Applications of PV&FV:

A retail firm wishes to decide which of the two expansion options to go for: should it upgrade the retail store by moving to a wonderful new premises, or should it concentrate on staff training and on-line sales? The present value (of predicted funds in and out) over the lives of each project contributes to the decision.

A state government is considering borrowing money to expand an East-West road network over several years, with repayments over many years. Does the return, as measured by better driving conditions for some motorists, justify the cost of borrowing and construction? PV&FV analysis play a part in this.

When interest rates drop, many firms will give the “green light” to projects which had previously not been feasible under higher interest rates. Capital projects like mine expansion, planting new crops or forests, acquiring a neighbouring vineyard. The analysis to assist decision-makers involves PV&FV analysis.

The concepts of PV (present value) and FV (future value) are key to understanding any Finance subject. They are based on the concept of money having a cost (the cost being the interest rate which has to be paid, or could be expected if you invested elsewhere). And that cost depends on the time in which the money is being used, as well as what lenders may want for the use of their money, the interest rate.

It is noted that some methods of finance do not explicitly use an interest rate, as in Islamic Finance. In such methods of finance, a proxy or substitute cost may be used.

The basic formula used is, for an amount PV and future value of that amount FV

\[ FV = PV/(1+i)^N \]

Where FV = future value, i is the interest rate expressed as a decimal (example 6%, i=.06) and N is the number of time periods. Note: 6% p.a. can be 3% if paid every half-year (6mths) if that is the frequency of payment.

**METHOD BY EXAMPLE**

**WORKED EXAMPLE.** When there are multiple payments and multiple flows of income, the same formula applies to each payment and income, and a spreadsheet or programmable calculator is recommended.

Say you are thinking of paying an amount for the promise to be paid $1000 in 3 years (a $1000 bond), while giving you a coupon (income) of 5% p.a. every 6 months. During that time the expected interest rate is actually 6%.

**What is its PV of your investment? And therefore how much are you prepared to pay for this bond?**

Note the difference in the application of the two interest rates, as well as the N periods, plus how to use the discount factor.

PV = unknown, i = .03 per 6-mths, N=6 (3 years is 6 * 6 months). Coupon income 5%p.a./2 = 2.5% per 6-months, that 6% of $1000 = $25

<table>
<thead>
<tr>
<th>Basis of calculated discount factor</th>
<th>Calculated discount factor</th>
<th>Nett cash multiplied by discount factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>[1/(1+.03)^N]</td>
<td>1.000</td>
<td>unknown</td>
</tr>
<tr>
<td>1</td>
<td>0.971</td>
<td>$24.27</td>
</tr>
<tr>
<td>2</td>
<td>0.943</td>
<td>$23.56</td>
</tr>
<tr>
<td>3</td>
<td>0.915</td>
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<tr>
<td>4</td>
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<tr>
<td>5</td>
<td>0.863</td>
<td>$21.57</td>
</tr>
<tr>
<td>6</td>
<td>0.837</td>
<td>$20.84</td>
</tr>
</tbody>
</table>

So The present value PV of what you pay, with coupon income planned, is $972.91.

This becomes the maximum price you are willing to pay for the bond, if you are rational!

$ 972.91

See over for hints on how to use this table for many problems.
FINANCE: PRESENT and FUTURE VALUES

HINTS TO REPRODUCE THE TABLE ABOVE, AND FOR USING IT AS A MODEL (basis for other problems):

- Put $ signs in front of any money items. This keeps things clear, saves some confusion.
- Discount factors are not money items, they are just numbers. Don’t use $ signs. Again clarity.
- *Know and love your %’s and their decimal equivalents!* (5% = .05, not 0.50). It helps “get it right”.
- The “^” symbol is the power symbol. (Powers are sometimes called indices, indexes, exponents)
- Put a *negative* in front of money *out* and a positive in front of money in.
- Nett Cash, on this basis, is the sum of money out (negative) and money in (positive).
- Calculate the discount factors line by line. They should get smaller as N increases.
- You multiply the nett cash in each row (each time period) by the calculated discount factor to produce the discounted cash flow for that time period. It is the PV present value of that period’s cash flow. The discounted cash flow should always be less than or equal to the nett cash flow of that row.
- You add up all the discounted cash flows to produce the total Nett Present Value NPV of the project (/option/ plan/ whatever you wish to call it).

ACTIVITIES

The following guide is highly-recommended:

Videos:

Mark McCracken’s video is recommended. Put it on pause at times and try the calculations he does using your own calculator. Consider pausing it often. It can be found here:
https://www.youtube.com/watch?v=BXm5mZqMp6Y

There are also six Mr Patrick videos here:
http://patrickjmt.com/deriving-the-annual-compound-interest-formula/