Simple and Compound Interest

INTEREST

WHAT — THE COST OF USING SOMBODY ELSE'S MONEY

LOAN — 100 $ → % OVER TIME = 150 $

BANK

50 $ = INTEREST

USES

GOOD = MAKE MONEY

1,000 $

SAVINGS ACCOUNT
+
1-2 % INTEREST
=
1,020 $ AFTER YEAR

MONEY GROWS OVER TIME
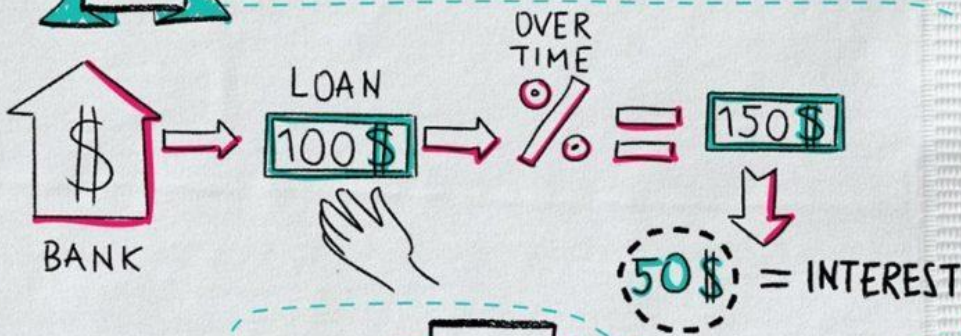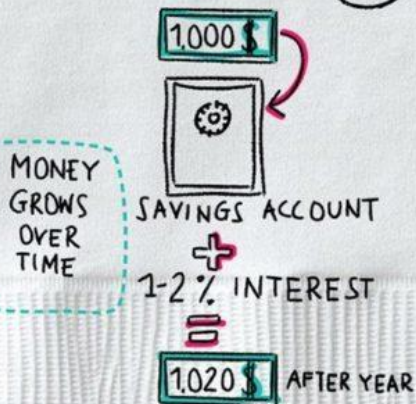
BAD = OWE MORE MONEY THAN BORROWED

2,000 $ CREDIT
=
PAY BACK MORE THAN YOU BORROWED

OVERDUE !

+20% INTEREST
=
3,300 $ TO PAY BACK
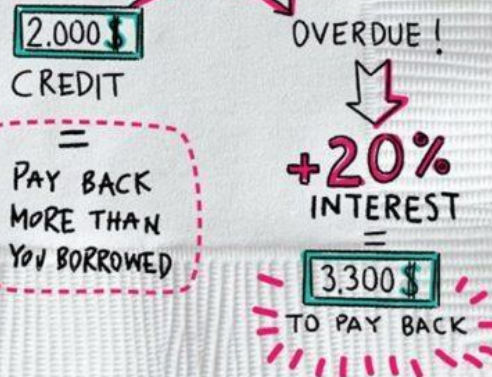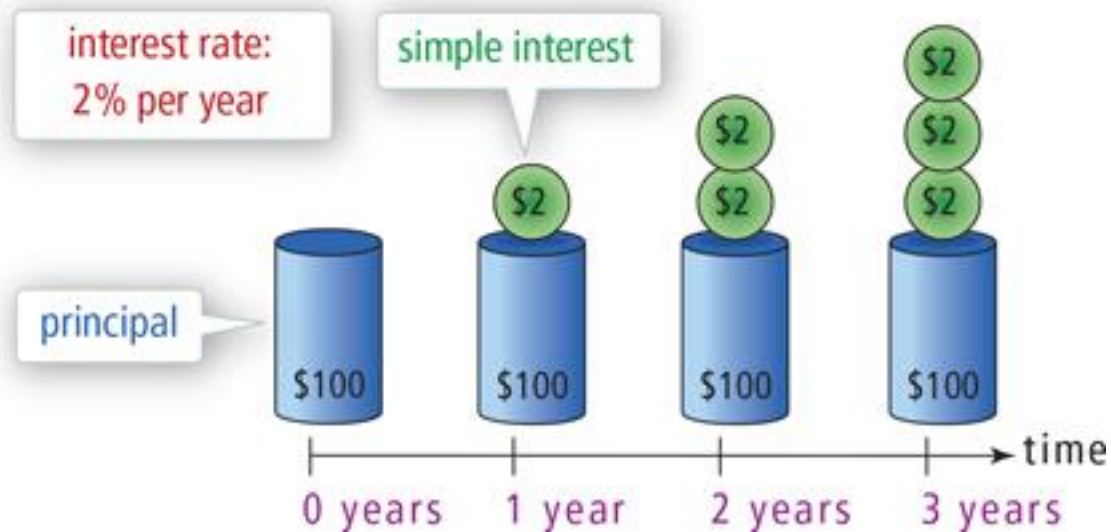
Simple interest

FORMULA

- Simple Interest:
- $SI= \dfrac{P* R* N}{100}$ Where,

P= Principal Amount (Rupees)

R= Rate of Interest (per cent per annum) (p.c.p.a)

N= No. of period (Years)

SI= Simple Interest (Rupees)

Que1. A person borrows $50000 for 5 years. What is the rate of simple interest charged if the person had to pay $66000 ?

Que2. After how many years would a sum doubles itself at 10% rate of simple interest ?

Que3. At a certain rate of simple interest a sum becomes three times in 15 years . In how many years will the sum become 9 times ?

Que4. A certain sum of money amounts to 7/4 times of itself in 3 years at simple interest. Find the rate percent per annum ?

Que5. If $460 amounts to $640 in 6 years at simple interest, what will it amounts to in 2 years at the same rate ?

Que6. A certain sum was put at certain rate at SI for 3 years. Had it been put at 2% higher rate , it would have fetched $360 more. Find the sum ?

Simple Interest	Compound Interest
1. In simple interest, interest for all years is same.	1. In compound interest, interest for all years is different.
2. SI is smaller than CI	2. CI is larger than SI
3. Formula is $$\text{Interest} = \frac{P \times R \times T}{100}$$	3. Formula is $$\text{Amount} = P\left(1 + \frac{R}{100}\right)^{n}$$
4. Interest is on Principal amount only.	4. Interest is on previous interest as well as the principal amount.

Compound Interest
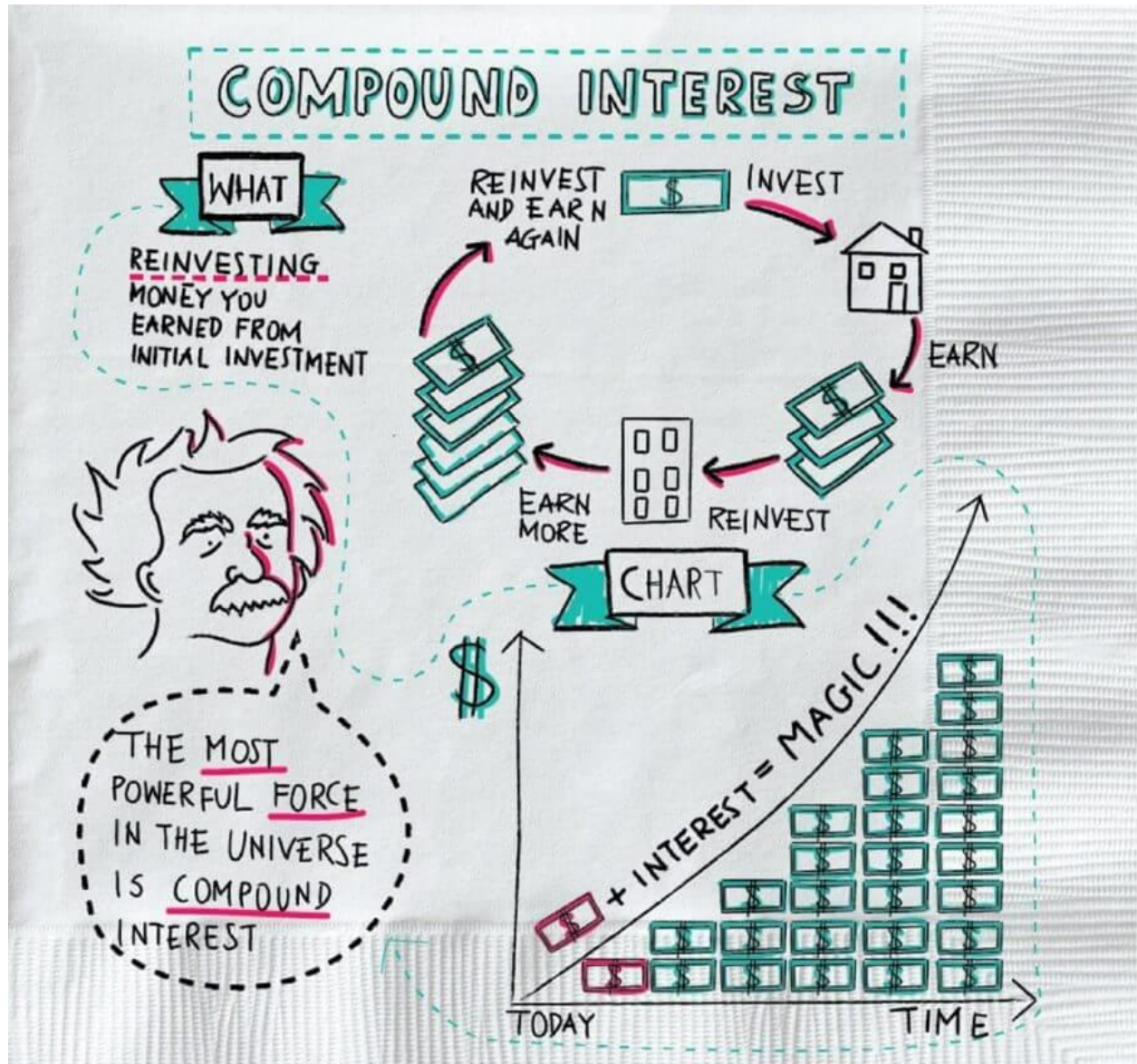
Que7. A bank charges a rate of 10% compounded annually . What is the total amount to be paid on a loan of $36000 for 2 years?

Explanation

Compound Interest
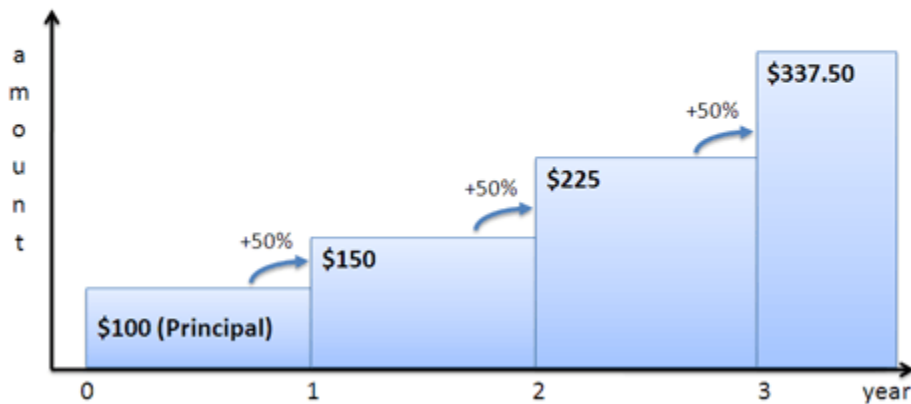
Note: Amount and compound interest increases at the same rate every year which is equal to Rate (R).

Que8. If the ratio of CI in the 7th and 8th year is 10:11, then find the rate of interest being offered ?

Que9. If the rate of interest is 12.5%, then find the ratio of CI earned in 24th to 25th year ?

Que10. If the rate of interest is 15%, then find the ratio of the total CI earned in the first 2 years to total SI earned in the first two years, if the Principal kept is same?

Que11. A sum triples in 5 years at CI. Find in how many years the sum becomes 9 times of itself ?

Compounding Annually, Semi Annually, Quarterly

COMPOUND INTEREST FORMULA

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

- Amount
- Interest Rate (Decimal)
- Time (years)
- Principal
- Number of times interest is compounded per year
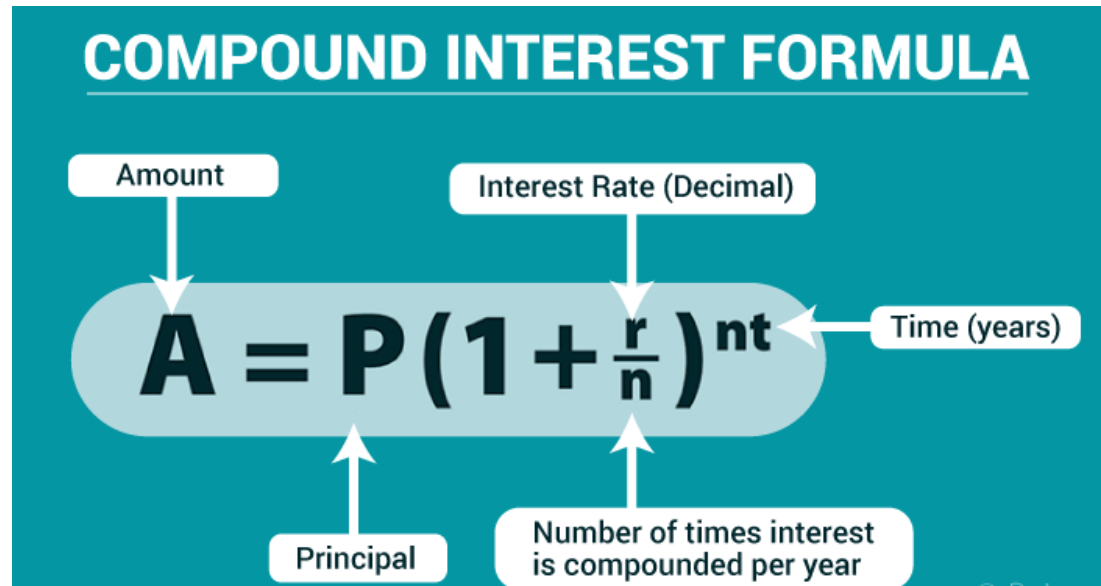
Que12. If a bank offers two schemes i.) Semi annual compounding at 40% per annum. ii.) Quarterly compounding at 40% per annum. Which of the two is a better scheme for depositors?

Rules of Indices	
For $a \neq 0, b \neq 0$	
Rule	**Example**
$a^x \times a^y = a^{x+y}$	$a^3 \times a^2 = a^{3+2} = a^5$
$a^x \div a^y = a^{x-y}$	$a^6 \div a^2 = a^{6-2} = a^4$
$\left(a^x\right)^y = a^{xy}$	$\left(a^2\right)^3 = a^{2 \times 3} = a^6$
$a^0 = 1$	$a^0 = 1$
$a^{-x} = \dfrac{1}{a^x}$	$a^{-5} = \dfrac{1}{a^5}$
$a^{\frac{x}{y}} = \sqrt[y]{a^x} = \left(\sqrt[y]{a}\right)^x$	$a^{\frac{3}{5}} = \sqrt[5]{a^3} = \left(\sqrt[5]{a}\right)^3$

Que.

Quantity A	Quantity B
3^{60}	2^{100}

Que. $\sqrt{20} + \sqrt{125} = \sqrt{x}.$ Find x .

Que.

Quantity A	Quantity B
$(1/2)^y$	$(1/4)^y$

Que. Given $12^x + 12^{x+1} = 3^x + 3^{x+1} + 3^{x+2}$

Quantity A	Quantity B
x	1

Simple and Compound Interest

Que 1) $P = 50000\$$ Time $= 5$ years, $A = 66000\$$

$$A = P + I = 66000$$

$$\boxed{I = 16000\$}$$

$$I = \frac{PRN}{100}$$

$$16000 = \frac{50000 \times R \times 5}{100}$$

$$R = \frac{16000}{2500} \cdot \frac{32}{5}$$

$$\boxed{R = 6.4\%}$$

Que 2) $A = 2P = P + I$

$$so \quad I = P$$

$$I = \frac{P \times R \times N}{100}$$

$$P = \frac{P \times \cancel{0} \times 10 \times N}{100}$$

$$\boxed{N = 10\,years}$$

Que 3) $A = 3P = P + I$

$$I = 2P$$

① $$I = \frac{PRN}{100}$$

$$2P = \frac{PRN5}{100}$$

$$\boxed{R = \frac{200}{15}}$$

$$\boxed{RN = 200}$$

$$Sum = A = 9P = P + I$$

$$\boxed{I = 8P}$$

$$8P = \frac{P \times 200 \times N}{15 \times 100}$$

$$\boxed{N = 60 \text{ years}}$$

Alternate method:

$$P \xrightarrow[15 \text{ years}]{I = 2P} 3P \xrightarrow[15 \text{ years}]{I = 2P} 5P \xrightarrow[15 \text{ years}]{I = 2P} 7P \xrightarrow[15 \text{ years}]{I = 2P} 9P$$

So Total = 60 years

(4) $A = \frac{7}{4}P = P + I$ N = 3 years

$$I = \frac{3}{4}P \qquad\qquad I = \frac{PRN}{100}$$

$$\frac{3P}{4} = \frac{P \times R \times 3}{100}$$

$$\boxed{R = 25\%}$$

(5) Every year SI is same.

So in 6 years Interest = 640 - 460
$$= 180$$

Every year Interest = $\frac{180}{6} = 30$ ₹

In 2 years Interest = 60 ₹

Amount in 2 years = 460 - 60
$$= \boxed{520 \text{ ₹}}$$

Que:- 6

$$I = \frac{PRN}{100}$$

$$I_1 = \frac{PR(3)}{100} \qquad\qquad I_2 = \frac{P(R+2) \times 3}{100}$$

$$I_2 - I_1 = 360$$

$$\frac{6P}{100} = 360$$

$$\boxed{P = 6000.₹}$$

Que:- 7

$$A = P\left[1 + \frac{R}{100}\right]^n$$

$$A = 36000\left[1 + \frac{18}{10\%}\right]^2$$

$$A = 36000\left[\frac{11}{10}\right]^2$$

$$A = 36000 \times 1.21$$

$$\boxed{A = 43560 ₹}$$

Que:- 8 CI increases every year by rate (R).

If in 7th year CI = 10x
then in 8th year CI = 11x

% Increase in CI = $\frac{x}{10x} \times 100 = \boxed{10\%}$

Que 9. CI increases every year by rate (R)%.

Let CI earned in 24th year = x

then CI earned in 25th year will be = $1.125x$

Ratio = $\dfrac{x}{1.125x} = \dfrac{1000}{1125} = \dfrac{40}{45} = \boxed{\dfrac{8}{9}}$

Que 10. CI is interest on interest

	CI	SI
1st year	15%	15%
2nd year	15% + $\dfrac{15\% \text{ of } 15\%}{}$ 32.25%	30%

$\dfrac{\text{Total CI 2years}}{\text{Total SI 2years}} = \dfrac{32.25\% \text{ of } P}{30\% \text{ of } P} = \dfrac{3225}{3000}$

$= \dfrac{129}{120} = \boxed{\dfrac{43}{40}}$

Ques!! A7 CI,

$$P \xrightarrow[\times 3]{5 \text{ years}} 3P \xrightarrow[\times 3]{5 \text{ years}} 9P$$

total [10] years .

Que!!!② ① semi annual compounding, it means
two times in a year.

40% per annum , so 20% in six months

first six months   20%,

Next six months   20% + 20% of 20%,
                                    _____
                                    44% of P

② Quarterly compounding, it means four
times in a year.

40% per annum,   10% per quarter.

first 3 months   10%.

Next 3 months   10% + 10% of 10% = 11%,

Next 3 months   10% + 10% of 21% = 12·1%,

Next 3 months   10% + 10% of 33·1% = 13·31%,

Interest in Case 2 > Case 1