MASTERING THE HP-12C

TWO

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MASTERING THE HP-12C

BOOK I, BOOK II, or BOOK III

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PREFACE

This book is the product of several years of standing in the front of a classroom presenting seminars to patient students. Throughout the many hours of discussing today's business technology with them never once have they publicly expressed their unwillingness to learn more about the fantastic devices readily available to make their work easier. This book and the others in the series are dedicated to them.

But in addition to the students I must also thank the groups or individuals among whom have allowed me to even attempt this effort. At the top of the list is Ralph Hillier. Without his expertise and creativity and professionalism in presenting seminars I doubt I would find this business such a rewarding career. Let me also thank the people of Hewlett-Packard for their unselfish encouragement and support including my teacher Mike Curran of Hewlett-Packard, Wilsonville, Oregon and Marcia Paxton of Hewlett-Packard, Corvallis, Oregon.

Finally, without the support, humor and patience of Debbie and Megan; and the understanding of the MacGilvary Clan none of this would have meaning.

R.F.
Portland, Oregon
1984

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PART ONE

INVESTMENT ANALYSIS

I. PERCENTAGE FUNCTIONS

A. Percentage Keys

1. Standard Percent (%)
2. Difference in Percent (Δ%)
3. Percent Total (%T)

PLEASE NOTE: Conversion to a decimal is automatic in the HP financial calculator. Never enter the percentage qualtity as a decimal. Only as a whole number.

B. Standard Percent

BASE NUMBER

(ENTER)

SECOND NUMBER

(%)

EXAMPLE:

K	D
300	300.
(ENTER)	300.00
14	14.
(%)	42.00

a. Net Amount

The HP Financial Calculator allows you to add or subtract the calculated percentage quantity with a simple keystroke.

K	D
(+)	342.00

Try this example:

K	D
2500 (ENTER)	2500.00
27.5 (%)	687.50
(-)	1,812.50

C. Difference in Percent (Δ%)

BASE NUMBER

(ENTER)

SECOND NUMBER

(Δ%)

K	D	
2000 (ENTER)	2000.00	
3000	3000.	
(Δ%)	50.00	Percent Increase

K	D	
3000 (ENTER)	3000.00	
2000	2000.	
(Δ%)	-33.00	Percent Decrease

1. Things to remember about difference in percent functions:

   a. If the 2nd number is greater than the base number the answer will be positive.

   b. If the 2nd number is less than the base number the answer will be negative.

<u>K</u>	<u>D</u>
47350 (ENTER)	47,350.00
72500 (Δ%)	53.12%

If you purchased a property for $47,350 5 years ago, and the property is now worth $72,500, your property has increased in value by 53.12%.

D. <u>Percent Total (%T)</u>

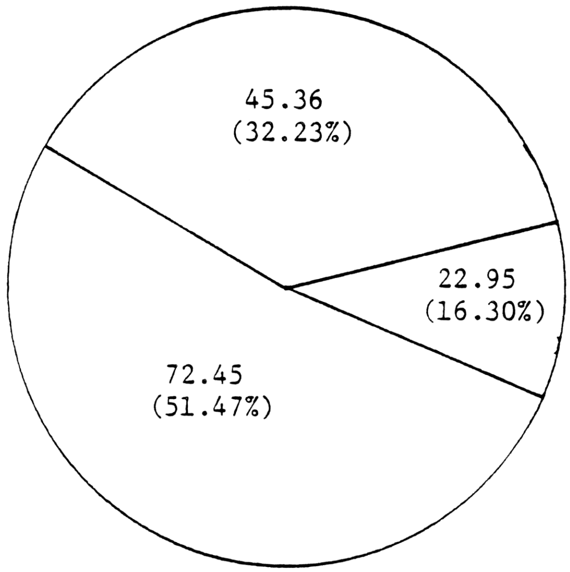
1. Percent of one number to another.

EXAMPLE:

45.36 + 22.95 + 72.45 = 140.76

<u>K</u>	<u>D</u>
45.36 (ENTER)	45.36
22.95 (+)	68.31
72.45 (+)	140.76

<u>K</u>	<u>D</u>
22.95 (%T)	16.30 %
(CLx)	0.00
45.36 (%T)	32.23 %
(CLx)	0.00
72.45 (%T)	51.47 %



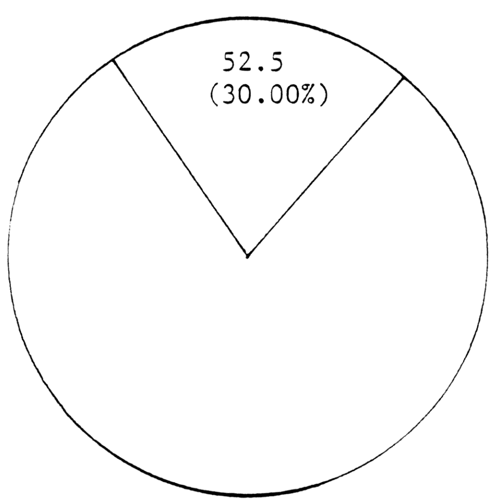
140.76
(IN MILLIONS)

PERCENT ON ONE NUMBER TO ANOTHER

2. <u>Percent of one number to the total</u>

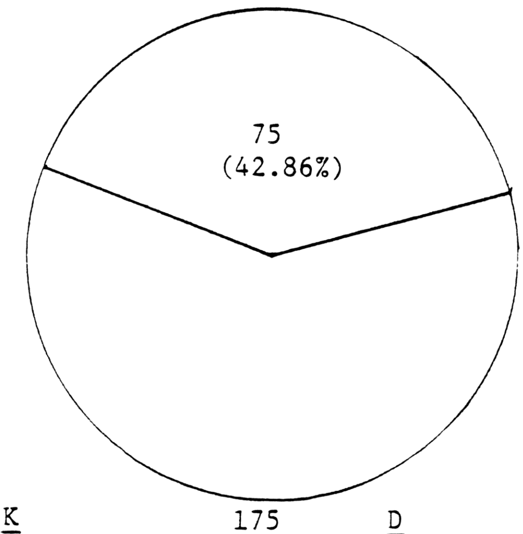
EXAMPLE:

K	D
175 (ENTER)	175.00
52.5 (%T)	30.00 %

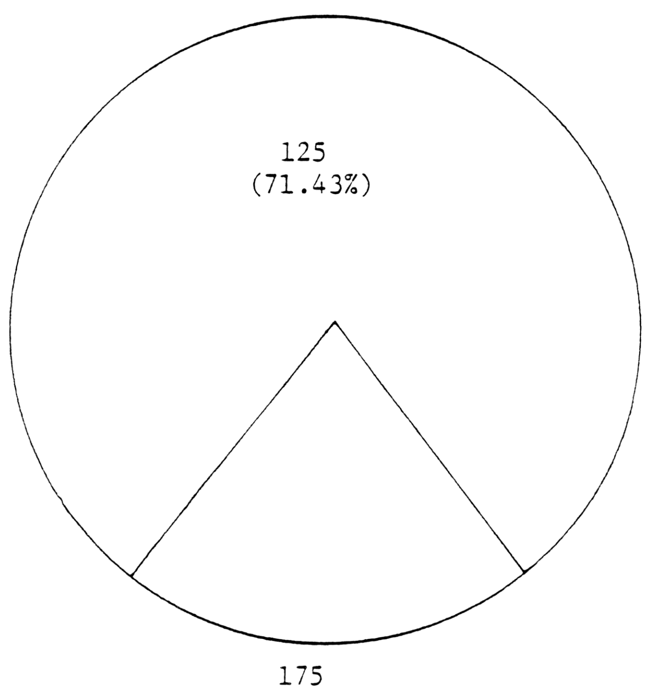


175

K	D
(CLx)	0.00
75 (%T)	42.86 %



K	D
(CLx)	0.00
125 (%T)	71.43



II. STATISTICAL FUNCTIONS

A. Statistical Storage Registers

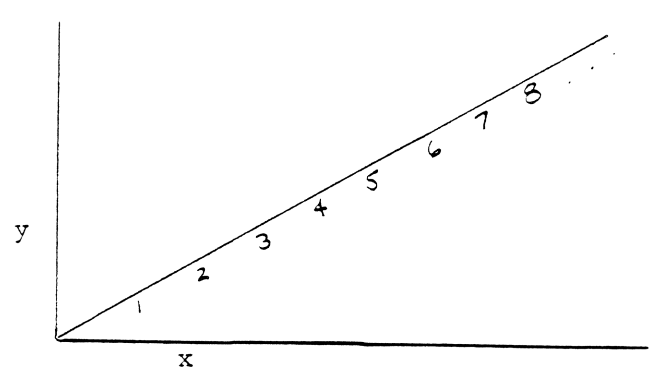
R_1	....	n
R_2	....	Ex
R_3	....	Ex^2
R_4	....	Ey
R_5	....	Ey^2
R_6	....	Exy

1. (f CLEAR E) - Clears the statistical registers (R_1 - R_6) and the display.

B. Statistical Functions

1. Mean

Property #	Value
1	110,000
2	95,000
3	96,150
4	129,750
5	95,250
6	105,000
7	99,950
8	115,150



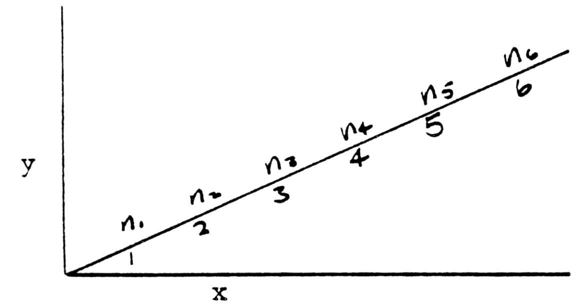
Mean

K	D
(f CLEAR REG)	0.00
(f) 2	0.00
110000 (E+) *	1.00
95000 (E+)	2.00
96150 (E+)	3.00
129750 (E+)	4.00
95250 (E+)	5.00
105000 (E+)	6.00
99950 (E+)	7.00
115150 (E+)	8.00
(g $\bar{x}$)	105,781.25

2. Weighted Mean

Value	Sq. Ft.
110,000	3000
95,000	2475
96,150	2500
129,750	3550
95,250	2125
105,000	2950
99,950	2725
115,150	3200

* (g E-) subtracts one data point in the event of an error situation.



Weighted Mean

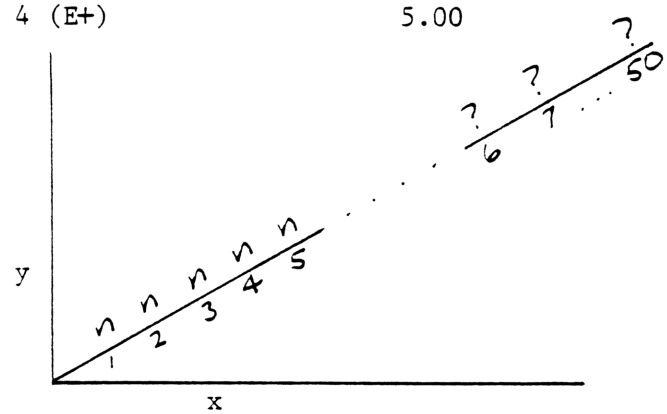
K	D
(f CLEAR E)	0.00
110000 (ENTER)	110,000.00
3000 (E+)	1.00
95000 (ENTER)	95000.00
2475 (E+)	2.00
96150 (ENTER)	96,150.00
2500 (E+)	3.00
129750 (ENTER)	129,750.00
3550 (E+)	4.00
95250 (ENTER)	95,250.00
2125 (E+)	5.00
105000 (ENTER)	105,000.00
2950 (E+)	6.00
99950 (ENTER)	99,950.00
2725 (E+)	7.00
115150 (ENTER)	115,150.00
3200 (E+)	8.00
(g $\bar{x}$w)	107,396.78

3. Projected Value

Value	Year	Increase in Value
149,950	0	0
?	1	3
?	2	5
?	3	-2.0
?	4	1.5

K	D
149950 (ENTER)	149,950.00
3 (%)(+)	154,448.50
5 (%)(+)	162,170.93
2 (%)(-)	158,927.51
1.5 (%)(+)	161,311.42

K	D
(f CLEAR E)	0.00
149,950 (ENTER)	149,950.00
0 (E+)	1.00
154,448.50 (ENTER)	154,448.50
1 (E+)	2.00
162,170.93 (ENTER)	162,170.93
2 (E+)	3.00
158,927.51 (ENTER)	158,927.51
3 (E+)	4.00
161,311.42 (ENTER)	161,311.42
4 (E+)	5.00



Projected value or Trend Line

K	D
6 (g $\hat{y}$,r)	168,242.41
7 (g $\hat{y}$,r)	170,962.60
15 (g $\hat{y}$,r)	192,724.08

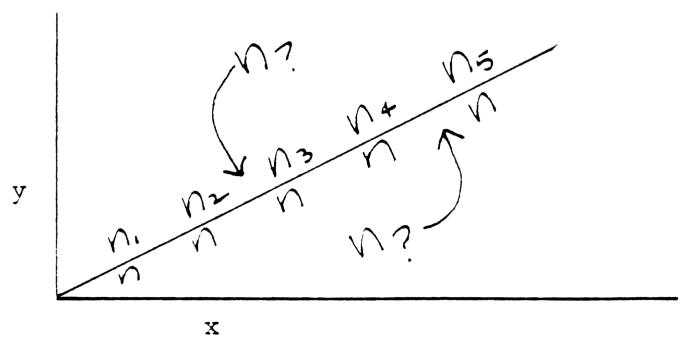
K	D
200,000 (g $\hat{x}$,r)	17.67 YEARS
175,000 (g $\hat{x}$,r)	8.48 YEARS
250,000 (g $\hat{x}$,r)	36.06 YEARS

4. <u>Linear Regression</u>

a. <u>Correlation Coeffecient</u>

(1) Testing the data to achieve a reasonable approximation within $\pm$ 1.

K	D
55000 (ENTER)	55,000.00
1000 (E+)	1.00
79900 (ENTER)	79,900.00
2600 (E+)	2.00
62500 (ENTER)	62,500.00
1500 (E+)	3.00
60250 (ENTER)	60,250.00
1200 (E+)	4.00
71500 (ENTER)	71,500.00
2100 (E+)	5.00
69900 (ENTER)	69,900.00
1900 (E+)	6.00



Linear Regression

K	D	
(g y,r)	40,954.35	
(X $\lessgtr$ Y)	0.99	CORRELATION COEFFECIENT

K	D	
1700 (g $\hat{y}$,r)	66,259.37	Sq.Ft. to Value
2200 (g $\hat{y}$,r)	73,728.38	
900 (g $\hat{y}$,r)	54,308.95	

K	D	
82500 (g $\hat{x}$,r)	2,787.20	Value to Sq.Ft.
56500 (g $\hat{x}$,r)	1,046.68	
65500 (g $\hat{x}$,r)	1,649.17	

5. Multiple Regression

Sq. Ft.	Lot Size	#BDRMS
66,250.79	65,772.82	68,787.25

K	D	
66250.79 (E+)	1.00	
65772.82 (E+)	2.00	
68,787.25 (E+)	3.00	
(g $\bar{x}$)	66,936.95	Average Value

III. CALENDER FUNCTIONS

A. Your calculator operates with dates from October 15,1582 to November 25, 4046.

1. October 15, 1582: The day the Julian calender became the present day Gregorian calender.

2. November 25, 4046: This date appears to be the last date to which accuracy of the calculator is guaranteed.

B. Calender Keys

1. Format Keys

M.DY	April 3, 1985 = 4.031985	(U.S.)
D.MY	April 3, 1985 = 3.041985	(European; Military)

2. Calculation Keys

DATE	Given the number of days, this key will calculate a date in the present, future, or past; and also display the day of the week the calculated date occurs.
ΔDYS	This keystroke will display the number of days between any two dates.

C. DATE Calculations

PROCEDURE:

1. Key in the first date, press (ENTER)

2. Key in the number of days (may be negative, positive, or zero

3. Press (g DATE)* and the calculator will display the DATE and day of the week

* (f DATE) on the HP-38

EXAMPLE:

K	D	
(g M.DY)*	0.00	Sets calculator to Month.DayYear format
7.041776	7.041776	
(ENTER)	7.04	
0	0.	
(g DATE)	7,04,1776	4

1	2	3	4	5	6	7
M	T	W	Th	F	S	Su

International numerical symbols for the days of the week

K	D	
180	180.	
(g DATE)	12,31,1776	2

K	D	
180 (CHS)	-180.	
(g DATE)	7,04,1776	4

* Set the slide swith in the upper right corner of the HP-38 to M.DY by moving it to the right.

EXAMPLE: Calculating the Day You Were Born

August 5, 1944

K	D	
8.051944	8.051944	
(ENTER)	8.05	
0	0.	
(g DATE)	8,05,1944 6	You were born on Saturday

D. Δ DYS Calculations

PROCEDURE:

1. Key in the first date and press (ENTER)
2. Key in the second date
3. Press (g Δ DYS)* and the calculator will display the difference in days negative for dates in the past, positive for dates in the future.

K	D	
7.041776 (ENTER)	7.04	
7.041985	7.041985	
(g Δ DYS)	76,335.00	Difference in days
365 (÷)	209.14	Years

K	D
12.311983 (ENTER)	12.31
12.311984 (g ΔDYS)	366.00

* (f DAYS) on the HP-38

EXAMPLE:

K	D	
10.151582 (ENTER)	10.15	
11.254046 (gΔDYS)	899,999.00	
(X $\gtrless$ Y)	887,080.00	30 Day Calender
(X $\gtrless$ Y)	899,999.00	Actual Days Calender

K	D
12.311984 (ENTER)	12.31
12.311985 (gΔDYS)	365.00
(X $\gtrless$ Y)	360.00
(X $\gtrless$ Y)	365.00

PART TWO

ADVANCED FINANCIAL FUNCTIONS

I. SIMPLE INTEREST

A. Ask yourself how much it would cost you to borrow \$5000 at 10% interest for one year. If you said \$500 you were only half right. The example below illustrates how different financial institutions calculate simple interest.

$$\frac{10\%}{360} = 0.027777778$$ Daily interest 360 day method

$$\frac{10\%}{365} = 0.027397260$$ Daily interest actual days method

It should be evident to you that if you were loaning money you might choose the first method for calculating interest since it affords you the opportunity to make more money.

Your HP-12C calculates simple interest using both methods.

B. Simple Interest Calculations

Steps necessary to calculate simple interest:

1. Key in or calculate the number of days interest will accrue

   Press (n)

2. Key in the <u>ANNUAL</u> interest rate

   Press (i)

3. Key in the principal amount (-) for the lender (+) for the borrower

   Press (PV)

4. Press (f INT)

THE DISPLAY WILL THEN SHOW THE 360 DAY INTEREST CALCULATION

5. Press R↓ X≷Y

DISPLAY WILL THEN SHOW THE ACTUAL DAYS INTEREST CALCULATION

6. Press (+) before or after step 5 to calculate total interest and principal for interest method preferred

KEYSTROKE	DISPLAY	
5000 (PV)	5000.00	
10 (i)	10.00	
365 (n)	365.00	
(f INT)	-506.94	360 Interest
(R X≷Y)	-500.00	Actual Days Interest
(+)	-5,500.00	Actual Days Interest plus Principal
(f INT)	-506.94	360 Interest
(+)	-5,506.94	360 Interest plus Principal

C. Example:

It is your intention to loan $2000 to a business associate. The transaction will take place on March 1, 1985 and you expect to collect both principal and interest on November 1, 1985. Assuming that you will lend the money on an actual days basis regarding the simple interest method, at the rate of 31%, what is the total dollar amount due and payable to you on November 1, 1985?

KEYSTROKE	DISPLAY
(f CL REG)	0.00
3.011985 (ENTER)	3.01
11.011985 (g ΔDYS)	245.00
(n)	245.00

KEYSTROKE	DISPLAY
31 (i)	31.00
2000 (CHS PV)	-2000.00
(f INT)	421.94
(R↓ X≶Y)	416.16
(+)	2416.16

D. Example - Interest Only, Real Estate

You intend to make an interest only real estate loan to a prospective real estate purchaser. You will make the loan on January 2, 1985 and the contract will expire on January 2, 1990. The loan amount is $59,000 and the interest rate is 14%. What is the interest only monthly payment due you over the term if the contract is based upon 360 interest?

KEYSTROKE		DISPLAY	
1.021985	(ENTER)	1.02	
1.021990	(g Δ DYS)	1826.00	Term in days
(n)		1826.00	
14 (i)		14.00	Annual rate
59000 (PV)		59,000.00	Loan amount
(f INT)		-41,896.56	Total interest
60 (÷)		-698.28	Monthly payment

Problem A - Simple Interest, less than one year

An acquaintance asks you to make a short term loan of $1500 for the purpose of investing in the stock market. You agree but with the following conditions. The interest rate will be 31% and the term will be six months from today's date July 1, 1985. Furthermore you require the loan be computed on a thirty day basis rather than an actual day basis. What would be the total amount due and payable on January 1, 1986?

Problem A - Simple Interest, less than one year (ANSWER)

An acquaintance asks you to make a short loan of $1500 for the purpose of investing in the stock market. You agree but with the following conditions. The interest rate will be 31% and the term will be six months from today's date, July 1, 1985. Further more you require the loan be computed on a thirty day basis rather than an actual day basis. What would be the total amount due and payable on January 1, 1986?

KEYSTROKE	DISPLAY
1500 (CHS PV)	-1,500.00
31 (i)	31.00
7.011985 (ENTER)	7.01
1.011986 (Δ DYS)	184.00
(n)	184.00
(f INT)	237.67
(+)	1737.67

Problem B - Simple Interest, more than one year, interest only

To close a sale on a piece of real property you offer to finance the sale with an interest only contract with the following terms of sale. The term of the loan will be five years beginning April 15, 1985 and will conclude April 15, 1990. If the loan amount is $25,000 and the interest rate is 10% what is the monthly payment the borrowers will have to pay?

Problem B - Simple interest, more than one year, interest only (ANSWER)

To close a sale on a piece of real property you offer to finance the sale with an interest only contract with the following terms of sale. The term of the loan will be five years beginning April 15, 1985 and will conclude April 15, 1990. If the loan amount is $25,000 and the interest rate is 10%, what is the monthly payment the borrowers will have to pay?

KEYSTROKE	DISPLAY
(f CL REG)	0.00
4.151985 (ENTER)	4.15
4.151990 (Δ DYS)	1826.00
(n)	1826.00
10 (i)	10.00
25000 (PV)	25,000.00
(f INT)	-12,680.56
60 (÷)	-211.34

II. PRACE AND YIELD CALCULATIONS

A. The Investment relationship

BORROWER		INVESTOR	
(n)	Term	Term	(n)
(i)	Rate	Yield	(i)
(PV)	Loan	Price	(PV)
(PMT)	PMT	Cash Flow	(PMT)
(FV)	Balloon	Balloon	(FV)

B. The Simple Balloon Payment Calculation

Since in most cases your calculation of price and yield will require a working knowledge of how to calculate balloon payments, following is an illustration of the simple balloon payment calculation method.

EXAMPLE:

A thirty year mortgage is written with a 13.25% interest rate, a $60,000 listing with 20% down. Calculate the balloon payment required after 60 payments.

KEYSTROKE	DISPLAY
30 (g 12X)	360.00
13.25 (g 12÷)	1.10
60000 (ENTER) 20 (%) (-) (PV)	48,000.00
(PMT)	-540.37
60 (n)	60.00
(FV)	-47,124.02

C. Calculating Price

1. Key in the total number of periods until the balloon payment occurs and press (n). If no balloon occurs enter the total number of payments then press (n).

2. Key in the desired yield and press (i).

3. Key in the payment per period and press (PMT).

4. Key in the balloon payment amount and press (FV). If no balloon go on to the next step.

5. Press (PV) to obtain the price.

KEYSTROKE	DISPLAY
60 (n)	60.00
31 (g 12÷)	2.58
425.75 (PMT)	425.75
(PV)	-12,913.13

D. Calculating Price with a Balloon Payment

KEYSTROKE	DISPLAY
69850 (PV)	69,650.00
6 (g 12÷)	0.50
25 (g 12X)	300.00
(PMT)	-450.C4
48 (n) (FV)	-64,397.23
18 (g 12÷)	1.50
(PV)	46,834.20

Problem A - Solving for Price

To purchase an 8.75% mortgage with 21 years remaining and a remaining balance of $52,350, what price will an investor have to pay if the desired yield is 19% calculated on a monthly basis?

Problem A - Solving for Price (Answer)

To purchase an 8.75% mortgage with 21 years remaining and a remaining balance of $52,350, what price would and investor have to pay if the desired yield is 19% calculated on a monthly basis?

KEYSTROKE	DISPLAY
21 (g 12X)	252.00
8.75 (g 12÷)	0.73
52350 (PV)	52,350.00
(PMT)	-454.58
19 (g 12÷)	1.58
(PV)	28,162.23

E. Calculating Yield

1. Key in the total number of periods until the balloon payment occurs and press (n). If no balloon occurs key in the total number of periods and press (n).

2. Key in the periodic payment amount and press (PMT)

3. Key in the purchase price of the paper then press (CHS PV).

4. Key in the balloon amount and press (FV). If no balloon go on to the next step.

5. Press (i) to obtain the yield per period.

KEYSTROKE	DISPLAY	
60 (n)	60.00	
8500 (CHS PV)	-8,500.00	
325 (PMT)	325.00	
(i)	3.27	Periodic Yield
12 (X)	39.22	Annual Yield

F. Calculating Yield with a Balloon Payment

KEYSTROKE	DISPLAY	
48 (n)	48.00	
125 (PMT)	125.00	
11415 (CHS PV)	-11,415.00	
15000 (FV)	15,000.00	
(i)	1.54	PERIODIC YIELD
(f) 9	1.541653667	
12 (x)	18.49984400	ANNUAL YIELD
(RCL g 12 ÷)	18.49984400	
(f) 2	18.50	

Problem B - Solving for Yield

Calculated on a monthly basis, what would the annual yield of a mortgage be if an investor was willing to purchase it for $28,162, the cash flow was $454.58 and there was a balloon payment in five years in the amount of $40,000.

Problem B - Solving for Yield (ANSWER)

Calculated on a monthly basis, what would the annual yield of a mortgage be if an investor was willing to purchase it for $28,162, the cash flow was $454.58 and there was a balloon payment in five years in the amount of $40,000.

KEYSTROKE	DISPLAY	
454.58 (PMT)	454.58	
40000 (FV)	40,000.00	
28162 (CHS PV)	-28,162.00	
60 (n)	60.00	
(i)	1.98	Periodic Yield
12 (X)	23.82	Annual Yield

Problem C - Borrowers and Investors

A young couple wish to purchase a home. The sale however is contingent upon their finding and successfully obtaining secondary financing. The seller's agent suggests selling a note to a third party private paper investor as a source of the funds. If the face value of the note is $7950 and the interest rate to the borrowers is 12% calculated over a thirty year term with a balloon payment in two years:

1. What is the monthly payment the borrowers will have to pay?

2. What is the balloon payment amount?

3. If the investor requires a 25% annual yield:

   A. What is the purchase price of the note?

   B. What is the total dollar return the investor will receive including annuities and the difference between his initial investment and the balloon payment at the end of two years?

Borrower's payment	$____________
Balloon Payment	$____________
Purchase price of the note	$____________
Total dollar return of investment	$____________

KEYSTROKE	DISPLAY	
7950 (PV)	7,950.00	
12 (g 12÷)	1.00	
30 (g 12X)	360.00	
(PMT)	-81.77	Monthly Payment
24 (n) (FV)	-7,888.64	Balloon Payment
25 (g 12÷)	2.08	
(PV)	6,341.53	Purchase price
(RCL FV +)	-1,547.12	Difference between purchase price and the balloon
(RCL PMT RCL n X)	-1,962.59	Total of the cash flows
(+)	-3509.71	Total dollar return of investment

PART 3

CASH FLOW ANALYSIS

I. UNDERSTANDING CASH FLOW

A. Defined:

The spendable income from an investment after deducting from gross income all operating and fixed expenses including principal and interest.

James Reilly - THE LANGUAGE OF REAL ESTATE

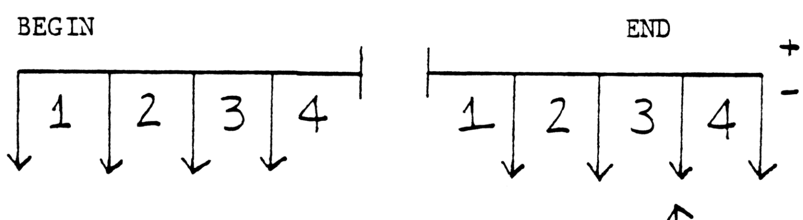
B. Cash Flow Sign Convention

\+ - Money received

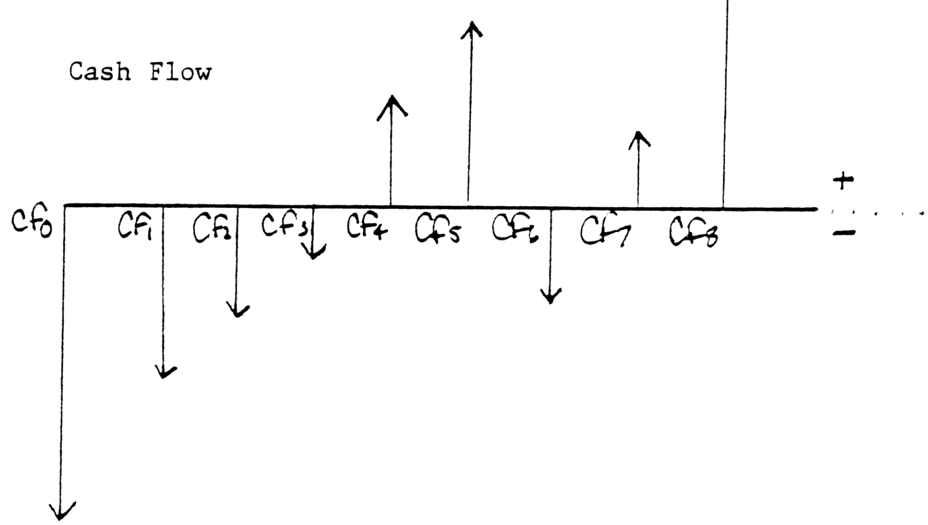
\- - Money paid

C. Cash Flow Diagrams

1. Compound Interest



2. Cash Flow



D. The relationship between compound interest calculations and cash flow analysis

1. Time and payments

	COMPOUND INTEREST	CASH FLOWS
TIME	=	=
PAYMENTS	=	= & ≠

2. Level payments versus equal or unequal cash flows

Solve for:	PRESENT VALUE	INTEREST RATE
Equal (PMT)	Price (PV)	Yield (i)
Equal or Unequal (CFJ)	Investment (NPV)	Internal Rate of Return (IRR)

E. Cash Flow Keys

INPUT KEYS

Cfo = Initial investment, may be zero, negative, or positive

Cfj = Subsequent cash flows, may be positive, negative, or zero

Nj = Number of times a cash flow occurs, semi- automatic

CALCULATION KEYS

NPV = Net Present Value

IRR = Internal Rate of Return

II. NET PRESENT VALUE CALCULATIONS

A. Net Present Value is the measurement of the desirability of an investment. This computation allows you the choice of computing:

1. The investment required to earn a desired yield, and;

2. The determination of the status of an investment based upon a required yield

B. Things to remember when calculating Net Present Value:

1. If NPV is negative the actual rate of return is less than desired

2. If NPV is zero the actual rate of return is equal to the desired rate

3. If NPV is positive the actual rate of return is greater than the desired rate

C. Calculating NPV - Unequal Consecutive

1. Useful for up to a maximum of 20 cash flows

#	CASH FLOW	K*
0	0	(g Cfo)
1	150,000	(g Cfj)
2	175,000	(g Cfj)
3	200,000	(g Cfj)
4	225,000	(g Cfj)
5	250,000	(g Cfj)

Desired Yield: 15 (i)

(f NPV) ____________

KEYSTROKE	DISPLAY
(f NPV)	647,201.84
(CHS) (STO 0)	-647,201.84
(f NPV)	-0.00005

* K = Keystroke

KEYSTROKE	DISPLAY
(f IRR)	15.00

Problem A - NPV, Unequal Consecutive Cash Flows

If cash flows are discounted at 14.75%, calculate the NPV using the following cash flows assuming no initial investment

#	CASH FLOW
0	0
1	1,525,000
2	1,475,000
3	- 300,000
4	1,205,000
5	1,742,000
6	2,200,000
7	- 950,000
8	1,550,000
9	1,725,000
10	750,000

PROBLEM A - NPV - Unequal Consecutive Cash Flows

KEYSTROKE	DISPLAY
0 (g Cfo)	0.00
1525000 (g Cfj)	1,525,000.00
1475000 (g Cfj)	1,475,000.00
300000 (CHS g Cfj)	-300,000.00
1205000 (g Cfj)	1,205,000.00
1742000 (g Cfj)	1,742,000.00
2200000 (g Cfj)	2,200,000.00
950000 (CHS g Cfj)	-950,000.00
1550000 (g Cfj)	1,550,000.00
1725000 (g Cfj)	1,725,000.00
750000 (g Cfj)	750,000.00
14.75 (i)	14.75
(f NPV)	5,627,264.67

You shouldn't invest more than $5,627,264.67 if you intend to earn 14.75 % on your money.

(CHS STO 0)	-5,627,264.67
(f NPV)	0.0003

D. Calculating NPV - Equal Consecutive Cash Flows

#	CASH FLOW	
0	-80,000	(CHS g Cfo)
1	15,000	(g Cfj)
2	12,000	(g Cfj)
3	11,000	(g Cfj 3 g Nj)
4	11,000	
5	11,000	
6	10,100	(g Cfj)
7	10,000	(g Cfj 2 g Nj)
8	10,000	
9	5,500	(g Cfj)
10	101,000	(g Cfj)

14 (i)

(f NPV) 3,080.94

If NPV is positive, the actual rate of return is greater than the desired yield.

(f IRR) 14.75 % Actual Rate of Return

PROBLEM B - NPV, Equal Consecutive Cash Flows

An investor would like to determine the desirability of purchasing a duplex. If the initial investment for the property is $105,000 and he intends to keep the property for five years and sell it for $200,000, using the cash flow table below will the investment yield 17%?

#	CASH FLOW
0	-105,000
1	750 X 12
2	775 X 12
3	800 X 12
4	800 X 12
5	800 X 12
6	200,000

PROBLEM B - NPV, Equal Consecutive Cash Flows (ANSWER)

KEYSTROKE	DISPLAY	
105000 (CHS g Cfo)	-105,000.00	
750 (g Cfj 12 g Nj)	12.00	
775 (g Cfj 12 g Nj)	12.00	
800 (g Cfj 36 g Nj)	36.00	
200000 (g Cfj)	200,000.00	
17 (g 12÷)	1.42	Desired periodic yield
(f NPV)	11,203.22	
(f IRR)	1.62	Actual periodic yield
12 (X)	19.40	Actual yield

PROBLEM C - Calculating the price of a mortgage with uneven cash flows and periodic balloon payments

Assuming you would like to calculate the price of a mortgage with even cash flow of $277 over 10 years, calculated monthly and balloon payments at the end of each 60 month period amounting to $15,000. If you desire a 20% yield on your investment how much must you invest?

#	CASH FLOW
0	0 (g Cfo)
1	277 (g Cfj 59 g Nj)
2	15277 (g Cfj)
3	277 (g Cfj 59 g Nj)
4	15277 (g Cfj)
20 (g 12÷)	1.67
(f NPV)	21,960.97

You shouldn't invest more than $21,961 if you wish to earn a 20% yield.

III. RECALLING OR ALTERING CASH FLOW ENTRIES

A. The Cash Flow Registers

Cfo - (g Cfo) stores Cfo in Ro and stores the number 0 in the n-register

Cfj - (g Cfj) stores the Cfj amount in the next register and updates the n-register by 1

Nj - (g Nj) preceded by a number equal to the number of cash flows updates the N_0 - N_{20} registers. No Nj keystroke automatically updates the register by 1.

B. Location of Cash Flows

Cfo - Stored in R_0

Cf_1 through Cf_9 stored in R_1 through R_9

Cf_{10} through Cf_{19} stored in $R._0$ through $R._9$

Cf_{20} stored in the FV-register

C. Recalling or Altering Cash Flows

KEYSTROKE	DISPLAY	
(RCL 0)	0.00	Cfo
(RCL 1)	277.00	Cf1
(RCL 2)	15,277.00	Cf2
(RCL 3)	277.00	Cf3
(RCL 4)	15,277.00	Cf4
(RCL i)	1.67	PERIODIC IRR
(RCL PV)	21,960.97	NPV

1. Altering cash flows

(CHS STO 0)	-21,960.97
(f NPV)	-0.000001

2. Changing the number of times cash flows occur

3 (n)	3.00
29 (g Nj)	29.00
1 (n)	1.00
29 (g Nj)	29.00
4 (n)	4.00
0 (STO 0)	0.00
(f NPV)	25,154.63

3. Recalling cash flows and the number of times they occur

(RCL g Nj)	1.00
(RCL g Cfj)	15,277.00
(RCL g Nj)	29.00
(RCL g Cfj)	277.00

This procedure allows you to view the number of times a cash flow occurs and the cash flow.

KEYSTROKE	DISPLAY
(RCL n)	2.00
4 (n)	4.00
(RCL PV)	25,154.63

IV. CALCULATING INTERNAL RATE OF RETURN

A. Defined:

A rate of discount at which the present worth of future cash flows is exactly equal to the initial capital investment.

James Reilly - THE LANGUAGE OF REAL ESTATE

B. INTERNAL = One investment

RATE = A measurement based upon percentages

OF RETURN = On investment

C. Calculating the Simple IRR

	#	CASH FLOW		
	0	-10,000		PV
	1	1,820		PMT
n	10	1,820	6,500	FV

Use this procedure to compute the required sales proceeds by using the FV key or the required cash flow by using the PMT key.

Problem A - Simple IRR

A property owner would like to know what the investment in his property has earned him, in percentage terms, over the last 20 years. If his original investment was $20,000 and he has been receiving payments of $638.63 per month, and recently sold the property for $150,000, what is the IRR?

Problem A - Simple IRR (ANSWER)

KEYSTROKE	DISPLAY
20000 (CHS PV)	-20,000.00
20 (g 12X)	240.00
150000 (FV)	150,000.00
638.63 (PMT)	638.63
(i)	3.20
12 (X)	38.45

D. Calculating IRR - Unequal Consecutive Cash Flows

#	Cash Flow
0	-10,000
1	1,820
2	1,825
3	1,900
4	20,000

You may use this method for 20 or fewer cash flows.

KEYSTROKE	DISPLAY	
10000 (CHS g Cfo)	-10,000.00	
1820 (g Cfj)	1820.00	
1825 (g Cfj)	1825.00	
1900 (g Cfj)	1900.00	
20000 (g Cfj)	20,000.00	
(f IRR)	31.35	Periodic Yield

Problem B - IRR, Unequal Consecutive Cash Flows

Solve for IRR. Use the cash flow analysis form on the next page to obtain the cash flows.

Cash Flow Analysis

Date ______________________

Name ______________________ Purpose ______________________

Mortgage Data

	Encumbrances	Amount	Remaining Term	Payment Period	Interest Rate	Payment Period	Remarks
1	1st Mortgage	1 357 000	24 years	mo	variable 13.2	15 223	
2	2nd Mortgage	673 000	5 years	mo	10	5 906	
3	3rd ~~XXXXXXX~~ Total	2 030 000					

		(1) Year: 1	(2) Year: 2	(3) Year: 3	(4) Year: 4	(5) Year: 5	(6) Year: 6
4	Initial Investment	0 870 000				BALLOON	643 794
5	1st Mortgage	1 353 225	1 348 920	1 344 011	1 338 413	1 332 030	1 324 752
6	2nd Mortgage	669 259	665 127	660 562	655 551	649 948	643 794
7	3rd Mortgage	-------	-------	-------	-------	-------	-------
8	Total Encumbrances	2 022 484	2 014 047	2 004 573	1 993 964	1 981 978	1 968 546
9	Principal Reduction	7 516	8 437	9 474	10 609	11 986	13 432
	Ownership Analysis of Property Income:		**Taxable Income**				
10	Total Gross Income	409 173	441906	447 258	515 438	556 673	601 206
11	– Vacancy & Credit Loss	20 457	22 095	23 863	25 772	27 833	30 060
12	– Operating Expenses	143 210	154 667	167 040	180 403	194 836	210 422
13	Net Operating Income	245 506	265 144	286 382	309 263	334 004	360 724
14	– Non-Operating Expense	----	----	----	----	----	----
15	– Interest	246 039	245 118	244 081	242 946	241 569	240 123
16	– Depreciation	243 333	243 333	243 333	243 333	243 333	243 333
17	Taxable Income	<243 866>	<223 307>	<201 032>	<177 016>	<150898>	<122 732>
			Cash Flows				
18	Net Operating Income	245 506	265 144	286 382	309 263	334004	360724
19	– Princp. & Int. Pymts.	253 555	253 555	253 555	253 555	253555	253555
20	– Funded Reserves	----	----	----	----	----	----
21	– Capital Additions	----	----	----	----	----	----
22	Cash Flow before Taxes	<8049>	11 589	32827	55708	80449	107 169
23	– Income Tax 50%	121 933	89 322	100516	88 508	75449	61 366
24	Cash Flow after Taxes	1 133 844	2 100 911	3 133343	4 144216	5 155 898	6 168 535

Analysis of Sales Proceeds Year: 1,107,210

	Adjusted Basis		Excess Depreciation		Tax on Gain %	1,275,745
25	Original Basis	2 900 000	Total Depr.		Excess	-------
26	- Capital Improvements	-----	S/L Depr.		Cap. Gain 50%	599 800
27	- Costs of Sale	161 000	Excess Depr.		Cap. Gain STATE	119 650
28	Sub-Total	3 061 000			Total Tax Liab.	719 450
29	– Depreciation	1 459 998	Gain		Sales Proceeds	
30	– Partial Sales	-----	Sales Price	4 600 000	Sales Price	4 600 000
31	AB at Sale	1 601 002	– AB	1 601 000	– Sales Costs	161 000
32			Gain	2 999 000	– Mortgage	1 968 564
33			– Excess	-----	Proceeds before Taxes	2 470 434
34	IRR =		Cap. Gain	2 999 000	– Total Tax Liab.	719 450
			40%	1 199 600	Proceeds after Taxes	1 751 004

BALLOON 643 794

7 PROCEEDS AFTER TAX 1, 107,210

Problem B - Unequal Consecutive Cash Flows, Solving for IRR

KEYSTROKE	DISPLAY	
870000 (CHS g Cfo)	-870,000.00	
133844 (g Cfj)	133,844.00	
100911 (g Cfj)	100,911.00	
133343 (g Cfj)	133,343.00	
144216 (g Cfj)	144,216.00	
155898 (g Cfj)	155,898.00	
168535 (g Cfj)	168,535.00	
1107210 (g Cfj)	1,107,210.00	
(f IRR)	16.56	Periodic return

Problem C - IRR, Unequal Consecutive Cash Flows

Solve for IRR.

#	Cash Flow
0	-150,000
1	20,000
2	25,000
3	12,000
4	15,000
5	10,000
6	15,000
7	20,000

(More cash flows next page)

#	Cash Flow
8	17,000
9	14,000
10	13,000
11	200,000

Problem C - IRR, Unequal Consecutive Cash Flows

KEYSTROKE	DISPLAY
150000 (CHS g Cfo)	-150,000.00
20000 (g Cfj)	20,000.00
25000 (g Cfj)	25,000.00
12000 (g Cfj)	12,000.00
15000 (g Cfj)	15,000.00
10000 (g Cfj)	10,000.00
15000 (g Cfj)	15,000.00
20000 (g Cfj)	20,000.00
17000 (g Cfj)	17,000.00
14000 (g Cfj)	14,000.00
13000 (g Cfj)	13,000.00
200000 (g Cfj)	200,000.00
(f IRR)	12.19

E. Calculating IRR - Equal Consecutive Cash Flows

Problem D - Solve for IRR, Equal Consecutive Cash Flows

#	Cash Flow	Groups
0	-27,270,000	1
1	5500	12
2	6000	12
3	6500	12
4	7000	12
5	7500	12
6	8000	12
7	9000	12
8	10,000	12
9	15,000	12
10	15,000	12
11	15,000	12
12	12,500	12
13	13,500	12
14	15,000	12
15	16,000	12
16	16,500	12
17	17,000	12
18	17,500	12
19	18,000	12
20	351,744,440	1

Problem D - Solve for IRR, Equal Consecutive Cash Flows (ANSWER)

KEYSTROKE	DISPLAY	
27270000 (CHS g Cfo)	-27,270,000.00	
5500 (g Cfj 12 g Nj)	12.00	
6000 (g Cfj 12 g Nj)	12.00	
6500 (g Cfj 12 g Nj)	12.00	
7000 (g Cfj 12 g Nj)	12.00	
7500 (g Cfj 12 g Nj)	12.00	
8000 (g Cfj 12 g Nj)	12.00	
9000 (g Cfj 12 g Nj)	12.00	
10000 (g Cfj 12 g Nj)	12.00	
15000 (g Cfj 36 g Nj)	36.00	
12500 (g Cfj 12 g Nj)	12.00	
13500 (g Cfj 12 g Nj)	12.00	
15000 (g Cfj 12 g Nj)	12.00	
16000 (g Cfj 12 g Nj)	12.00	
16500 (g Cfj 12 g Nj)	12.00	
17000 (g Cfj 12 g Nj)	12.00	
17500 (g Cfj 12 g Nj)	12.00	
18000 (g Cfj 12 g Nj)	12.00	
351744440 (g Cfj)	351,744,440.00	
(f IRR)	1.14	Periodic Return
12 (X)	13.62	Annual Return

V. PROBLEMS WITH IRR COMPUTATIONS

A. Problems with Displayed Answers

1. Positive answer - Probably the only answer

2. Negative answer - May be other answers, some may be positive

3. ERROR 7 - No solution to your problem exists, probably due to the cash flows you entered

4. ERROR 3 - Enter Best guess (RCL g R/S)

B. Computation Problems with IRR

1. IRR assumes that all cash flows are either reinvested or discounted at the computed yield rate

2. As IRR becomes either smaller or larger the financial assumption becomes less valid as an investment measure

3. For every sign change IRR has the potential for an additional answer

VI. MODIFIED INTERNAL RATE OF RETURN

A. Instructions for calculating MIRR

1. Using a risk rate, calculate the FV of the positive cash flows

2. Using a safe rate, calculate the PV of the negative cash flows

3. Knowing n, PV and FV solve for i

#	Cash Flow	Groups
0	-360,000	1
1	200,000	5
2	-200,000	5
3	0	9
4	400,000	1

KEYSTROKE	DISPLAY	
0 (g Cfo)	0.00	
200000 (g Cfj 5 g Nj)	5.00	
0 (g Cfj 5 g Nj)	5.00	
0 (g Cfj 9 g Nj)	9.00	
400000 (g Cfj)	400,000.00	
10 (i)	10.00	
(f NPV)	817,614.81	NPV
(CHS PV)	-817,614.81	
20 (n)	20.00	
(FV)	5,500,503.56	NFV of + CF's
360000 (CHS g Cfo)	-360,000.00	
0 (g Cfj 5 g Nj)	5.00	
200000 (CHS g Cfj 5 g Nj)	5.00	
6 (i)	6.00	
(f NPV)	-989,544.65	NPV
20 (n)	20.00	
(i)	8.96	MIRR