

# Financial Mathematics

MATH 5870/6870<sup>1</sup>  
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<sup>1</sup>Based on Robert L. McDonald's *Derivatives Markets*, 3rd Ed, Pearson, 2013.

## Chapter 13. Market-Making and Delta-Hedging

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§ 13.1 What do market-makers do?

§ 13.2 Market-maker risk

§ 13.3 Delta-Hedging

§ 13.4 The mathematics of Delta-hedging

§ 13.5 The Black-Scholes analysis

§ 13.6 Market-Making as insurance

§ 13.7 Problems

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§ 13.1 What do market-makers do?

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**§ 13.3 Delta-Hedging**

§ 13.4 The mathematics of Delta-hedging

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TABLE 13.2

Daily profit calculation over 5 days for a market-maker who delta-hedges a written option on 100 shares.

	Day					
	0	1	2	3	4	5
Stock (\$)	40.00	40.50	39.25	38.75	40.00	40.00
Call (\$)	278.04	306.21	232.82	205.46	271.04	269.27
100 × delta	58.24	61.42	53.11	49.56	58.06	58.01
Investment (\$)	2051.58	2181.30	1851.65	1715.12	2051.35	2051.29
Interest (\$)		-0.45	-0.48	-0.41	-0.38	-0.45
Capital gain (\$)		0.95	-3.39	0.81	-3.62	1.77
Daily profit (\$)		0.50	-3.87	0.40	-4.00	1.32

**Example 13.3-1** Given the first line of the above table, filling all the rest entries.

**Solution.** Check codes/Section\_13-2.nb



## Self-financing portfolio: stock moves one $\sigma$

TABLE 13.3

Daily profit calculation over 5 days for a market-maker who delta-hedges a written option on 100 shares, assuming the stock price moves up or down  $1\sigma$  each day.

	Day					
	0	1	2	3	4	5
Stock (\$)	40.000	40.642	40.018	39.403	38.797	39.420
Call (\$)	278.04	315.00	275.57	239.29	206.14	236.76
100 $\times$ delta	58.24	62.32	58.27	54.08	49.80	54.06
Investment (\$)	2051.58	2217.66	2056.08	1891.60	1725.95	1894.27
Interest (\$)		-0.45	-0.49	-0.45	-0.41	-0.38
Capital gain (\$)		0.43	0.51	0.46	0.42	0.38
Daily profit (\$)		-0.02	0.02	0.01	0.01	0.00

**Example 13.3-2** Given the first line of the above table, filling all the rest entries.

**Solution.** Check codes/Section\_13-2.nb

