Calculator practice problems

The approved calculator for the CPA Preparatory Courses is the BAII Plus calculator.

Being efficient in using your calculator is essential for success in the Preparatory Courses. One of the most important calculations that you will do is calculate the ‘Time Value of Money’. Below are some sample problems on different calculations used to calculate the ‘Time Value of Money’. It is recommended that you practice these and compare your answers to the solutions provided in order to ensure you are ready for Prep.

Time value of money
The premise of the time value of money (TVM) is that a dollar that you have today is worth more than the value of a dollar in the future. Money that you hold today is worth more because you can invest it and earn interest. Given that many financial liabilities are measured at the present value of the future cash flow stream, it is important to have a working knowledge of TVM.

Interest
Interest is the money paid by a borrower to a lender for the use of the lender’s money over a certain period of time. The sum of money borrowed or loaned is called the principal. The rate of interest is the amount charged for the use of the principal over that given period of time. Interest rates are normally quoted as a nominal (for example, ignoring compounding effects) annual rate.

Compound interest
Compounding is when interest is calculated on the outstanding principal plus accumulated unpaid interest, rather than just the principal balance.
Present value of a lump sum
A question that often arises is what is the present value (now) of $3,500 to be paid in three years' time? Expressed differently, what amount would I have to pay today that would make me indifferent between paying that amount today or paying $3,500 three years from now?

This process of calculating the present value of amounts to be paid (or received) at future dates is known as discounting and the rate of interest is known as the discount rate. The discount rate is based on market discount rates, opportunity cost rate (the interest rate that would be earned under another use for the funds) or the entity's internal rate of return.

Example 1
John has a $15,000, 0% loan due in five-year's time. The market rate of interest for this type of obligation is 8%. What is the present value of John's obligation?

Solution to Example 1
N = 5; FV = $15,000; I = 8; CPT PV = –$10,209 (rounded)

Present value of an annuity
An annuity is a series of payments of the same amount paid at regular intervals. A regular annuity is one in which the payments are received at the end of each period. An annuity due is one in which payments are received at the beginning of the period. Unless explicitly stated otherwise, payments are assumed to be paid at the end of the period.

To calculate the present value of an annuity, due you need to set the mode to BGN (beginning of period) on your financial calculator.

Example 2 (regular annuity)
Tony is required to make payments of $3,333 per year on a loan for the next four years. The market rate of interest for this type of obligation is 5%. What is the present value of the obligation?

Solution to Example 2
N = 4; PMT = $3,333; I = 5; CPT PV = –$11,819 (rounded)
Example 3 (annuity due)
You are buying a new vehicle and are trying to determine whether to lease the vehicle over five years or to pay cash today. The salesperson has offered a cash price of $23,000 or a five-year lease with payments of $300/month, with the first payment due at the signing of the lease and a buyout of $9,500 at the end of five years. Because the first payment is made at the start of the lease, the lease will require 59 additional equal payments at the beginning of each month to cover the 60-month or five-year lease period. The buyout will occur at the end of the lease after the 60-month lease period is concluded. Which is the better offer, assuming the rate on loans for new vehicles is 6% per year compounded monthly?

Solution to Example 3
Because the payments are made monthly, you need to calculate a monthly interest rate to coincide with these payments.

Monthly rate = 6% / 12 months = 0.5% per month

There are also two different types of payments: the monthly annuity and the lump-sum buyout in five years.

\[ \text{BGN; N = 60; I = 0.5; FV = $9,500; PMT = $300; CPT PV = \$22,638 (rounded)} \]

Therefore, the lease is a better deal since the PV of the lease is less than the cash price.

Calculating the payment on a loan
The financial calculator can be used to determine the required payment for a given loan amount, term and interest rate.

Example 4
Davinder has borrowed $10,000 repayable annually over five years, including interest at 12% per annum. What is the required annual payment?

Solution to Example 4
\[ \text{N = 5; I = 12; PV = \$10,000; CPT PMT = \$2,774 (rounded)} \]
Perpetuities
A perpetuity is a special case of an annuity where the contract runs forever (that is, there is no end to the payments). This may seem like a strange concept, but there are some government securities that are undated and it is unlikely that the principal on these securities will be repaid. Also, the dividends on preferred shares are often thought of as a perpetuity as there is no maturity date on the shares. The formula to determine the value of a perpetuity $P$ with an annual payment $C$ and an interest rate of $r\%$ is $P = \frac{C}{r\%}$

Example 5
Your company sells a bond that pays $1,000 interest per annum in perpetuity. The market rate of interest for this type of obligation is 9%. What amount will you be able to sell the bond to an investor for?

Solution to Example 5
$P = \frac{C}{r\%} = \frac{1,000}{0.09} = 11,111$ (rounded)

Bond valuation
When bonds are issued, there is a contract attached to them that details the important aspects of the bonds, such as the par value (face or maturity value), coupon rate, payment dates, maturity date and principal payment. This contract is called the bond indenture. Often, bonds also have a security attached to them that may be seized in the event of default. If bonds are issued with no security attached, they are called debentures. Note that the coupon rate is the actual rate of interest paid on the bond.

The price of a bond can be determined by discounting the future cash flows associated with the bond using the appropriate discount rate (market rate). There are two cash flows associated with a bond — the periodic payments of interest (the coupons) and the lump sum at maturity (the face value) — so the price of the bond is the sum of the present value of the interest payments (an annuity) and the present value of the maturity amount (a lump sum). Financial calculators allow you to calculate the sum of these values simultaneously.

Example 6
Determine the price of a $1,000, 5% (coupon rate) bond that pays interest semi-annually and matures in five years, assuming a market rate of 6%.

Solution to Example 6
$N = 10 \times 2; I = 3 \times 2; FV = 1,000; PMT = 25 \times 1,000 \times 5\% \times 2; PV = -957$ (rounded)
In the preceding example, because the market was demanding a higher interest rate than that offered on the bond, the price of the bond fell below its par value and the bonds sold at a discount. If the market rate had been lower than the coupon rate, the price of the bonds would have been higher than the par value and the bonds would have sold at a premium. It follows that if interest rates increase, then the price of bonds will decrease and vice versa.

**Interest rate conventions**

In Canada, by established convention, the method used to calculate interest expense depends to some degree on the nature of the financial instrument. For example, interest expense on bonds payable and finance leases is usually calculated based on the number of months outstanding without regard to the number of days in each month.

The method used to calculate interest expense on notes payable also depends on their nature. If the term note includes a set payment amount that includes principal and interest (for example, bonds and leases), interest expense is usually calculated based on the number of months outstanding. However, if the note is repayable on a principal-plus-interest basis or does not include an established repayment schedule, interest expense is calculated on a daily basis.

**Calculating interest based on number of days**

When interest is calculated on a daily basis, you include the day that the money was borrowed but not the day that it was paid off. Note, however, that when you are accruing interest, you include the last day of the month because the loan is still outstanding. An easy way to remember this is to think of whether the money was owed at midnight. If yes, include that day; if no, exclude that day.

**Notes issued at a discount**

The net book value (NBV) of a liability is referred to in the governing standards as amortized cost.

- Interest expense for the period = amortized cost$^1 \times$ market rate of interest $\times$ #days/365.
- Debit interest expense, credit notes payable.
- At maturity, the discount will have been amortized and the amortized cost = the face value (maturity value) of the note.
- Debit notes payable, credit cash.

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$^1$ You need to remain aware of the compounding frequency specified in the note. Amortized cost is only updated for determining interest expense when the interest is compounded in accordance with the terms of the note, rather than simply accrued for bookkeeping purposes.
Example 7
On June 15, 20X5, Fencing Superstore Inc. (FSI) issued a $100,000 interest-free note to a supplier in exchange for inventory. The note is repayable in full on June 15, 20X6. The fair market value of the inventory approximates the fair value of the note. The market rate of interest for similar transactions is 5%. FSI’s year end is December 31. FSI only accrues interest at year end.

Required:

a) Prepare the journal entry to record the issuance of the note.

b) Prepare the journal entry to accrue interest expense on the note at year end.

c) Prepare the journal entry to accrue interest expense and derecognize the note at maturity.

Solution to example 7

a) June 15, 20X5
DR Inventory 95,238
CR Notes payable 95,238
FV = $100,000; N = 1; I = 5; CPT PV = -$95,238 (rounded)

b) December 31, 20X5
DR Interest expense 2,609
CR Notes payable 2,609

June, 16 days + July, 31 days + August, 31 days + September, 30 days + October, 31 days + November, 30 days + December, 31 days = 200 days. Include the day borrowed.

$95,238 × 0.05 × 200/365 = $2,609 (rounded)

c) June 15, 20X6
DR Interest expense 2,153
CR Notes payable 2,153
DR Notes payable 100,000
CR Cash 100,000

January, 31 days + February, 28 days + March, 31 days + April, 30 days + May, 31 days + June, 14 days = 165 days. Exclude the day paid off.

$95,238 × 0.05 × 165/365 = $2,153 (rounded). Amortized cost is not updated because interest was simply accrued for bookkeeping purposes.