

Compound Interest Future Value and Present Value

Learning goals - understanding and using the
compound interest formula

In your groups

- answer the question
- use the board to **show all your work**

DO NOT use formulas from the last unit.

Jason got \$5000 from his grandparents.
He is going to invest it in a Canada Savings
Bonds. The bonds will give him 5%
interest every year. How much money is
he going to have at the end of 10 years.

7500 or 8144.47

Which solution is right?

Both

Which kind of investment would you rather have? Explain.

Simple - only use the principal

Compound - use principal + interest
- more money long run

Principal - amount of money borrowed / lent / invested

Interest - money paid by borrower OR to an investor for the use of money

Loan - you pay interest on it

Investment - you earn interest on it

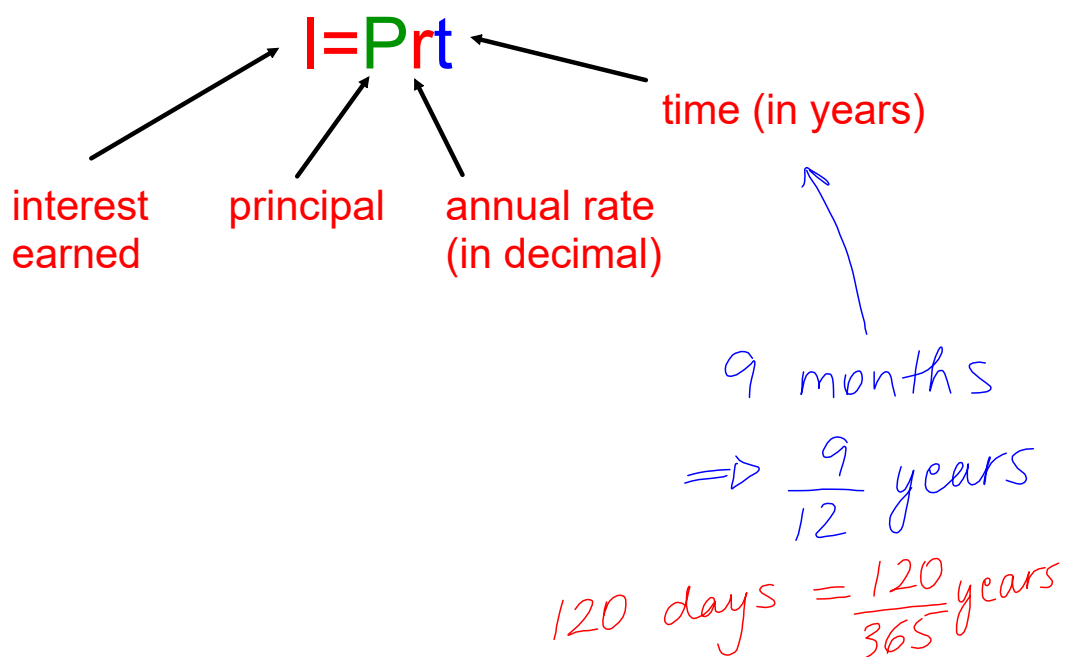
Simple interest

- interest is earned on the initial principal

Compound Interest

- interest is earned on the principal and on the interest already earned

Simple Interest



Compound Interest

- money is **deposited** into account
- makes **interest**
- interest gets calculated on the **principle** and **interest**

Future Value - total amount after a certain period

$$A = P(1+i)^n$$

amount in the future → A
 principle → P
 interest rate/compounding period → i
 number of compounding periods → n

↑
 How many
 time interest
 is calculated
 in 1 year

Compounding Period

- annually	1
- semi-annually	2
- monthly	12
- bi-weekly	26
- weekly	52
- daily	365

ex. Brigitta invests \$5000 at 2% compounded monthly.
How much money will she have 5 years later?

$$\begin{aligned}
 A &= P(1+i)^n \\
 &= 5000 \left(1 + \frac{0.02}{12}\right)^{5(12)} \\
 &= 5000 (1.0016)^{60} \\
 &= 5000 (1.105) \\
 &= 5525.39
 \end{aligned}$$

∴ She will have \$5525.39

Present Value

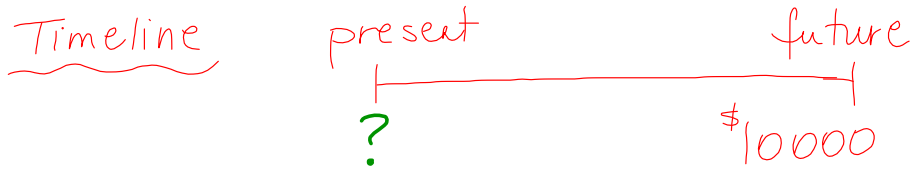
- the amount of money that would have to be invested now to get a specific value in the future

To get **present value** formula we must rearrange **compound interest** formula.

$$\begin{array}{ccc}
 \text{future} \rightarrow & A = P(1+i)^n & \leftarrow \text{today} \\
 & \searrow & \nearrow \\
 & & \frac{A}{(1+i)^n} = P \\
 & \nearrow & \searrow \\
 & A(1+i)^{-n} = PV &
 \end{array}$$

Mason wants to buy a car for \$10000 at the end of high school (2 years from now). He puts his money into the bank at 3% interest compounded semi-annually.

How much money does he need to put in today to have enough money for the car?



$$\begin{aligned}
 PV &= A(1+i)^{-n} \\
 &= 10000 \left(1 + \frac{0.03}{2}\right)^{-2(2)} \\
 &= 9421.84
 \end{aligned}$$

← semi-annually

∴ He needs to invest \$9421.84

On the Boards...

Nathan borrows \$2000 at 8% compounded semi-annually for 3 years.

How much will he have to pay back at the end?

Hint: Draw a timeline

$$\begin{aligned}
 A &= P(1+i)^n \\
 &= 2000 \left(1 + \frac{0.08}{2}\right)^{3(2)} \\
 &= 2530.63
 \end{aligned}$$

∴ He pays back \$2530.63

Justin wants to have \$5000 in 3 years. He can put money into the bank at 2% compounded monthly.

How much money does he need to put in today so he can have the \$5000?

Hint: Draw a timeline

$$\begin{aligned}PV &= A(1+i)^{-n} \\ &= 5000\left(1 + \frac{0.02}{12}\right)^{-3(12)} \\ &= 4709.06 \\ \therefore \text{He needs to invest } &\$4709.06\end{aligned}$$

ex. Joe invests \$5000 at 2% compounded monthly.
How much money will he have 5 years later?

Hint: Draw a timeline

$$\begin{aligned}A &= 5000\left(1 + \frac{0.02}{12}\right)^{5(12)} \\ &= 5525.39 \\ \therefore \text{He will have } &\$5525.39\end{aligned}$$

Joe invested \$3000 at 5% interest for 4 years.

a. How much interest will he earn?

Hint: Do you see the word "compounded"?

$$\begin{aligned} I &= Prt \\ &= 3000(0.05)(4) \\ &= 600 \end{aligned}$$

∴ He will earn \$600

Kate invested \$5000 at 2.5% interest for 9 months.

a. How much interest will she earn?

b. How much money will she have at the end of 9 months?

Hint: Do you see the word compounded?

$$\begin{aligned} \text{a.) } I &= Prt \\ &= 5000(0.025)\left(\frac{9}{12}\right) \\ &= 93.75 \end{aligned}$$

$$\begin{aligned} \text{b.) } &5000 + 93.75 \\ &= 5093.75 \end{aligned}$$

Seatwork

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