# Loan Amortization Example

| | | | |
|---|---|---|---|
| Amount of Loan | 125,000.00 | Monthly Payment | 1,005.78 |
| Term of Loan | 30.00 | Total Payments | 362,080.18 |
| Interest Rate per Year | 9.00 | Total Interest | 237,080.18 |
| Balloon Payment | 0.00 | | |

| Period | Payment | Interest | Principal | Balance | Total Payments | Amt to Principal | Amt to Interest |
|---|---|---|---|---|---|---|---|
| 0 | | | | 125,000.00 | | | |
| 1 | 1,005.78 | 937.50 | 68.28 | 124,931.72 | 1,005.78 | 68.28 | 937.50 |
| 2 | 1,005.78 | 936.99 | 68.79 | 124,862.93 | 2,011.56 | 137.07 | 1,874.49 |
| 3 | 1,005.78 | 936.47 | 69.31 | 124,793.63 | 3,017.33 | 206.37 | 2,810.96 |
| 4 | 1,005.78 | 935.95 | 69.83 | 124,723.80 | 4,023.11 | 276.20 | 3,746.91 |
| 5 | 1,005.78 | 935.43 | 70.35 | 124,653.45 | 5,028.89 | 346.55 | 4,682.34 |
| 6 | 1,005.78 | 934.90 | 70.88 | 124,582.57 | 6,034.67 | 417.43 | 5,617.24 |
| 7 | 1,005.78 | 934.37 | 71.41 | 124,511.16 | 7,040.45 | 488.84 | 6,551.61 |
| 8 | 1,005.78 | 933.83 | 71.94 | 124,439.22 | 8,046.23 | 560.78 | 7,485.44 |
| 9 | 1,005.78 | 933.29 | 72.48 | 124,366.73 | 9,052.00 | 633.27 | 8,418.74 |
| 10 | 1,005.78 | 932.75 | 73.03 | 124,293.71 | 10,057.78 | 706.29 | 9,351.49 |
| 11 | 1,005.78 | 932.20 | 73.58 | 124,220.13 | 11,063.56 | 779.87 | 10,283.69 |
| 12 | 1,005.78 | 931.65 | 74.13 | 124,146.00 | 12,069.34 | 854.00 | 11,215.34 |
| 349 | 1,005.78 | 86.26 | 919.52 | 10,581.47 | 351,016.62 | 114,418.53 | 236,598.08 |
| 350 | 1,005.78 | 79.36 | 926.42 | 9,655.05 | 352,022.39 | 115,344.95 | 236,677.44 |
| 351 | 1,005.78 | 72.41 | 933.37 | 8,721.68 | 353,028.17 | 116,278.32 | 236,749.86 |
| 352 | 1,005.78 | 65.41 | 940.37 | 7,781.32 | 354,033.95 | 117,218.68 | 236,815.27 |
| 353 | 1,005.78 | 58.36 | 947.42 | 6,833.90 | 355,039.73 | 118,166.10 | 236,873.63 |
| 354 | 1,005.78 | 51.25 | 954.52 | 5,879.38 | 356,045.51 | 119,120.62 | 236,924.88 |
| 355 | 1,005.78 | 44.10 | 961.68 | 4,917.69 | 357,051.29 | 120,082.31 | 236,968.98 |
| 356 | 1,005.78 | 36.88 | 968.90 | 3,948.80 | 358,057.06 | 121,051.20 | 237,005.86 |
| 357 | 1,005.78 | 29.62 | 976.16 | 2,972.63 | 359,062.84 | 122,027.37 | 237,035.48 |
| 358 | 1,005.78 | 22.29 | 983.48 | 1,989.15 | 360,068.62 | 123,010.85 | 237,057.77 |
| 359 | 1,005.78 | 14.92 | 990.86 | 998.29 | 361,074.40 | 124,001.71 | 237,072.69 |
| 360 | 1,005.78 | 7.49 | 998.29 | 0.00 | 362,080.18 | 125,000.00 | 237,080.18 |

# Loan Amortization Example

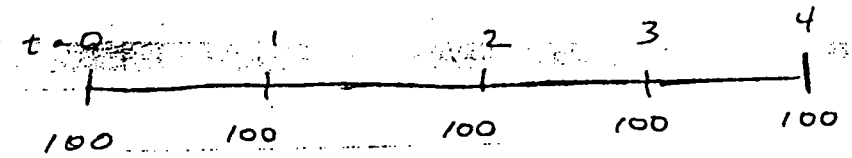
| | | | |
|---|---|---|---|
| Amount of Loan | 125,000.00 | Monthly Payment | 978.47 |
| Term of Loan | 30.00 | Total Payments | 402,248.11 |
| Interest Rate per Year | 9.00 | Total Interest | 277,248.11 |
| Balloon Payment | 50,000.00 | | |

| Period | Payment | Interest | Principal | Balance | Total Payments | Amt to Principal | Amt to Interest |
|---|---|---|---|---|---|---|---|
| 0 | | | | 125,000.00 | | | |
| 1 | 978.47 | 937.50 | 40.97 | 124,959.03 | 978.47 | 40.97 | 937.50 |
| 2 | 978.47 | 937.19 | 41.27 | 124,917.76 | 1,956.93 | 82.24 | 1,874.69 |
| 3 | 978.47 | 936.88 | 41.58 | 124,876.18 | 2,935.40 | 123.82 | 2,811.58 |
| 4 | 978.47 | 936.57 | 41.90 | 124,834.28 | 3,913.87 | 165.72 | 3,748.15 |
| 5 | 978.47 | 936.26 | 42.21 | 124,792.07 | 4,892.33 | 207.93 | 4,684.40 |
| 6 | 978.47 | 935.94 | 42.53 | 124,749.54 | 5,870.80 | 250.46 | 5,620.34 |
| 7 | 978.47 | 935.62 | 42.85 | 124,706.70 | 6,849.27 | 293.30 | 6,555.97 |
| 8 | 978.47 | 935.30 | 43.17 | 124,663.53 | 7,827.74 | 336.47 | 7,491.27 |
| 9 | 978.47 | 934.98 | 43.49 | 124,620.04 | 8,806.20 | 379.96 | 8,426.24 |
| 10 | 978.47 | 934.65 | 43.82 | 124,576.22 | 9,784.67 | 423.78 | 9,360.89 |
| 11 | 978.47 | 934.32 | 44.15 | 124,532.08 | 10,763.14 | 467.92 | 10,295.22 |
| 12 | 978.47 | 933.99 | 44.48 | 124,487.60 | 11,741.60 | 512.40 | 11,229.21 |
| 349 | 978.47 | 426.75 | 551.71 | 56,348.88 | 341,484.97 | 68,651.12 | 272,833.85 |
| 350 | 978.47 | 422.62 | 555.85 | 55,793.03 | 342,463.44 | 69,206.97 | 273,256.47 |
| 351 | 978.47 | 418.45 | 560.02 | 55,233.01 | 343,441.90 | 69,766.99 | 273,674.91 |
| 352 | 978.47 | 414.25 | 564.22 | 54,668.79 | 344,420.37 | 70,331.21 | 274,089.16 |
| 353 | 978.47 | 410.02 | 568.45 | 54,100.34 | 345,398.84 | 70,899.66 | 274,499.18 |
| 354 | 978.47 | 405.75 | 572.71 | 53,527.63 | 346,377.30 | 71,472.37 | 274,904.93 |
| 355 | 978.47 | 401.46 | 577.01 | 52,950.62 | 347,355.77 | 72,049.38 | 275,306.39 |
| 356 | 978.47 | 397.13 | 581.34 | 52,369.28 | 348,334.24 | 72,630.72 | 275,703.52 |
| 357 | 978.47 | 392.77 | 585.70 | 51,783.58 | 349,312.71 | 73,216.42 | 276,096.29 |
| 358 | 978.47 | 388.38 | 590.09 | 51,193.49 | 350,291.17 | 73,806.51 | 276,484.66 |
| 359 | 978.47 | 383.95 | 594.52 | 50,598.97 | 351,269.64 | 74,401.03 | 276,868.61 |
| 360 | 50,978.47 | 379.49 | 50,598.97 | 0.00 | 402,248.11 | 125,000.00 | 277,248.11 |

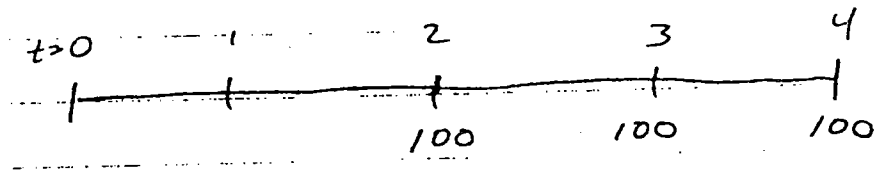
# Section 2 Quiz 2

① Find the total present value of the following cash flows using a 12% rate:

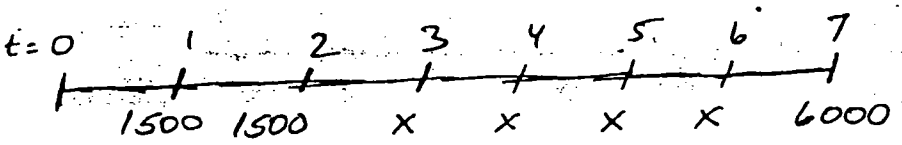
a.




b.



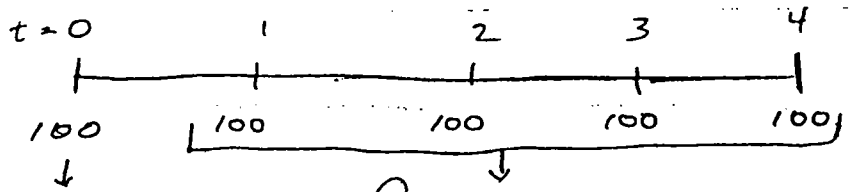

2. Find the missing cash flows (X - all equal). The present value of all cash flows, including the missing ones, is $12,000 and the interest rate is 9%.



# Section 2 Quiz 2

① Find the total present value of the following cash flows using a 12% rate:

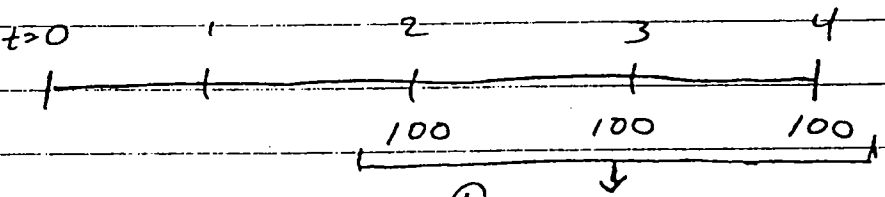
a.




② 100 + 303.73 = 403.73

① FV = 0, PMT = 100, n = 4, i = 12, PV = ? ⇒ 303.73

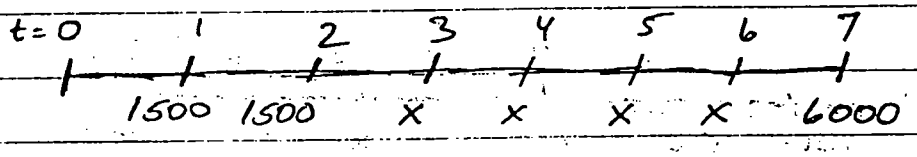
b.




② FV = 240.18, n = 1, i = 12, PMT = 0, PV = ? ⇒ 214.45

① $V_t$ = ? ⇒ 240.18 at t = 1, FV = 0, n = 3, PMT = 100, i = 12

2. Find the missing cash flows (X - all equal). The present value of all cashflows, including the missing ones, is $12,000 and the interest rate is 9%.




① PV of known cash flows (1, 2, 7) = 5920.87

② PV of unknown cashflows = 12000 − 5920.87 = 6079.13

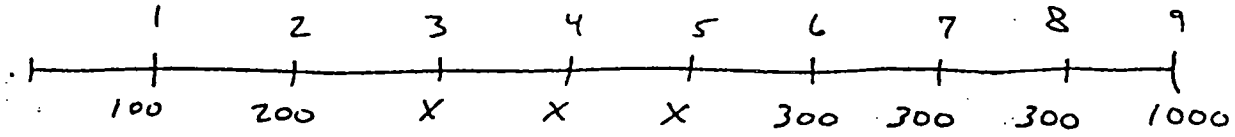
③ Value of unknown cashflows at t = 2 = 7,222.46

④ Missing Payments are 2,229.35 ✓

PV = 7222.46 n = 4 i = 9 FV = 0 PMT = ?

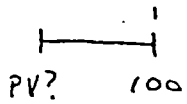
Example:

Consider the following cash flows

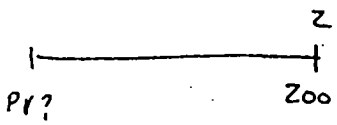



The total present value of all 9 cash flows is $3,000. The three missing cash flows are all equal amounts. Using a discount rate of 10%, find the value of X.

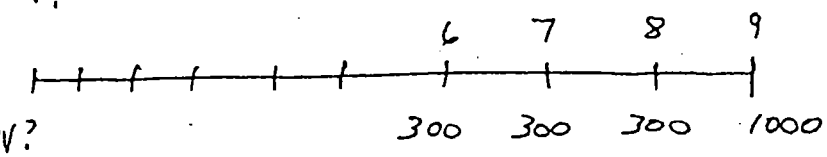
I) Find the total PV of all known cash flows.

a) 


FV = 100 n = 1 i = 10 PMT = 0 PV = ? = 90.91

b) 


FV = 200 n = 2 i = 10 PMT = 0 PV = ? = 165.30

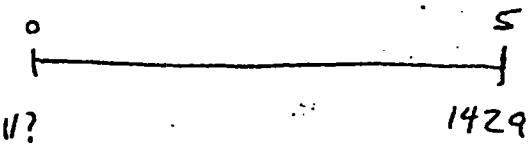
c) 


1) Collapse the four cash flows into a single equivalent cash flow one period before the first annuity cash flow:

n = 4 PMT = 300 FV = 700 (1000 − 300) i = 10 $PV_t$ = ? ⇒ 1429.07

$\Downarrow_t = 5$

2) The problem (c) can now be equivalently stated as:




FV = 1429.07 n = 5 i = 10

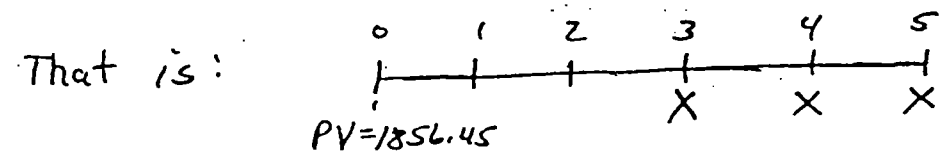
PMT = 0 PV = ? = 887.34

d) The total PV of the known cash flows is
$90.91 + 165.30 + 887.34 = \$1,143.55$

II) The PV of the missing cash flows must be

$3,000 - 1143.55 = 1856.45$

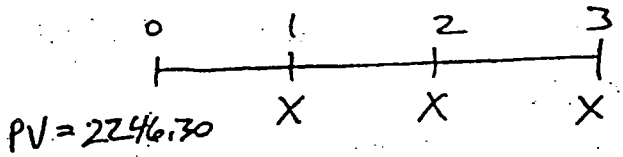
That is:




a) If you knew the equivalent value of the missing cash flows at time 2 (one period before the first annuity cash flow) you could solve for X. So... find the Future Value of \$1856.45 at time 2:

PV=1856.45 n=2 i=10 PMT=0 FV=?=2246.

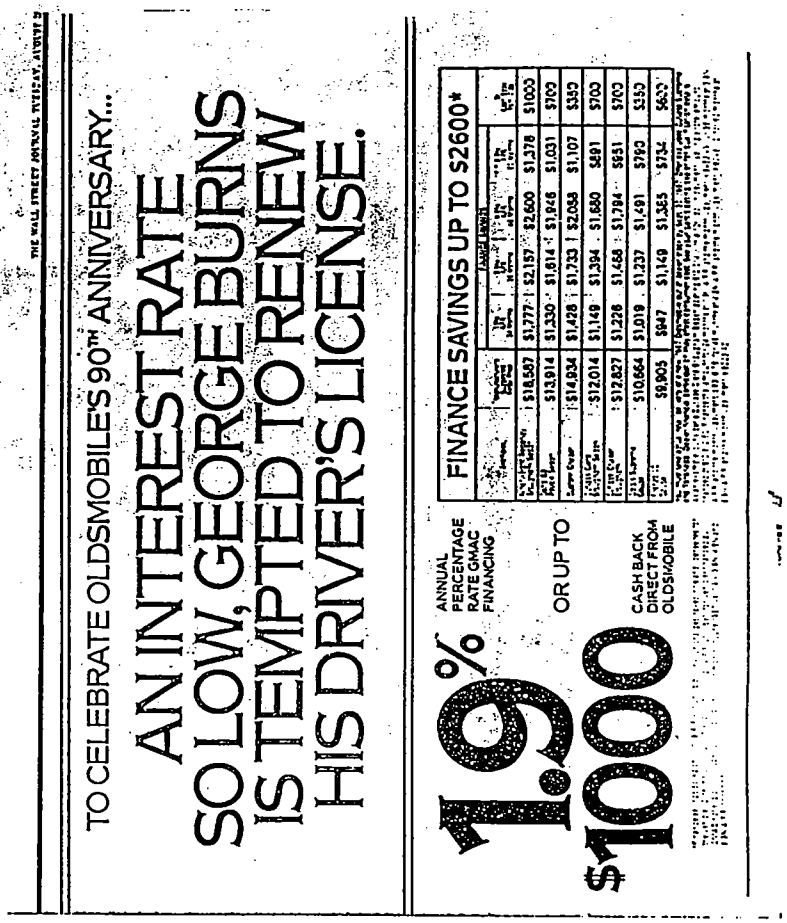
b) You can now think of the problem as:




and its just like solving for the payment on a loan.

PV=2246.30 n=3 i=10 FV=0 PMT=?= <u>903.27</u>

Note: There are <u>many</u> other ways to solve this problem!




4. You have the choice between two different loan plans to purchase a new car. The purchase price of the car is $24,500. The two loan plans are described below:

| | PLAN A | PLAN B |
|---|---|---|
| Required Down Payment | $0 | $5,000 |
| Loan Term | 5 years | 4 years |
| Annual Rate | 10% | 6.0% |
| Cash Rebate | $2,000 | $0 |

The required down payment is the minimum down payment that is acceptable by the lender. If you choose to do so, you may use the $2,000 cash rebate as a down payment on Plan A. Regardless of how you finance the car, you plan to keep the car for three years and then sell it immediately following your 36th payment on the loan.

If your personal opportunity rate for cash is 8.0%, describe the best way to finance the car and calculate the <u>value</u> of the advantage of the better plan over the next best alternative.

[4] Description of best financing method: _____

_____

[2] Description of next best alternative: _____

_____

[6] Value of the advantage of the best plan over the next best alternative: $_____

# FINANCE 634 EXAM 1
# Fall 1998
# Time Value Questions

1. Consider the following loan conditions:

| | |
|---|---|
| Amount borrowed: | $400,000 |
| Time | 25 years |
| Interest Rate | 9.75% stated annual rate |
| Payment Frequency | Monthly |
| Balloon Payment | $0 |

Answer the following questions:

a. Suppose you pay off the loan immediately following the 200th payment. What is the total dollar amount of interest you will have paid over the life of the loan?

[8] Total Interest $ _____

b. Suppose the largest payment you can afford is $3,400 per month, so you want to arrange a 5-year balloon loan with a $3,400 monthly payment. What will the amount of the balloon payment be?

[5] Balloon payment $ _____

c. Returning to the original loan conditions (ignore b), suppose you make an extra payment of $200 with each required monthly payment. How much money, in actual dollars, would you save using this payment scenario versus the one described in Part A (make only the required payment and carry the loan for the full 25 years)?

[5] Total Savings: $_____

d. What is the effective annual rate of the loan scenario described in part c?

[3] Effective Annual Rate _____ %

e. Suppose the lending institution runs a special promotional deal such that every 12th payment is reduced by $500. What is the effective annual rate on this promotional loan? Be precise and show your work.

[3] Answer: _____

2. Consider the following annual cash payments:

| TIME | CASH FLOW |
|---|---|
| 1 | 0 |
| 2 | 0 |
| 3 | 0 |
| 4 | 0 |
| 5 | 0 |
| 6 | 1500 |
| 7 | 1500 |
| 8 | 1500 |
| 9 | 1500 |
| 10 | ? |
| 11 | ? |
| 12 | ? |
| 13 | ? |
| 14 | 3000 |
| 15 | 3000 |
| 16 | 3000 |
| 17 | 2000 |

The missing cash flows (?s) are all equal amounts. Using a 9.5% discount rate, the TOTAL present value of all of the cash flows is $10,000. Find the missing cash flows.

[6] Answer:_____

3. You deposit $3500 now and $1000 at the end of each month for 10 years (120 $1000 deposits) in an account that has a stated annual rate of 8.75% with interest compounded quarterly. How much will be in the account immediately following the final deposit? (Assume that every month has 30 days and every quarter has 3 months and 90 days.)

[5] Answer: $ _____

4. You deposit $3500 now and make equal monthly deposits for 10 years (120 monthly deposits) in an account that has a stated annual rate of 8.75% with interest compounded continuously. How much will be in the account immediately following the final deposit? (Assume that every month has 30 days and every quarter has 3 months and 90 days.)

[5] Answer: $ _____

**Extra Credit: Points as Marked**
**NO PARTIAL CREDIT**

1. You deposit $3500 now and make equal monthly deposits for 4 years (48 monthly deposits) in an account that has a 9.5% stated annual rate with interest compounded daily. If the account has a total of $62,000 in it immediately following the final deposit, what was the dollar amount of your monthly payment? (Assume that every month has 30 days and every quarter has 3 months and 90 days.)

[3] Answer: $ _____

2. You deposit $3500 now and make equal monthly deposits of $1000 for 4 years (48 monthly deposits) in an account that has interest compounded continuously. If the account has a total of $23,600 in it immediately following the final deposit, what was the stated (nominal) annual interest rate on the account?

[3] Answer: _____ %

3. Consider the following loan:

| | |
|---|---|
| Stated Annual Rate | 10.25% |
| Payment Frequency | Monthly |
| Balloon Payment | $25,000 |
| Loan Term | 10 years |

For the 100th payment on this loan, the dollar amount of interest from the payment is $651.50. What was the original amount of the loan?

[4] Answer: _____