

### 3.7 Interest & Borrowing



#### Simple Interest

- Interest is paid on the original amount only.
- The value increases by the same amount each time period.

Ex. 1 \$5000 is borrowed with a simple interest rate of 9%/year.

a) Complete the table to show the total amount owed after 5 years.

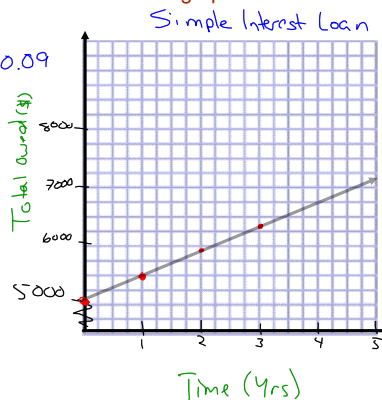
Time (years)	Total Owed (\$)
0	5000
1	5450
2	5900
3	6350
4	6800
5	7250

Interest  
 $5000 \times 0.09 = 450$

$5000 \times 0.09 = 450$

$+450$   
 $+450$

b) Display the information from your table on a graph.



c) How much total interest is charged after 5 years?

Total =  $7250 - 5000 = 2250$

or Total =  $450 \cdot 5 = 2250$

∴ The total interest was \$2250

d) Write an equation to model the total owed after t years.

$A = 5000 + 450t$

e) Use the equation to determine how much is owed after 12 years.

$A = 5000 + 450(12) = 10400$

∴ We would \$10400 after 12 years

f) Does simple interest represent a linear or non-linear relationship? How do you know?

Simple = Linear

① Table of values:

→ Adding / subtracting same amount

② Graph:

→ Straight line

③ Equation:

→ If adding / subtracting our original amount, is LINEAR

$y = 5000 + 450t$

**Compound Interest**

- Interest is paid on the current balance.
- The amount of interest paid increases each time period.

Ex. 2 <sup>2000</sup>~~10000~~ is deposited into an account paying 7.5%/month compounded monthly.  $7.5\% \div 100\% = 0.075$

a) Complete the table to show the account balance after 8 months.

Time (months)	Account Balance (\$)
0	2000
1	2150
2	2311.25
3	2484.59
4	2670.99
5	2871.26
6	3086.61
7	3318.10
8	3566.96

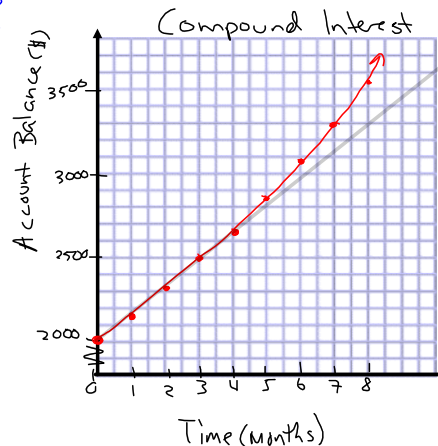
$100\% + 7.5\% = 107.5\%$   
 $\div 100 = 1.075$

$\times 1.075$   
 $\times 1.075$

$150 <$   
 $161.25 <$   
 $\vdots$

Non-linear

b) Display the information from your table on a graph.



c) What is the account balance after 8 months?

\$3566.96

d) How much interest was earned <sup>as of</sup> month 5?

$$\text{Interest} = 2871.26 - 2000 = 871.26$$

e) How much total interest was earned in the first 8 months?

$$\text{Interest} = 3566.96 - 2000 = 1566.96$$

f) Write an equation to show the account balance after t months.

$$A = 2000 \cdot (1.075)^t$$

g) Use the equation to determine how much money is in the account after a year.

$$A = 2000 \cdot (1.075)^{12} \quad \text{A year! } t=12$$

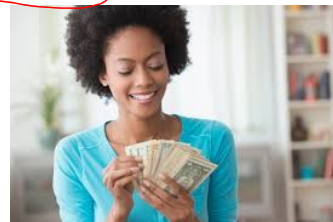
$$= 2000 (1.075)^{12}$$

$$= 4763.96 \quad \therefore \text{You would have } \$4763.96$$

after a year

h) Does compound interest represent a linear or non-linear relationship? How do you know?

- ① Graph  $\rightarrow$  Curve
- ② Table of Values  $\rightarrow$  Multiplying
- ③ Equation  $\rightarrow$  Multiplying



Formulas & Definitions

**Simple Interest**

$A = P + Prt$

Annotations: *Ampl. you start with* (pointing to P), *principal (initial value)* (pointing to P), *time (# of years)* (pointing to t), *rate as a decimal* (pointing to r), *amount after time t* (pointing to A).

ex.  $A = 2000 + 20t$


*The amt it goes up or down.*

**Compound Interest**

$A = P(1+r)^t$

Annotations: *principal (initial value)* (pointing to P), *# of time periods* (pointing to t), *rate per time period (as a decimal)* (pointing to r), *Growth factor* (pointing to  $(1+r)$ ), *amount after time t* (pointing to A).

- Down Payment**
- an amount paid at the time of purchase.
  - no interest is charged on the down payment.
  - reduces the amount that needs to be borrowed.

- Mortgage**
- a loan used to purchase a house
  - if regular payments are not made the bank can take over possession of the home
  - usually taken out for 20-25 years in Canada
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Ex. 3 Rhea borrowed \$6500 from their parents for their first year tuition. They will pay the money back at the end of 4 years paying 6% simple interest per year. Calculate how much money Rhea will need to pay back at the end of 4 years.



*Given*

$P = 6500$   
 $r = 6\% = 0.06$   
 $t = 4$

$A = P + Prt$   
 $= 6500 + 6500(0.06)(4)$   
 $= 6500 + 1560$   
 $= 8060$

$\therefore$  Rhea has to pay back \$8060.

Ex. 4 Matt buys a used car for \$12000. He makes a down payment of \$3500 and makes a bank loan for the balance. He agrees to pay the loan back after 5 years and is charged 8.5% per year compounded yearly. Calculate how much Matt owes at the end of 5 years.

*Given*

$P = 8500$   
 $i = 8.5\% = 0.085$   
 $t = 5$

$Loan = 12000 - 3500 = 8500$

$A = P(1+i)^t$   
 $= 8500(1.085)^5$   
 $= 12781.02$

$\therefore$  Matt owes \$12781.02

*or*  
 $(1+0.085)$   
 $(1.085)$

$\frac{100\%}{+ 8.5\%}$   
 $\hline 108.5\%$   
 Decimal = 1.085

