

Toward Quantitative Literacy: Interesting Problems in Finance

Jim Ham

2008 AMATYC Conference, Washington, D.C., Saturday, November 22, 2008

<http://www.delta.edu/jaham>

Answers to Finance Problems

1. **\$8,763.47**

m	A (r = .06; P = 3000; t = 18)
1	\$8,563.02
2	\$8,694.83
4	\$8,763.47
12	\$8,810.30
52	\$8,828.54
365	\$8,833.25

The future value increases slightly as m gets larger. The compounding factor plays a minor role in accumulating wealth.

r	A (m = 4; P = 3000; t = 18)
.01	\$3,590.85
.05	\$7,337.76
.08	\$12,483.42
.09	\$14,889.50
.13	\$30,005.83
.20	\$100,635.40

The future value increases dramatically as the interest rate gets larger. The interest rate plays a significant role in accumulating wealth.

2. **12.2462%**

t	r	r * t
2	41.4214	82.8427
3	25.9921	77.9763
4	18.9207	75.6828
6	12.2462	73.4772
8	9.0508	72.4062
9	8.0060	72.0538
12	5.9463	71.3557
18	3.9259	70.6666
24	2.9302	70.3254
36	1.9441	69.9863

3. (a) **8.7748%**

(b) **6.8879%**

4. **43.14 years**

R	t (m = 1; r = .08; S = 1000000)
600	63.67
1200	54.76
3000	43.14
7200	32.41
12000	26.47
15000	23.98

r	t (m = 1; R = 3000; S = 1000000)
.01	147.37
.05	58.86
.08	43.14
.09	39.85
.13	31.02
.20	23.12

5. (a)

Salary	\$50,000	\$50,000
Investment in TSA	\$15,000	\$0
Taxable Income	\$50,000 – \$15,000 = \$35,000	\$50,000
Fed Tax Paid	\$5,308	\$9,058
State Tax Paid (4%)	(.04)(\$35000) = \$1,400	(.04)(\$50000) = \$2,000

Tax Savings:	$(\$9,058 + \$2,000) - (\$5,308 + \$1,400) = \$4,350$
Rate of return:	$\$4,350/\$15,000 = 29\%$

(b)

Salary	\$80,000	\$80,000
Investment in TSA	\$15,000	\$0
Taxable Income	\$65,000	\$80,000
Fed Tax Paid	\$12,902	\$17,102
State Tax Paid (4%)	\$2,600	\$3,200
Tax Savings:	\$4,800	
Rate of return:	32%	

6. (a)

- How much did Johnny on the Spot invest over the 40-year period? **\$80,000**
- How much did Johnny Come Lately invest over the 40-year period? **\$200,000**
- How much did Johnny on the Spot accumulate over the 40-year period? **\$1,025,875.40; \$183,047.86 after the first 20 years.**
- How much did Johnny Come Lately accumulate over the 40-year period? **\$511,601.20**
- Who was the wiser investor and why? **Johnny on the Spot. He invested less than half the money, yet earned about twice as much or a half million dollars more.**

(b)

	Johnny on the Spot	Johnny Come Lately
Age at first Investment	25	30
Number of years investing	30	30
Annual Investment	\$3,000	\$3,000
APR	8%	8%
Total Amount Invested	\$90,000	\$90,000
Future Value at Age 65	\$773,709.87	\$499,350.61

(c)

	Johnny on the Spot	Johnny Come Lately
Age at first Investment	20	40
Number of years until age 65	45	25
Annual Investment	\$3,000	\$10,000
APR	8%	8%
Total Amount Invested	\$135,000	\$250,000
Future Value at Age 65	\$1,159,516.85	\$731,059.40

(d)

	Johnny on the Spot	Johnny Come Lately
Age at first Investment	20	40
Number of years until age 65 (invests only first 25 years)	45	25
Annual Investment	\$3,000	\$3,000
APR	8%	8%
Total Amount Invested	\$75,000	\$75,000
Future Value at Age 65	\$1,022,230.96	\$219,317.82

(e) **\$20,052.25; \$401,045.00**

7. **\$232.18**

r	R (m = 12; t = 15; S = 25000)
9%	\$253.57
8%	\$238.91
7%	\$224.71
6%	\$210.96
5%	\$197.70
4%	\$184.92

t	R (m = 12; r = .065; S = 135000)
10	\$1,532.90
15	\$1,175.99
16	\$1,132.75
20	\$1,006.52
25	\$911.53
30	\$853.29

Varies. Decreases by about \$13-\$15.

The longer the term, the smaller the monthly payment. The decrease is not proportional.

8. (a) **\$1,401.73**

(b) **\$322,322.44; \$504,622.44; \$2,777.78; \$361,260.41**

(c) **\$161,522.53**

(d) **Interest = \$147,430.13; Principal = \$20,777.47; Equity = \$60,700.15**

(e)

t = n	PV (Original Loan = \$182300; m = 12; r = .085; PMT = 1401.73)
1	\$180,921.97
2	\$179,422.04
3	\$177,789.53
5	\$174,078.84
10	\$161,522.53
20	\$113,055.79
25	\$68,321.98
28	\$30,837.29
29	\$16,071.24
30	\$0

(f)

	Current Mortgage (8.5%)	New Mortgage (7.25%)
Present Value	\$161,522.53	\$163,322.53
Monthly Payment?	\$1401.73	\$1,290.86
Savings per month?	\$110.87	
Number of months to recoup the closing costs?	16.235 months	
Yes, they should refinance. They will save \$110.87 per month for about 7.8 months before they move.		

(g)

	Current Mortgage (8.5%)	New Mortgage (7.75%)
Present Value	\$161,522.53	\$163,322.53
Monthly Payment?	\$1401.73	\$1340.79
Savings per month?	\$60.94	
Number of months to recoup the closing costs?	29.537 months	
No, they should not refinance. They will move before they can recoup their closing costs.		

- (h) Additional \$100: t = **23.2**; Years reduced = **6.8**
 Additional \$200: t = **19.4**; Years reduced = **10.6**
 Additional \$300: t = **16.8**; Years reduced = **13.2**
 If term = 15 years, Additional Payment = **\$393.45**

9.

\$21,000 Car Loan			
Loan Term	3 Years (1.9%)	4 Years (3.9%)	5 Years (5.9%)
Monthly Payments	\$600.58	\$473.22	\$405.01
Total Number of Payments	36	48	60
Total payout during the term	\$21,620.80	\$22,714.61	\$24,300.78
Cost to Finance - Interest	\$620.80	\$1,714.61	\$3,300.78

10. (a)

Option 1	Option 2
N= 48	N= 60
I%= 6.75	I%= 4.75
PV= 14500	PV= 17000
PMT= -345.54	PMT= -318.87
FV= 0	FV= 0
P/Y= 12	P/Y= 12
C/Y= 12	C/Y= 12
PMT: <input type="checkbox"/> END <input type="checkbox"/> BEGIN	PMT: <input type="checkbox"/> END <input type="checkbox"/> BEGIN

Option 1: Interest = 48(\$345.54) – \$14,500 = \$2,085.92

Option 2: Interest = 60(\$318.87) – \$17,000 = \$2,132.20

Option 1 (the cash back option) is best since less interest is paid and the loan is paid off sooner.

(b)

Option 2	
N= 60	<p>Option 2: Interest = 60(\$316.93) – \$17,000 = \$2,015.80 Option 2 (the low interest option) is best since less interest is paid and the monthly payments are lower.</p>
I%= 4.5	
PV= 17000	
PMT= -316.93	
FV= 0	
P/Y= 12	
C/Y= 12	
PMT: <input type="checkbox"/> END <input type="checkbox"/> BEGIN	

(c) **About \$2,187**

11. (a)

	Dodge Caravan	Toyota Sienna
List Price	\$21,011	\$37,695
8% 3-year loan pymt	\$658.41	\$1,181.22
Total Payments	(\$658.41)(36) = \$23,702.76	(\$1181.22)(36) = \$42,523.92
Residual	31.8%	60%
Residual Value	(\$21,011)(.318) = \$6,681.50	(37,695)(.60) = \$22,617
Total Cost	\$23,702.76 – \$6,681.50 = \$17,021.26	\$42,523.92 – \$22,617 = \$19,906.92
Cost per Month	\$17,021.26/36 = \$472.81	\$19,906.92/36 = \$552.97

(b)

	Chevy Cavalier	Toyota Camry
List Price	\$17,510	\$29,650

8% 3-year loan pymt	\$548.70	\$929.12
Total Payments	\$19,753.19	\$33,448.44
Residual	26.3%	63%
Residual Value	\$4,605.13	\$18,679.50
Total Cost	\$15,148.06	\$14,768.94
Cost per Month	\$420.78	\$410.25

12. (a) **About 52.5 months or 4 years, 4.5 months; \$1,837.50**

N= 52.46684889
I%= 19.99
PV= 1218
PMT= -35
FV= 0
P/Y= 12
C/Y= 12
PMT: <input type="checkbox"/> END <input type="checkbox"/> BEGIN

(b) **About 82.6 months or 6 years, 10.6 months; \$2,891**

N= 82.56168813
I%= 29.99
PV= 1218
PMT= -35
FV= 0
P/Y= 12
C/Y= 12
PMT: <input type="checkbox"/> END <input type="checkbox"/> BEGIN

(a) **\$48.36**

(b) **About 32.6 months.**

13. (a)

	Regular 3/27 ARM	Interest-only 3/27 ARM
Monthly Payments (first 3 years)	\$963.07	Varies: \$875.00 down to \$851.94
Interest Paid over 1 st 3 years	\$31,100.72	\$31,100.72
Principal Paid over 1 st 3 years	\$3,569.80	\$0
Present Value of Loan after 3 years	\$127,680.20	\$131,250.00
Monthly Payment after 3 rd year	\$1,329.72	\$1,366.90
Increase in payment	\$366.65	\$403.83

(b) **Value of the Home = \$82,034.71; Outstanding Loan Balance = \$127,680.20; You owe \$49,215.29 more than the home is worth. If you can not afford the higher monthly payment, you may be looking at foreclosure.**

(c)

	Regular 2/28 ARM	Interest-only 2/28 ARM
Monthly Payments (first 2 years)	\$1,674.90	Varies: \$1468.54 down to \$1439.00
Interest Paid over 1 st 2 years	\$34,898.17	\$34,898.17
Principal Paid over 1 st 2 years	\$5,299.47	\$0
Present Value of Loan after 2 years	\$246,450.53	\$251,750.00

Monthly Payment after 2 nd year	\$2,369.57	\$2,420.53
Increase in payment	\$694.67	\$745.63

(d) **Value of the Home = \$234,435.89; Outstanding Loan Balance = \$246,450.53; You owe \$12,014.64 more than the home is worth. If you can not afford the higher monthly payment, you may be looking at foreclosure.**

(e) **Value of the Home = \$102,543.39; Outstanding Loan Balance = \$127,680.20; You owe \$25,136.81 more than the home is worth. Foreclosure may be an option, but you would lose your huge down payment, would destroy your credit rating, and would be bothered by debt collectors.**

(f) **Value of the Home = \$293,044.87; Outstanding Loan Balance = \$246,450.53; You have \$46,594.34 in equity on your home. Even if you can not afford the higher monthly payment, foreclosure is a bad idea. Try to refinance to a lower interest rate so that you can afford the monthly payment. Or sell the home to recoup some of your losses; then purchase a less expensive house.**