

3 Compound Interest: Present Value

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Math 11/12: Financial Literacy

Day 3: Compound Interest: Present Value

COMPOUND INTEREST: The interest that is earned on both the principal and accumulated interest.

This formula gives the **FUTURE VALUE** of your investment (the Principal + Compound Interest):

The Compound Interest Formula

$$FV = P \left(1 + \frac{r}{n} \right)^{nt}$$

Amount (FV) = Principal (P) + Compound Interest

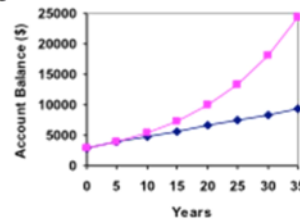
Interest Rate (decimal) (r)

Time (t)

Principal or present value (P)

Number of times interest is compounded per unit 't' (n)

the calculatorsite.com



This formula gives just the interest:

$$I = FV - PV$$

PRESENT VALUE (PV): The amount that must be invested NOW to result in a specific future value. (It is just the **PRINCIPAL, P!**)

Example 1: What is the present value of \$5,860.13 if it was invested at 3.2%, compounded semi-annually for 5 years?

PV = ?

FV = 5,860.13

r = 3.2% = 0.032

n = 2

t = 5 years

FV = PV $\left(1 + \frac{r}{n} \right)^{nt}$

5,860.13 = PV $\left(1 + \frac{0.032}{2} \right)^{(2)(5)}$

5,860.13 = PV $(1.016)^{10}$

$(1.016)^{10}$

$(1.016)^{10}$

Calculator: $1.016 \times 1.016 \times \dots \times 1.016 = 1.1720255$

$5,860.13 \div 1.1720255 = \text{Ans}$

PV = \$5,000.00

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Example 2: Sammy is 18 years old. They inherited some money from an aunt. They want to invest the money to be able to buy a condo in Burnaby when they turn 30. They estimate needing about \$600,000 to buy a condo. How much do they need to invest now, at 6.5% compounded annually? (i.e., what is the present value?)



$$\begin{aligned} FV &= 600,000 \\ PV &= ? \\ r &= 6.5\% = 0.065 \\ n &= 1 \\ t &= 30 - 18 = 12 \text{ year} \end{aligned}$$

$$\begin{aligned} FV &= PV \left(1 + \frac{r}{n}\right)^{nt} \\ 600,000 &= PV \left(1 + \frac{0.065}{1}\right)^{1(12)} \\ 600,000 &= PV (1.065)^{12} \\ \frac{600,000}{(1.065)^{12}} &= \frac{600,000}{(1.065)^{12}} \\ PV &= \$281,809.7126 \\ &= \$281,809.71 \end{aligned}$$

Example 3: Laura invested \$15,500 in a Registered Education Savings Plan (RESP). She wants her investment to grow to at least \$50,000 by the time her baby enters university, in 18 years.

a) What interest rate, compounded annually, will result in a future value of \$50,000? Round your interest rate to 2 decimal places.



$$\begin{aligned} FV &= 50,000 \\ PV &= 15,500 \\ r &= ? \\ n &= 1 \\ t &= 18 \text{ years} \end{aligned}$$

$$\begin{aligned} FV &= PV \left(1 + \frac{r}{n}\right)^{nt} \\ 50,000 &= 15,500 \left(1 + \frac{r}{1}\right)^{(1)(18)} \\ \frac{50,000}{15,500} &= \frac{15,500}{15,500} (1+r)^{18} \end{aligned}$$

$$3.225806452 = (1+r)^{18}$$

b) Suppose Laura wants her \$15,500 to grow to at least \$60,000 at the interest rate from a). How long will it take?!

Calculator: $18 \text{ shift } x^y 3.225806452 =$

$$\begin{aligned} 1.067229 &= 1+r \\ -1 & \quad -1 \\ 0.067229 &= r \\ \text{Multiply by 100 to get } \% & \\ \Rightarrow r &= 6.72\% \end{aligned}$$

Boards: #4, 7

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