DETERMINATION > FINANCIAL ARRANGEMENTS > GENERAL

Present Value Calculation Methods

Issued: 24 October 1990

G10B

This Determination may be cited as "Determination G10B: Present Value Calculation Methods".

1 Explanation (which does not form part of the determination)

1. This determination rescinds and replaces Determination G10A: Present Value Calculation Methods, made by the Commissioner on 23 April 1990. This determination differs from Determination G10A by modifying present value Method A to enable it to apply to perpetuities.

2. For the purposes of the accrual tax accounting regime it may be necessary to calculate present values for a variety of reasons, for example:

   (a) To calculate the yield to maturity of a financial arrangement. The yield to maturity is the interest rate at which the first amount payable under the financial arrangement is equal to the present value of all subsequent amounts payable under the financial arrangement calculated as at the due date of the first payment:

   (b) To calculate present values at intermediate times during the term of a financial arrangement in order to calculate the amount of the income derived or expenditure incurred by a person in respect of the financial arrangement.

3. The present value of a financial arrangement as at a date excludes any amounts payable under the financial arrangement on that date.

4. This determination specifies approved methods of calculating present values for use in other determinations. These methods may be added to or removed from time to time.

   Method A is a general purpose method suitable for many applications and gives very similar results to Determination G3: Yield to Maturity Method. Method A may be used on either a 360 or 365 day basis. Method A is applicable both to perpetuities in which all coupons are the same after some period, and to financial arrangements which have a final payment

   Method B is used to calculate prices of government or local authority stock, and other financial arrangements having similar characteristics, employing the formula approved by the International Association of Bond Dealers and used in calculators such as the HP12C. It differs from Method A in two respects—

   (a) Coupons must be payable at regular half yearly or quarterly intervals, and

   (b) Compound interest is used in the first period, unless it is also the last period in which case simple daily interest is used (Method A always uses simple daily interest in the first period).

Both methods calculate the present value at the beginning of a period by taking the present value at the end of the period, adding or subtracting the net cashflows at the end of the period, and discounting the total at a Specified Discount Rate.

5. Alternative approved methods may not generate exactly identical results.

6. Once a person has elected to use an approved method of calculating the present value of a financial arrangement, that method shall be used by the person over the life of the financial arrangement unless the prior consent of the Commissioner is obtained to adopt another method.

7. This determination is for use in conjunction with other determinations, for example Determination G11A: Present Value Based Yield to Maturity Method.

2 Reference

1. This determination is made pursuant to section 64E(1)(a) and 64E(6) of the Income Tax Act 1976.

2. Determination G10A: Present Value Calculation Methods is hereby rescinded with effect from the day on which this Determination G10B is signed.

3 Scope of Determination

This determination shall be used as required by any other determination which will specify—

a) The date at which the present value shall be calculated (the "Specified Date"); and
b) The interest rate that shall be used in the calculation (the "Specified Discount Rate"); and
c) The amounts and due dates for which the present value shall be calculated—

and which may specify the method to be used.

4 Principle

This determination specifies alternative methods for calculating the present value of a financial arrangement, equal to the sum of the values as at the Specified Date of all amounts payable under the financial arrangement after that date, discounted at the Specified Discount Rate.

5 Interpretation

1. For convenience, words and phrases defined in this determination are indicated by initial capital letters, but the absence of a capital letter shall not alone imply that the word or phrase is used with a meaning different from that given by its definition.

2. In this determination unless the context otherwise requires—

"The Act" means the Income Tax Act 1976:

"Income Year" has the same meaning as in sections 64B to 64M of The Act:

"Period" and "Period Between Payments" in relation to a person means a term—

(a) Commencing immediately after—

(i) A Specified Date in relation to a financial arrangement; or

(ii) A date on which an amount is payable under a financial arrangement as the case may be; and

(b) Ending on the next succeeding date on which an amount is payable under a financial arrangement.

Provided that if a Period or a Period Between Payments exceeds one year it shall be deemed to comprise one or more Periods each of one year followed (or preceded, at the option of the person) by a Period of not more than one year:

"Specified Date" in relation to a financial arrangement means the date at which the present value of the financial arrangement is required to be calculated:

"Specified Discount Rate" in relation to a financial arrangement and a person means the annual rate of interest at which the present value of the financial arrangement is required to be calculated.

3. The number of days in a Period calculated on a 365 day basis is the actual number of days in the Period including the ending date of the Period but excluding the starting date of the Period.

The number of days in a Period calculated on a 360 day basis means the number of days falling within the Period including the ending date of the Period but excluding the starting date of the Period and calculated as if every calendar month of the Period had exactly 30 days;

Provided that if the ending date is the 31st day of the month and—

(a) The starting date of the Period is not the 30th or 31st day of a month, the ending date shall be included in the number of days in the Period;

(b) The starting date of the Period is the 30th or 31st day of a month, the ending date shall be deemed to be the 30th day of the month.

4. In this determination, unless the context otherwise requires, expressions used that are not defined in this clause have the same meaning as in sections 2 and 64B to 64M of The Act.

5. Any reference in this determination to another determination made by the Commissioner shall be construed as referring to any fresh determination made by the Commissioner to vary, rescind, restrict, or extend that determination.

6 Method

1. A person shall elect to use a method allowed under a determination made by the Commissioner under section 64E(1)(a) of The Act for the purpose of calculating a present value in relation to a financial arrangement, and shall apply that method consistently in respect of that financial arrangement, until it matures or is remitted, sold or otherwise transferred by the person unless the prior consent of the Commissioner (which may be given conditionally) to adopt another method is obtained.

2. Method A

(a) For the purpose of applying clause 6(2)(b) of this determination, in relation to any person N shall be calculated as follows:

(i) Where the greatest common divisor of all Periods Between Payments is—

(A) A year or 12 months, N shall be taken as 1;

(B) A halfyear or 6 months, N shall be taken as 2;

(C) A quarter or 3 months, N shall be taken as 4;

(D) A month, N shall be taken as 12;

(E) A fortnight, N shall be taken as 26;

(F) A week, N shall be taken as 52;

Provided that where 1 or 2 of the Periods are shorter or longer than all the other Periods this fact shall be disregarded in determining the greatest common divisor,

and for the shorter or longer Period or Periods N shall be, at the option of the person, taken as—

(G) 365 divided by the number of days in the Period calculated on a 365 day basis; or

(H) 360 divided by the number of days in the Period calculated on a 360 day basis.

(ii) Where N cannot be determined according to the foregoing subparagraph it shall be, at the option of the person, taken as—

(A) 365 divided by the number of days in the Period calculated on a 365 day basis—

(B) 360 divided by the number of days in the Period calculated on a 360 day basis— for all of the Periods.

(b) The amount of the present value of a financial arrangement calculated according to Method A as at a date shall—

(i) Where the given date is a date on which an amount is payable under a financial arrangement, and the same amount is payable at the end of every period following the given date, be calculated according to the following formula:

$$\frac{E}{F};$$

History: Cl 6(2)(b)(i) and the formula $\frac{"E"}{F}$ inserted by Det G10B.

(ii) In any other case, be calculated according to the following formula:

$$\frac{A + B - C}{1 + F}$$

where—

A is the present value (if any) as at the end of the Period immediately following the given date; and

B is the sum of the amounts receivable by the holder or payable by the issuer at the end of the Period immediately following the date; and

C is the sum of the amounts payable by the holder or receivable by the issuer at the end of the Period immediately following the given date; and

E is the same amount receivable by the holder or payable by the issuer at the end of every Period following the given date; and

F is the amount calculated in relation to the financial arrangement and the person and the period immediately following the date according to the following formula:

$$\frac{R}{100 \times N}; \text{ and}$$

R is the Specified Discount Rate.

3. Method B

(a) A person shall apply Method B only to financial arrangements which are debt instruments under which all payments after the issue or acquisition date are at regular halfyearly or quarterly intervals.

(b) For purposes of applying clause 6(3)(c) of this determination in relation to any person—

(i) If amounts are payable at regular halfyearly intervals, N shall be taken as 2 and the preceding due date shall be taken as the date 6 calendar months prior to the date on which the first amount is payable on or after the date of issue or acquisition;

(ii) If amounts are payable at regular quarterly intervals, N shall be taken as 4 and the preceding due date shall be taken as the date 3 calendar months prior to the date on which the first amount is payable on or after the date of issue or acquisition.

(c) The amount of the present value of a financial arrangement calculated according to Method B as at a date shall be calculated according to the following formula:

$$\frac{A + B - C}{D}$$

where—

A is the present value (if any) as at the end of the Period immediately following the date; and

B is the sum of the amounts receivable by the holder or payable by the issuer at the end of the Period immediately following the date; and

C is the sum of the amounts payable by the holder or receivable by the issuer at the end of the Period immediately following the date; and

D is

(a) Where an amount is payable at the end of the Period immediately following the date is the last amount payable under the financial arrangement, an amount calculated according to the following formula:

$$= 1 + \frac{F \times T1}{T2}$$

(b) In any other case, an amount calculated according to the following formula:

$$\frac{T1}{T2}$$
$$(1 + F) \quad ; \text{ and}$$

F means an amount calculated according to the following formula:

$$\frac{R}{100 \times N} \; ; \text{ and}$$

R is the Specified Discount Rate; and

T1 is the number of days in the Period immediately following the date calculated on a 365 day basis; and

T2 is the sum of T1 and—

(i) where an amount is payable on the date, zero; or

(ii) In any other case, the number of days between the preceding due date and the date calculated on a 365 day basis.

7 Example

1. Example A

(a) This example illustrates Method A, using the same example as in Determination G3: Yield to Maturity Method (except for the dates) and Determination G11A: Present Value Based Yield to Maturity Method, Example A. The example shows

that the present value at the beginning of a Period is the same as the principal outstanding during the Period.

On 12 March 1991 (the Specified Date) a holder acquires for $1,012,500 the right to receive the following income—

15 May 1991	$ 70,000
15 November 1991	$ 70,000
15 May 1992	$ 70,000
15 November 1992	$1,070,000

The greatest common divisor of all Periods except the first is 6 months, so that N = 2; in the first (broken) Period ending on 15 May 1991

$$N = \frac{365}{64} = 5.703125$$

The Specified Discount Rate R is 16.2308% per annum, which in this case is also the yield to maturity as is verified in the schedule below.

Therefore F = 0.028459 in the Period ending 15/5/1991 and 0.081154 in all the remaining Periods.

(b) The following schedule may then be constructed, starting at the bottom and working up:—

Period Ending	Present Value at Beginning	Payments by Issuer	Payments by Holder	Present Value at End
		B	C	A
15/5/91	1,012,500	70,000	—	971,315
15/11/91	971,315	70,000	—	980,141
15/5/92	980,141	70,000	—	989,683
15/11/92	989,683	1,070,000	—	—

The present value at the beginning of the first Period is the same as the acquisition price, verifying that the Specified Discount Rate is equal to the yield to maturity for this particular transaction. Note that this will often **not** be the case.

2. **Example B**

(a) This example illustrates Method B, using the same example as in Determination G3: Yield to Maturity Method (except for the dates) and Determination G11B: Present Value Based Yield to Maturity Method, Example B.

On 12 March 1991 (the Specified Date) a holder acquires for $1,012,500 the right to receive the following income—

15 May 1991	$ 70,000
15 November 1991	$ 70,000
15 May 1992	$ 70,000
15 November 1992	$1,070,000

All amounts are expressed in New Zealand dollars.

Amounts are payable at regular halfyearly intervals, so that N = 2 and the preceding due date is 6 months prior to 15 May 1991, namely 15 November 1990.

Also, T1 = T2 except for the first (broken) Period ending on 15 May 1991 for which

T1 = 15/5/91 — 12/3/91 = 64 days, and

T2 = 64 days + 12/3/91 — 15/11/90 = 181 days.

The Specified Discount Rate R is 16.265% per annum, derived in Example B of Determination G11A: Present Value Based Yield to Maturity Methods.

Therefore F = 0.081325, and
D = 1.028032 in the [period] ending 15/5/91 (that being (1 + F) to the power of 64/181) and 1.081325 in all the remaining Periods.

(b) The following schedule may then be constructed, starting at the bottom and working up:—

Period Ending	Present Value at Beginning	Payments by Issuer	Payments by Holder	Present Value at End
		B	C	A
15/5/91	1,012,500	70,000	—	970,884
15/11/91	970,884	70,000	—	979,841
15/5/92	979,841	70,000	—	989,527
15/11/92	989,527	1,070,000	—	—

(See footnote to this Example B for details of the present value calculations using the HP-12C calculator.)

The present value at the beginning of the first Period is the same as the acquisition price, verifying that the Specified Discount Rate is equal to the yield to maturity for this transaction.

Footnote: Calculating the present values

The "Present Values at Beginning" shown in the schedule may be calculated on an, HP12C or equivalent calculator, directly using the BOND PRICE function. The following steps reproduce the value at 15 November 1991 for example:

Specified Discount Rate	16.265	(i)
Coupon % pa	14	(PMT)
Value date	15.111987	(ENTER)
Maturity date	15.111988	(f) (PRICE)
		97.984116
Add accrued interest	(zero)	(+)
		97.984116

which is the per $100 nominal price corresponding to $979,841.

3. **Example C**

(a) This illustrates the calculations involved in applying Method A to a straightforward perpetual security. The perpetual has a face value of 100, a yearly coupon of 10% payable half yearly, and was issued at 78.00 on 1 August 1991. This issuer is a New Zealand resident taxpayer with a 30 June balance date. The Specified Discount Rate, R, corresponding to this issue price is 12.82% p.a., derived in Example C of Determination G11A: Present Value Based Yield to Maturity Method.

$$\text{Therefore } F = 12.82/(100 \times N)$$
$$= 0.06410$$

in all periods, since N = 2.

(b) At any payment date the formula (i) for Method A applies, and the present value is

$$E/F = 5/0.06410$$
$$= 78.00$$

4. **Example D**

(a) This example illustrates the application of Method A to a more complicated perpetual note than in Example C. The note was issued at 90.00 on 1 February 1991. It has a nominal capital of 100, and has coupon interest at 14% p.a. commencing 1 August 1993 and payable halfyearly thereafter on 1 February and 1 August each year in perpetuity. The nominal capital is repayable only if the issuer defaults on an interest payment. The issuer is a New Zealand resident taxpayer with a 30 June balance date. The Specified Discount Rate, R, corresponding to this issue price is 12.261% p.a., derived in Example D of Determination G11A: Present Value Based Yield to Maturity Method.

$$\text{Therefore } F = 12.261/(100 \times N)$$
$$= 0.061305$$

in all periods, since N = 2.

(b) The following schedule may then be constructed, starting in any period commencing on or after 1 February 1993:

Period Ending	Present Value at Beginning	Payments by Issuer	Payments by Holder	Present Value at End
		B or E*	C	A
1/8/91	90.00	—	—	95.52
1/2/92	95.52	—	—	101.37
1/8/92	101.37	—	—	107.58
1/2/93	107.58(2)	—	—	114.18
1/8/93	114.18(1)	7.0	—	114.18
1/2/94	114.18	7.0	—	114.18
1/8/94	114.18	7.0	—	114.18
.....	.....	...	.	.....

*B for periods ending prior to 1/8/93 during which formula (ii) applies; E thereafter when formula (i) applies.

(1) E = 7, F = 0.61305, E/F = 114.18

(2) A = 114.18, B = 0, C = 0, F = 0.061305

$$\frac{A + B - C}{1 + F} = 107.58$$

About this document

General determinations set out the Commissioner's view on how the financial arrangements rules apply to a specific type of financial arrangement. All general determinations are binding on the Commissioner and some are also binding on taxpayers.