution to question 24, on the second line, change the t in the first exponent to h .
- [5/5/2010] On page 585, in the solution to question 5, on the first line, put “ln” before $X(5)/X(0)$.
- [4/7/2010] On page 588, in the solution to question 18, on the third line, change the denominator from -0.1 to 0.1 . (For bond models, the Sharpe ratio is defined by McDonald to divide by negative the coefficient of the $dZ(t)$ term. This contrasts with stock models, where we divide by the coefficient itself.)
- [3/7/2011] On page 595, in the solution to question 10, on the third line, change -0.5156 to -0.5126 .
- [4/18/2010] On page 601, in the solution to question 3, on the first displayed line, change the denominator from dt to $S_1(t)$.
- [2/26/2010] On page 603, change the last 3 lines of the solution to question 7 to

$$dY(t) = (1.5X^3 + 2X^2 + 12X + 8 + 4)dt + \sigma(t, X(t))dZ$$

So setting $t = 2$, $X(t) = 4$.

$$\alpha(2, 4) = 1.5(4^3) + 2(4^2) + 12(4) + 12 = \boxed{188} \quad (\mathbf{A})$$

- [5/8/2010] On page 604, in the solution to question 10, on the third line from the end, change the exponent rt_1 to $-rt_1$.
- [4/28/2011] On page 604, in the solution to question 12, on the second line, add “ t ” before $+0.10Z(t)$.
- [11/10/2011] On page 609, the solution to question 3 is incorrect. The correct solution is

The prepaid forward price of currency, as indicated in Table ??, is

$$x_t e^{-r_f(T-t)}$$

Here, for dollars in terms of euros, $x_t = 1/1.50$ and dollars are the foreign currency so $r_f = 0.04$. Also, $T - t = 2$. We conclude that the prepaid forward price is $100e^{-0.04}/1.50 = \boxed{61.54}$.

- [10/26/2010] On page 609, the solution to question 3 is incorrect. The correct solution is:

We want $100F_{0,2}^P(1/x(2))$. We can apply formula (17.8) with $S(0) = 1.5$, $a = -1$, $r = r_s = 0.04$, and $\delta = r_e = 0.02$ to obtain

$$F_{0,2}(y(2)) = \frac{1}{1.5} e^{[-1(0.04-0.02)+0.5(-1)(-2)0.1^2]2} = \frac{1}{1.5} e^{-0.02}$$

Formula (17.9) is not appropriate, since it assumes payment is in dollars, and discounts at the dollar rate, but we want to pay in euros. Instead, we discount using the euro discount rate of 0.02 to obtain the final answer:

$$100F_{0,2}^P(1/x(2)) = \frac{100}{1.5} e^{-2(0.02)} e^{-0.02} = \boxed{62.78}$$

- [4/28/2010] On page 618, in the solution to question 4, replace the right side of the third displayed equation ($0.06\sigma\sqrt{t}$) with $(\ln S - \ln 55 + (r - \delta + 0.5\sigma^2)t) - (\ln 61 - \ln 55)$.
- [5/2/2010] On page 625, in the solution to question 2, change the exponent 0.04 on the first line, the coefficient 0.04 on the fourth line, and the coefficient 0.04 on the seventh line, all three to 0.0375.
- [3/16/2010] On page 626, in the solution to question 4, replace the first three lines with:

From the risk-neutral process of $S(t)$, we see $r - \delta = 0.06$, and we're given $\delta = 0.02$, so $r = 0.08$.

The price of a cash-or-nothing option paying 100 at the end of 4 years is $100e^{-4r}N(d_2)$, or $100e^{-0.32}N(d_2)$ here.

$$100e^{-0.32}N(d_2) = 35.73$$

[4/1/2011] On page 627, the solution to question 6 is incorrect. The correct solution is:

At time t , there are two ways to acquire 1 share of Wachovia stock at time T :

1. Buy $e^{-0.04(T-t)}$ shares of Wachovia immediately and hold on to them.
2. Buy $x(t)e^{-0.03(T-t)}$ shares of Chemical immediately, and enter into the specified forward agreement. At time T , you will have $x(t)$ shares of Chemical, which you will exchange for 1 share of Wachovia.

These two ways must have equal cost to avoid arbitrage. The first way costs $e^{-0.04(T-t)}Q(t)$ and the second way costs $x(t)e^{-0.03(T-t)}S(t)$, so

$$\begin{aligned} x(t)e^{-0.03(T-t)}S(t) &= e^{-0.04(T-t)}Q(t) \\ x(t) &= \frac{Q(t)e^{-0.01(T-t)}}{S(t)} \\ \ln x(t) &= \ln Q(t) - 0.01(T-t) - \ln S(t) \end{aligned}$$

Differentiating, we get

$$d \ln x(t) = d \ln Q(t) - d \ln S(t) + 0.01 dt$$

where the constant $-0.01T$ drops out. As usual, we subtract $0.5\sigma^2$ when calculating $d \ln S(t)$ and $d \ln Q(t)$.

$$\begin{aligned} d \ln S(t) &= (0.12 - 0.5(0.3^2))dt + 0.3 dZ(t) = 0.075 dt + 0.3 dZ(t) \\ d \ln Q(t) &= (0.10 - 0.5(0.2^2))dt + 0.2 dZ(t) = 0.08 dt + 0.2 dZ(t) \\ d \ln x(t) &= (0.08 - 0.075 + 0.01)dt + (0.2 - 0.3)dZ(t) = 0.015 dt - 0.1 dZ(t) \end{aligned}$$

We add $0.5\sigma^2$ to calculate $dx(t)/x(t)$.

$$\frac{dx(t)}{x(t)} = (0.015 + 0.5(0.1^2))dt - 0.1 dZ(t) = 0.02 dt - 0.1 dZ(t)$$

Therefore $\alpha = \boxed{0.02}$.

[3/16/2010] On page 643, in the solution to question 22, replace the last two lines with

$$\begin{aligned} 0.015 + 0.03 + \beta &= 0.05 \\ \beta &= \boxed{0.005} \quad (\text{A}) \end{aligned}$$

The answer key on page 635 needs to be corrected as well.

[5/3/2010] On page 643, in the solution to question 22, remove 7 negative signs from β 's in exponents: 3 on the first displayed line, 4 from the 3rd displayed line.

[5/1/2010] On page 645, in the answer key, the answers for 13 and 14 should be A and B respectively.

[5/10/2010] On page 648, in the solution to question 9, on the last line, change the denominator $u - d$ to $F_{uu} - F_{ud}$.

[4/14/2010] On page 656, replace the last line of the solution to question 4 with:

Thus **1500** is invested in the stock and the investor receives 500 in proceeds from selling the derivative security. **(E)**

[7/26/2010] On page 663, in the solution to question 24, on the second displayed line, change $-e^{-3r_f}$ to $+e^{-3r_f}$.

[4/5/2011] On page 668, the solution to question 10 is incorrect. The correct solution is

Back out the strike price using put-call parity.

$$\begin{aligned} P - C &= Ke^{-rt} - (S - \text{PV}(\text{Dividends})) \\ 1.00 - 6.41 &= Ke^{-0.04} - (65 - e^{-0.02} - e^{-0.04}) \\ -5.41 &= Ke^{-0.04} - 63.0590 \\ K &= (63.0590 - 5.41)e^{0.04} = 57.6490e^{0.04} = 60.00 \end{aligned}$$

The maturity value per put is the strike price (60) plus the accumulated value of the dividends $(1 + e^{0.02})$, or $60 + (e^{0.02} + 1) = 62.0202$, and the number of puts needed is $\frac{10,000}{62.0202} = \mathbf{161.24}$ puts.

[4/29/2010] On page 671, there are several typos in the solution to question 18. The solution, starting with “The second term in the sum”. should read:

The second term in the sum can be expressed as

$$\frac{1}{S(0)^{0.7}} \max(0, S(0)^{0.7} - S(1)^{0.7})$$

which is $1/S(0)^{0.7}$ one-year puts with underlying asset $S(t)^{0.7}$ and strike price $K = S(0)^{0.7}$. The risk-neutral process for $S(t)^{0.7}$ has drift equal to the drift of the prepaid forward, or -0.01905 , and volatility $0.7(0.1) = 0.07$. Using the Black-Scholes formula, the price P of each of these puts is

$$\begin{aligned} d_1 &= \frac{-0.01905 + 0.06 + 0.5(0.07^2)}{0.07} = 0.62 & N(-d_1) &= N(-0.62) = 0.2676 \\ d_2 &= 0.62 - 0.07 = 0.55 & N(-d_2) &= N(-0.55) = 0.2912 \\ P &= S(0)^{0.7} (e^{-0.06}(0.2912) - e^{-0.01905}(0.2676)) = 0.01169S(0)^{0.7} \end{aligned}$$

so $1/S(0)^{0.7}$ puts have value 0.01169.

Therefore the insurance company's profit is $1000(1 - 0.98113 - 0.01169) = \mathbf{\$7.18}$. **(C)**

[5/15/2011] On page 672, in the solution to exercise 20, 4 lines after the boldface answer key **(B)**, change the last exponent from 0.90 to 0.09.

[5/14/2011] On page 676, in the solution to question 3, on the last displayed line, change $0.12Y^2$ to $0.03Y^2$.

[4/27/2010] On page 679, in the solution to question 11, on the second to last line, change $0.36 + 0.2 = 0.56$ to $0.36 - 0.2 = 0.16$, and change the final line to:

$$\Pr(\ln G(1) - \ln S(1)) > 0 = \Pr(X > \ln 1.2) = 1 - N\left(\frac{\ln 1.2 - 0.0352}{0.16}\right) = 1 - N(0.92) = \mathbf{0.1788}$$

[4/6/2011] On page 683, in the solution to question 22, on the last two lines (once apiece), change $\alpha(0.04, 0, 2)$ to $\alpha(0.04, 0, 3)$.

[4/27/2010] On page 683, in the solution to question 23, on the first line, change “put” to “call”. On the last line, change Y to X .

- [5/14/2011] On pages 690–691, in the solution to question 11, on the last line of page 690, delete the minus sign. On the 2nd line of page 691, delete 0.04 from the first denominator.
- [10/25/2010] On page 695, in the solution to question 21, on the 2nd and 3rd lines from the end, change 0.6739 to 0.6736.
- [2/12/2010] On page 696, in the solution to question 25, on the second line, change $e^{-0.05}$ to $e^{-0.05/4}$.
- [2/12/2010] On page 697, in the solution to question 28, on the second displayed line, change 6.98 to 8.74.
- [10/25/2010] On page 699, in the solution to question 7, change the last four lines to

$$1.13 = 2 \left(\frac{e^r - d}{u - d} \right) e^{-r} = 2 \left(\frac{e^r - 0.8}{0.4} \right) e^{-r} = 5 - 4e^{-r}$$

$$e^{-r} = \frac{5 - 1.13}{4} = 0.9675$$

In the revised tree,

$$C = 2 \left(\frac{e^r - 0.6}{0.6} \right) e^{-r} = \frac{10}{3} - 2(0.9675) = \boxed{1.3983} \quad (\mathbf{D})$$

- [3/29/2010] On page 701, in the solution to question 11, on the second line from the end, change “negative” to “positive”.
- [3/9/2011] On page 701, in the solution to question 12II, on the third line, change $P(45, T) > P(50, T)$ to $P(45, T) \leq P(50, T)$.
- [3/29/2010] On page 703, in the solution to question 17, 3 lines from the end, delete “carrying”.
- [4/10/2011] The url on page 705, second line of Section B.6, should be

http://www.beanactuary.org/exams/pdf/MFE_SampleQS1-76.pdf

- [10/19/2010] On page 716, in the solution to question 32, on the fourth and fifth displayed lines, the ones for $W(t)$ and $\left(\frac{S(t)}{S(0)}\right)^\varphi$, delete the d in front of $Z(t)$. Also, on the last displayed line, the right-hand side is missing a t and the last minus should be plus: $(1 - \varphi)(r + 0.5\varphi\sigma^2)t$.
- [12/5/2009] On page 729, Table C.1 is not correct. A replacement page is at the end of these errata.

Appendix C. Lessons Corresponding to Questions on Released and Practice Exams

Table C.1: Lessons Corresponding to Practice Exam Questions

Question Number	Practice Exam											
	1	2	3	4	5	6	7	8	9	10	11	12
1	2	1	6	2	2	5	1	1	1	1	1	2
2	1	3	17	7	6	17	17	2	15	15	6	12
3	13	10	12	17	17	13	12	1	14	14	9	17
4	9	17	8	12	13	10	16	20	17	17	12	10
5	18	16	14	9	18	12	4	16	20	17	8	20
6	16	12	1	17	12	17	16	7	13	20	18	15
7	12	9	20	17	1	17	12	18	12	1	4	4
8	9	18	16	13	14	16	17	16	12	10	7	4
9	8	14	16	15	12	14	10	13	4	19	16	13
10	1	15	9	13	20	20	13	5	10	4	1	14
11	17	17	18	1	5	19	13	4	18	16	20	17
12	6	17	7	17	14	10	9	14	17	5	17	17
13	12	15	12	10	1	1	6	17	16	14	9	17
14	7	10	19	16	3	9	1	17	13	3	13	1
15	20	17	1	1	16	4	17	12	17	5	17	1
16	10	7	17	12	15	3	9	9	15	17	10	6
17	14	1	13	13	7	17	18	8	9	20	15	10
18	17	20	16	20	17	7	2	10	7	9	17	9
19	4	8	4	4	14	9	20	7	17	4	10	18
20	11	13	5	5	4	6	15	4	1	7	3	7
21	7	3	3	20	19	20	1	3	2	12	17	15
22	15	6	15	18	17	8	4	17	5	17	12	20
23	17	20	5	3	9	15	3	9	5	7	13	16
24	3	5	10	15	8	18	7	15	9	13	4	6
25	10	13	1	10	12	9	10	19	19	10	15	13