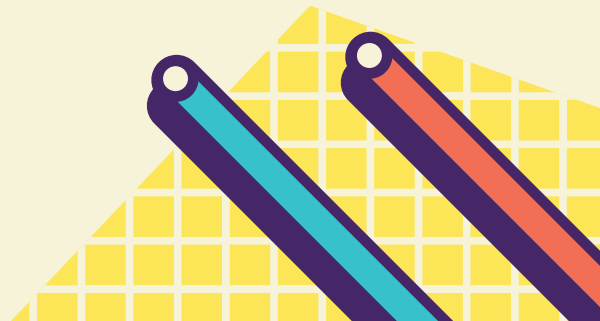# THE MATH BEHIND INTEREST

What is

Interest?

- Interest is the extra money you have to pay when you borrow money from someone or a bank. It's like a fee for using their money. The interest rate is the percentage of the borrowed amount that you have to pay as an extra cost
- Interest can also refer to the income generated from investments and savings

Types of Interest

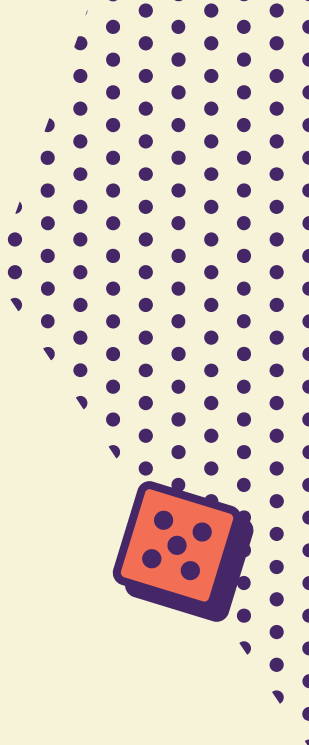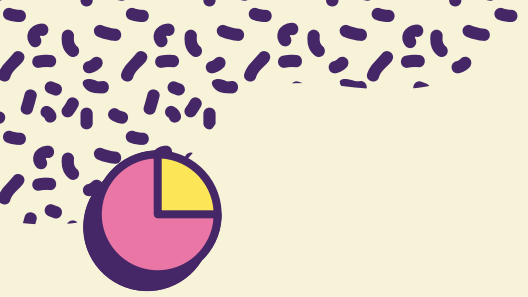Compound Interest Rate

Fixed Interest Rate

Simple Interest Rate

Variable Interest Rate

Discounted Interest Rate

Annual Percentage Rate

Prime Interest Rate

WallStreetMojo

"Compound Interest is The Most Powerful Force in The Universe."

▶ ▶ ▶ ▶ ▶ ▶ ▶ ▶

—Albert Einstein
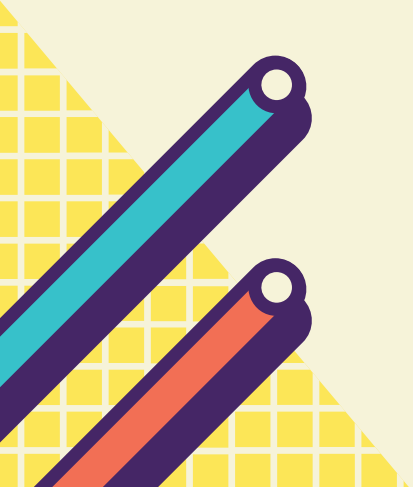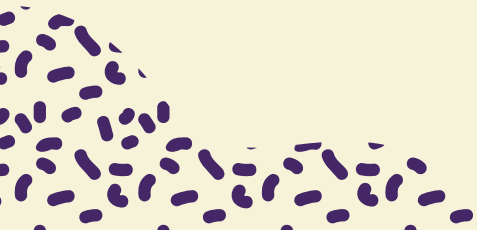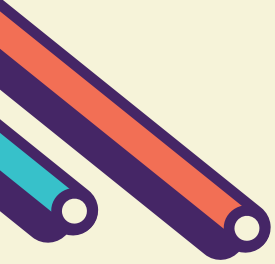
SIMPLE V.S COMPOUND

▶ ▶ ▶ ▶ ▶ ▶ ▶ ▶ ▶

SIMPLE INTEREST

Simple interest is straightforward. It is calculated based only on the initial amount of money (called the principal) and the interest rate.
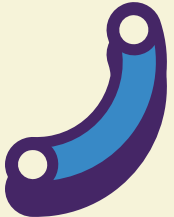
COMPOUND INTEREST

Compound interest is interest computed on the original
principal as well as on any accumulated interest.

$$I = P * R * T$$

SIMPLE INTEREST

▶ ▶ ▶ ▶ ▶ ▶ ▶

$$A = P(1 + R)^\wedge T$$

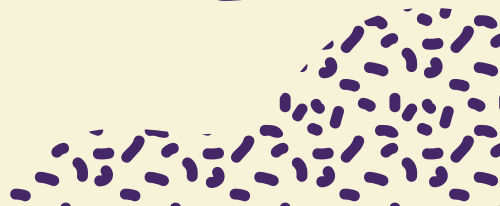COMPOUND INTEREST

P = Principal value (loan amount)
R = Rate of interest
T= Time

Simple interest Practice question 1

Rahul borrowed $20 000 to buy a car. The loan was taken over 5 years at a simple interest rate of 5.25% annually. What is the total amount Rahul will pay?

P = 20,000 R =5.25% T = 5 years

$I = PRT$
I = 20 000 × 0.525 × 5
I = $5,250

Total paid = 20,000 + 5,250 = $25,250

Simple interest Practice question 2

Anjali borrows $14 000 to buy a new machine for his business. The loan is to be paid back in equal monthly installments over 4 years at a simple interest rate of 6.5% per annum.Calculate the monthly repayment Anjali must make.

P = $14 000 R = 6.5% T = 4 years

$I = PRT$
I = 14 000 × 0.065 × 4
I = $3 640

Total Amount = 14 000 + 3 640 = $17 640
Monthly payment = 17 640/48   = $367.50

Simple interest Practice question 3

Sai is investing to save up for a dream vacation. Sai wants a vacation that will cost 8400, and he is willing to invest 7500 right now. Sai calculates What simple interest rate is required to grow an investment of $7 500 to a total investment of $8 400 in 10 years. Unfortunately he makes some errors in hs math. Can you spot them and correct it?

P = $7 500 I = $8 400 T = 10 years

$I = PRT$

$R = "I" / "PT$

$R = "8 400" / "7 500 \times 10"$

$R = 0.112$

The interest rate required is 0.112% p.a.

Simple interest Practice question 3

Sai is investing to save up for a dream vacation. Sai wants a vacation that will cost 8400, and he is willing to invest 7500 right now. Sai calculates What simple interest rate is required to grow an investment of $7 500 to a total investment of $8 400 in 10 years. Unfortunately he makes some errors in hs math. Can you spot them and correct it?

P = $7 500 I = $8 400 T = 10 years

* final total not the interest
I = 8400-7500=900

$I = PRT$
$R = "I"/"PT$
$R = "8 400"/"7 500 × 10"$
$R = 0.112$

The interest rate required is 0.112% p.a.   *11.2%

Compound interest Practice question 1

You deposit $2000 in a savings account at Hometown Bank, which has a rate of 6%.
a. Find the amount, A, of money in the account after 3 years subject to compound interest.
b. Find the interest

P = 200 R=0.06 T=3
A = P(1 + r)t
 2000(1 + 0.06)^3
2000(1.06)3 ≈ 2382.03

Rounded to the nearest cent, the amount in the savings account after 3 years is $2382.03.
b. The amount in the account after 3 years is $2382.03.
So, we take the difference of this amount and the principal to obtain the interest amount.
$2382.03 − $2000 = $382.03
Thus, the interest you make after 3 years is $382.03

$$A = P(1 = R/n)^{nT}$$

COMPOUND INTEREST PAID MORE THAN ONCE A YEAR

P = Principal value (loan amount)
R = Rate of interest
T= Time
n = the number of times the interest is compounded per
year

Compound interest Practice question 2

You deposit $7500 in a savings account that has a rate of 6%. The interest is compounded monthly. a. How much money will you have after five years? b. Find the interest after five years.

P = $7500 R = 0.06 T = 5 years n=12
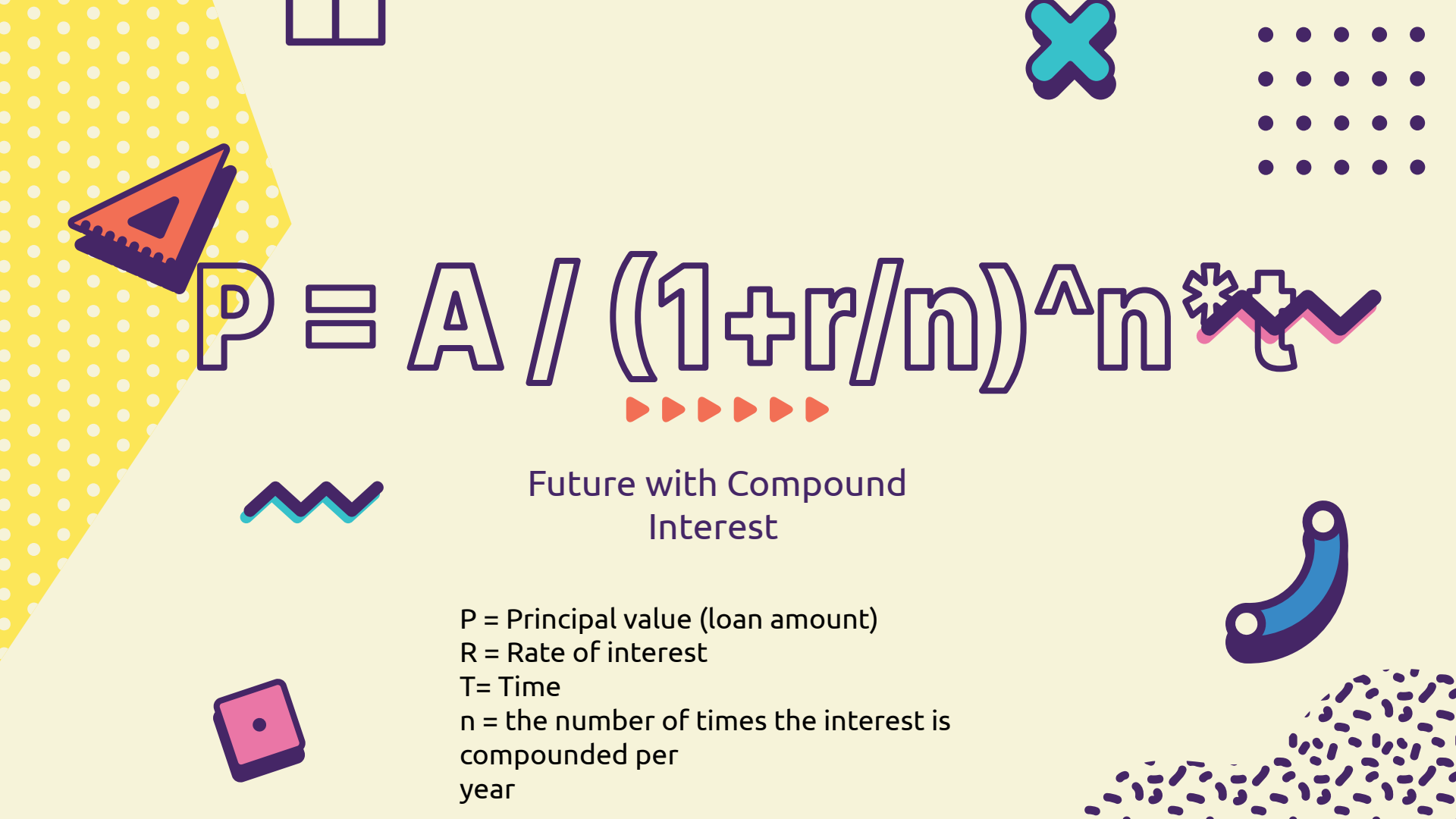
A = P(1+R/n)^nT
A=7500(1+0.06/12)^12x5
A= 10,116.38 money after 5 years

10,116.38 − $7500 = $2616.38

P = A / (1+r/n)^n*t

Future with Compound Interest

P = Principal value (loan amount)
R = Rate of interest
T= Time
n = the number of times the interest is
compounded per
year

Compound interest Practice question 3

How much money should be deposited in an account today that earns 6% compounded monthly so that it will accumulate to $20,000 in five years

A = $20000 R = 0.06 T = 5 years n=12

P = A / (1+r/n)^n*t
20,000/(1+0.06)^12*5
p= 14,827.44

$14,827.45 should be invested today in order to accumulate to $20,000 in five years.

Power of Compounding illustrated

Compound vs Simple Interest
8% per year for 40 Years

1006.27

340.00

FV (Simple Interest)   FV (Compound Interest)
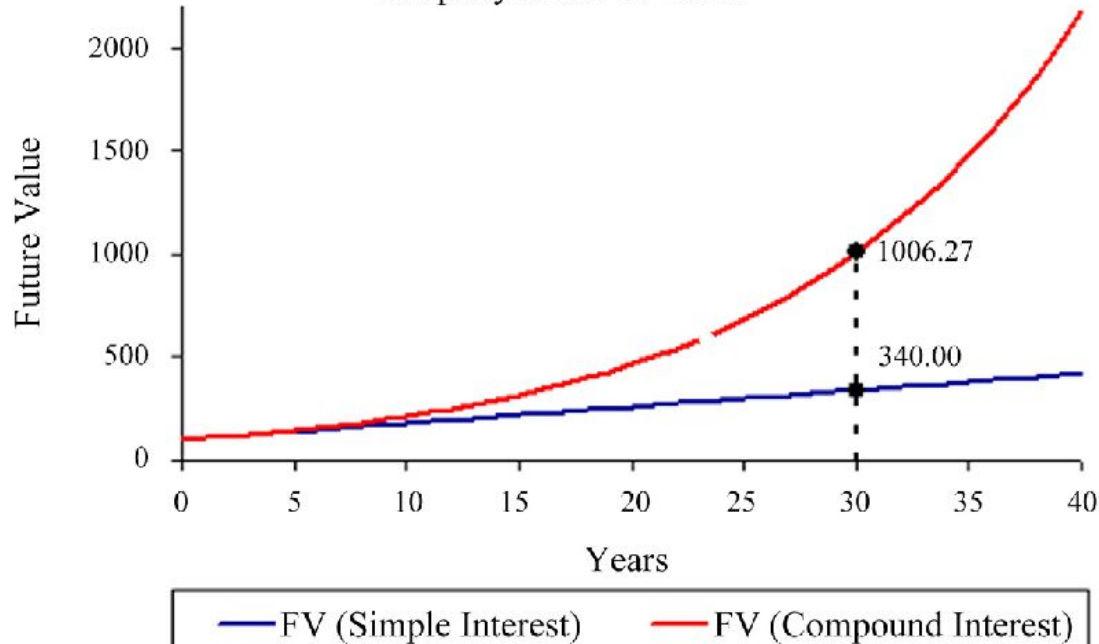
POWER OF COMPOUNDING

PARAMETERS	SIMPLE INTEREST	COMPOUND INTEREST
Investment	Rs. 1 Lac at 10%	Rs. 1 Lac at 10%
Interest received after 1 year	Rs. 10,000	Rs. 10,000 which is reinvested
Total returns as interest after 5 years	Rs. 50,000	Rs. 61,000*

*Extra Return (due to interest on interest) = Rs. 11,000

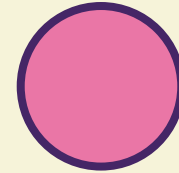MoneyvsMe

What Can we apply this to

Future savings
When we have an end goal and a rate of growth to our investments we can find out how much we have to invest to meet our goal.

Loan planning
Calculate what the end amount you will be paying on loans and how much interest the bank is making

Knowing that simple loans tend to be better when borrowing and compounding is better when loansing or investing
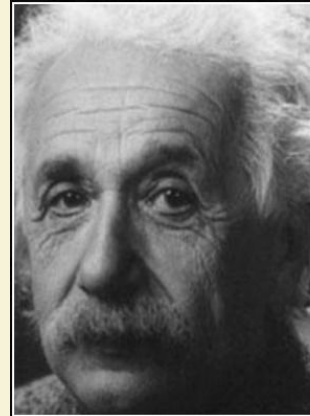
Take Away for Day 2 : Dos and Don'ts

Dos

- Compound Interest is very powerful
- Starting early makes a big difference
- Loans and investments are both impacted by interest rates
- Understand difference between monthly, quarterly, yearly interest rates

Compound interest is the eighth wonder of the world. He who understands it, earns it... he who doesn't... pays it.

— *Albert Einstein* —

AZ QUOTES

Don'ts

- Get in to high interest rate debts
- Fall trap to time manipulated interest rates