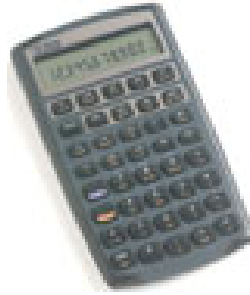


USING THE HEWLETT PACKARD - HP10BII FINANCIAL CALCULATOR



Basic financial examples with financial calculator steps

Prepared by Colin C Smith 2010

Some important things to consider

1. These notes cover basic financial calculations using the HP10bII financial calculator. The notes do not deal with the underlying theory and/or formulae. Students should ideally have a working knowledge of the underlying theory.
2. At best these notes are designed to get you started. They do not claim to be a comprehensive guide to the use of your calculator. Consult your user manual for more information and further examples.
3. The logic used in approaching these examples will be similar to the logic used when performing manual calculations – the interest rate is converted to a periodic interest rate (i/m) and the number of years will be converted to compounding periods ($n \times m$).
4. Financial calculators have functionality not available to the human brain and the multi-functionality of financial calculators is not demonstrated in these notes. If you use different functionality and get the same answer – congratulations - you are an advanced financial calculator user. If you use different functionality and do not get the same answer follow our basic steps and read your manual to learn more.

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GETTING STARTED

There are a few things you need to do before we can start with the calculations.

FUNCTION SET-UP

The **HP10BII** is already set up as a financial calculator so it is not necessary to set a particular mode.

SETTING PAYMENTS PER PERIOD

In these notes, we use the same logic used with manual calculations and set our payments to one payment per period.

HP10BII financial calculator	
KEYS	DISPLAY
1 ■ P/YR	1.00

■ This is the orange second function key situated just below a similar purple key.

DECIMAL PLACES

To set your calculator to the conventional two decimal places or four decimal places.

HP10BII financial calculator	
KEYS	DISPLAY
■ DISP 2	0.00
■ DISP 4	0.0000

DECIMAL INDICATOR

The HP10BII can show the decimal indicator as a comma or a point.

HP10BII financial calculator	
KEYS	DISPLAY
	<i>*Must not display BEGIN</i>
■ ./,	0,00
■ ./,	0.00

CLEARING PREVIOUS WORK

Every transaction in this document will commence with the following keystrokes. **C All** is the function to clear all the internal registers of the calculator.

HP10BII financial calculator	
KEYS	DISPLAY
■ C ALL	0.00

SETTING FOR PAYMENTS AT BEGINNING OF THE PERIOD

If you are working with an annuity due you must set your calculator to perform calculations from the beginning of the period. If you are doing lump-sum calculations or ordinary annuities check to see that your calculator is correctly set and does not display "BEGIN"

HP10BII financial calculator	
KEYS	DISPLAY
If it does display	BEGIN 0.00
■ BEG/END	
Removes this	0.00

LUMPSUMS – FUTURE VALUES AND PRESENT VALUES

* see getting started

1. Simple Future Value (FV)

You borrow R5,000 from a friend at 8% p.a. interest to be compounded annually. Capital and interest is repayable in 5 years time. How much will you repay?

HP10BII financial calculator	
KEYS	DISPLAY
	<i>*Must not display BEGIN</i>
■ C ALL	0.00
5,000 +/- PV	-5,000.00
8 I/YR	8.00
5 N	5.00
FV	7,346.64

2. Future Value (FV) with frequent compounding

You have saved R10,000 and invest this in a fixed deposit with a bank at 10.5% compounded quarterly for 4 years. How will you receive in 4 years time?

HP10BII financial calculator	
KEYS	DISPLAY
	<i>*Must not display BEGIN</i>
■ C ALL	0.00
10,000 +/- PV	-10,000.00
10.5 ÷ 4 I/YR	2.63
4 x 4 N	16.00
FV	15,137.38

3. Simple Present Value (PV)

You have just turned 20 years of age and your late Uncle Scrooge bequeathed you an amount of R5,000 payable on your 25th birthday. Your father offers to give you the present value today in cash. At an interest rate of 10% p.a. compounded annually how much must your father give you today? What is the present value of the bequest?

The –ve amount reflects what should be paid today.

HP10BII financial calculator	
KEYS	DISPLAY
	<i>*Must not display BEGIN</i>
■ C ALL	0.00
5,000 FV	5,000.00
10 I/YR	10.00
5 N	5.00
PV	-3,104.61

4. Present Value (PV) with frequent compounding

Uncle George is more generous and leaves you a substantial inheritance. You want to set aside and amount to buy your dream car when you complete your trainee contract in 5 years time. Estimates are that the dream car will cost R220,000 at that time. A bank is offering you a 5 year fixed deposit at 11.5% compounded monthly for 5 years. How much should you invest today?

The –ve amount reflects what should be paid today.

HP10BII financial calculator	
KEYS	DISPLAY
	<i>*Must not display BEGIN</i>
■ C ALL	0.00
220,000 FV	220,000.00
11.5 ÷ 12 I/YR	0.96
5 x 12 N	60.00
PV	-124,134.45

LUMPSUMS –INTEREST RATE AND PERIODS, AND NOMINAL AND EFFECTIVE INTEREST RATES

These calculations are quite challenging in an equation format but much easier with a financial calculator.

* see getting started

5. Calculating the interest rate

An amount of R400,000 is invested in a savings account that compounds interest monthly. After one year the balance in the account is R464 301.81. Calculate the nominal interest rate (i.e. the quoted rate or APR).

The R400,000 is shown as a –ve as this is the cash outflow required now.

HP10BII financial calculator	
KEYS	DISPLAY
	<i>*Must not display BEGIN</i>
■ C ALL	0.00
464,301.81 FV	464,301.81
400,000 +/- PV	-400,000.00
1 x 12 N	12.00
I/YR	1.25
X 12	15.00

6. Calculating the periods

An amount of R100,000 was invested in an account that accumulates interest at a rate of 14% per annum, compounded quarterly. The balance in the account, immediately after the latest quarter's interest credit is R173,398.60. How long ago was the amount invested?

Remember that because you have compounded more than once a year ($n \times m$ in the formula) N is not years but periods. So the answer is $16 \div 4 = 4$ years.

HP10BII financial calculator	
KEYS	DISPLAY
	<i>*Must not display BEGIN</i>
■ C ALL	0.00
173,398.60 FV	173,398.60
100,000 +/- PV	-100,000.00
14 ÷ 4 I/YR	3.50
N	16.00

7. Calculating the effective rate

Calculate the effective rate of 13% per annum compounded monthly.

This reflects the compounding periods per year (m in the formula) and can be changed to any frequency.

HP10BII financial calculator	
KEYS	DISPLAY
	<i>*Must not display BEGIN</i>
■ CLEAR ALL	0.00
13 ■ NOM%	13.00
12 ■ P/YR	12.00
■ EFF%	13.80

8. Calculating the nominal or annual percentage rate (APR)

Calculate the nominal rate (APR) of 14.9342% per annum compounding monthly.

This reflects the compounding periods per year (m in the formula) and can be changed to any frequency.

HP10BII financial calculator	
KEYS	DISPLAY
	<i>*Must not display BEGIN</i>
■ CLEAR ALL	0.00
14.9342 ■ EFF%	14.93
12 ■ P/YR	12.00
■ NOM%	14.00

ANNUITIES – ORDINARY, DUE, FUTURE VALUE, PRESENT VALUE

* see getting started

9. Simple Future Value of an Ordinary Annuity (FVA)

Assume you put R1,000 into a savings account at the end of every year for 10 years at 9.5% interest compounded annually. How much will you have in the account after 10 years?

HP10BII financial calculator	
KEYS	DISPLAY
	<i>*Must not display BEGIN</i>
■ C ALL	0.00
1 ■ P/YR	1.00
1,000 +/- PMT	-1,000.00
9.5 I/YR	9.50
10 N	10.00
0 PV	0.00
FV	15,560.29

10. Simple Future Value of an Annuity Due (FVA_{due})

Assume you put R1,000 into a savings account at the beginning of every year for 10 years at 9.5% interest compounded annually. How much will you have in the account after 10 years?

HP10BII financial calculator	
KEYS	DISPLAY
	<i>*Must display BEGIN</i>
■ C ALL	0.00
■ BEG/END	BEGIN 0.00
1 ■ P/YR	1.00
1,000 +/- PMT	-1,000.00
9.5 I/YR	9.50
10 N	10.00
0 PV	0.00
FV	17,038.52

11. Present Value of an Annuity Due (PVA_{due})

An overseas benefactor has offered to sponsor new Care Centre for Aids Orphans in Cape Town and they have pledged to provide the equivalent of R25,000 per month for the next four years payments starting immediately. The benefactor will make a single investment lump sum investment into a bank account paying 9.5% interest. How large will this initial investment be?

HP10BII financial calculator	
KEYS	DISPLAY
	<i>*Must display BEGIN</i>
■ C ALL	0.00
■ BEG/END	BEGIN 0.00
1 ■ P/YR	1.00
25,000 +/- PMT	-25,000.00
9.5 ÷ 12 I/YR	0.79
4 x 12 N	48.00
0 FV	0.00
PV	1,002,976.54

ANNUITIES – ORDINARY, DUE, FUTURE VALUE, PRESENT VALUE

12. Calculating the payment (PMT) for a normal financial transaction - Annuity Due

You buy a new car today for R120 000 and obtain finance for 80% of the purchase price (R96,000) over four years. The bank quotes you a finance rate of 12% per annum (nominal rate). Instalments are payable monthly in advance. Calculate the monthly instalment.

HP10BII financial calculator	
KEYS	DISPLAY
	<i>*Must display BEGIN</i>
■ C ALL	0.00
■ BEG/END	BEGIN 0.00
1 ■ P/YR	1.00
96,000 PV	96,0000.00
0 FV	0.00
12 ÷ 12 I/YR	1.00
4 x 12 N	48.00
PMT	-2503.02

You can also solve for the interest rate and for the number of periods using the same functions.

13. Calculating the interest rate for a normal financial transaction - Annuity Due

A bank offers you a personal loan of R20,000 repayable in 24 easy instalments of R1,050 per month starting immediately. What nominal interest rate (APR) is being charged?

HP10BII financial calculator	
KEYS	DISPLAY
	<i>*Must display BEGIN</i>
■ C ALL	0.00
■ BEG/END	BEGIN 0.00
1 ■ P/YR	1.00
20,000 PV	20,0000.00
0 FV	0.00
1,050 +/- PMT	-1050.00
24 N	24.00
I/YR	2.1237
X 12	25.48

Additional notes:

Please also see the Bond Valuation section for similar transactions.

Where we have irregular cash flow payments, we cannot use the annuity functionality and instead can use the NET PRESENT VALUE and INTERNAL RATE OF RETURN functions.

AMORTISATION

* see getting started

N.B. ENSURE THAT YOU CORRECTLY IDENTIFY YOUR PAYMENTS AS AN ORDINARY ANNUITY OR AN ANNUITY DUE AND SET YOUR CALCULATOR ACCORDINGLY.

14.1 Calculating the instalment /payment (PMT) for a normal financial transaction - Annuity Due with amortisation

A company takes a loan of R100,000 loan repayable in equal month instalments, at the beginning of the month, over a period of two years term, an interest rate of 12% per year is quoted by the bank (this is the nominal or Annual Percentage Rate APR.

HP10BII financial calculator	
KEYS	DISPLAY
	<i>*Must display BEGIN</i>
■ C ALL	0.00
■ BEG/END	BEGIN 0.00
1 ■ P/YR	1.00
100,000 PV	100,000.00
0 FV	0.00
12 ÷ 12 I/YR	1.00
2 x 12 N	24.00
PMT	-4,660.74

This is your monthly instalment. →

14.2 THE AMORTISATION SCHEDULE – ANNUITY DUE

We could derive the interest payments by preparing a manual amortisation schedule (very time consuming) or one below using Microsoft Excel (not allowed in examinations).

‡ In an annuity due the entire first payment is applied to capital

Month	Instalment	Interest	Capital paid off	Capital Balance
today				100,000.00
1	R 4,660.74	-	‡ 4,660.74	95,339.26
2	R 4,660.74	953.39	3,707.35	91,631.91
3	R 4,660.74	916.32	3,744.42	87,887.49
4	R 4,660.74	878.87	3,781.87	84,105.63
5	R 4,660.74	841.06	3,819.68	80,285.94
6	R 4,660.74	802.86	3,857.88	76,428.06
7	R 4,660.74	764.28	3,896.46	72,531.60
8	R 4,660.74	725.32	3,935.42	68,596.18
9	R 4,660.74	685.96	3,974.78	64,621.40
10	R 4,660.74	646.21	4,014.53	60,606.87
11	R 4,660.74	606.07	4,054.67	56,552.20
12	R 4,660.74	565.52	4,095.22	52,456.99
13	R 4,660.74	524.57	4,136.17	48,320.82
14	R 4,660.74	483.21	4,177.53	44,143.28
15	R 4,660.74	441.43	4,219.31	39,923.98
16	R 4,660.74	399.24	4,261.50	35,662.48
17	R 4,660.74	356.62	4,304.12	31,358.36
18	R 4,660.74	313.58	4,347.16	27,011.20
19	R 4,660.74	270.11	4,390.63	22,620.58
20	R 4,660.74	226.21	4,434.53	18,186.04
21	R 4,660.74	181.86	4,478.88	13,707.16
22	R 4,660.74	137.07	4,523.67	9,183.49
23	R 4,660.74	91.83	4,568.91	4,614.59
24	R 4,660.74	46.15	4,614.59	-0.00

Year 1 interest
R8,385.86

Year 1 capital
R47,543.02

Year 2 interest
R3,471.88

Year 2 capital
R52,457.00

AMORTISATION

14.3 Amortising the payments using a financial calculator to calculate the amount of capital and interest paid and the balance at the end of each year

This step follows directly on your calculation of the instalment above.

We enter the first financial period and the number of payments made in that period

Note: You can set the amortisation function for any period but here it is for a 12-month period.

This is for periods 1 - 12

- ① Capital paid in year 1
- ② Interest paid in year 1
- ③ Balance at the end of year 1

HP10BII financial calculator	
KEYS	DISPLAY
1 INPUT12	12
■ AMORT	1-12
=	-47,543.02
=	-8,385.86
=	52,456.98

- ①
- ②
- ③

For the next 12 months (periods 13 – 24)

- ④ Capital paid in year 2
- ⑤ Interest paid in year 2
- ⑥ Balance at the end of year 2

HP10BII financial calculator	
■ AMORT	13-24
=	-52,457.00
=	-3,471.88
=	-0.02

- ④
- ⑤
- ⑥

YOU CAN CHECK THESE NUMBERS AGAINST THE AMORTISATION SCHEDULE in section 14.2 that was completed using Microsoft Excel.

15.1 Calculating the instalment /payment (PMT) for a financial transaction – Ordinary Annuity with amortisation

A company takes a loan of R100,000 loan repayable in equal month instalments, at the end of the month, over a period of two years term, an interest rate of 12% per year is quoted by the bank (this is the nominal or Annual Percentage Rate APR).

This is your monthly instalment. →

HP10BII financial calculator	
KEYS	DISPLAY
	<i>*Must not display BEGIN</i>
■ C ALL	0.00
1 ■ P/YR	1.00
100,000 PV	100,000.00
0 FV	0.00
12 ÷ 12 I/YR	1.00
2 x 12 N	24.00
PMT	-4,707.35

AMORTISATION

15.2. THE AMORTISATION SCHEDULE – ORDINARY ANNUITY

As for the schedule at 14.2 this was prepared using Microsoft Excel.

Month today	Instalment	Interest	Capital paid off	Capital Balance
				100,000.00
1	R 4,707.35	1,000.00	3,707.35	96,292.65
2	R 4,707.35	962.93	3,744.42	92,548.23
3	R 4,707.35	925.48	3,781.86	88,766.37
4	R 4,707.35	887.66	3,819.68	84,946.68
5	R 4,707.35	849.47	3,857.88	81,088.80
6	R 4,707.35	810.89	3,896.46	77,192.34
7	R 4,707.35	771.92	3,935.42	73,256.92
8	R 4,707.35	732.57	3,974.78	69,282.14
9	R 4,707.35	692.82	4,014.53	65,267.62
10	R 4,707.35	652.68	4,054.67	61,212.95
11	R 4,707.35	612.13	4,095.22	57,117.73
12	R 4,707.35	571.18	4,136.17	52,981.56
13	R 4,707.35	529.82	4,177.53	48,804.03
14	R 4,707.35	488.04	4,219.31	44,584.72
15	R 4,707.35	445.85	4,261.50	40,323.22
16	R 4,707.35	403.23	4,304.12	36,019.10
17	R 4,707.35	360.19	4,347.16	31,671.95
18	R 4,707.35	316.72	4,390.63	27,281.32
19	R 4,707.35	272.81	4,434.53	22,846.79
20	R 4,707.35	228.47	4,478.88	18,367.91
21	R 4,707.35	183.68	4,523.67	13,844.24
22	R 4,707.35	138.44	4,568.90	9,275.33
23	R 4,707.35	92.75	4,614.59	4,660.74
24	R 4,707.35	46.61	4,660.74	0.00

Year 1 interest
R9,469.73

Year 1 capital
R47,018.47

Year 2 interest
R3,506.61

Year 1 capital
R52,981.59

15.3 Amortising the payments to calculate the amount of capital and interest paid and the balance at the end of each year

This step follows directly on your calculation of the instalment above.

We enter the first financial period and the number of payments made in that period. The amortisation function can be for any period but here it is for a 12-month period.

This is for periods 1 - 12

- ① Capital paid in year 1
- ② Interest paid in year 1
- ③ Balance at the end of year 1

HP10BII financial calculator	
KEYS	DISPLAY
1 INPUT12	12
■ AMORT	1-12
=	-47,018.47 ①
=	-9,469.73 ②
=	52,981.53 ③

For the next 12 months (periods 13 – 24)

- ④ Capital paid in year 2
- ⑤ Interest paid in year 2
- ⑥ Balance at the end of year 2

HP10BII financial calculator	
KEYS	DISPLAY
■ AMORT	13-24
=	-52,981.59 ④
=	-3,506.61 ⑤
=	-0.06 ⑥

YOU CAN CHECK THESE NUMBERS AGAINST THE AMORTISATION SCHEDULE ABOVE.

BOND VALUATION

* see getting started

16. Value of an annual payment bond with a single annual payment

A company purchases bonds on 1 January of this year. The nominal/face/coupon value is R1,000 and the annual nominal/coupon interest rate is 10%. The bond is redeemable on 31 December 6 years later. The market interest rate for similar bonds is 15%. Assume that the bond payments are made annually in arrears. What price would the company pay for the bond? (i.e. what should the value be on 1 January of this year?)

HP10BII financial calculator	
KEYS	DISPLAY
	<i>*Must not display BEGIN</i>
■ CLEAR ALL	0.00
15 I/YR	15.00
6 N	6.00
1,000 FV	1,000.00
100 PMT	100.00
1 ■ P/YR	1.00
PV	-810.78

17. Value of a typical government bond with semi-annual payments

Assume same information as for 16 above except that the bond is a typical government bond that pays semi-annually in arrears. What price would the company pay for the bond?

HP10BII financial calculator	
KEYS	DISPLAY
	<i>*Must not display BEGIN</i>
■ CLEAR ALL	0.00
15 ÷ 2 I/YR	7.50
6 x 2 N	12.00
1,000 FV	1,000.00
100 ÷ 2 PMT	50.00
1 ■ P/YR	1.00
PV	-806.62

18. Calculating the yield to maturity

This is extremely difficult to calculate when using a formula approach without a financial calculator.

The nominal/face/coupon value is R1,000 and the annual nominal/coupon interest rate is 10% paid semi annually in arrears. You purchased the bond on 1 January of this year and the bond is redeemable on 31 December 10 years later at a premium of 10%. The bond is priced at R980 on 1 January of this year. What is the yield to maturity on 1 January of this year?

‡ Remember that this is the rate for 6 months. To annualise the convention (from bond trading in the United States) has been to multiply this by 2.

HP10BII financial calculator	
KEYS	DISPLAY
	<i>*Must not display BEGIN</i>
■ CLEAR ALL	0.00
10 x 2 N	20.00
1,000 x 1.10 FV	1,100.00
980 +/- PV	-980.00
50 PMT	50.00
1 ■ P/YR	1.00
I/YR	5.45
X 2	10.91

‡

NET PRESENT VALUE and INTERNAL RATE OF RETURN

* see getting started

19 & 20. What is the Net Present Value and IRR of this project?

A project has the following cash flows

Year	Cash Flow (R)
0	-1,000
1	-1,700
2	1,500
3	1,800
4	1,900

If the weighted average cost of capital WACC is 15 %
what is the Net Present Value of this project?

What is the Internal Rate of Return of the
above cash flows?

HP10BII financial calculator	
KEYS	DISPLAY
	<i>*Must not display BEGIN</i>
■ CLEAR ALL	0.00
1 ■ P/YR	1.00
1,000 +/- CFj	-1,000.00
1,700 +/-CFj	-1,700.00
1,500 CFj	1,500.00
1,800 CFj	1,800.00
1,900 CFj	1,900.00
15 I/YR	15.00
■ NPV	925.812
■ IRR/ YR	31.54