

Learning how to learn

Learn smarter not harder

Phu Nguyen

Department of Civil Engineering
Monash University

phu.nguyen@monash.edu

<http://nvinhphu.wixsite.com/mysite>



TARGETTING ...

high school students

college students

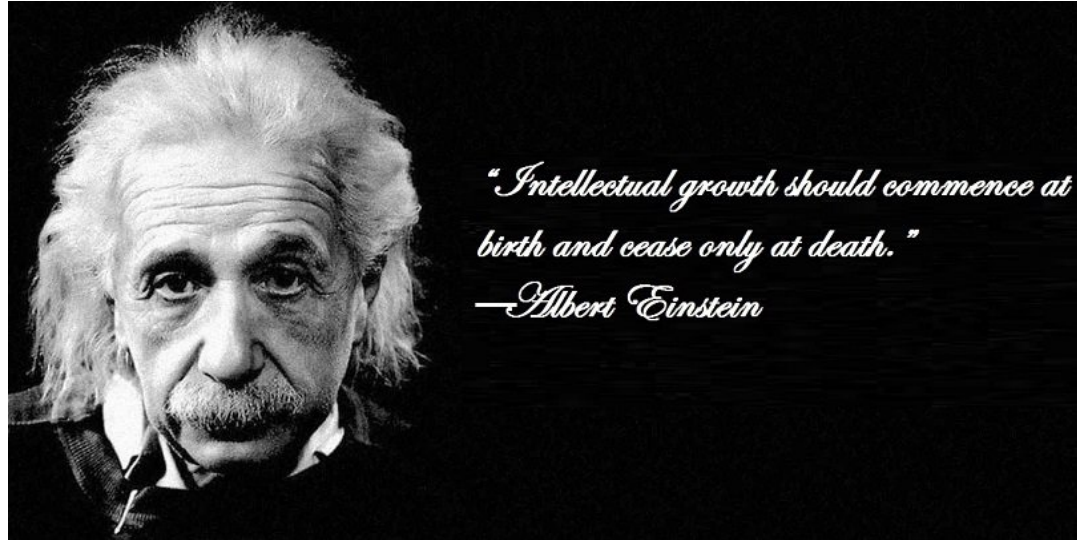
post-graduate students

researchers

academics

...

All people willing to learn



SOURCES

Learning how to learn by Barbara Oakley

How to be a high school superstar by Cal Newport

How to become a straight-A Student by Cal Newport

3Blue1Brown (Youtube): better understanding of maths

Lectures by Walter Lewin. They will make you ♥ Physics (Youtube)

unsplash.com (images)

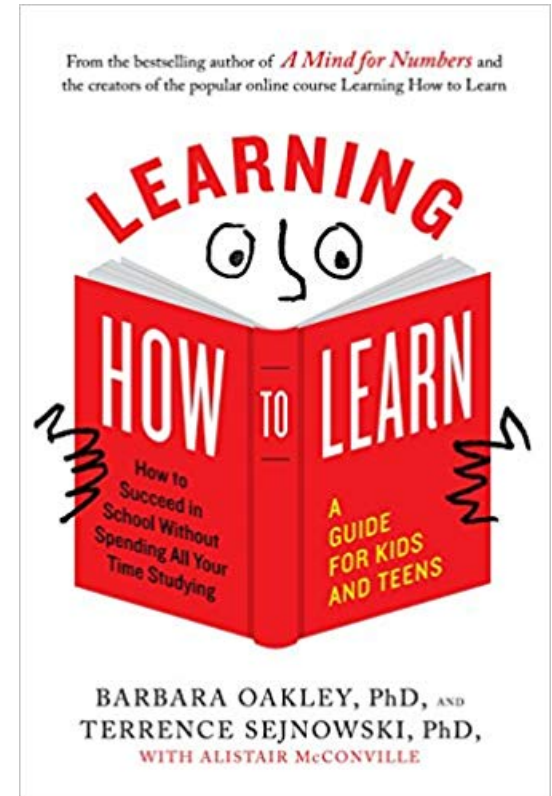
HOW YOU SHOULD STUDY NEW SUBJECTS?

Learning How to Learn:

Powerful mental tools to help you master tough subjects

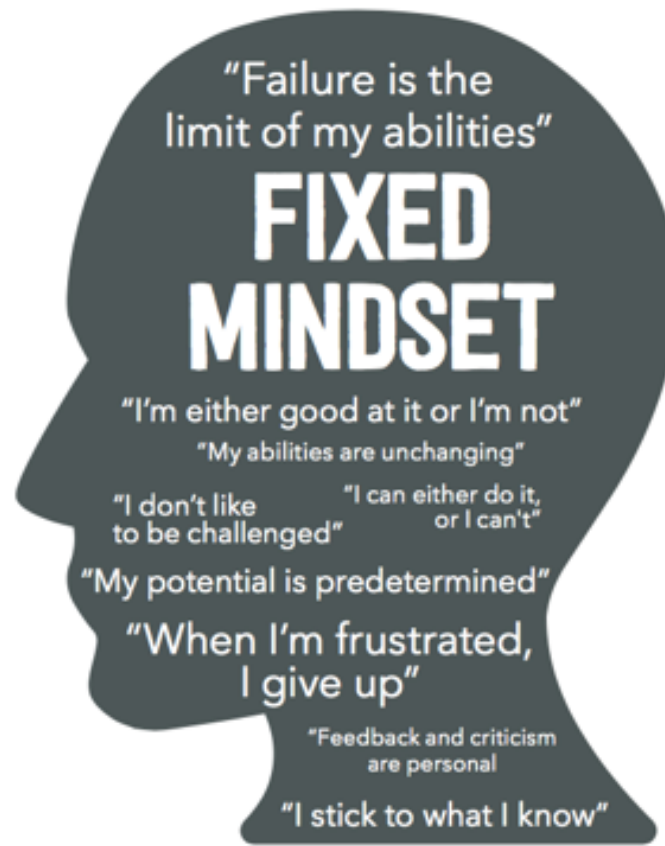


Free



25AUD

FIXED MINDSET VERSUS GROWTH MINDSET



Based on the book 'Mindset' by Carol Dweck (Stanford psychologist)

Brain is **plastic** not rigid, exercising your brain makes you smarter

<https://mindsetkit.org>

BENEFITS OF PROGRAMMING (CODING)

Automate repeated tasks

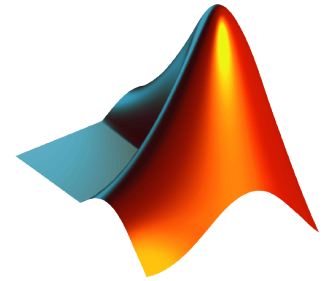
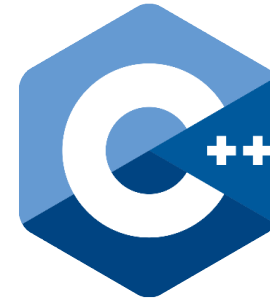
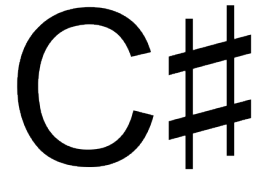
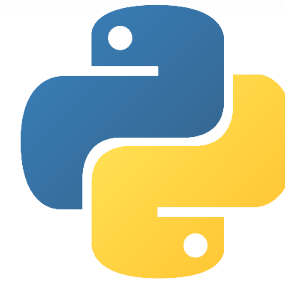
Improve **problem solving skills**

Develop **resilience**

Post-graduate studies (master/PhD)

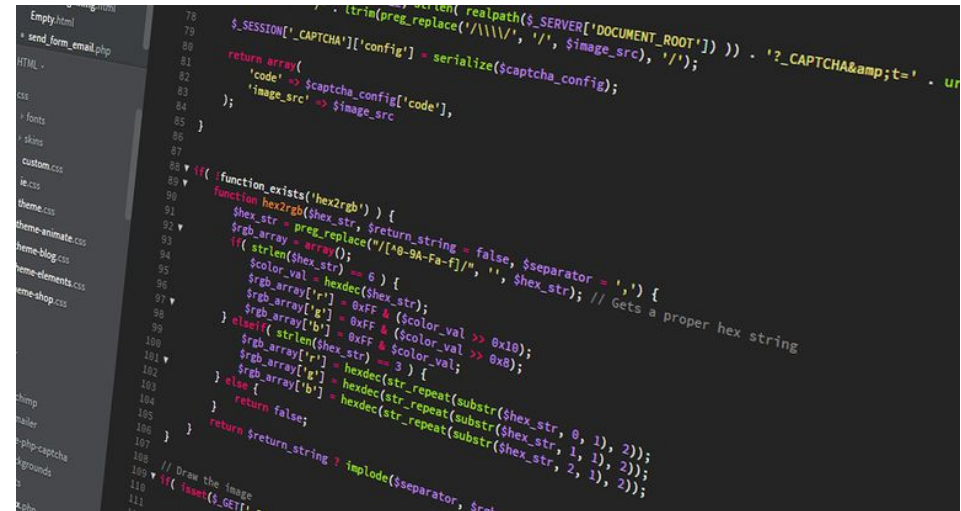
Give you an edge in job seeking

Learning to code offers **career flexibility**

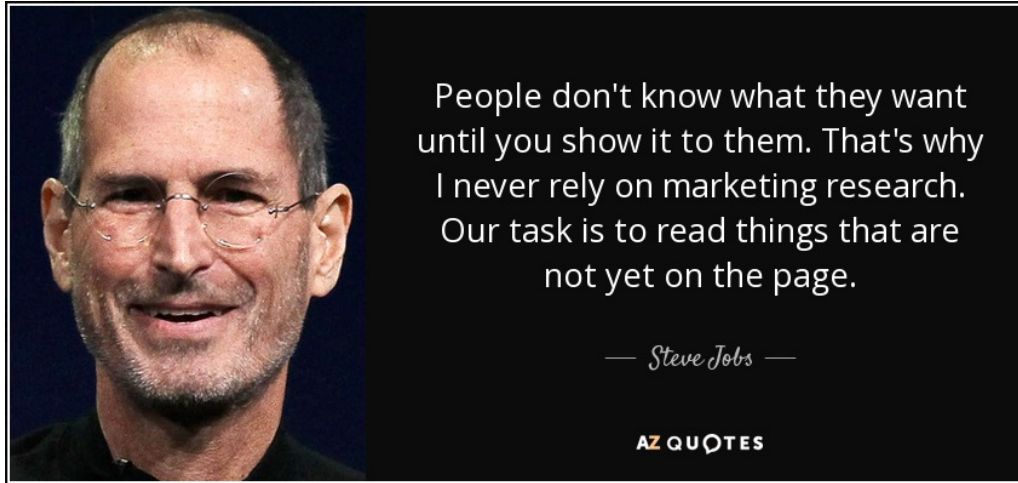


...

and it is art.



HOW TO FIND YOUR PASSIONS



Balance what one *has to do* and what one **wants to do**

Leave **plenty of leisure time** to explore

Use that time to expose you to *lots of different things*

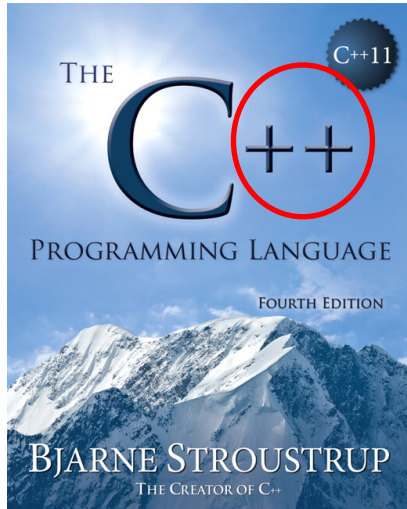
***Reflect* to find out what fascinates you**

Master one serious interest.

Don't **waste time** on unrelated activities

Follow up on this interest

HOW TO FIND YOUR PASSIONS: EXAMPLE 1



First Course In The Finite Element Method 5th Edition Logan Solutions Manual
Full Download: <https://testbanklive.com/download/first-course-in-the-finite-element-method-5th-edition-logan-solutions-manual/>

INSTRUCTOR'S SOLUTIONS MANUAL
TO ACCOMPANY

A FIRST COURSE IN THE
**FINITE
ELEMENT
METHOD**

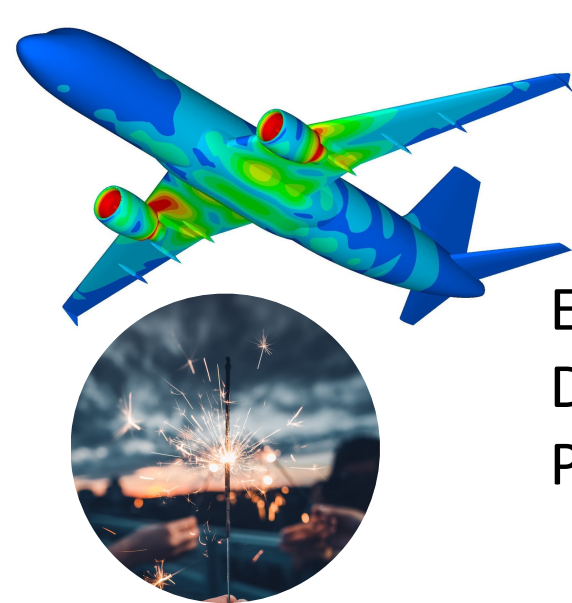
FIFTH EDITION

DARYLL L. LOGAN

Full download all chapters instantly please go to Solutions Manual, Test Bank site: TestBankLive.com

While a undergrad of Civil Engineering,
at HUT, Vietnam

I **self-studied C++** (and Matlab)
Attended (and quit) a course in FEM
(Department of mechanical engineering)



Enrolled in master of engineering mechanics
Did a master thesis (FEM, **C++**) with S. Bordas (EPFL)
PhD in computational mechanics at TU Delft

HOW TO FIND YOUR PASSIONS: EXAMPLE 2

1800s: mathematicians worked on **wave equations** for fun?

1864: Maxwell used them to predict **existence of electrical waves**

1888: Hertz **confirmed Maxwell's predictions experimentally**

1896: Marconi made **the 1st radio transmission**



span of 150 years!!!

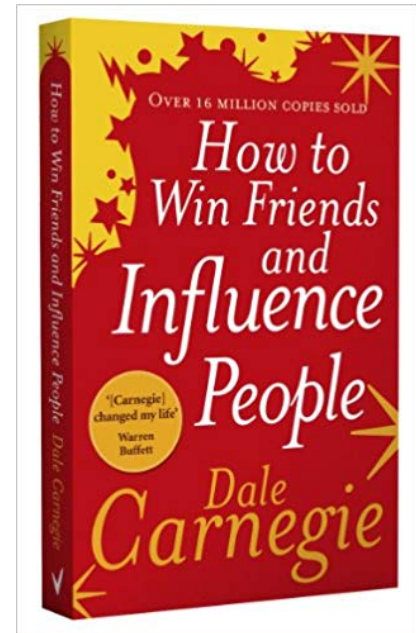
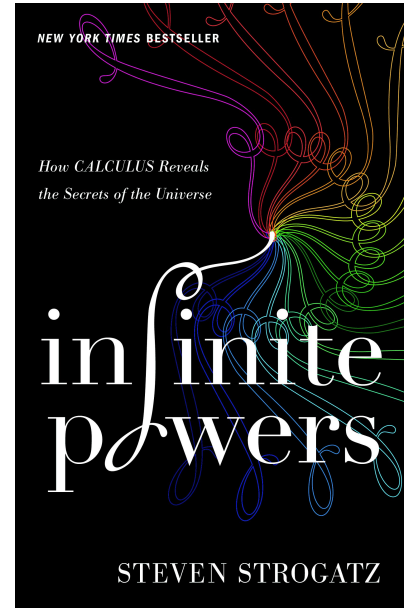
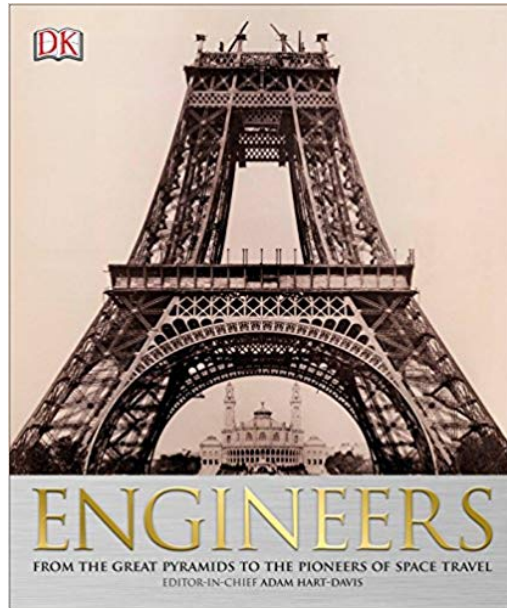
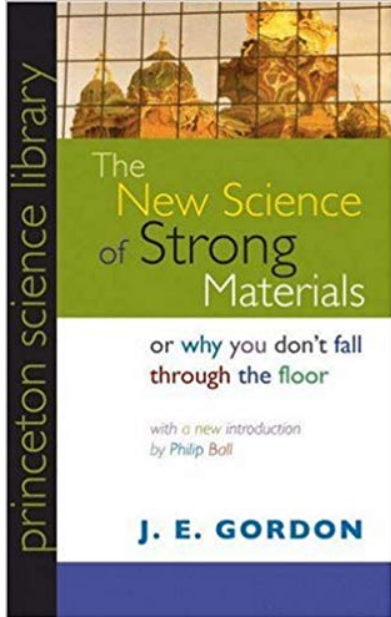
intellectual satisfaction



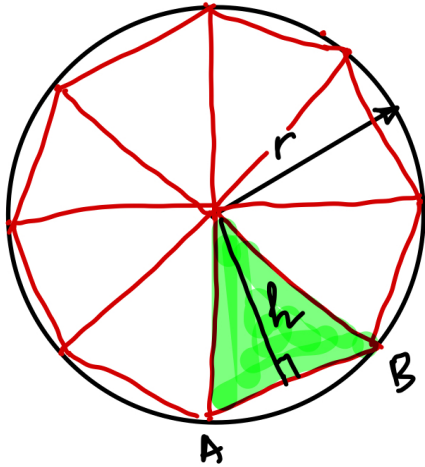
practical applications

Read **popular science books**
Read **history books**
Read **biographies books**
Watch **TED talks**
Read **inspirational quotes**

big picture of the field
intuitions not details
very interesting stories
better ways to learn
find your passions
they are CHEAP



LEARNING/DISCOVERING...



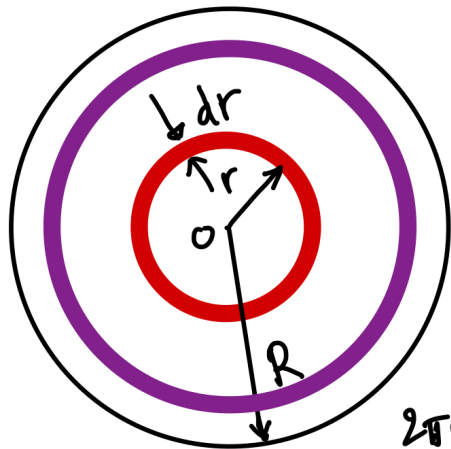
$$\text{Perimeter} = 2\pi r$$

$$\text{Area} = ?$$

$$\text{Area} = \lim_{n \rightarrow \infty} \sum_n \triangle$$

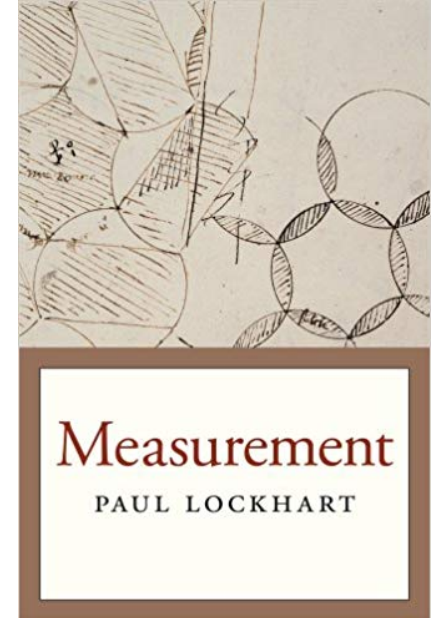
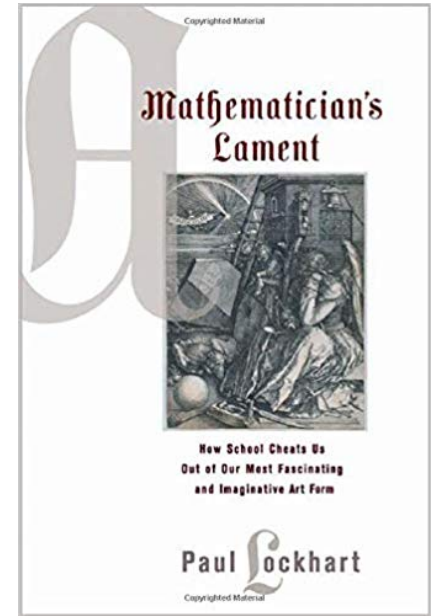
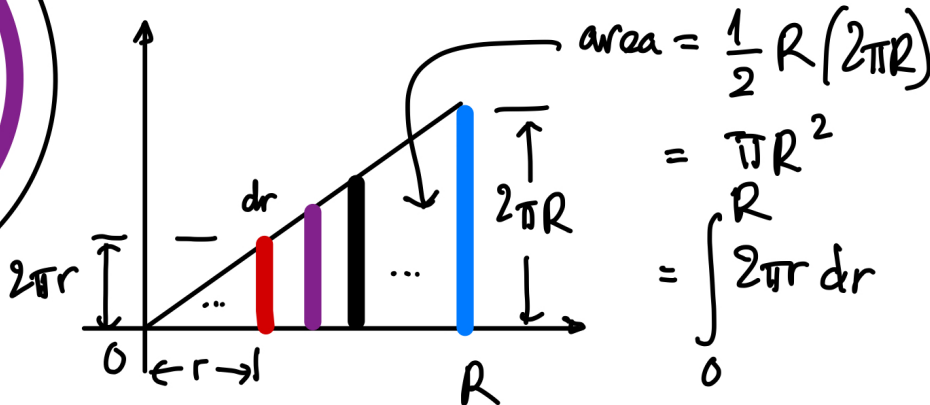
$$= \lim_{n \rightarrow \infty} \sum \frac{1}{2} h AB$$

$$= \lim_{n \rightarrow \infty} \frac{1}{2} h \frac{\sum AB}{r} = \pi r^2$$



$$\frac{dr}{I} \text{ ————— } \Rightarrow \text{area} = 2\pi r dr$$

$$| \longleftarrow 2\pi r \longrightarrow |$$



PROCRASTINATION

“Let’s watch a movie before doing homework...”



Pomodoro technique:

1. Shut off all distractions
2. Set the timer for **25 mins** or so
3. Do whatever you need to do
4. After 25 mins, **stop** and **reward** yourself



LEARNING ZONE AND PERFORMANCE ZONE

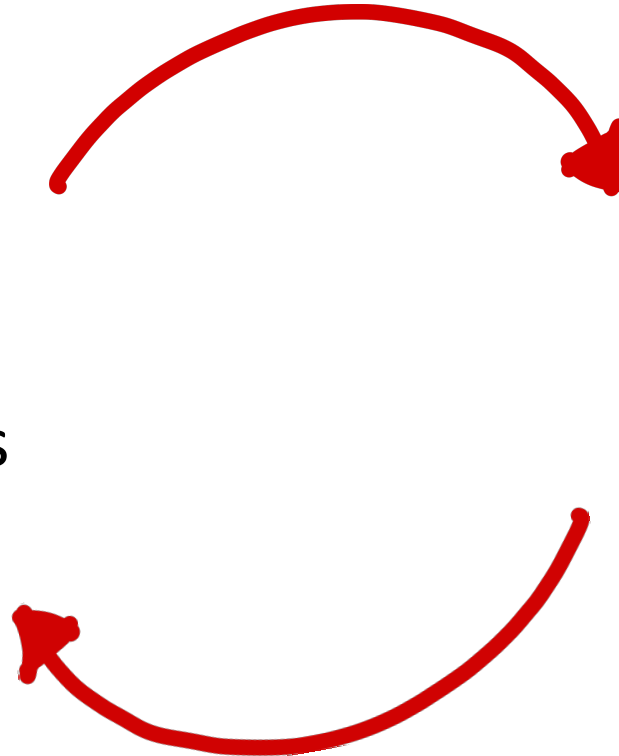
TED Talk by Eduardo Briceno

Learning zone

improve things
learn new things
mistakes are ok
exciting

Performance zone

daily jobs
execution
no mistakes
usually boring



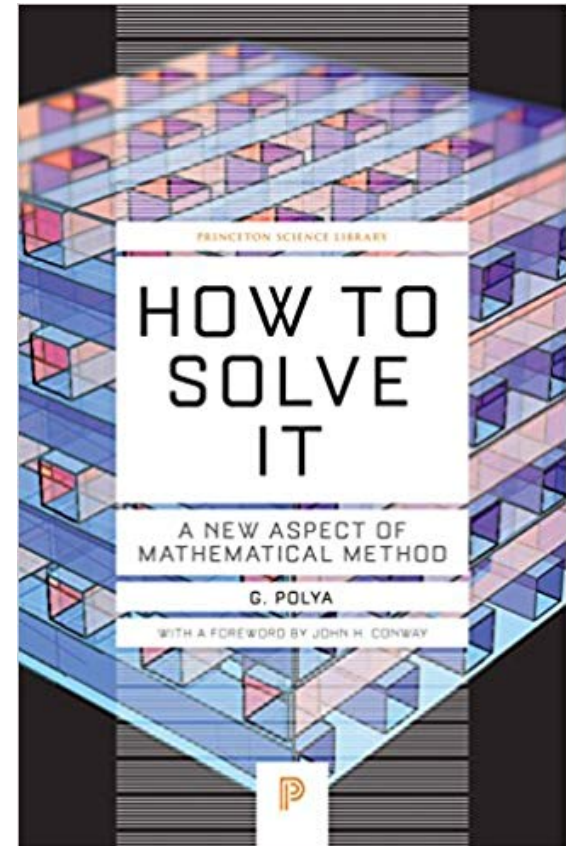
STEPS TO SOLVE A PROBLEM

Understanding the problem

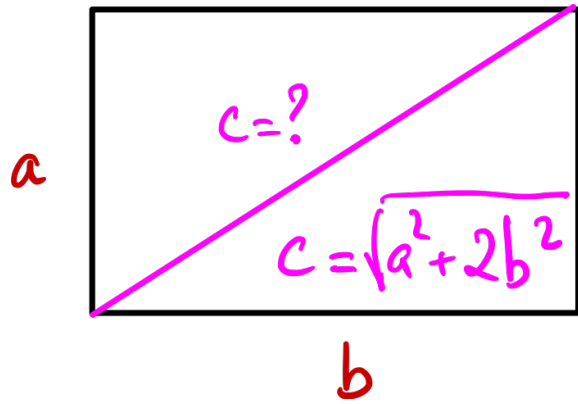
Devising a plan

Carry out the plan: get your hand DIRTY!!!

Looking at your solution



WHAT SHOULD BE DONE AFTER SOLVING A PROBLEM



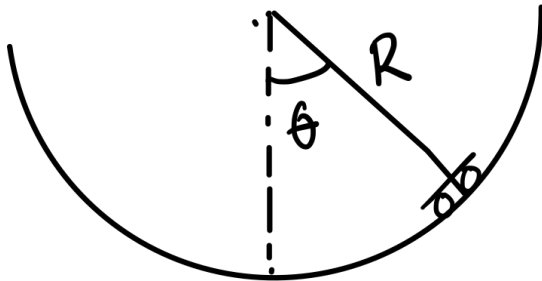
Reflect on the problem

Is the solution making sense?

Why the solution is in that form?

Is there another way(s) to get same solution?

$$\ddot{\theta} = -\frac{g}{R}\theta$$



MORE WORK DONE WITH LESS TIME

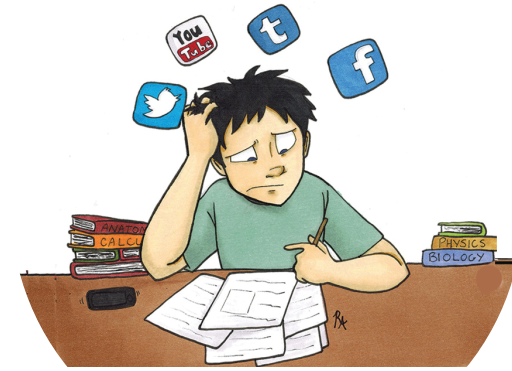
*Work accomplished = time spent x **intensity of focus***

*Maximise **intensity of focus***

***location** (avoid bedrooms, living room)*

times of the day

***duration** (short durations avoid fatigue)*



pseudo-working

HOW YOU SHOULD STUDY?

understand concepts

do not memorise things

illusions of competence

focused and diffuse mode

active reading

skim through the content

read carefully

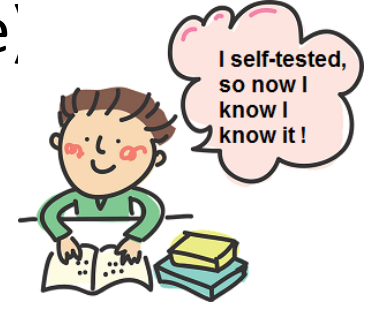
recall

condensing materials as much as possible

spend time on the **most significant** parts (80-20 rule)

reflect on your performances

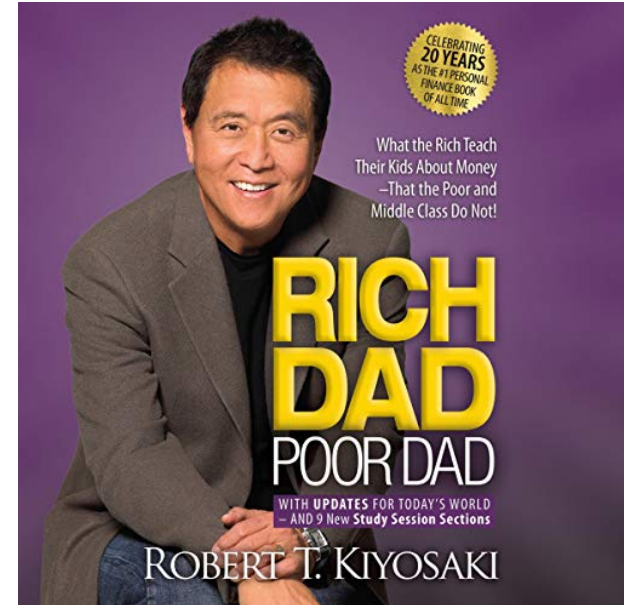
The image shows a dense page of handwritten mathematical notes. The notes are organized into sections with bold headers. Key sections include: 'MATH' with a small diagram of a triangle; 'CONIC SECTION' with equations for circles and ellipses; 'DESCARTES' RULE SIGNS'; 'TRUNCATED CONE'; 'CAUCHY SEQUENCE'; 'L'HOPITAL'S RULE'; 'TAYLOR'S IDENTITY'; 'COMPLEX VERSIONS'; 'COMPARISON RATIO'; 'DIRICHLET TEST'; 'LEIBNIZ RULE'; 'FINITE TRIG SERIES'; 'RATIO TEST #1'; 'RATIO TEST #2'; 'REFLECTION'; 'DOUBLE FOURIER SINE SERIES'; 'L'HOPITAL'S RULE'; 'L'HOPITAL'S RULE'; 'L'HOPITAL'S RULE'. The handwriting is in black ink on white paper, with some red and blue highlights.



REFLECT ON YOUR PERFORMANCE

Japanese aware of three powers:

1. power of sword
2. power of jewel
3. **power of a mirror**



INTERLEAVING

Maths

50 mins

10 mins of break

Physics

50 mins

Chemistry

50 mins

Mathematics

3 continuous hours

Chapter 1:

Using the ... method to solve the following problems

Exercise 1.

Exercise 2.

Chapter 2:

Using the ... method to solve the following problems

Exercise 1.

Exercise 2.

Solve the following problems

Which methods???

Problem 1.

Problem 2.

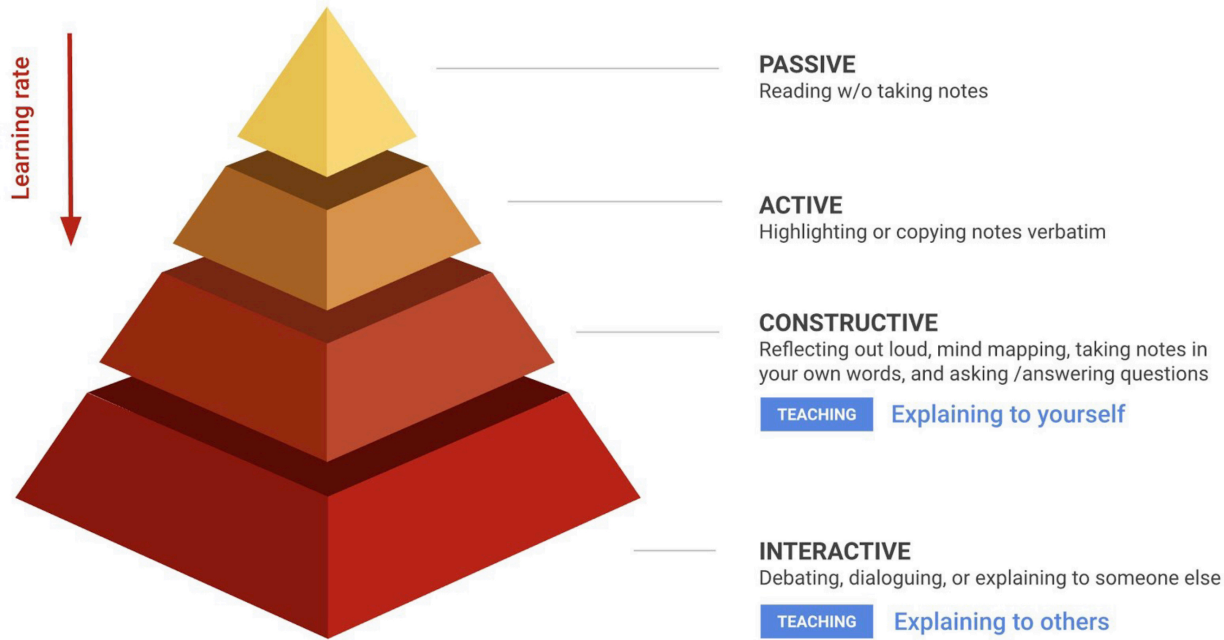


Mix the exercises/problems

BEST WAY TO LEARN IS TO TEACH



Modern Learning Pyramid



Teach what you learn, as soon as you learn it
Teach yourself ('today I learned' journal)
Teach others (write a blog)

PARETO PRINCIPLE (80/20 RULE)

Italian economist Vilfredo Pareto:

80% lands owned by **20%** people

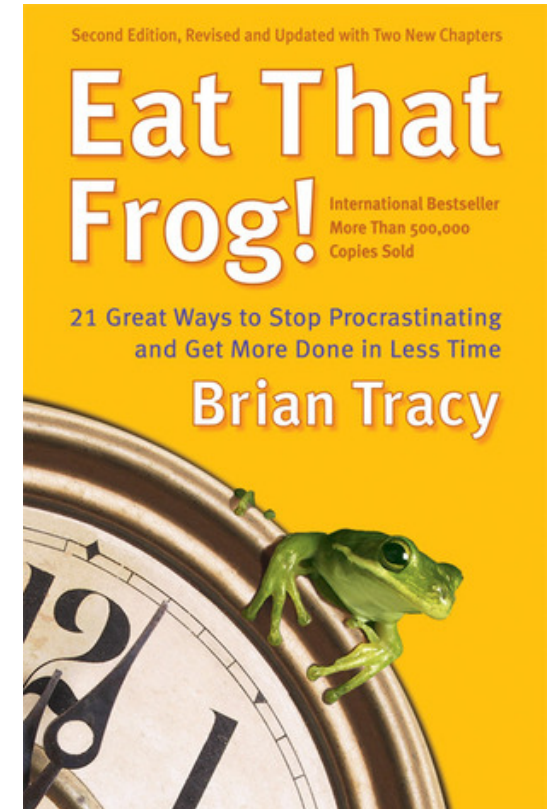
20% of our activities account for 80% of our results

10 things to do: **2 of them** worth 5-10 times the other 8 items together

Identify most important things

Work on these things first

*Mark Twain “if the first thing you do each morning is to **eat a live frog**, you can go through the day with the satisfaction of knowing that that is probably the worst thing that is going to happen to you all day long.”*



THE ART OF BECOMING GOOD

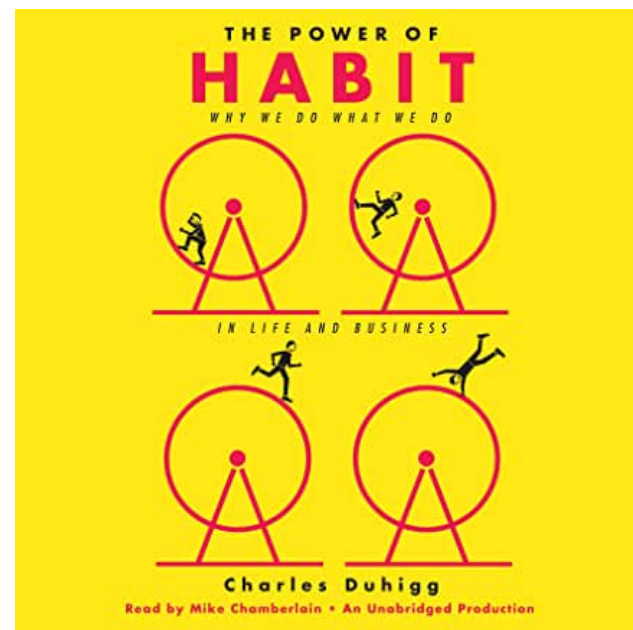
Learn **best habits** from experts
(friends, well-known scientists etc.)

Immerse yourself in the topic of interest

Use the **best tools** (make your life easier)

- LaTeX for scientific writings
- Unix/Linux for programming

Disciplines	LaTeX rate
Mathematics	96.9%
Statistic and Probability	89.1%
Physics	74.0%
Computer Sciences	45.8%
Engineering	1.0%



READING

In my whole life, I have known no wise people who did not read all the time — none.

Charlie Munger (Self-made billionaire and Warren Buffett's business partner)

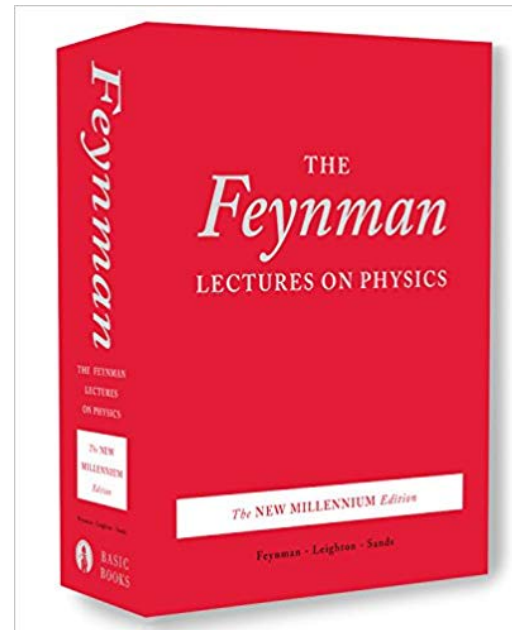
Read for information

Read for knowledge

Read something above your level

Reserve 1 hour for reading everyday

How to read a book?



BE CURIOUS

“I wonder why.

I wonder why.

I wonder why I wonder

I wonder why I wonder why

I wonder why I wonder!”

“When I was in high school, I’d see *water running out of a faucet* growing narrower, and **wonder if I could figure out what determines that curve.** I found it was rather easy to do”



Richard Feynman

Nobel Prize in Physics (1965)

MOVE OUT OF COMFORT ZONE

Instead of using MS Word, use LaTeX to write your thesis/papers

Instead of using Excell to plot data, use **Python (not Matlab)**

Instead of using Windows, use **Ubuntu** or Mac OS

Already know solid mechanics?, learn fluid mechanics

Go to work by a new street

Learn data sciences (machine learning)

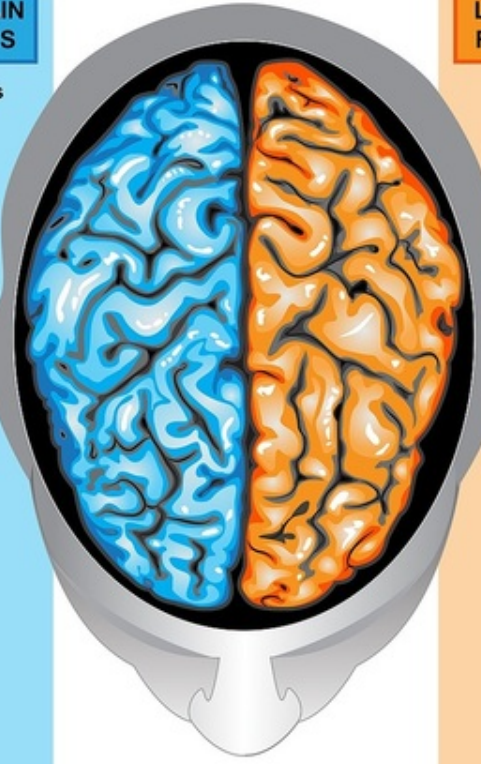
Learn quantum mechanics, astronomy

Learn something **totally NEW** (**right brain**)

- play a music instrument
- drawing
- learning a new speaking language
- learning a (new) programming language

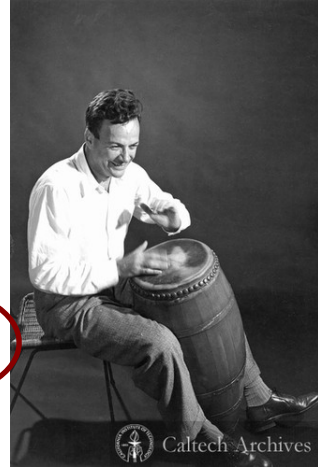
RIGHT-BRAIN FUNCTIONS

- Art awareness
- Creativity
- Imagination
- Intuition
- Insight
- Holistic thought
- Music awareness
- 3-D forms
- Left-hand control



LEFT-BRAIN FUNCTIONS

- Analytic thought
- Logic
- Language
- Reasoning
- Science and math
- Written
- Numbers skills
- Rigby-hand control



Keep your notes (iPad can help)

+ New...

- [advanced calculus](#)
24 Apr 2019 at 2:35 pm
- [geometry](#)
23 Mar 2019 at 10:09 pm
- [high school maths](#)
27 Apr 2019 at 11:27 pm
- [linear algebra](#)
18 Mar 2019 at 2:23 pm
- [mechanics](#)
12 Mar 2019 at 1:51 pm
- [partial differential equations](#)
16 Mar 2019 at 10:30 am
- [trigonometry](#)
8 Apr 2019 at 7:12 pm

FAILURE

- ‘If someone is better than you at something, it’s likely that they’ve failed at it more times than you’ by Mark Manson
- ‘ Failure isn’t fatal, but failure to change might be’ by John Wooden
- ‘If you’re not prepared to be **wrong**, you’ll never come up with anything **original**’ by Ken Robinson
- ‘The very important thing you should have is patience’ by Jack Ma
- ‘I never learned a thing from a tournament I won’ by Bobby Jones

DO NOT GIVE UP

“It does not matter how slowly you go
as long as you do not stop”

Confucius (551– 479 BC)

Thomas Edison made **1,000 unsuccessful attempts** at
inventing the light bulb.

Winston Churchill was placed in the **lowest division of the
lowest class**, twice **failed the entrance exam** to the Royal
Military Academy, became Prime Minister at **the age of 62.**

“Never give in, never give in, never, never, never, never - in
nothing, great or small, large or petty - never give in except to
convictions of honor and good sense. Never, Never, Never,
Never give up.”

UNITS

3 fundamental quantities in physics

Length (L) Time (T) Mass (M)

meter (m) second (s) kg
mm ms mg
⋮ ⋮ ⋮

All remaining are **derived** quantities

Volume
[L]³
m³
mm³

Area
[L]²
m²
cm²

Density
[M]/[L]³
kg/m³
g/cm³

Velocity
[L]/[T]
m/s
cm/s

Acceleration
[L]/[T]²
m/s²
cm/s²

Force
 $\frac{[M][L]}{[T]^2}$
1 kg $\frac{m}{s^2}$

(N) Newton

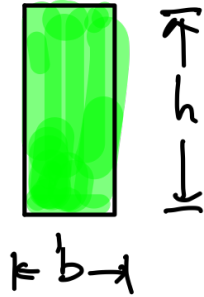
Pressure: $\frac{\text{Force}}{\text{area}} = \frac{N}{m^2} = 1 \text{ Pa (Pascal)}$

DO NOT MEMORISE THINGS

$$\sigma = \frac{M}{I} y$$

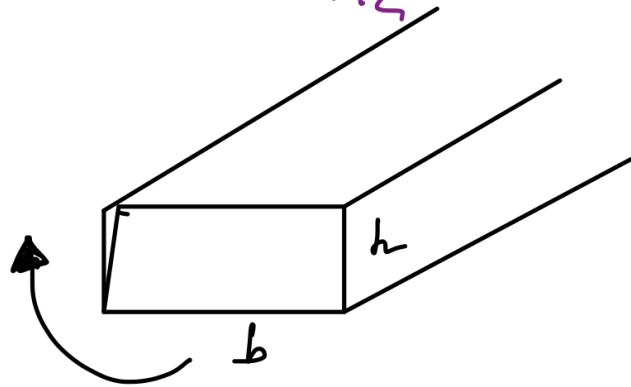
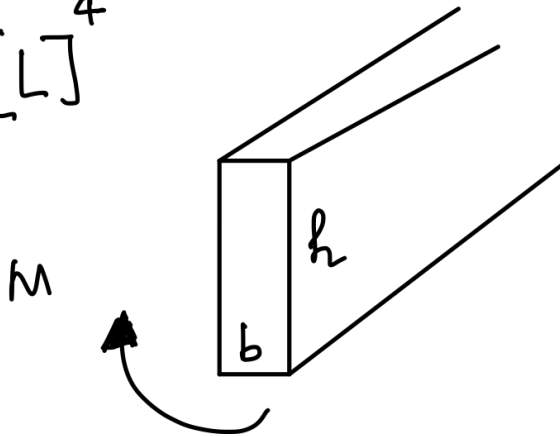
$$\frac{[F]}{[L]^2} = \frac{[F][L]}{I} [L]$$

$$I = [L]^4$$

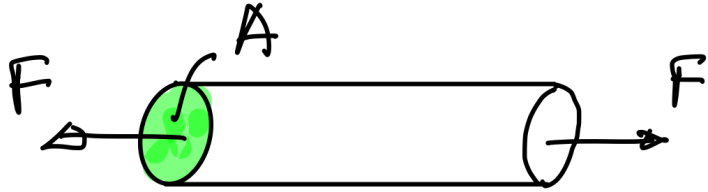


$$I = \alpha \frac{b^2 h^2}{b^3 h} \quad \text{NO}$$
$$I = \alpha \frac{b h^3}{b^3 h} \quad \text{NO}$$

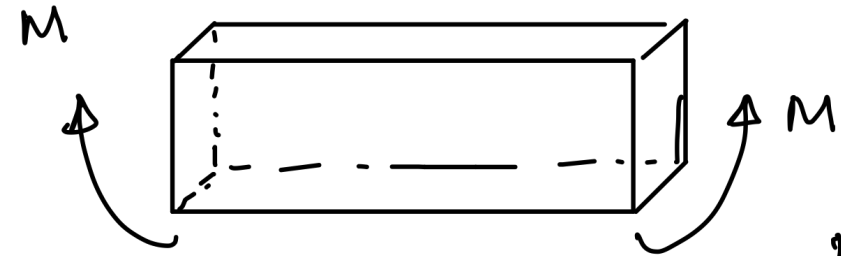
$$\alpha = \frac{1}{12}$$



ANALOGIES



$$\sigma = \frac{F}{A} \Rightarrow F = A\sigma$$

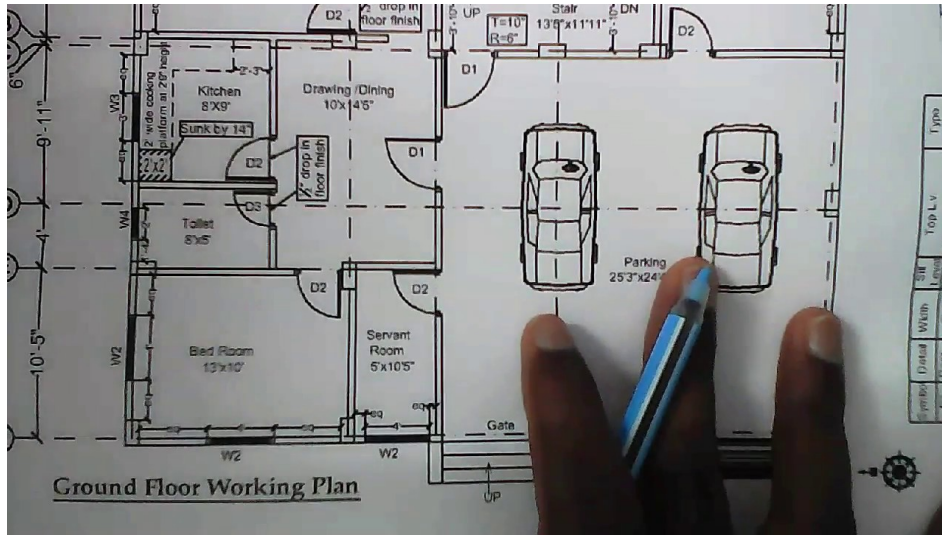


$$\sigma = \frac{M}{I} y \Rightarrow \sigma^{\max} = \frac{M}{I/y}$$

$$M = \frac{bh^2}{6} \sigma^{\max}$$



SKETCHING



NO

SCIENTIFIC WRITING TIPS

To **inform** not to impress;

Aim for **clarity, readability, reproducibility**;

Contributions must be clearly stated;

Each paragraph conveys only **a single idea**;

Avoid jargon;

Use **simple English** (e.g. *to* instead of *in order to*)

Minimize chances for reviewers to raise issues;

Figures: high resolution PDFs, font matches text font

When to write? At the **beginning** of the project



S. P. Jones. How to write a great research paper, 2016.

<https://www.nature.com/scitable/topicpage/scientific-papers-13815490/>

STUDYING ABROAD

USA, UK

EU (France, Germany, Holland, Belgium,...)

Asia (Japan, Korea)

Aim for the **best universities/best advisors** first

Aim for western profs first

Easy route: **master in Korea, PhD in USA/EU**

If advisor not nice, topic is boring, no future: QUIT



shutterstock.com • 341604614

Writing papers/proposals/books

Teaching courses

Supervising students

Collaborating with other people

Flexible working time

Do what fascinates you

Sort of exciting

> **6 years** of PhD and postdoc

Lower salary

Doing practical things

Strict working time

Do what clients told you to do

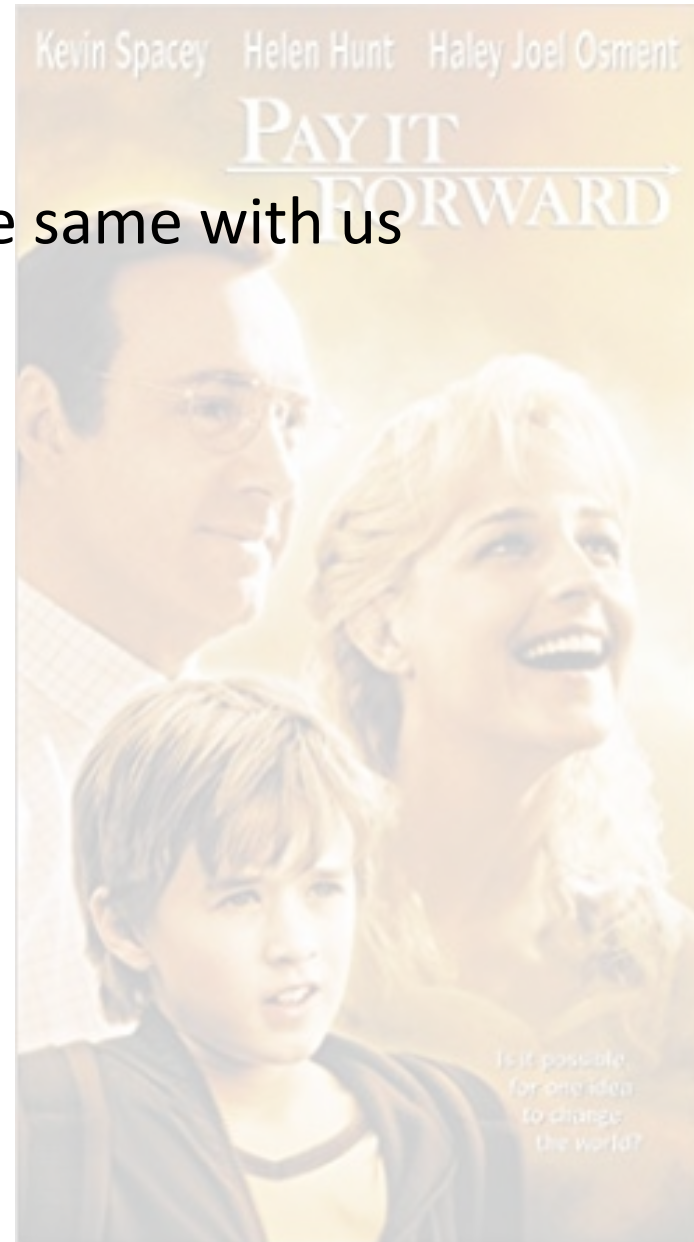
Kind of boring (?)

Higher salary

share & feel gratitude release oxytocin: **reduction of stress hormones**

open up more to others, they likely do the same with us

'If you want to **go quickly**, go **alone**.
If you want to **go far**, go **together**'



The Man Who **Asks a Question** is a **Fool for a Minute**, the Man Who Does Not Ask Is a **Fool For Life**



Confucius 孔子 (551– 479 BC)