

DARK MODE (Do not print; will waste ink)

Reminders:

- This reviewer is split into two parts, one for the first semester and another for the second. The reason is it is too big to be put into one document.
- The subjects within this reviewer are all STEM subjects for Grade 11.
- These are compiled based on my notes that I typed during classes and from PowerPoint presentations and other learning materials provided.
- This reviewer might contain wrong/inaccurate information; if you spot one, I would be glad to correct it.
- This reviewer is available in default light mode, separated by subjects, and dark mode (the background is black – dark gray). If you're planning to have this printed, PLEASE USE THE LIGHT MODE ONE, AS THE DARK MODE VERSION WILL PRINT WITH THE DARK BACKGROUND AND WILL WASTE PRINTER INK.
- If you have any concerns, please contact me on contentbyelmerf@gmail.com.

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Basic Calculus

A. Limit of a function

The limit of $f(x)$ as x approaches c is equal to L , provided that we can make the number $f(x)$ as close to L by choosing x sufficiently near, though not equal to the number c . In symbols,

$$\lim_{x \rightarrow c} f(x) = L$$

"The limit of $f(x)$ as x approaches c is L ."

Examples:

$$\lim_{x \rightarrow c} \frac{2x^2 - 5x - 3}{x - 3}$$

$$\lim_{x \rightarrow 0} \frac{\sqrt{x + 4} - 2}{x}$$

$$\lim_{x \rightarrow 0} \frac{|x + 2| - 2}{|x|}$$

Tabular Approach

Example 1:

To understand the concepts of limits, let's consider a particular function f given by

$$\lim_{x \rightarrow 2} = \frac{x^2 + x - 6}{x - 2}$$

We will analyze the behavior of the function as values of x are closer and closer to 2; values that are less than 2 and more than 2 but not equal to 2.

We begin with the values from the left of 2.

Values from the left of 2

x	f(x)	➤ Substitute the values of x to $\lim_{x \rightarrow 2} = \frac{x^2+x-6}{x-2}$
1	4	
1.5	4.5	➤ Since the idea is to use values that are sufficiently becoming close to 2 but not equal to 2, we initially use 1 being the integer closest to 2 from the left side.
1.9	4.9	
1.99	4.99	
1.999	4.999	
1.9999	4.9999	
1.99999	4.99999	

On the other hand, we also evaluate f using values to the right of 2.

Values to the right of 2

x	f(x)	
3	6	
2.5	5.5	
2.1	5.1	➤ Since the idea is to use values that are sufficiently becoming close to 2 but not equal to 2, we initially use 3 being the integer closest to 2 from the right side.
2.01	5.01	
2.001	5.001	
2.0001	5.0001	
2.00001	5.00001	

Left of 2

Right of 2

x	f(x)	x	f(x)
1	4	3	6
1.5	4.5	2.5	5.5
1.9	4.9	2.1	5.1
1.99	4.99	2.01	5.01
1.999	4.999	2.001	5.001
1.9999	4.9999	2.0001	5.0001
1.99999	4.99999	2.00001	5.00001

Summarizing the results of the investigation for $\lim_{x \rightarrow 2} = \frac{x^2+x-6}{x-2}$, we have the following conclusions:

- As x approaches 2 from the left, f approaches 5.
- As x approaches 2 from the right, f also approaches 5.

We call 5 as the limit of f as x approaches 2.

$$\lim_{x \rightarrow 2} = \frac{x^2 + x - 6}{x - 2} = 5$$

"The limit of $\lim_{x \rightarrow 2} = \frac{x^2 + x - 6}{x - 2}$ as x approaches 2 is 5."

Example 2:

To understand the concepts of limits, let's consider a particular function f given by

$$\lim_{x \rightarrow 4} x^2 - 6x + 11$$

We will analyze the behavior of the function as values of x are closer and closer to 4; values that are less than 4 and more than 4 but not equal to 4.

We begin with values from the left of 4.

Values from the left of 4

x	$f(x) = x^2 - 6x + 11$	➤ Substitute the values of x to $f(x) = x^2 - 6x + 11$
3	2	➤ Since the idea is to use values that are sufficiently becoming close to 4 but not equal to 4, we initially use 3 being the integer closest to 4 from the left side.
3.5	2.25	
3.9	2.81	
3.99	2.9801	
3.999	2.998001	
3.9999	2.9980001	
3.99999	2.99800001	

On the other hand, we also evaluate f using values to the right of 4.

Values from the right of 4

x	$f(x) = x^2 - 6x + 11$	
5	6	
4.5	4.25	
4.1	3.21	➤ Since the idea is to use values that are sufficiently becoming close to 4 but not equal to 4, we initially use 5 being the integer closest to 4 from the right side.
4.01	3.0201	
4.001	3.002001	
4.0001	3.00020001	
4.00001	3.0000200001	

Left of 4

$$x \quad f(x) = x^2 - 6x + 11$$

Right of 4

$$x \quad f(x) = x^2 - 6x + 11$$

3	2	5	6
3.5	2.25	4.5	4.25
3.9	2.81	4.1	3.21
3.99	2.9801	4.01	3.0201
3.999	2.998001	4.001	3.002001
3.9999	2.9980001	4.0001	3.00020001
3.99999	2.99800001	4.00001	3.0000200001

Summarizing the results of the investigation from $\lim_{x \rightarrow 4} x^2 - 6x + 11$, we have the following conclusions:

- As x approaches 4 from the left, f approaches 3.
- As x approaches 4 from the right, f also approaches 3.

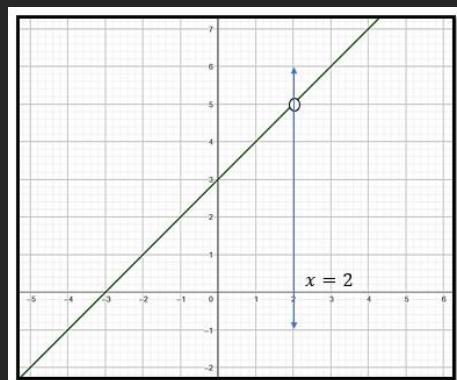
We call 3 as the limit of f as x approaches 4.

$$\lim_{x \rightarrow 4} x^2 - 6x + 11 = 3$$

"The limit of $\lim_{x \rightarrow 4} x^2 - 6x + 11$ as x approaches 4 is 3."

Graphical Approach

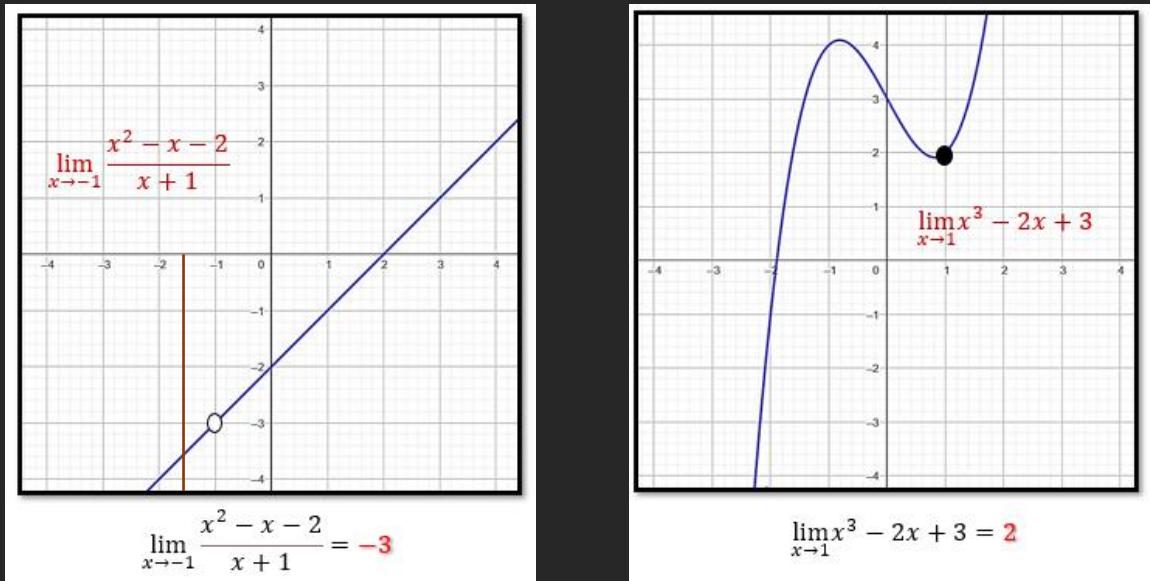
To further analyze the idea presented about the limit of the given function $\lim_{x \rightarrow 2} \frac{x^2+x-6}{x-2}$, let us illustrate the graph of f .



X: 2 Y: 5

Hence, in this graphical approach, we find that $\lim_{x \rightarrow 2} \frac{x^2+x-6}{x-2} = 5$.

Examples:



One sided limit

$$\lim_{x \rightarrow 1^-} f(x)$$

$$\lim_{x \rightarrow 1^+} f(x)$$

$$\lim_{x \rightarrow 0^+} f(x)$$

$$\lim_{x \rightarrow 2^-} f(x)$$

Left hand limit

$$\lim_{x \rightarrow a^-} f(x) = L$$

We can make $f(x)$ as close to L as we want for all x sufficiently close to a with $x < a$ without actually letting x be a .

Right hand limit

$$\lim_{x \rightarrow a^+} f(x) = L$$

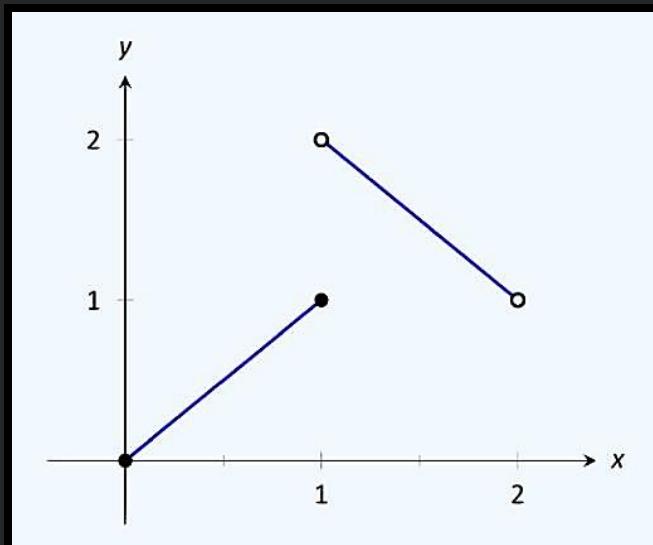
We can make $f(x)$ as close to L as we want for all x sufficiently close to a with $x > a$ without actually letting x be a .

$$\lim_{x \rightarrow 1^-} f(x)$$

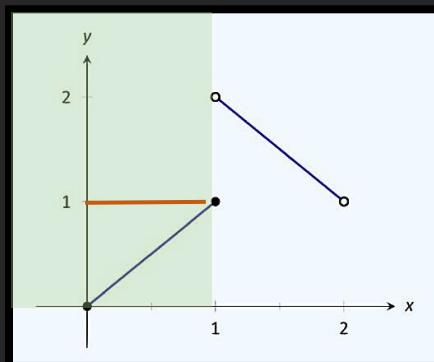
$$\lim_{x \rightarrow 1^+} f(x)$$

$$\lim_{x \rightarrow 0^+} f(x)$$

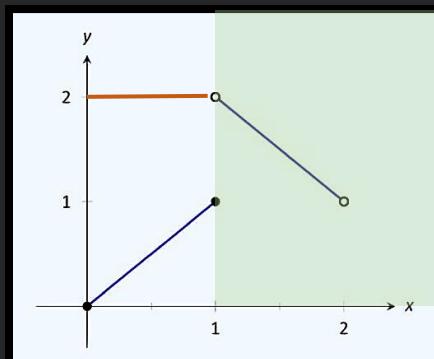
$$\lim_{x \rightarrow 2^-} f(x)$$



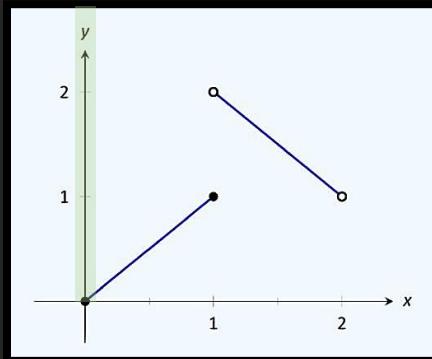
Example 1: $\lim_{x \rightarrow 1^-} f(x)$ As x goes to 1 from the left, we see that $f(x)$ is approaching the value of 1. Therefore,
 $\lim_{x \rightarrow 1^-} f(x) = 1$



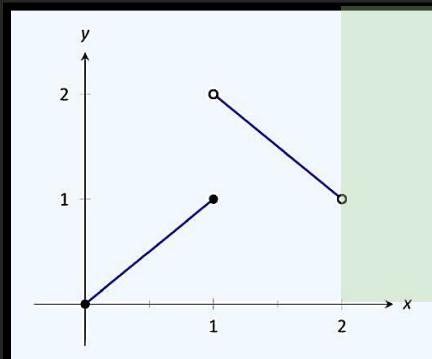
Example 2: $\lim_{x \rightarrow 1^+} f(x)$ As x goes to 1 from the right, we see that $f(x)$ is approaching the value of 2. Recall that it does not matter that there is an “open circle” there; we are evaluating a limit, not the value of the function. Therefore, $\lim_{x \rightarrow 1^+} f(x) = 2$.



Example 3: $\lim_{x \rightarrow 0^+} f(x)$ As x goes to 0 from the right, we see that $f(x)$ is approaching the value of 0. Therefore, $\lim_{x \rightarrow 0^+} f(x) = 0$.



Example 4: $\lim_{x \rightarrow 2^-} f(x)$ As x goes from the left, we see that $f(x)$ is approaching the value of 1. Therefore, $\lim_{x \rightarrow 2^-} f(x) = 1$.



B. Limit Theorems

Assuming f and g are functions of variable x . Subsequently, if the following limits exists:

$$\lim_{x \rightarrow a} f(x) = A \text{ and } \lim_{x \rightarrow a} g(x) = B$$

Then we can say that:

$$\lim_{x \rightarrow a} c = c \text{ where } c \text{ does not depend on } x$$

$$\lim_{x \rightarrow a} [f(x) + g(x)] = A + B$$

$$\lim_{x \rightarrow a} [f(x) \cdot g(x)] = AB$$

$$\lim_{x \rightarrow a} \left[\frac{f(x)}{g(x)} \right] = \frac{A}{B} \text{ where } B \neq 0$$

Theorem 1

The limit of a constant is equal to the constant itself.

$$\lim_{x \rightarrow a} c = c$$

Example 1: $\lim_{x \rightarrow 2} 4$

Solution:

$$\lim_{x \rightarrow a} c = c$$

Therefore:

$$\lim_{x \rightarrow 2} 4 = 4$$

NOTE: Any value of x nearer to 2 cannot change the value of the function. It will remain unchanged and constant.

Example 2: $\lim_{x \rightarrow -3} -2$

Solution:

$$\lim_{x \rightarrow a} c = c$$

Therefore:

$$\lim_{x \rightarrow -3} -2 = -2$$

NOTE: Any value of x nearer to -3 cannot change the value of the function. It will remain unchanged and constant.

Theorem 2

The sum of the limits of two functions is equal to the limit of their sum.

$$\lim_{x \rightarrow a} f(x) + \lim_{x \rightarrow a} g(x) = \lim_{x \rightarrow a} [f(x) + g(x)]$$

Example 1: $\lim_{x \rightarrow 2} (2x^2 + 5x)$

Solution:

Substitute 2 to x

$$[f(x) = 2x^2]$$

$$[g(x) = 5x]$$

$$[f(x) = 2(2)^2]$$

$$[g(x) = 5(2)]$$

$$[f(x) = 8]$$

$$[g(x) = 10]$$

$$8 + 10 = 18$$

Therefore:

$$\lim_{x \rightarrow 2} (2x^2 + 5x) = 18$$

Example 2: $\lim_{x \rightarrow -2} (x^3 - 3x)$

Solution:

Substitute -2 to x

$$[f(x) = x^3]$$

$$[g(x) = 3x]$$

$$[f(x) = (-2)^3]$$

$$[g(x) = 3(-2)]$$

$$[f(x) = -8]$$

$$[g(x) = -6]$$

$$-8 - (-6) = -2$$

Therefore:

$$\lim_{x \rightarrow -2} (x^3 - 3x) = -2$$

Theorem 3

The product of the limits of the two functions is equal to the limit of their product.

$$\lim_{x \rightarrow a} f(x) \cdot \lim_{x \rightarrow a} g(x) = \lim_{x \rightarrow a} [f(x) \cdot g(x)]$$

Example 1: $\lim_{x \rightarrow 3} [(3x + 1)(2x^3)]$

Solution:

Substitute 3 to x

$$[f(x) = 3x + 1]$$

$$[g(x) = 2x^3]$$

$$[f(x) = 3(3) + 1]$$

$$[g(x) = 2(3)^3]$$

$$[f(x) = 10]$$

$$[g(x) = 54]$$

Multiply 10 and 54

$$(10)(54) = 540$$

Therefore:

$$\lim_{x \rightarrow 3} [(3x + 1)(2x^3)] = 540$$

Example 2: $\lim_{x \rightarrow -1} [(2x)(3x^3 - 1)]$

Solution:

Substitute -1 to x

$$[f(x) = 2x]$$

$$[g(x) = 3x^3 - 1]$$

$$[f(x) = 2(-1)]$$

$$[g(x) = 3(-1)^3 - 1]$$

$$[f(x) = -2]$$

$$[g(x) = -4]$$

Multiply -2 and -4

$$(-2)(-4) = 8$$

Therefore:

$$\lim_{x \rightarrow -1} [(2x)(3x^3 - 1)] = 8$$

Theorem 4

The quotient of the limits of the two functions is equal to the limit of their quotient.

$$\lim_{x \rightarrow a} \left[\frac{f(x)}{g(x)} \right] = \frac{\lim_{x \rightarrow a} f(x)}{\lim_{x \rightarrow a} g(x)} \text{ if } \lim_{x \rightarrow a} g(x) \neq 0$$

Example 1: $\lim_{x \rightarrow -1} \left[\frac{2x^2 + 1}{3x} \right]$

Solution:

Substitute -1 to x

$$[f(x) = 2x^2 + 1]$$

$$[g(x) = 3x]$$

$$[f(x) = 2(-1)^2 + 1]$$

$$[g(x) = 3(-1)]$$

$$[f(x) = 3]$$

$$[g(x) = -3]$$

Divide 3 and -3

$$\frac{3}{-3} = -1$$

Therefore:

$$\lim_{x \rightarrow -1} \left[\frac{2x^2 + 1}{3x} \right] = -1$$

Example 2: $\lim_{x \rightarrow 2} \left[\frac{x^2 - 1}{2x} \right]$

Solution:

Substitute 2 to x

$$[f(x) = x^2 - 1]$$

$$[g(x) = 2x]$$

$$[f(x) = (2)^2 - 1]$$

$$[g(x) = 2(2)]$$

$$[f(x) = 3]$$

$$[g(x) = 4]$$

Divide 3 and 4

$$\frac{3}{4}$$

Therefore:

$$\lim_{x \rightarrow 2} \left[\frac{x^2 - 1}{2x} \right] = \frac{3}{4}$$

C. Continuity of a function

A function $y = f(x)$ is said to be continuous at c or has continuity at c if *all* of the following conditions are satisfied:

- i. $f(c)$ exists
- ii. $\lim_{x \rightarrow c} f(x)$ exists
- iii. $\lim_{x \rightarrow c} f(x) = f(c)$

If one or more of the conditions are not satisfied, then we say that f is *not continuous* at c or f is said to have *discontinuity* at c .

Example 1:

Using the definition of continuity, determine whether the function $f(x) = \frac{x-1}{2x^2-x-1}$ is continuous at the indicated value of a or not.

At $a = 0$

Solutions:

Condition 1: $f(c)$ exists

Substitute 0 to x

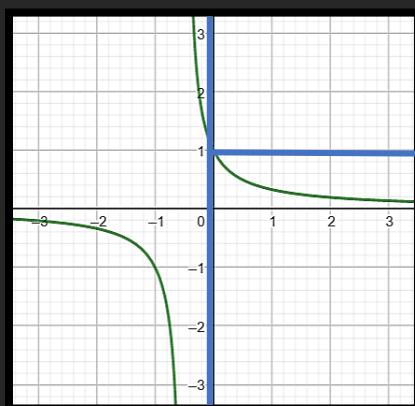
$$\begin{aligned}f(x) &= \frac{0-1}{2(0)^2-(0)-1} \\f(0) &= \frac{-1}{-1} \\f(0) &= 1\end{aligned}$$

Since $f(0) = 1$ which is a real number, $f(0)$ is defined.

Since $f(0)$ is defined and exists, move on to condition 2.

Condition 2: $\lim_{x \rightarrow c} f(x)$ exists

Use graphical approach:



$$\lim_{x \rightarrow 0} f(x) = 1$$

Using properties of limits, we see that $\lim_{x \rightarrow 0} f(x)$ exists.

Since $\lim_{x \rightarrow 0} f(x)$ exists, move on to condition 3.

Condition 3: $\lim_{x \rightarrow c} f(x) = f(c)$

$$\lim_{x \rightarrow 0} f(x) = 1 = f(0) = 1$$

Since $\lim_{x \rightarrow c} f(x) = f(c)$,

Condition 1: $f(c)$ exists

Condition met

Condition 2: $\lim_{x \rightarrow c} f(x)$ exists

Condition met

Condition 3: $\lim_{x \rightarrow c} f(x) = f(c)$

Condition met

Since all 3 conditions are met, we can conclude that **f is continuous at 0**.

Example 2:

Using the definition of continuity, determine whether the function $f(x) = \frac{2x-3}{x+3}$ is continuous at the indicated value of a or not.

At $a = -3$

Solutions:

Condition 1: $f(c)$ exists

Substitute -3 to x

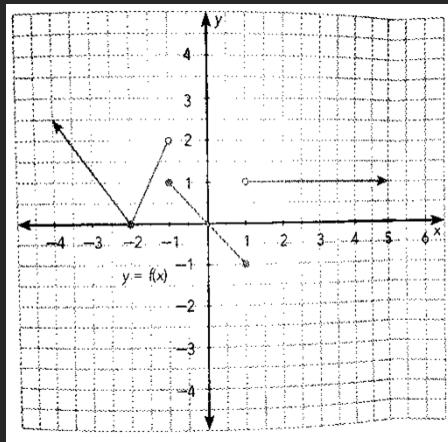
$$f(-3) = \frac{2(-3) - 3}{(-3) + 3}$$

$$f(-3) = \frac{-9}{0}$$

$$f(-3) = \text{Undefined}$$

Since $f(-3) = \text{undefined}$, **f is discontinuous at -3**. Do not move on to the next conditions.

Example 3: Determine if the function is continuous at $x = -2$



Condition 1: $f(c)$ exists

$f(c) = 0 \leftarrow \text{Exists; Condition 1 met}$

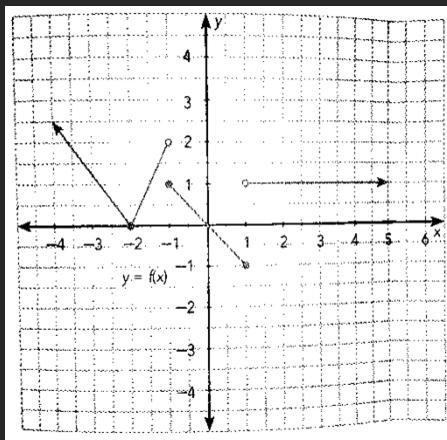
Condition 2: $\lim_{x \rightarrow c} f(x)$ exists

$-2^- = 0 \quad -2^+ = 0 \quad \leftarrow \text{Exists; Condition 2 met}$

Condition 3: $\lim_{x \rightarrow c} f(x) = f(c)$

Since $\lim_{x \rightarrow c} f(x) = f(c)$, continuous at -2

Example 4: Determine if the function is continuous at $x=1$



Condition 1: $f(c)$ exists

$f(c) = 1 \leftarrow$ Exists; Condition 1 met

Condition 2: $\lim_{x \rightarrow c} f(x)$ exists

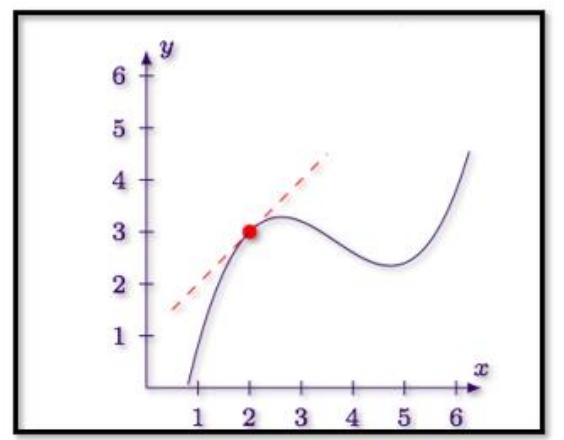
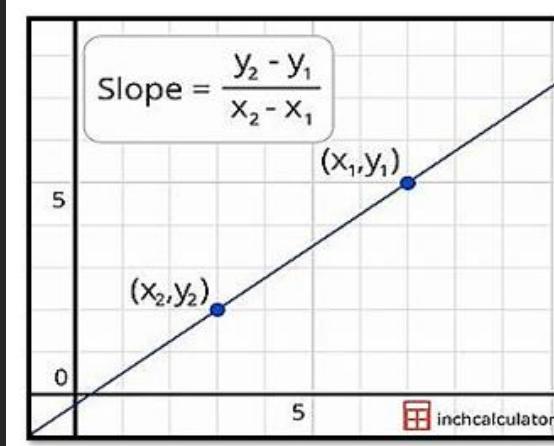
$$1^- = -1 \quad 1^+ = 1$$

\leftarrow DNE; Condition 2 not met

Since $\lim_{x \rightarrow c} f(x)$ does not exist, discontinuous at 1

D. Basic concepts of derivatives

Derivative – slope of a curve/rate of change



Slope of a Tangent line to f at (x_0, y_0)

The slope m_1 of the line tangent to a given function f at the point (x_0, y_0)

$$M_T = \lim_{x \rightarrow x_0} \frac{f(x) - f(x_0)}{x - x_0}$$

Examples

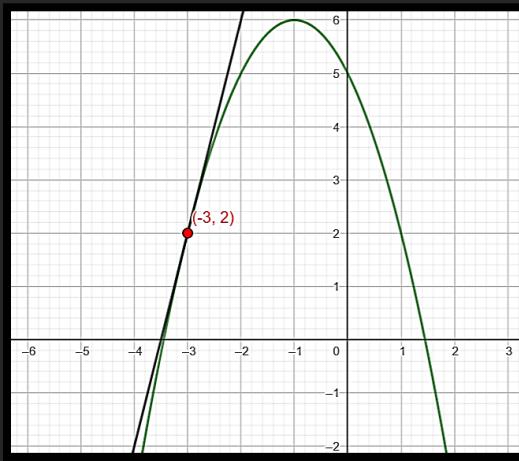
Example 1: Find the slope M_T of the line tangent to $f(x) = 5 - 2x - x^2$ at the point $(-3, 2)$. Sketch the curve and the tangent line

- a. Here, $(x_0, y_0) = (-3, 2)$. Thus, $x_0 = -3$ and $f(x_0) = f(-3) = 2 \leftarrow$ Substitute -3 to all the x in $f(x) = 5 - 2x - x^2$

$M_T = \lim_{x \rightarrow x_0} \frac{f(x) - f(x_0)}{x - x_0}$	$f(x) \rightarrow 5 - 2x - x^2$ $f(x_0) \rightarrow 2$ $x \rightarrow$ Remains as x $x_0 \rightarrow -3$
--	---

$M_T = \lim_{x \rightarrow -3} \frac{(5 - 2x - x^2) - 2}{x - (-3)}$	Substitute values
$M_T = \lim_{x \rightarrow -3} \frac{5 - 2x - x^2 - 2}{x - (-3)}$	Remove parenthesis
$M_T = \lim_{x \rightarrow -3} \frac{-x^2 - 2x + 5 - 2}{x + 3}$	Numerator: Arrange terms based on degree Denominator: $x - (-3) = x + 3$
$M_T = \lim_{x \rightarrow -3} \frac{-x^2 - 2x + 3}{x + 3}$	$5 - 2 = 3$
$M_T = \lim_{x \rightarrow -3} \frac{(x + 3)(-x + 1)}{x + 3}$	Turn into binomial
$M_T = \lim_{x \rightarrow -3} \frac{(x + 3)(-x + 1)}{x + 3}$	$x + 3$ on the numerator and denominator gets cancelled out
$M_T = \lim_{x \rightarrow -3} (-x + 1)$	Substitute -3 on $(-x+1)$ $[-(-3)+1]$ $[3+1]$ 4
$M_T = \lim_{x \rightarrow -3} 4$	Final answer

Hence, the slope of the line tangent to $f(x) = 5 - 2x - x^2$ at the point $(-3, 2)$ is **4**. The graph of the given curve and the tangent line is shown below:

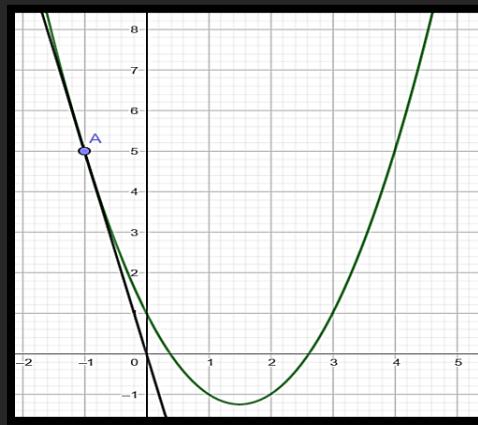


Example 2: Find the slope M_T of the line tangent to $f(x) = x^2 - 3x + 1$ at the point $(-1, 5)$. Sketch the curve and the tangent line.

- a. Here, $(x_0, y_0) = (-1, 5)$. Thus, $x_0 = -1$ and $f(x_0) = f(-1) = 5 \leftarrow$ Substitute -1 to all the x in $f(x) = x^2 - 3x + 1$

$M_T = \lim_{x \rightarrow x_0} \frac{f(x) - f(x_0)}{x - x_0}$	$f(x) \rightarrow x^2 - 3x + 1$ $f(x_0) \rightarrow 5$ $x \rightarrow$ Remains as x $x_0 \rightarrow -1$
$M_T = \lim_{x \rightarrow -1} \frac{(x^2 - 3x + 1) - (5)}{x - (-1)}$	Substitute values
$M_T = \lim_{x \rightarrow -1} \frac{x^2 - 3x + 1 - 5}{x + 1}$	Remove parentheses Denominator: $x - (-1) = x + 1$
$M_T = \lim_{x \rightarrow -1} \frac{x^2 - 3x - 4}{x + 1}$	$1 - 5 = -4$
$M_T = \lim_{x \rightarrow -1} \frac{(x - 4)(x + 1)}{x + 1}$	Turn numerator into two binomials
$M_T = \lim_{x \rightarrow -1} \frac{(x - 4)(x + 1)}{x + 1}$	$x + 1$ on both numerators and denominators gets cancelled
$M_T = \lim_{x \rightarrow -1} (x - 4)$	Substitute -1 on x $x - 4 \rightarrow -1 - 4 = -5$
$M_T = \lim_{x \rightarrow -1} -5$	Final answer

Hence, the slope of the line tangent to $f(x) = x^2 - 3x + 1$ at the point $(-1, 5)$ is -5 . The graph of the given curve and the tangent line is shown below:

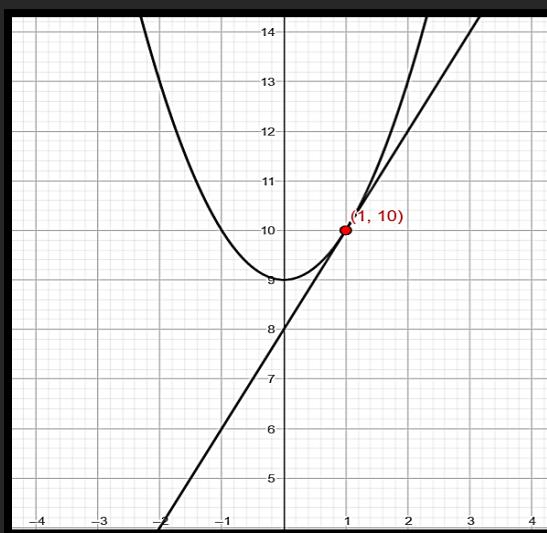


Example 3: Find the slope M_T of the line tangent to $f(x) = x^2 + 9$ at the point $(1, 10)$. Sketch the curve and the tangent line.

- a. Here, $(x_0, y_0) = (1, 10)$. Thus, $x_0 = 1$ and $f(x_0) = f(1) = 10 \leftarrow$ Substitute 1 to all the x in $f(x) = x^2 + 9$

$M_T = \lim_{x \rightarrow x_0} \frac{f(x) - f(x_0)}{x - x_0}$	$f(x) \rightarrow x^2 + 9$ $f(x_0) \rightarrow 10$ $x \rightarrow \text{Remains as } x$ $x_0 \rightarrow 1$
$M_T = \lim_{x \rightarrow 1} \frac{(x^2 + 9) - (10)}{x - (1)}$	Substitute values
$M_T = \lim_{x \rightarrow 1} \frac{x^2 + 9 - 10}{x - 1}$	Remove parentheses
$M_T = \lim_{x \rightarrow 1} \frac{x^2 - 1}{x - 1}$	$9-10 = -1$
$M_T = \lim_{x \rightarrow 1} \frac{(x+1)(x-1)}{x-1}$	Expand
$M_T = \lim_{x \rightarrow 1} \frac{(x+1)(x-1)}{x-1}$	$(x-1)$ on both numerators and denominators gets cancelled
$M_T = \lim_{x \rightarrow 1} x + 1$	Substitute 1 to x x+1 (1)+1 1+1 2
$M_T = \lim_{x \rightarrow 1} 2$	Final answer

Hence, the slope of the line tangent to $f(x) = x^2 + 9$ at the point $(1, 10)$ is 2. The graph of the given curve and the tangent line is shown below:



Derivative of a function

The derivative of $f'(x)$ of a function f at a number x in its domain is the expression obtained in the following limit:

$$f'(x) = \lim_{\Delta x \rightarrow 0} \frac{f(x + \Delta x) - f(x)}{\Delta x}$$

This definition is sometimes called limit definition of a derivative of a function

Examples

Example 1: Find the derivative of $f(x) = 5x - 1$ with respect to x using the limit definition

- a. Applying the definition of the derivative for $f(x) = 5x - 1$, we have:

$f'(x) = \lim_{\Delta x \rightarrow 0} \frac{f(x + \Delta x) - f(x)}{\Delta x}$	$f \rightarrow 5$ $f(x) \rightarrow 5x - 1$ $x + \Delta x \rightarrow \text{Remains the same}$ $\Delta x \rightarrow \text{Remains the same}$
$f'(x) = \lim_{\Delta x \rightarrow 0} \frac{[5(x + \Delta x) - 1] - (5x - 1)}{\Delta x}$	Substitute values
$f'(x) = \lim_{\Delta x \rightarrow 0} \frac{5x + 5\Delta x - 1 - 5x + 1}{\Delta x}$	Distribute 5 to $(x + \Delta x)$ Remove parenthesis for $(5x - 1) - 1$ becomes +1
$f'(x) = \lim_{\Delta x \rightarrow 0} \frac{5\Delta x + 5x - 5x - 1 + 1}{\Delta x}$	$5x - 5x = 0$ $-1 + 1 = 0$
$f'(x) = \lim_{\Delta x \rightarrow 0} \frac{5\Delta x}{\Delta x}$	Δx on both numerators and denominators gets cancelled
$f'(x) = \lim_{\Delta x \rightarrow 0} 5$	Final answer

Thus, the derivative of $f(x) = 5x - 1$ is $f'(x) = \lim_{\Delta x \rightarrow 0} 5$

Example 2: Find the derivative of $f(x) = x^2 + 3x$ with respect to x using the limit definition

- a. Applying the definition of the derivative for $f(x) = x^2 + 3x$ we have:

$f'(x) = \lim_{\Delta x \rightarrow 0} \frac{f(x + \Delta x) - f(x)}{\Delta x}$	$f \rightarrow x^2$ $f(x) \rightarrow x^2 + 3x$ $x + \Delta x \rightarrow \text{Remains the same}$ $\Delta x \rightarrow \text{Remains the same}$
$f'(x) = \lim_{\Delta x \rightarrow 0} \frac{[(x + \Delta x)^2 + 3(x + \Delta x)] - (x^2 + 3x)}{\Delta x}$	Substitute values
$f'(x) = \lim_{\Delta x \rightarrow 0} \frac{x^2 + 2x\Delta x + (\Delta x)^2 + 3x + 3\Delta x - x^2 - 3x}{\Delta x}$	Use the FOIL method for $(x + \Delta x)^2$ Distribute 3 on $(x + \Delta x)$ $-(x^2 + 3x) \rightarrow -x^2 - 3x$
$f'(x) = \lim_{\Delta x \rightarrow 0} \frac{2x\Delta x + (\Delta x)^2 + 3\Delta x + x^2 - x^2 + 3x - 3x}{\Delta x}$	Arrange by degree

$f'(x) = \lim_{\Delta x \rightarrow 0} \frac{2x\Delta x + (\Delta x)^2 + 3\Delta x}{\Delta x}$	$x^2 - x^2 = 0$ $3x - 3x = 0$
$f'(x) = \lim_{\Delta x \rightarrow 0} \frac{2x\Delta x + (\Delta x)^2 + 3\Delta x}{\Delta x}$	All Δx from the numerator and the denominator will get cancelled. $(\Delta x)^2$ will become Δx
$f'(x) = \lim_{\Delta x \rightarrow 0} (2x + \Delta x + 3)$	Substitute 0 to all Δx
$f'(x) = \lim_{\Delta x \rightarrow 0} 2x + 3$	Final answer

Thus, the derivative of $f(x) = x^2 + 3x$ is $f'(x) = \lim_{\Delta x \rightarrow 0} 2x + 3$

E. Differentiation rules

Recall, the limit definition of the derivative of a function is given by

$$f'(x) = \lim_{\Delta x \rightarrow 0} \frac{f(x + \Delta x) - f(x)}{\Delta x}$$

To determine the derivative of algebraic functions without using the limit definition, certain rules are to be considered.

Theorem 1 – Constant rule of differentiation

The derivative of a constant function is 0. That is, if a is a real number, then

$$\frac{d}{dx}[a] = 0$$

The rule specifies that the derivative of any constant is always zero.

Examples

Examples 1 – 3: Find the derivative of the following functions using the constant rule.

$y = 10$	$f(x) = \sqrt{2}$	$g(x) = \frac{2}{3}$
Using the constant rule, the derivatives are as follows:		
$\frac{dy}{dx} = 0$	$f'(x) = 0$	$g'(x) = 0$

Theorem 2 – The power rule of differentiation

If n is a rational number, then the derivative of the function $f(x) = x^n$ is $\frac{d}{dx}[x^n] = nx^{n-1}$

The rule indicates that to get the derivative of an algebraic function in the power form, we make the exponent n of the power the coefficient then copy the base x , and then supply the new exponent $n-1$.

Examples

Example 1: $y = x^3$

$$y = \textcolor{blue}{x}^3$$

$$y = 3(\textcolor{blue}{x})^{3-1}$$

$$\frac{dy}{dx} = 3x^2$$

Example 2: $f(x) = \textcolor{blue}{x}^6$

$$f(x) = \textcolor{blue}{x}^6$$

$$f(x) = 6(\textcolor{blue}{x})^{6-1}$$

$$f'(x) = 6x^5$$

Example 3: $f(x) = \frac{1}{x^8}$

a. First transform the function into power form

$$f(x) = \frac{1}{x^8}$$

$$f(x) = x^{-8}$$

b. Apply the power rule

$$f(x) = x^{-8}$$

$$f(x) = -8x^{-9}$$

c. Turn the function into fraction (exponent is negative)

$$f'(x) = \frac{-8}{x^9}$$

Example 4: $g(t) = (3x + 2)^2$

a. Expand the binomial (FOIL method)

$$g(t) = (3x + 2)^2$$

$$g(t) = 9x^2 + 12x + 4$$

b. Use the power rule on each term

$$g(t) = 9x^2 + 12x + 4$$

$$g(t) = 18x + 12 + 0$$

$$\mathbf{g(t) = 18x + 12}$$

Theorem 3 – The sum and difference rules of differentiation

The derivative of the sum of f and g is given by $\frac{d}{dx} [f(x) + g(x)] = f'(x) + g'(x)$

The derivative of the difference of f and g is given by $\frac{d}{dx} [f(x) - g(x)] = f'(x) - g'(x)$

Examples

Example 1: $y = x^2 + 3x$

- a. Find the derivative on each term

$$\begin{aligned}y &= x^2 + 3x \\ \frac{d}{dx} x^2 + \frac{d}{dx} 3x &\\ 2(x)^{2-1} + 1(3x)^{1-0} &\\ \frac{dy}{dx} &= 2x + 3\end{aligned}$$

Example 2: $y = x^4 - 2x^3 + 6x^2 - 1$

- a. Find the derivative on each term

$$\begin{aligned}y &= x^4 - 2x^3 + 6x^2 - 1 \\ \frac{d}{dx} x^4 - \frac{d}{dx} 2x^3 + \frac{d}{dx} 6x^2 - \frac{d}{dx} 1 &\\ 4(x)^{4-1} - 3(2x)^{3-1} + 2(6x)^{2-1} - 0 &\\ \frac{dy}{dx} &= 4x^3 - 6x^2 + 12x\end{aligned}$$

Theorem 4 – The product rule of differentiation

Let f and g be differentiable functions, then the product of f and g is also differentiable and its derivative is given by

$$\frac{d}{dx} [f(x)g(x)] = f(x)g'(x) + g(x)f'(x)$$

Examples

Example 1: $y = x^2(x^4 - 8x)$

- a. Distribute x^2 to $(x^4 - 8x)$

$$\begin{aligned}y &= x^2(x^4 - 8x) \\ y &= x^6 - 8x^3\end{aligned}$$

- b. Find the derivative for each term

$$y = x^6 - 8x^3$$

$$\begin{aligned}\frac{d}{dx} x^6 - \frac{d}{dx} 8x^3 \\ 6(x)^{6-1} - 3(8x)^{3-1} \\ \frac{dy}{dx} = 6x^5 - 24x^2\end{aligned}$$

Example 2: $y = (2 + 5t)^2$

- a. Expand the binomials (FOIL method)

$$\begin{aligned}y &= (2 + 5t)^2 \\ y &= 4 + 20t + 25t^2\end{aligned}$$

- b. Find the derivative for each term

$$\begin{aligned}y &= 4 + 20t + 25t^2 \\ \frac{d}{dx} 4 + \frac{d}{dx} 20t + \frac{d}{dx} 25t^2 \\ 0 + 1(20t)^{1-1} + 2(25)t^{2-1} \\ 0 + 20(1) + 50t \\ \frac{dy}{dx} &= 20 + 50t\end{aligned}$$

Theorem 5 – The quotient rule of differentiation

Let f and g be differentiable functions, then the quotient of f and g is also differentiable at all values of x for which $g'(x) \neq 0$ and its derivative is given by

$$\frac{d}{dx} \left[\frac{f(x)}{g(x)} \right] = \frac{g(x)f'(x) - f(x)g'(x)}{[g(x)]^2}$$

Examples

Example 1: $y = \frac{2x^3}{x^4+2}$

$y = \frac{2x^3}{x^4+2}$	$f(x) \rightarrow$ Numerator $\rightarrow 2x^3$ $g(x) \rightarrow$ Denominator $\rightarrow x^4+2$
$\frac{g(x)f'(x) - f(x)g'(x)}{[g(x)]^2}$	Given formula
$\frac{(x^4+2)\frac{d}{dx}[2x^3] - 2x^3\frac{d}{dx}[x^4+2]}{(x^4+2)^2}$	Substitute the values
$\frac{(x^4+2)\frac{d}{dx}[2x^3] - 2x^3\frac{d}{dx}[x^4+2]}{(x^4+2)^2}$	Get the derivative of $\frac{d}{dx}[2x^3]$ and $\frac{d}{dx}[x^4+2]$ If there are 2 or more terms inside the brackets, get the derivative for each term

$\frac{(x^4 + 2)(6x^2) - 2x^3(4x^3)}{(x^4 + 2)^2}$	$6x^2 \rightarrow 3(2x)^{3-1} \rightarrow 6x^2$ $4x^3 \rightarrow 4(x)^{4-1} \rightarrow 4x^3$
$\frac{6x^6 + 12x^2 - 8x^6}{(x^4 + 2)^2}$	Distribute $6x^2$ to (x^4+2) Distribute $2x^3$ to $4x^3$
$\frac{-2x^6 + 12x^2 - 0}{(x^4 + 2)^2}$	Simplify
$\frac{dy}{dx} = \frac{-2x^6 + 12x^2 - 0}{(x^4 + 2)^2}$	Final answer

Example 2: $y = \frac{8x-5}{1-2x}$

$y = \frac{8x-5}{1-2x}$	$f(x) \rightarrow$ Numerator $\rightarrow 8x-5$ $g(x) \rightarrow$ Denominator $\rightarrow 1-2x$
$\frac{g(x)f'(x) - f(x)g'(x)}{[g(x)]^2}$	Given formula
$\frac{(1-2x)\frac{d}{dx}[8x-5] - (8x-5)\frac{d}{dx}[1-2x]}{(1-2x)^2}$	Substitute the values
$\frac{(1-2x)\frac{d}{dx}[8x-5] - (8x-5)\frac{d}{dx}[1-2x]}{(1-2x)^2}$	Get the derivative of $\frac{d}{dx}[8x-5]$ and $\frac{d}{dx}[1-2x]$ If there are 2 or more terms inside the brackets, get the derivative for each term
$\frac{(1-2x)(8-0) - (8x-5)(0-2)}{(1-2x)^2}$	$8x \rightarrow 1(8x)^{1-1} \rightarrow 8x^0 \rightarrow 8(1) \rightarrow 8$ $2x \rightarrow 1(2x)^{1-1} \rightarrow 2x^0 \rightarrow 2(1) \rightarrow 2$
$\frac{8-16x+16x-10}{(1-2x)^2}$	Distribute 8 to $(1-2x)$ Distribute -2 to $(8x-5)$
$\frac{-2}{(1-2x)^2}$	Simplify
$\frac{dy}{dx} = \frac{-2}{(1-2x)^2}$	Final answer

F. Higher order derivatives

In general, if $y = f(x)$, then the notation of its derivatives are as follows:

First derivative	$y', f'(x)$, or $\frac{dy}{dx}$	Position or displacement (tells how fast the function is changing over time)
Second derivative	$y'', f''(x)$, or $\frac{d^2y}{dx^2}$	Tells how fast the first derivative is changing

Third derivative	$y''', f'''(x)$, or $\frac{d^3y}{dx^3}$	Tells how fast the second derivative is changing
nth derivative	$y^{(n)}, f^{(n)}(x)$, or $\frac{d^n y}{dx^n}$	

Examples**Example 1:** Determine the first, second, third, and fourth derivatives of the function

$$f(x) = x^5 - 2x^3 + 4x^2 - 5x - 12$$

- a. Using the differentiation rules, find the derivative of each term to get the first derivative

$$f(x) = x^5 - 2x^3 + 4x^2 - 5x - 12$$

$$f'(x) = 5x^4 - 6x^2 + 8x - 5$$

First derivative

- b. Using the differentiation rules, find the derivative of each term of the first derivative to get the second derivative

$$f'(x) = 5x^4 - 6x^2 + 8x - 5$$

$$f''(x) = 20x^3 - 12x + 8$$

Second derivative

- c. Using the differentiation rules, find the derivative of each term of the second derivative to get the third derivative

$$f''(x) = 20x^3 - 12x + 8$$

$$f'''(x) = 60x^2 - 12$$

Third derivative

- d. Using the differentiation rules, find the derivative of each term of the third derivative to get the fourth derivative

$$f'''(x) = 60x^2 - 12$$

$$f^4(x) = 120x$$

Fourth derivative

Example 2: Determine the first, second, third, and fourth derivatives of the function

$$y = \frac{2}{x^3} - \frac{x^3}{2} \rightarrow y = 2x^{-3} - \frac{1}{2}x^3$$

- a. Solutions (same process as above, use differentiation rules to get the derivatives)

$$\text{First derivative: } f'(x) = -6x^{-4} - \frac{3}{4}x^2 \text{ or } -\frac{6}{x^4} - \frac{3x^2}{2}$$

$$\text{Second derivative: } f''(x) = 24x^{-5} - 3x \text{ or } \frac{24}{x^5} - 3x$$

Third derivative: $f'''(x) = -120x^{-6} - 3$ or $-\frac{120}{x^6} - 3$

Fourth derivative: $f^4(x) = 720x^{-7}$ or $\frac{720}{x^7}$

G. Chain Rule

The chain rule tells us how to find the derivative of a composite function.

A composite function is generally a function that is written inside another function.

$f(x) = (5x + 1)^2$	$f(x) = (3x - 2)^7$	$f(x) = \sqrt{x + 1}$	$f(x) = (e^{3x})^{\frac{2}{3}}$
$f(g(x))$	$f(g(x))$	$f(g(x))$	$f(g(x))$
$f(x) = x^2$	$f(x) = x^7$	$f(x) = \sqrt{x}$	$f(x) = x^{\frac{2}{3}}$
$g(x) = 5x + 1$	$g(x) = 3x - 2$	$g(x) = x + 1$	$g(x) = e^{3x}$

Examples

Example 1: $f(x) = (5x + 1)^2$

$$f(u) = f(x) \rightarrow f(u) = u^2$$

$$u = g(x) \rightarrow u = 5x + 1$$

$f(g(x))$	u	$\frac{du}{dx}$	$y = f(u)$	$\frac{dy}{du}$	$\frac{dy}{dx} = \frac{dy}{du} \cdot \frac{du}{dx}$
$(5x + 1)^2$	$5x + 1$	5	u^2	$2u$	$2u \cdot 5$ $(2)(5)[u]$ $10(u)$
					Final answer: $10(5x + 1)$

- $f(g(x))$ – Given problem; in this case, $(5x + 1)^2$
- u – Value of $g(x)$; in this case, $5x+1$
- $\frac{du}{dx}$ – Derivative of u ; in this case, 5.
- $y = f(u)$ – Value of $f(x)$; in this case, u^2
- $\frac{dy}{du}$ – Derivative of $y=f(u)$; in this case, $2u$
- $\frac{dy}{dx} = \frac{dy}{du} \cdot \frac{du}{dx}$
 - Multiply $2u$ and 5, excluding u .
 - It will look something like this: $(2)(5)[u]$. Multiply the numbers (2 and 5)
 - $(2)(5) = 10 \rightarrow 10(u)$
 - Substitute u with the value of u (in this case, $5x+1$).
 - $10(u) \rightarrow 10(5x+1)$
 - That will be the final answer. No need to distribute.

Example 2: $(3x - 7)^{12}$

$$f(u) = f(x) \rightarrow f(u) = u^{12}$$

$$u = g(x) \rightarrow u = 3x - 7$$

$f(g(x))$	u	$\frac{du}{dx}$	$y = f(u)$	$\frac{dy}{du}$	$\frac{dy}{dx} = \frac{dy}{du} \cdot \frac{du}{dx}$
$(3x - 7)^{12}$	$3x - 7$	3	u^{12}	$12u^{11}$	$12u^{11} \cdot 3$ $(12)(3)[u]^{11}$ $36(u)^{11}$
Final answer:					36(3x - 7)¹¹

- $f(g(x))$ – Given problem; in this case, $(3x - 7)^{12}$
- u – Value of $g(x)$; in this case, $3x - 7$
- $\frac{du}{dx}$ – Derivative of u ; in this case, 3.
- $y = f(u)$ – Value of $f(x)$; in this case, u^{12}
- $\frac{dy}{du}$ – Derivative of $y=f(u)$; in this case, $12u^{11}$
- $\frac{dy}{dx} = \frac{dy}{du} \cdot \frac{du}{dx}$
 - Multiply $12u^{11}$ and 3, excluding u .
 - It will look something like this: $(12)(3)[u]^{11}$. Multiply the numbers (12 and 3)
 - $(12)(3) = 36 \rightarrow 36(u)^{11}$
 - Substitute u with the value of u (in this case, $3x - 7$).
 - $36(u)^{11} \rightarrow 36(3x-7)^{11}$
 - That will be the final answer. No need to distribute.

Example 3: $(3x^2 - 7x)^5$

$$f(u) = f(x) \rightarrow f(u) = u^5$$

$$u = g(x) \rightarrow u = 3x^2 - 7x$$

$f(g(x))$	u	$\frac{du}{dx}$	$y = f(u)$	$\frac{dy}{du}$	$\frac{dy}{dx} = \frac{dy}{du} \cdot \frac{du}{dx}$
$(3x^2 - 7x)^5$	$3x^2 - 7x$	$6x - 7$	u^5	$5u^4$	$5u^4 \cdot 6x - 7$ $5(6x - 7)[u]^4$ $30x - 35(u)^4$
Final answer:					$30x - 35(3x^2 - 7x)^4$

- $f(g(x))$ – Given problem; in this case, $(3x^2 - 7x)^5$
- u – Value of $g(x)$; in this case, $3x^2 - 7x$
- $\frac{du}{dx}$ – Derivative of u ; in this case, $6x - 7$.
- $y = f(u)$ – Value of $f(x)$; in this case, u^5
- $\frac{dy}{du}$ – Derivative of $y=f(u)$; in this case, $5u^4$
- $\frac{dy}{dx} = \frac{dy}{du} \cdot \frac{du}{dx}$
 - Multiply $5u^4$ and $6x-7$, excluding u .

- It will look something like this: $5(6x-7)[u]^4$. Distribute 5 to $6x-7$
- $5(6x-7)[u]^4 \rightarrow 30x-35(u)^4$
- Substitute u with the value of u (in this case, $3x^2-7x$).
- $30x-35(u)^4 \rightarrow 30x-35(3x^2-7x)^4$
- That will be the final answer. No need to distribute.

Example 4: $\sqrt{2x^3 + 5}$

$$f(u) = f(x) \rightarrow f(u) = \sqrt{u}$$

$$u = g(x) \rightarrow u = 2x^3 + 5$$

$f(g(x))$	u	$\frac{du}{dx}$	$y = f(u)$	$\frac{dy}{du}$	$\frac{dy}{dx}$ $= \frac{dy}{du} \cdot \frac{du}{dx}$
$\sqrt{2x^3 + 5}$	$2x^3 + 5$	$6x^2$	\sqrt{u} or $u^{\frac{1}{2}}$	$\frac{1}{2}u^{-\frac{1}{2}}$ or $\frac{1/2}{\sqrt{u}}$ or $\frac{1/2}{u^{\frac{1}{2}}}$	$\frac{1/2}{\sqrt{u}} \cdot 6x^2$ $\frac{3x^2}{\sqrt{u}}$
Final answer:					$\frac{3x^2}{\sqrt{2x^3 + 5}}$

- $f(g(x))$ – Given problem; in this case, $\sqrt{2x^3 + 5}$
- u – Value of $g(x)$; in this case, $2x^3 + 5$
- $\frac{du}{dx}$ – Derivative of u ; in this case, $6x^2$.
- $y = f(u)$ – Value of $f(x)$; in this case, \sqrt{u} or $u^{\frac{1}{2}}$

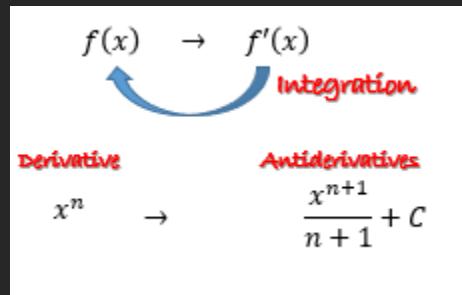
$\frac{dy}{du}$ – Derivative of $y=f(u)$; in this case, $\frac{1}{2}u^{-\frac{1}{2}}$ or $\frac{1/2}{\sqrt{u}}$ or $\frac{1/2}{u^{\frac{1}{2}}}$

- $\frac{dy}{dx} = \frac{dy}{du} \cdot \frac{du}{dx}$
 - Multiply $\frac{1/2}{\sqrt{u}}$ and $6x^2$
 - Since we can't move \sqrt{u} , it will remain in the equation
 - $6x^2 \cdot \frac{1/2}{\sqrt{u}} = \frac{3x^2}{\sqrt{u}}$
 - Substitute \sqrt{u} , in this case, $2x^3 + 5$
 - $\frac{3x^2}{\sqrt{u}} \rightarrow \frac{3x^2}{\sqrt{2x^3+5}}$
 - That will be the final answer. No need to simplify much further.

H. Indefinite Integral

A function F is an antiderivative of f on an interval I when $F'(x) = f(x)$ for all x in I .

The process of finding all the antiderivatives F of a function f is called antidifferentiation, which we shall call integration.



Integral Notation:

$$\int f(x)dx = F(x) + C$$

“The indefinite integral of $f(x)$ with respect to x is $F(x)$ plus the constant C ”

$f(x)$ – integrand

dx – variable of integration

$F(x)$ – antiderivative of $f(x)$

C – constant of integration

$$\int - \text{integral sign}$$

Examples

Find the indefinite integral of the following functions

Example 1: $\int x^3$

- Use the following formula:
 - $\int x^n = \frac{x^{n+1}}{n+1} + C, n \neq 1$
- X is the base (in this case, x), while n is the exponent (in this case, 3)
- $\int x^n = \frac{x^{n+1}}{n+1} + C \rightarrow \int x^3 = \frac{x^{3+1}}{3+1} + C$
- Simplify
 - $\int x^3 = \frac{x^4}{4} + C$
 - That will be the final answer. Do not forget to write $+ C$ at the end of the answer

Final answer: $\int x^3 = \frac{x^4}{4} + C$

- Checking
 - To check, find the derivative of $\frac{x^4}{4}$, the answer should be the given problem.

- $\frac{x^4}{4} \rightarrow \frac{4(x^{4-1})}{4} \rightarrow \frac{4x^3}{4} \rightarrow x^3$

Example 2: $\int x^7$

- $\int x^n = \frac{x^{n+1}}{n+1} + C, n \neq 1$
- $\int x^7 = \frac{x^{7+1}}{7+1} + C$
- $\int x^7 = \frac{x^8}{8} + C$

Final answer: $\int x^7 = \frac{x^8}{8} + C$

Example 3: $\int 3x^4 - 2x$

- Use the following formula:
 - $\int x^n = \frac{x^{n+1}}{n+1} + C, n \neq 1$
- Since there are two terms in the equation, we would do the following:
 - $\int x^n = \frac{x^{n+1}}{n+1} + C, n \neq 1$
 - $\int 3x^4 - 2x = \frac{3x^{4+1}}{4+1} - \frac{2x^{1+1}}{1+1} + C$
- Simplify
 - $\int 3x^4 - 2x = \frac{3x^5}{5} - \frac{2x^2}{2} + C$
 - $\int 3x^4 - 2x = \frac{3}{5}x^5 - x^2 + C$

Final answer: $\int 3x^4 - 2x = \frac{3}{5}x^5 - x^2 + C$

Example 4: $\int \frac{3x^2}{x}$

- Use the following formula:
 - $\int x^n = \frac{x^{n+1}}{n+1} + C, n \neq 1$
- Convert $\frac{3x^2}{x}$ into power form
 - $\frac{3x^2}{x} = 3x$
- Simplify
 - $\int x^n = \frac{x^{n+1}}{n+1} + C, n \neq 1$
 - $\int 3x = \frac{3x^{1+1}}{1+1} + C$
 - $\int 3x = \frac{3x^{1+1}}{1+1} + C$
 - $\int 3x = \frac{3x^2}{2} + C$
 - $\int 3x = \frac{3}{2}x^2 + C$

Final answer: $\int 3x = \frac{3}{2}x^2 + C$

Example 5: $\int \sqrt{t}$

- Use the following formula:

- $\int x^n = \frac{x^{n+1}}{n+1} + C, n \neq 1$

- Convert \sqrt{t} into power form

- $\sqrt{t} = t^{\frac{1}{2}}$

- Simplify

- $\int x^n = \frac{x^{n+1}}{n+1} + C, n \neq 1$

- $\int t^{\frac{1}{2}} = \frac{t^{\frac{1}{2}+1}}{\frac{1}{2}+1} + C$

- $\int t^{\frac{1}{2}} = \frac{t^{\frac{3}{2}}}{\frac{3}{2}} + C$

- $\int t^{\frac{1}{2}} = \frac{t^{\frac{3}{2}}}{\frac{3}{2}} + C$

- $\int t^{\frac{1}{2}} = \frac{2}{3}t^{\frac{3}{2}} + C$

Final answer: $\int t^{\frac{1}{2}} = \frac{2}{3}t^{\frac{3}{2}} + C$

Example 6: $\int \frac{1}{y^7}$

- Use the following formula:

- $\int x^n = \frac{x^{n+1}}{n+1} + C, n \neq 1$

- Convert $\frac{1}{y^7}$ into power form

- $\frac{1}{y^7} = y^{-7}$

- Simplify

- $\int x^n = \frac{x^{n+1}}{n+1} + C, n \neq 1$

- $\int y^{-7} = \frac{y^{-7+1}}{-7+1} + C$

- $\int y^{-7} = \frac{y^{-6}}{-6} + C$

- $\int y^{-7} = \frac{1}{-6y^6} + C$

Final answer: $\int y^{-7} = \frac{1}{-6y^6} + C$

Example 7: $\int 6x^2 - 4x + 3$

$$\int x^n = \frac{x^{n+1}}{n+1} + C, n \neq 1$$

- $\int x^n = \frac{x^{n+1}}{n+1} + C, n \neq 1$

- $\int 6x^2 - 4x + 3 = \frac{6x^{2+1}}{2+1} - \frac{4x^{1+1}}{1+1} + 3x + C$

- Notice above that + 3 became 3x. All constants will have to have an x beside it. This is done so if you find the derivative (of 3x in this case), you will get a constant (the given +3).
- $\int 6x^2 - 4x + 3 = \frac{6x^3}{3} - \frac{4x^2}{2} + 3x + C$
 - $\frac{6x^3}{3}$ and $\frac{4x^2}{2}$ can still be simplified
- $\int 6x^2 - 4x + 3 = 2x^3 - 2x^2 + 3x + C$

Final answer: $\int 6x^2 - 4x + 3 = 2x^3 - 2x^2 + 3x + C$

External Links

Limit of a function

<https://www.youtube.com/watch?v=EtUgSadwflc>

Christian Living Education

A. Human Person: Equal and Different

1 Corinthians 3:16

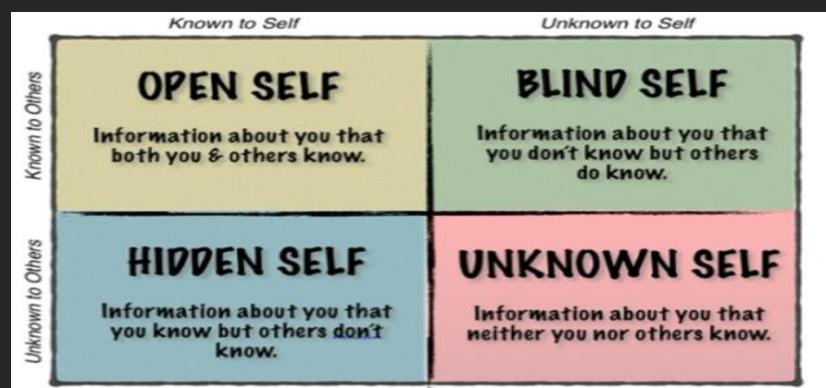
You are holy, for you are God's temple and God dwells in you.

Human life is sacred and that the dignity of the human person is the foundation of a moral vision for society. This belief is the foundation of all the principles of our social teaching.

Human Person

1. Embodied spirit
- Each person is created a body with a soul
2. Relational being
- We are always in a relationship
3. Conscious being
- We have free will and consciousness

Johari Window



Human Person: Unique yet fundamentally equal

Different	Equal
The way we relate with others	Dignity
Physical differences	

Traits and behavior	We are all created in the image and likeness of God
Talents and skills	
Status in life	Everyone deserves respect and love

Accepting persons for who they are can help us learn to appreciate our own selves. By appreciating our unique differences, we also acknowledge our common ground as persons.

Ephesians 2:10	You are God's masterpiece
Erin Mohring	God is so creative. He made each of us uniquely so that we connect with Him in different ways.

God uniquely created us, so we could learn to appreciate those who are different from us.

God's personal loving creative power, upholding all persons in their uniqueness, is the basis of our fundamental dignity as persons.

Created unique among all of God's creatures to share in His infinite knowing and loving.

Each of us is empowered by the Holy Spirit to love God and others and destined to live with God in eternity as His adopted son/daughter

Understanding how God loves each and every one of us personally becomes the foundation for loving our neighbor.

B. Human Person: Gifted with Rights

Definition

Human rights are the rights that all people have by virtue of being human beings. Human rights are derived from the inherent dignity of the human person and are defined internationally, nationally, and locally by various law-making bodies.

Human rights are defined as the supreme, inherent, and inalienable rights to life, to dignity, and to self-development. It is concerned with issues in both areas of civil and political rights and economic, social and cultural rights founded on internationally accepted human rights obligations.

Human Rights

Rights - Moral power

- To hold (rights to life, nationality, own property, rest and leisure)
- To do (rights to marry, peaceful assembly, run for public office, education)
- To omit (freedom from torture and cruel, inhuman or degrading punishment, freedom from arbitrary arrest, detention or exile)
- To exact something (equal protection for the law, equal access to public service, equal pay for equal work)

Rights are things that protect us from harm. Think of a baby that hasn't asked to come into the world... what are the basic rights you think any child should expect?

To be allowed to live (right to life) to be protected from harm; to be protected from disease; to have food and drink, basic minimum things such as these that we should all expect to have, wherever we live, have become known as human rights.

Five Basic Human Rights

Universal Declaration of Human Rights 1948

1. Equality in rights. All people should have the same rights.
2. Right to life. All people should be allowed to live.
3. Freedom from slavery. No person should be forced to work without fair pay and conditions.
4. Right to a fair trial. People should be able to defend themselves if they are accused of something wrong.
5. Freedom of expression. People should be able to say what they want as long as it does not go against the law or another human right.

Characteristics of Human Rights

- Universal
- Internationally guaranteed
- Legally protected
- Protects individual and group
- Cannot be taken away
- Equal and indivisible
- Obliges states and state actors

Categories of Human Rights

- Civil
 - The right to be treated as an equal to anyone else in society. Rights belonging to a person by reason of citizenship.
- Political
 - The right to participate in running or influencing the administration of the government.
- Economic
 - The right to participate in an economy that benefits all; access to resources.
- Social
 - Relates to living together or enjoying life in communities or organized group, the right to education, health care, food, clothing, shelter and social security.
- Cultural
 - Ensures the well-being of the individual and foster the of preservation, enrichment and dynamic evolution of arts, manners and way of living of a group with principles of unity in diversity of expression.

Some rights

Civil Rights

- Life
- Belief in own religion
- Opinion
- Free speech
- Non-discrimination according to sex

- Marry
- Race
- Cultural background

Political Rights

- Vote in elections
- Freely form or join political parties
- Live in an independent country
- Stand for public office
- Freely disagree with views and policies of political leaders

Economic Rights

- Jobs
- Work without exploitation
- Fair wage
- Safe working conditions
- Form trade unions
- Have adequate food
- Protection against labor malpractices

Social Rights

- Housing
- Education
- Health services
- Recreation facilities
- Clean environment
- Social security

Cultural Rights

- Use own language
- Develop cultural activities
- Ancestral domains
- Develop own kind of schooling

Importance of Human Rights

Human rights are important because, the States affirmed the universal respect for inalienable rights and fundamental freedoms of each and every person, including the principles of the prohibition against arbitrary detention, the right to due process and other civil and political rights as well as social, cultural and economic rights.

These fundamental human rights should be “a common standard of achievement for all peoples and nations”

They are the basic rights that all human beings should enjoy, respect, and protect.

The obligation to respect means that States must refrain from interfering with or curtailing the enjoyment of human rights. The obligation to protect requires States to protect individuals and groups against human rights abuses. The obligation to fulfill means that States must take positive action to facilitate the enjoyment of basic human rights.

"Human rights are what reason requires and conscience demands. They are us and we are them. Human rights are rights that any person has as a human being. We are all human beings; we are all deserving of human rights. One cannot be true without the other."

- Kofi Annan, Secretary-general of the UN.

C. Human Person: Rights and Responsibilities

Declaration of Human duties and Responsibilities

It states: "as the holders of human rights and fundamental freedoms, all individuals, peoples, and communities in the exercise of their rights and freedoms, have the duty and responsibility to respect those of others, and a duty to strive for the promotion and observance thereof".

This statement continues appropriately the way initiated the UDHR in Article 29 and reiterates the interaction of duties, responsibilities, and rights of the International Covenants on Human Rights of 1966.

Karapatan

Ang karapatan ay tumutukoy sa mga bagay na nararapat sa bawat nilalang o tao.

Ang karapatang-pantao ay mga prinsipyong gumagabay sa pananaw ng tao tungkol sa pagtrato ng kaniyang kapwa, at sa dignidad nya bilang tao.

Pangangalaga sa Karapatang-Pantao

- Universal Declaration of Human Rights (1946)
- "Peace on Earth" (Pacem in Terris) an encyclical of Pope John XXIII (1963)

Karapatang Pantao

- Sumapi sa ibang relihiyon
- Magkaroon ng ari-arian
- Mag-alaral
- Mamuhay nang ligtas at mapayapa
- Mag-asawa at magkaroon ng pamilya
- Kumita nang sapat upang mamuhay ng marangal
- Maglakbay
- Maipahayag ang mga kuro-kuro
- Maglibang
- Makisalamuha sa iba
- Mapangalagaan nang pantay ng batas
- Sumamba
- Magkaroon ng nasyonalidad
- Magkaroon ng kalayaan sa paniniwala at pag-iisip
- Magkaroon ng panlipunang seguridad

- Mabuhay ng marangal
- Magmahal at mahalin

Mga paglabag sa Karapatang Pantao

- Abortion
- Child abuse
- Diskriminasyon at karahasan sa mga kababaihan
- Pagwawalang-bahala sa mga may kapansanan
- Diskriminasyong pangkasarian
- Pagbebenta o ginagawalng kalakal ang tao (human trafficking)
- Pagkamkam ng lupa
- Galit sa ibang lahi (racism/racial discrimination)
- Terorismo

Mga tungkuling nakapaloob sa bawat karapatan

1. Ang bawat tao, hindi alintana ang kasarian, pinagmulan, katayuan sa lipunan, wika, edad, relihiyon, nasyonalidad, ay may pananagutan na pakitunguhan ang lahat ng tao sa makataong pamamaraan
2. Ang lahat ng tao ay may pananagutan na pagsumikapang pangalagaan ang dignidad at pagpapahalaga sa sarili at kapwa.
3. Ang bawat tao ay may pananagutang itaguyod ang mabuti at maiwasan ang kasamaan sa lahat ng bagay.
4. Ang lahat ng tao na pinagkalooban ng katwiran at budhi ay may pananagutan sa lahat, sa pamilya at lipunan, sa lahi, bansa at relihiyon.
5. Ang lahat ng tao ay may pananagutang igalang ang buhay.
6. Ang bawat tao ay may pananagutang kumilos nang may integridad, katapatan at pagkamakatarungan.
7. Ang lahat ng tao na pinagkalooban ng sapat na kakayaan ay may pananagutan na magsumikap upang mapaglabanan ang kahirapan, pagkagutom, kamangmangan at hindi pagkapantay-pantay.
8. Ang lahat ng tao ay may pananagutan na paunlarin ang kanilang talento sa pamamagitan ng masigasig na paggawa. Ang lahat ay kinakailangang magkaroon ng patas na pribilehiyo na makapag-aryl at "pagkakaroon ng makabuluhang trabaho/hanapbhay".
9. Ang lahat ng tao ay handang tumulong sa mga aba, may kapansanan at biktima ng diskriminasyon.
10. Ang lahat ng tao ay may pananagutan na magsalita at kumilos nang may katapatan.
11. "Ang kalayaan sa pamamahayag ay dapat gamitin nang may responsibilidad at masusing pagpapasya". Ang kalayaang ito ay nagdadala ng namumukod-tanging pananagutan para sa isang wasto at matapat na pag-uulat. Kailangang iwasan ang dramatikong pag-uulat na pagpapababa sa dignidad ng tao.
12. Ang kalayaang panrelihiyon ay nararapat bigyang katiyakan kaya naman ang mga kumakatawan sa bawat relihiyon ay may pananagutan na iwasan ang pahayag na may kinikilingan at diskriminasyon patungkol sa ibang pananampalataya.
13. Ang bawat lalaki at babae ay may pananagutang ipakita ang paggalang sa isa't isa. Walang sinuman ang magsasailalim ng ibang tao sa pananamantalang sekswal o

dependensiya. Sa halip, ang magkabiyak ay dapat tanggapin ang responsibilidad na kalingain ang bawat isa.

14. Ang pagpaplano ng pamilya ay pananagutan ng mag-asawa. Ang ugnayan sa pagitan ng magulang at mga anak ay dapat magpakita ng pag-ibig, paggalang, pagpapahalaga, at pagmamalasakit. Walang magulang o ibang nakatatanda ang mananamantala at mangaabuso ng bata.

D. Appreciating our Christian Family

What is a family

Pope John Paul II (Letter to Families)

- The family is the center and the heart of the civilization of love
- The family is the foundation of a just and loving world
- Each family is called to teach its members to be of loving service to one another

Christian view of the family

- Whoever is without love does not know God, for God is love. – 1 John 4:8

Conditions besetting the Filipino Family

1. The pressure to attain economic security
 - For other families, it is not poverty that pushes parents to seek better work opportunities but the ever-growing desire to have the greater comforts of the "good life".
2. The mindset of seeing relationships primarily as an exchange of goods
 - The attitude "what's in it for me" makes a person concerned only about what they can get out of their relationships with other people

A Covenant Relationship

The love we share within our families and the love of our parents have for one another, on which our families are built, are images of God's own love

It is in and through God's love that our families can truly become an intimate community of life and love.

The communion of love we share within our families begins with the love and fidelity which our father and mother have pledged to share with each other in marriage

This "forever" kind of love professed and celebrated by our parents in the sacrament of matrimony is founded on the covenant God made His people

Just as the covenant relationship between God and His people is a pledge of everlasting Fidelity. Our parents committed themselves in marriage to live in total fidelity and unbreakable oneness.

God's covenant love brings fullness of life to His people, the love of our parents allows us to be born, raised, nourished, and respected as human persons.

In faith, we believe that marriage is not just a contract but a sacrament of Christ's love for His Church. As such, we are called to stand against anything that threatens the stability of marriage (e.g., divorce) and the faithfulness of the spouse to one another (e.g., marital infidelity, polygamy)

By rejecting these violations of the sanctity of marriage, we affirm the truth that persons become their fullest selves only in the context of a family that lives a covenant relationship

A Domestic Church

Just as the Father has established with us eternal covenant of love in his Incarnate Son, so Christ has bound himself to the Church as his bride. The love shared and experienced between spouses and among family members is a sharing in Christ's love for the Church.

The experience being loved by parents and siblings and the responsibility of respecting and loving them are the fruits of Christ's faithful love for his people.

The human family, being the foundation of the whole Church and strengthened by Christ's own loving teaching and example, is thus a "Church in the home". a domestic Church.

Through our family we become loving communities in which human life is welcomed, nurtured, and raised to share life with others.

In the same way, the Church nourishes our faith through teaching, service, and worship, the Christian family is our "first school of discipleship".

It is through our parents that we introduced to the basic truths, good acts, and prayers we need to understand and live out as followers of Jesus.

It is also in our families that we are able to exercise the Christian virtues of "active, charity, mutual forgiveness, and obedience, prayer and thanksgiving" (CFC 1014)

Through guidance in faith, selfless service, and living as true communities of love, our families become a sacrament of Christ and a living example of our Church's own nature and mission

The first vital cell of society

The family is the most basic community upon which society builds itself. This means not only that the family is the necessary unit through which citizens are born and grow in number. More precisely, the family is the vital cell of society because it is where persons are nurtured and trained to become good and productive members of society.

Traditional Filipino Values

- Kasipagan (diligence in work)
- Katapatan (honesty)
- Pakikisama (cooperation with others)
- Pakikipagkapwa-tao (solidarity)

Through the formation and education, we receive from our families, we become aware of our social responsibilities, become more sensitive and compassionate to those who are suffering, and grow more committed to serve others with generosity and self-sacrifice.

E. Moral Law

What is law

An ordinance of reason promulgated by competent authority for the sake of common good. (St. Thomas Aquinas)

Ordinance of reason

- It is reasonable, a product of prudent and serious deliberation
- It should not be based merely on an individual's or a group's whims, emotions, or sentiments.
- Example: The law prohibiting a person who has consumed alcohol from driving is based on concrete scientific findings that alcohol consumption can lead to poor judgment and loss of muscle control and coordination

Properly promulgated

- It must be clearly communicated to all people concerned
- A person can't be expected to follow a law without sufficient notice; thus, we have the corresponding duty to know and understand the laws that affects us.
- Example: Students and parents' orientation in school. The school must provide students with a handbook containing the important academic and disciplinary policies that affect all students in the school.

Competent authority

- A person with legitimate authority has the power of creating and implementing laws for their respective communities
- Example: Based on the principle of the separation of the church and the state, the Church leader cannot create laws for the country nor can government leaders enact Church laws.

Common good

- Must foster a freedom and dignity of all persons and not just the individual good of some

Remember

- Not everything legal is automatically morally good
- An act is deemed legal if it does not contradict any state law, while an act is morally good if the nature, intention, and circumstances of the act are all positively good based on moral norm for the person as a person-in-community (CFC 804) Ex.: the argument of some people that abortion and divorce are perfectly moral because these acts are currently legal in other nations

Types of law

Natural law

- It is the universal moral law grounded on our human nature, discernible through human reason (VS 79)
- It is not the general "Law of Nature", which compasses all scientific laws, but rather the "Law of our human nature"
- The natural law flows from our human nature as created by God. Our nature as human natures are the first gift that God creates all persons to become free, responsible, and rational beings.

Divine law

- The laws revealed to us by God throughout history and at various events
- God's revelation of His Divine law was shown in two important events. The first event foreshadows the second, while the second event fulfills the first.
- Old Testament: Moses and the Ten Commandments
 - Through Moses, God gave the Ten Commandments (the Decalogue) to the Israelites, instructing and commanding them on how to live as His Chosen People.
 - For the Israelites, the Decalogue is the greatest proof of God's unconditional love for them
 - The Law (Torah) binds them to God in a loving relationship known as the Covenant.
 - For us Christians, the Decalogue is a fundamental part of Jesus' moral teachings. [Ex. The Rich Young Man (Mt. 19: 16-22)]
 - The Decalogue constitutes the fundamental moral law which governs authentic freedom in community. Jesus affirmed the truth that only in doing good-in performing our duties, in observing our moral obligations, in following the Ten Commandments - we can be truly free.
 - A Summary of the Ten Commandments and the Basic Human Values they uphold
 - Ten Commandments (Dt 5:6-21; Ex 20:2-17)
 1. I, the Lord, am your God, who brought you out of the land of Egypt, that place of slavery. You shall not have other gods beside me.
 - We recognize the One God as the one transcendent center of all reality. All other things are important insofar as they draw us closer to God.
 2. You should not take the name of the Lord, your God, in vain
 - We reverence God's transcendent holiness and all things associated with Him.
 3. Take care to keep holy the Sabbath Day
 - We value the indispensable role of worship - both personal and communal - as persons created by God.
 4. Honor your father and mother
 - We see the human family as a community and sacrament of God's love. We recognize the duties and roles of parents and children to one another.
 5. You shall not kill
 - We must cherish and uphold God's gift of life
 6. You shall not commit adultery
 7. You shall not covet your neighbor's wife

- We must respect the gift of our human sexuality as the sacredness of marriage
- 7. You shall not steal
- 10. You shall not covet your neighbor's house or field... nor anything that belongs to him
 - We must respect the property of all persons and foster justice for all
- 8. You shall not bear dishonest witness against your neighbor
 - We must value the right of all persons to a good name as well as the value of honesty in all our interpersonal human relations.
- New Testament: Jesus' Law of Love and the Beatitudes
 - Through Jesus, God perfect His covenant with His Chosen People with a New Covenant by offering His only begotten Son.
 - Jesus, the new Law-giver (Ex.: The greatest commandment (law of Love)
 - Summary of the Beatitudes and their meaning (Mt. 5:3-12)
 - 1. Blessed are they poor in spirit for theirs is the kingdom of heaven
 - We are called to recognize our radical dependence on God from whom flows all that we have and are
 - 2. Blessed are they who mourn for they shall be comforted
 - We are called to sincere compassion for all who suffer
 - 3. Blessed are the meek for they shall inherit the earth
 - We are called to open positive humble relation to others through all out powers graced by Christ's love
 - 4. Blessed are they who hunger and thirst for righteousness, for they will be satisfied
 - We are called to actively strive for justice and reject the injustices in our community
 - 5. Blessed are the merciful, for they will be shown mercy
 - We are called to a compassionate commitment to suffering persons. Mercy is not mere sentimentality but is shown in our hearts.
 - 6. Blessed are the clean of heart, for they will see God
 - We are called to be upright and truly Christ-centered in our love for God and others
 - 7. Blessed are the peacemakers, for they will be called the children of God
 - We are called to foster peace that is founded on truth, justice, and the grace of God.
 - 8. Blessed are they who are persecuted for the sake of righteousness, for theirs is the kingdom of heaven
 - We are called to follow Christ even in the face of strong opposition as he himself did and thus discover the true "good life"

9. Blessed are you when they insult you and persecute you and utter very kind of evil against you (falsely) because of me. Rejoice and be glad, for your reward will be great in heaven
- Our commitment to Jesus demands hearts willing to confront the reality of "not being too popular" because we have chosen what is good.

Church law

- These are expressions of Christ's laws of love in the particular circumstances of Christian living. As member of Christ's Body, we have the duty to understand the follow the teachings of the Church.
- Through many centuries of experience and serious reflection, the Catholic Church has handed down the apostolic tradition and Sacred Scripture, interpreting Christ's teachings to each new age and culture by responding to the ageless moral questions of human persons.
- Certain church laws have evolved through time. This is because of the ever-changing historical realities of following Christ through the ages. The basic human values fostered by the Church laws are constant - be just, be chaste, protect life - for they are intrinsically part of our being human as expressed in natural law, but the actual exercise of these values - how they lived out - changes with the historical, cultural, and physical circumstances
- Examples of Church laws pertinent to our study of morality
 - The fundamental understanding of who we are, what our final goal is, how we are to get there, what constitutes authentic freedom and love.
 - The role of the family in the formation of the youth and in the transformation of society
 - The marriage law of the Church
 - The specific teachings of the Church on moral issues like abortion, euthanasia, suicide, and human sexuality
 - The social teachings of the Church pertaining to human rights, social justice, and dignity of labor.

Civil law

- For our country, the most important civil law is the Philippine Constitution because this document expresses in clear terms the freedoms and obligations of both the state and its people. (Ex.: Article II, Section 12 of the 1987 Philippine Constitution)
 - Article II, Section 12 of the 1987 Philippine Constitution
 - The state recognizes the sanctity of family life and shall protect and strengthen the family as a basic autonomous social institution. It shall equally protect the life a mother and the life of the unborn from the conception. The natural and primary right and duty of parents in the rearing of the youth for civic efficiency and the development of moral character shall receive the support of the Government

Moral law

- Every human being has moral sense or the motivation deriving logically from ethical/moral principles that govern his thoughts and actions
- Functions of Moral Law
 - To provide criteria for judging who we are and how we should act
 - To help in our moral development, especially in the formation of our conscience
 - To provide stability and consistency in our lives
 - To challenge us by stretching us in view of an ideal
- Mabuti at tama
 - Ang mabuti ay ang mga bagay na tutulong sa pagkabuo ng sarili. Ang puso at isip ang gabay upang kilatisin ang mabuti.
 - Ang tama ay ang pagpili ng mabuti batay sa panahon, kasaysayan, konteksto, at sitwasyon. Tinitingnan dito ang mga pangangailangan at kakayahang gagawa ng pagpili.
- Conscience and moral law
 - Laws are universal; they do not touch the full reality of concrete individual thoughts, words, and actions. It is only our conscience that judges whether an individual moral act violates a certain law or not
 - Conscience is our subjective norm; it is our reason which applies a universal objective moral norm to a particular free act
 - Conscience and moral norms are always interrelated. They inseparable, but in the last analysis, the conscience is the final lawgiver.

Empowerment Technologies

A. Introduction to ICT

Information and Communications Technology

- ICT, or Information and Communications Technology (or technologies), is the infrastructure and components that enable modern computing.
- Although there is no single, universal definition of ICT, the term is generally accepted to mean all devices, networking components, applications and systems that when combined allows people and organizations to interact in the digital world.

B. Components of an ICT system

- ICT encompasses both the internet-enabled sphere as well as the mobile one powered by wireless networks. It also includes antiquated technologies, such as landline telephones, radio and television broadcast.
- The list of ICT components is exhaustive, and it continues to grow. Some components, such as computers and telephones, have existed for decades. Others, such as smartphones, digital TVs and robots, are more recent entries.

C. Philippine ICT roadmap

- In the Philippines, ICT is already widely recognized as a potent tool for socioeconomic upliftment. No less than the 1987 Constitution gives cognizance to ICT's role in nation-building. The Arroyo Administration's Medium Term Philippine Development Plan (MTPDP) identifies ICT as one of the drivers of job creations and investments.

- Philippines is dubbed as the ICT Hub of Asia because of the huge growth of ICT related jobs, one of which is Business Process Outsourcing, or call centers.
- Five years ago, the Philippines started its "Make IT Philippines" campaign packaged the country as "E-Service Hub of Asia" through the Department of Trade and Industry.
- The Philippines waved the flag in Asia, Europe, and USA to announce the Philippines outsourcing pitch from trade missions to outsourcing exhibitions.
- The DTI I.T Business Plan identified six priority areas that needs for promotion that includes contact centers, business process outsourcing, software development, medical transcription, and engineering design.

D. Trends in ICT

- As we enter the 4th year of the "4th Industrial evolution" - the era of connected intelligence, our relationships with technology and its impact on global society will come into even sharper focus. The primary new technologies of this decade - AI, cloud, mobile/5G, cybersecurity, blockchain and the Internet of Things (IoT) - are even more significant and impactful than we may realize.

Convergence

- Technology convergence is the integration of a number of disparate technologies or functions into a single integrated system. The Internet and digital convergence are classical examples of this. Virtually all modes of telecommunication are rapidly converging upon the Internet protocol as a single standard for telecommunications.
- Digital convergence refers to the merging of four distinct industries into one conglomerate: IT, telecommunication, consumer electronics, and entertainment.

Niche social media platforms

- Facebook and Instagram have long dominated social media as the largest and most popular platforms. However, in recent years, several other niche social media platforms have not only emerged but have significantly risen to fame.
- Tiktok, for example, is one such platforms that started in 2016 and immediately gained popularity among youth. There are several such alternative social media platforms that are gaining popularity and will continue doing so in 2020 and beyond.

Social commerce

- Social commerce is well on its way to becoming a mainstream retail channel on par with other mediums like websites and offline stores.

E. Internet Technologies

Mobile technologies

- Is enriching our lives. It is giving a voice to those without, either due to circumstance or medical conditions. It is making communication possible for those who live in a void.

Online platforms

- Are technologies that are grouped to be used as a base upon which other application processes or technologies are developed.
- Examples
 - Presentation/visualization
 - Communicates information clearly and efficiently via statistical graphics, plots and information graphics.
 - Ex: Prezi, Zoho, SlideShare, MindMeister
 - Cloud computing

- Using a network of remote servers hosted on the internet to store, manage, and process data, rather than a local server or a personal computer.
- Ex: Google Drive, Dropbox, Box, pCloud
- Social media
 - Computer-mediated tools that allow people, companies, and other organizations to create, share, or exchange information, career interests, ideas, and pictures/videos in virtual communities and networks.
 - Ex: Twitter, Facebook, Instagram
- Webpage creation
 - A cloud-based web development platform featuring a drag-and-drop website builder.
 - Ex: Wix, Weebly, Site 123, Squarespace, WordPress
- File management
 - Web applications that convert files
 - Ex: Zamzar, Word2PDF, CloudConvert
- Mapping
 - A transformation taking the points of space into points of the same or another space
 - Ex: Google map, Microsoft Bing Maps, OpenLayers, Mapquest, OpenStreetMap

F. Online security

Online security and safety

Online security

- The standard definition of online security calls it the mix of rules that are followed and actions that are taken to make sure online user data and privacy aren't compromised by cybercriminals
- Online security can be something as complex as a system that's designed to prevent credit card theft, or something as simple as you using an antivirus software to protect your device from malware and viruses.

Online safety

- Online safety represents the process of staying safe on the internet - basically making sure online security threats don't endanger your personal information or the integrity of the device you are using
- It's easy to get online security confused with online safety, but the best way to tell them apart is to consider this: online security is what offers you online safety

G. 11 Biggest threats to your online security

1. Malware
- Malware is malicious software that has been programmed to infect any device it comes in contact with. The total number of malware has been increasing significantly over the past years, so malware is one of the biggest security threats on the web right now.
2. Phishing
- Phishing generally involves cybercriminals trying to deceive you into revealing personal and financial information by either pretending to be a legitimate business or by trying to threaten you with legal repercussions if you don't comply.
3. Pharming

- It is a method cybercriminals might use to improve their odds of tricking online users with phishing websites. Unlike phishing, pharming doesn't rely so much on fake messages. Instead, cybercriminals attempt to directly redirect user connection request to malicious websites.
- 4. Application vulnerabilities
 - Application vulnerabilities are usually bugs and errors found in the code of a specific program which can be taken advantage of by cybercriminals to access and steal user data. These issues are normally solved with an update.
- 5. DoS and DDoS attacks
 - DoS (Denial of Service) and DDoS (Distributed Denial of Service) attacks are used to overwhelm network servers in an attempt to take a website or an online service down - either for a few minutes, hours, or even days. DoS attacks originate from a single computer, while DDoS attacks come from a whole network of infected computers (called a botnet)
- 6. Scams
 - Scammers have been preying on people even before the internet was a thing. Now, they're more active and successful than ever since scamming people out of their money and personal information is much easier.
 - Usually, scammers will employ all sorts of tactics to deceive online users and trick them into revealing sensitive information
- 7. Rootkits
 - It is a collection of programs or tools that give cybercriminals complete control over a computer or a network of internet-connected devices. Some rootkits will even install keyloggers and disable antivirus once they get into a computer
- 8. SQL injection attacks
 - Basically, SQL (Structured Query Language) is used by server to store website data. So, an SQL injection attack is something that can endanger all user data on a website
- 9. Man-in-the-middle attacks
 - Involves a cybercriminal intercepting or altering communications between two parties
- 10. Spamming
 - Can be defined as the mass distribution of unsolicited messages on the internet. The messages can contain anything from simple ads to pornography. The messages can be sent through email, on social media, blog comments, or messaging apps.
- 11. Wi-Fi eavesdropping
 - Normally takes place on unsecured Wi-Fi networks (usually the free ones you see in public) and it involves cybercriminals taking advantage of the lack of encryption to spy on your online connections and communications. They could see what websites you access, what email messages you send, or what you type into a messaging application.

H. Tips on how to stay safe online

1. Don't post any personal information online - like your address, email address or mobile number.
2. Think carefully before posting pictures or videos of yourself. Once you've put a picture of yourself online most people can see it and may be able to download it, it's not just yours anymore
3. Keep your privacy settings as high as possible
4. Never give out your password
5. Don't befriend people you don't know
6. Don't meet up with people you've met online.
7. Remember that not everyone online is who they say they are
8. Think carefully about what you say before you post something online
9. Respect other people's views, even if you don't agree with someone else's views doesn't mean you need to be rude.

10. If you see something online that makes you feel uncomfortable, unsafe or worried; leave the website, turn off your computer if you want to and tell a trusted adult immediately.
11. Kick-butt passwords. Regularly change passwords and don't use the same passwords for critical accounts.
12. Protect your info. Keep your guard up. Backup all of your data on your computer, smartphone, and tablet in the event of a loss, theft or a crash.
13. Watch your wi-fi connectivity. Protect your network by changing your router's default settings.
14. Install a firewall. A firewall is a great line of defense against cyber-attacks.
15. Keep up to date. The best security software updates automatically to protect your computer.

I. Advanced Word Processing (Mail Merge)

Mail Merge

Allows users to create form letters, mailing labels, envelopes, personalized certificates, and more for mass mailings. Creation of each document individually would take hours. Using mail merge allows you to easily pull together the following information in one simple task.

In Mail Merge you need the following:

- A main document that contains all of the information that everyone is going to receive.
- A data source that contains the recipient information such as name, address, etc.
- Place holders in the main document for each individual's information.
- Word then merges this information together and creates the set of documents that incorporates all of these elements.

Data source for recipient information

The recipient information would include things like first name, last name, title, street address, city, state, zip code, etc. Common data sources would be an Excel spreadsheet, your MS office contacts, a Word table, or an Access database, etc.

This information is usually listed in columns and rows so that specific information can be pulled out to go in specific placeholders.

The finished product

This will contain a main document with the placeholders filled in with contents from the data source.

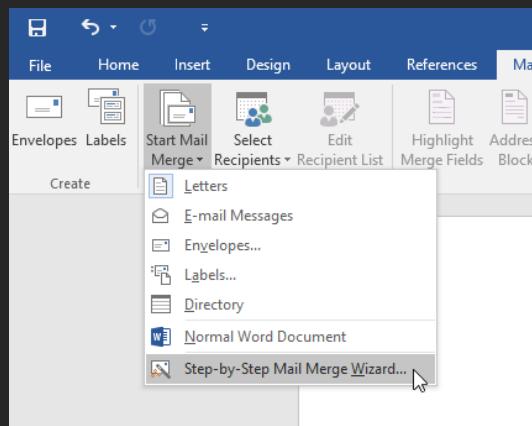
Mail Merge Steps

To begin:

1. Click on the Mailing tab of the ribbon
2. Select Start Mail Merge
3. Choose your document type
 - a. Letters
 - b. Email Messages
 - c. Envelopes
 - d. Labels
 - e. Directory

To use Mail Merge

- Open an existing Word document, or create a new one.
- From the Mailings tab, click the Start Mail Merge command and select Step-by-Step Mail Merge Wizard from the dropdown menu.
- The Mail Merge pane will appear and guide you through the six main steps to complete a merge. The following example demonstrates how to create a form letter and merge the letter with a recipient list.



Step 1:

From the Mail Merge task pane on the right side of the Word window, choose the type of document you want to create, in our example, we'll select Letters. Then click Next: Starting document to move on to Step 2.

Mail Merge

Select document type

What type of document are you working on?

Letters
 E-mail messages
 Envelopes
 Labels
 Directory

Letters

Send letters to a group of people. You can personalize the letter that each person receives.

Click Next to continue.

Step 1 of 6

→ [Next: Starting document](#)

Step 2:

Select Use the current document, then click Next: Select recipients to move on to Step 3

Mail Merge**Select starting document**

How do you want to set up your letters?

- Use the current document
- Start from a template
- Start from existing document

Use the current document

Start from the document shown here and use the Mail Merge wizard to add recipient information.

Step 2 of 6

→ [Next: Select recipients](#) 

← [Previous: Select document type](#)

Step 3:

Now you'll need an address list so Word can automatically place each address into the document. The list can be in an existing file, such as an Excel workbook, or you can type a new address list from within the Mail Merge Wizard.

1. Select Use an existing list, then click Browse to select the file
 2. Locate your file, then click Open
 3. If the address list is an Excel workbook, select the worksheet that contains the list, then click OK.
 4. In the Mail Merge recipients dialog box, you can check or uncheck each box to control which recipients are included in the merge. By default, all recipients should be selected. When you're done, click OK.
 5. Click Next: Write your letter to move to Step 4.
- * If you don't have an existing address list, you can click the Type a new list button and click Create, then type your address list manually.

Mail Merge**Select recipients**

- Use an existing list
- Select from Outlook contacts
- Type a new list

Use an existing list

Currently, your recipients are selected from:
[Sheet1\$] in "AdWorks_Recipients.xlsx"

-  [Select a different list...](#)
-  [Edit recipient list...](#)

Step 3 of 6

→ [Next: Write your letter](#) 

← [Previous: Starting document](#)

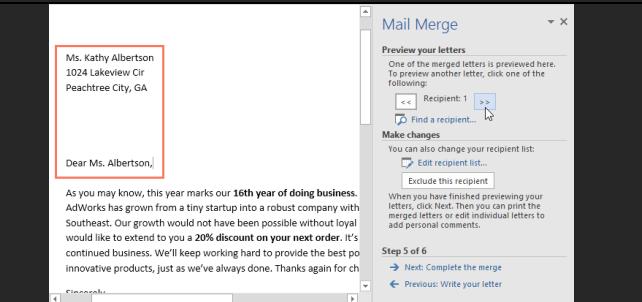
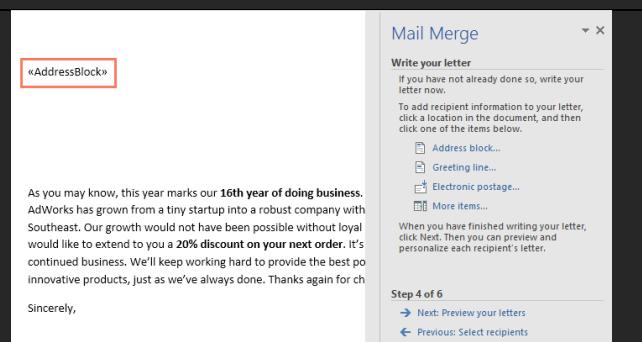
Step 4:

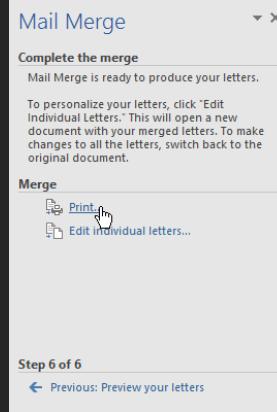
Now you're ready to write your letter. When it's printed, each copy of the letter will basically be the same; only the recipient data (such as the name and address) will be different. You'll need to add placeholders for the recipient data so Mail Merge knows exactly where to add the data.

1. Place the insertion points in the document where you want the information to appear.
 2. Choose one of the placeholder options. In our example, we'll select Address block.
 3. Depending on your selection, a dialog box may appear with various customization options. Select the desired options, then click OK.
 4. A placeholder will appear in your document (for example, <<AddressBlock>>)
 5. (To insert recipient data) Add any other placeholders you want. In our example, we'll add a Greeting line placeholder just above the body of the letter.
 6. When you're done, click Next: Preview your letters to move to step 5.
- * For some letters, you'll only need to add an Address block and Greeting line. But you can also add more placeholders (such as recipients' names or addresses) in the body of the letter to personalize it even further.

Step 5:

1. Preview the letters to make sure the information from the recipient list appears correctly in the letter. You can use the left and right scroll arrows to view each version of the document.
2. If everything looks correct, click Next: Complete the merge to move to step 6.



<p>Step 6:</p> <ol style="list-style-type: none"> 1. Click Print to print the letters. 2. A dialog box will appear. Decide if you want to Print all of the letters, the current document (record), or only a select group, then click OK. In our example, we'll print all of the letters. 3. A Print Dialog Box will appear. Adjust the print settings if needed, then click OK. The letters will be printed. 	
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Creating envelopes

1. Click on the Mailings tab
 2. Click envelopes. The delivery address will already be completed.
 3. Type a return address if desired.
 4. Click on the Options button to select the envelope size. You may have to use Custom Size.
 5. Also, double check to make sure the envelope is correctly positioned in the manual tray feed of your printer before you print.
 6. Click Add to document.
 7. The envelope will print first, followed by the letter.
- You can also use this feature to just print an envelope. Perhaps you hand wrote a letter on stationary and you want to print the envelope using the computer. Simply measure the envelope and select the correct size from the Options button. You may have to use Custom size. Type the mailing address, the return address and click Print.

J. Slide Master View

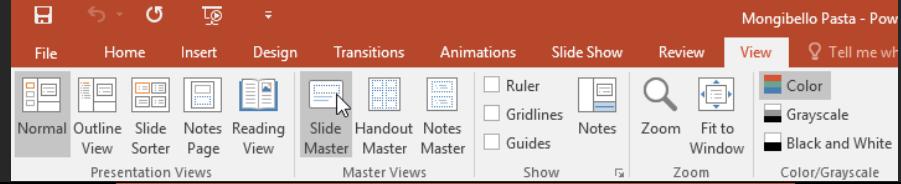
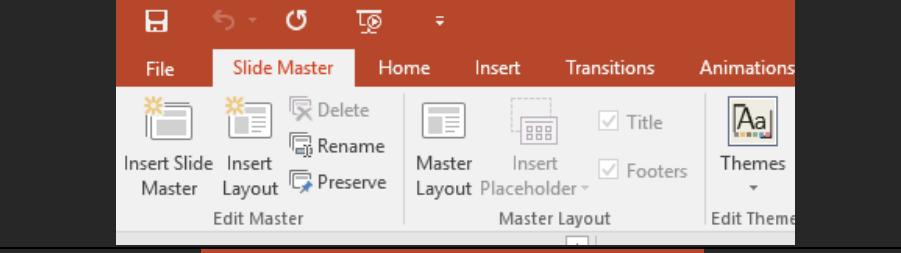
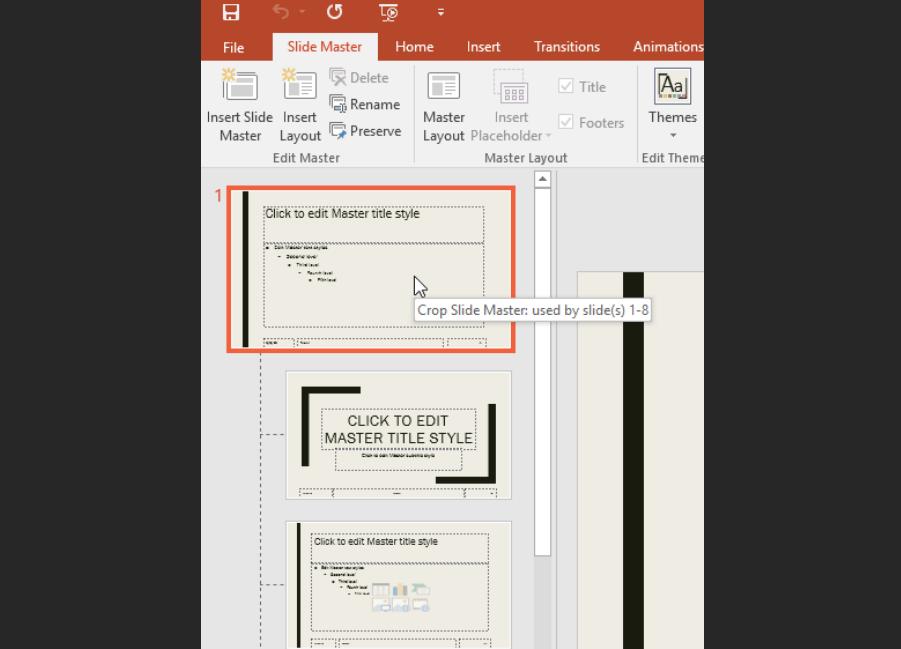
Slide master view is a special feature in PowerPoint that allows you to quickly modify the slides and slide layouts in your presentation. From there, you can edit the slide master, which will affect every slide in the presentation. You can also modify individual slide layouts, which will change any slides using those layouts.

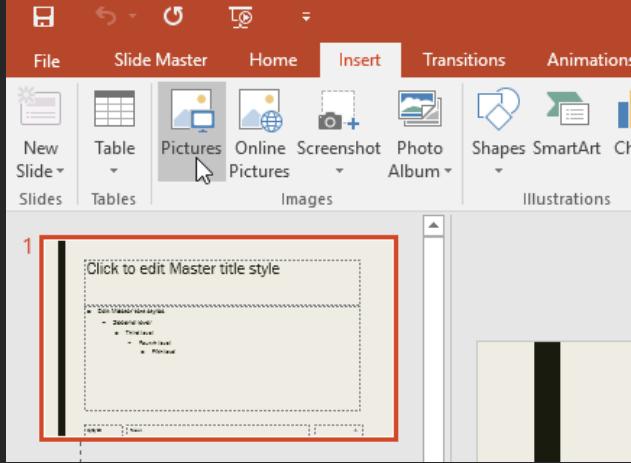
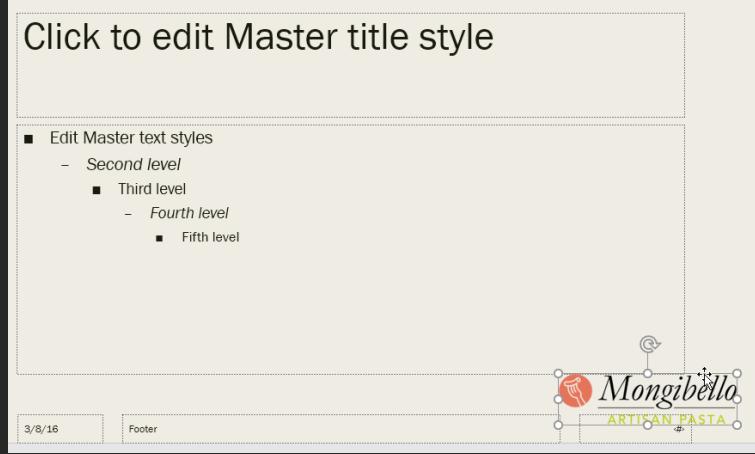
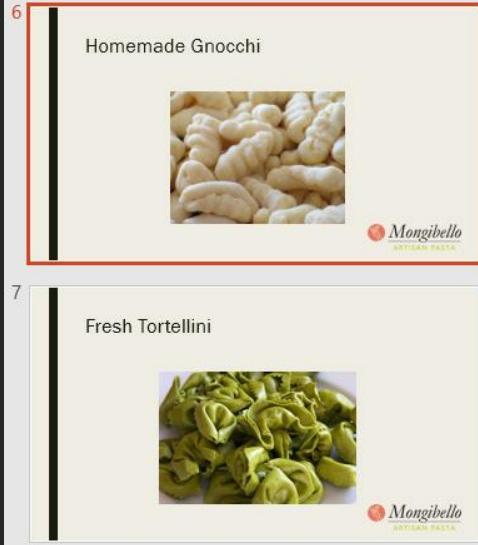
Whether you're making significant changes to your slides or just a few small tweaks, slide master view can help you create a consistent, professional presentation without a lot of effort. You could use slide master view to change just about anything in your presentation, but here are some of its most common uses.

1. Modify backgrounds: slide master view makes it easy to customize the background for all of your slides at the same time. For example, you could add a watermark or logo to each slide in your presentation, or you could modify the background graphics of an existing PowerPoint theme.
2. Rearrange placeholders: if you find that you often rearrange the placeholders on each slide, you can save time by rearranging them in slide master view instead. When you adjust one of the layouts in slide master view, all of the slides with that layout will change.
3. Customize text formatting: Instead of changing the text color on each slide individually, you could use the Slide Master to change the text color on all slides at once.

4. Create unique slide layouts: If you want to create a presentation that looks different from regular PowerPoint themes, you could use Slide Master view to create your own layouts. Custom layouts can include your own
5. Create unique slide layouts: If you want to create a presentation that looks different from regular PowerPoint themes, you could use Slide Master view to create your own layouts. Custom layouts can include your own background graphics and placeholders.

Making changes on all slides

<p>Step 1: Select the View tab, then click the Slide Master command.</p>	
<p>Step 2: The presentation will switch to Slide Master view, and the Slide Master tab will be selected on the Ribbon.</p>	
<p>Step 3: In the left navigation pane, scroll up and select the first slide. This is the slide master.</p>	

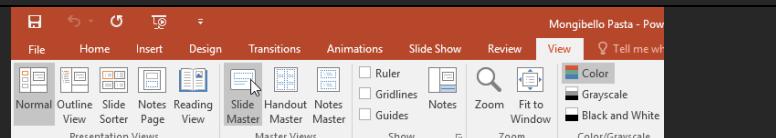
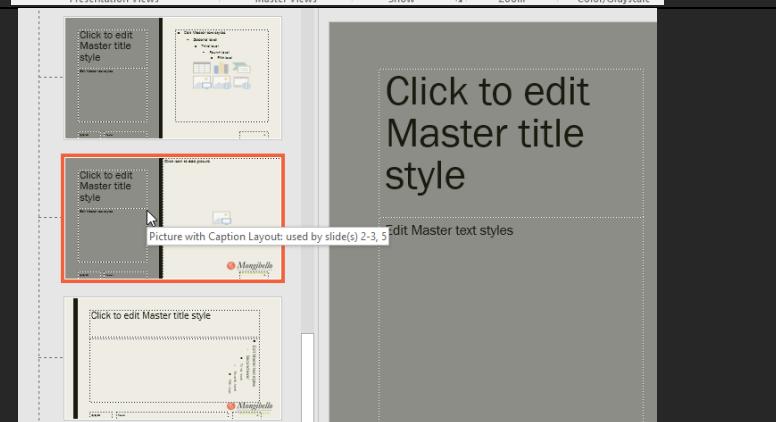
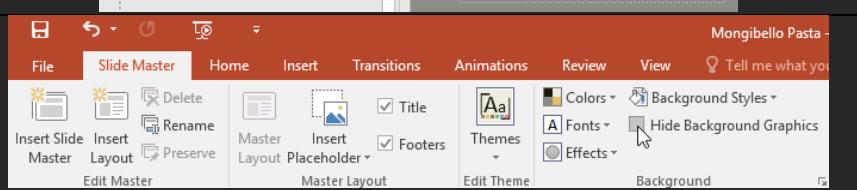
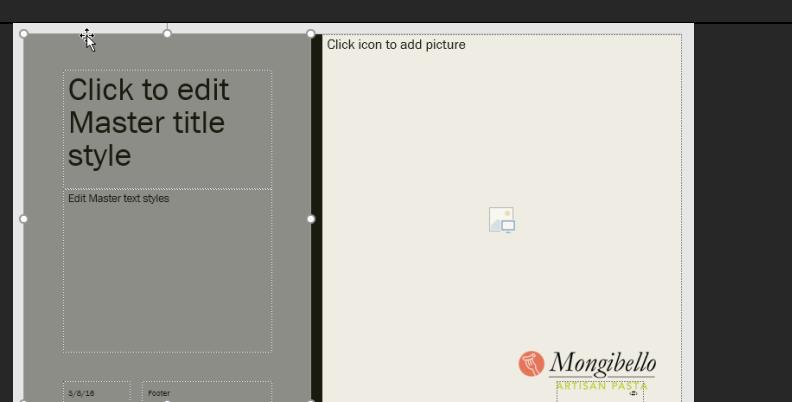
<p>Step 4: Make the desired changes to the slide master. In our example, we'll insert a picture of the Mongibello logo.</p>	
<p>Step 5: Move, resize, or delete slide objects as needed. In our example, we'll resize the logo and move it to the bottom-right corner.</p>	
<p>Step 6: When you're finished, click the Close Master View command on the Slide Master tab.</p>	
<p>The change will appear on all slides of the presentation.</p>	

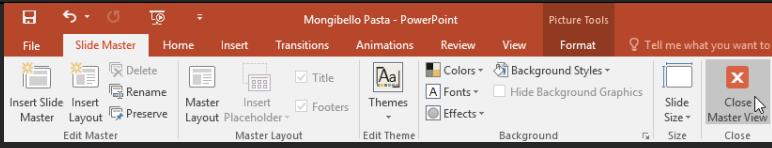
- When you make a change to the slide master, it's a good idea to review your presentation to see how it affects each slide. You may find that some of your slides don't look exactly right. On the next page, we'll show you how to fix this by customizing individual slide layouts.

Customizing slide layouts

You can use Slide Master view to modify any slide layout in your presentation. It's easy to make small tweaks like adjusting background graphics and more significant changes like rearranging or deleting placeholders. Unlike the slide master, changes to a slide layout will only be applied to slides using that layout in your presentation.

In our example, our newly added logo is hidden behind the photo in the Picture with Caption Layout. We'll customize this layout to make room for the logo.

Step 1: Navigate to Slide Master view	
Step 2: Locate and select the desired layout in the left navigation pane. You can hover the mouse over each layout to see which slides are currently using that layout in the presentation.	
Step 3: In some layouts, the background graphics may be hidden. To show the graphics, uncheck the box next to Hide Background Graphics.	
Step 4: Add, move, or delete any objects as desired. In our example, we'll delete the gray background shape.	

<p>Step 5: If you want to change the arrangement of the placeholders, you can move, resize, or delete any of them. In our example, we'll move our text placeholders and the black bar to the right side, and the photo placeholder to the left side.</p>	
<p>Step 6: When you're finished, click the Close Master View command on the Slide Master tab.</p>	 <ul style="list-style-type: none"> • All slides using the layout will be updated.

Customizing text formatting

You can also customize the text formatting from Slide Master view, including the font, text size, color, and alignment.

For example, if you wanted to change the font for every title placeholder in your presentation, you could modify the master title style on the slide master.

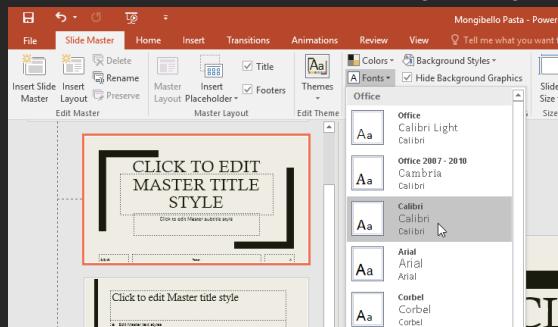
Each title placeholder is connected to the master title style on the slide master. For example, take a look at the slides before changing the title font.



Now look at the same slides after changing the title font.

Instead of customizing individual placeholders, you could change the theme fonts for a presentation.

From the Slide Master tab, click the Fonts command in the Background group, then select the desired fonts.



K. Advanced Word and PowerPoint Skills

Integrating images and external materials

Integrating or inserting pictures in your document is fun and it improves the impression of your document. A common use of inserting a picture on a document is when you are creating a resume. Though seemingly simple to do, your knowledge on the different kinds of materials that you can insert or integrate in a Word document and its characteristics can help you create a more efficient, richer document not only in content but also in physical form.

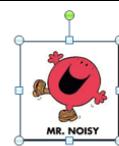
Kinds of materials

1. Pictures
 - Generally, these are electronic or digital pictures or photographs you have saved in any local storage device. There are three commonly used types of picture files. You can identify them by the extension on their file names.
 - JPG/JPEG: Pronounced as "jay-peg", and is the short for .jpeg or Joint Photographic Experts Group. Like all the rest of the image file extensions, it identifies the data compression process it uses to make it more compatible and portable through the internet. This type of image file can support 16.7 million colors that is why its suitable for use when working with full color photographic images
 - GIF: Stands for Graphics Interchange Format. This type of image file is capable of displaying transparencies. Therefore, it is good for blending with other materials or elements in your document. It's also capable of displaying simple animation.
 - PNG: Pronounced as "ping". Stands for Portable Network Graphics. IT was built around the capabilities of .GIF. Its development was basically for the purpose of transporting images on the internet at faster rates. It's also good with transparencies but unlike GIFs.
2. Clip art
 - This is generally a .GIF type; line art drawings or images used as generic representation for ideas and objects that you might want to integrate in your document. MS Word has a library of clip arts that is built in or can be downloaded and used freely.
3. Shapes
 - Printable objects or materials that you can integrate in your document to enhance its appearance or allow you to have some tools to use for composing and representing ideas or messages.
4. Smart art
 - Generally, are predefined sets of different shapes grouped together to form ideas that are organizational or structural in nature.
5. Chart
 - Another type of material that you can integrate in your Word document that allows you to represent data characteristics and trends. This is quite useful when you are preparing reports that correlate and present data in a graphical manner.
6. Screenshot
 - Sometimes, creating reports or manuals for training or procedures will require the integration of a more realistic image of what you are discussing on your report or manual.

Image Placement

In line with text:

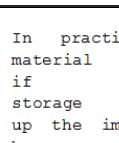
Default setting for images that are inserted or integrated in your document. It treats your image like a text font with the bottom side totally aligned with the text line. This setting is usually used when you need to place your image at the beginning of the paragraph.



In practice, inserting an image or any other material in your document is quite easy especially if the material already exist in your local storage device. It is just a matter of opening up the image file through the Microsoft word dialog box or wizard. Sometimes, if the image you would like to insert is on web page currently displayed on your screen, it could be copied and pasted. The real challenge is where to put the image you inserted or where to move it.

Square:

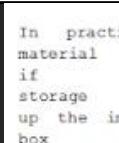
This setting allows the image you inserted to be placed anywhere with the paragraph with the text going around the image in a square pattern like frame.



In practice, inserting an image or any other material in your document is quite easy especially if the material already exist in your local storage device. It is just a matter of opening up the image file through the Microsoft word dialog box or wizard. Sometimes, if the image you would like to insert is on web page currently displayed on your screen, it could be copied and pasted. The real challenge is where to put the image you inserted or where to move it.

Tight:

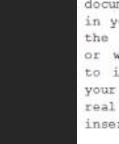
Almost the same as the square setting, but here the text "hugs" or conforms to the general shape of the image. This allows you to get a more creative effect on your document. This setting can mostly be achieved if you are using an image that supports transparency like .GIF/.PNG file.



In practice, inserting an image or any other material in your document is quite easy especially if the material already exist in your local storage device. It is just a matter of opening up the image file through the Microsoft word dialog box or wizard. Sometimes, if the image you would like to insert is on web page currently displayed on your screen, it could be copied and pasted. The real challenge is where to put the image you inserted or where to move it.

Through:

This setting allows the text on your document to flow even tighter taking the contours and shape of the image. Again, this can be best used with .GIF or .PNG type of image.



In practice, inserting an image or any other material in your document is quite easy especially if the material already exist in your local storage device. It is just a matter of opening up the image file through the Microsoft word dialog box or wizard. Sometimes, if the image you would like to insert is on web page currently displayed on your screen, it could be copied and pasted. The real challenge is where to put the image you inserted or where to move it.

Top and bottom:

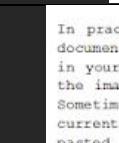
This setting pushes the texts away vertically to the top and/or bottom of the image so that the image occupies a whole text line on its own.



In practice, inserting an image or any other material in your document is quite easy especially if the material already exist in your local storage device. It is just a matter of opening up the image file through the Microsoft word dialog box or wizard. Sometimes, if the image you would like to insert is on web page currently displayed on your screen, it could be copied and pasted. The real challenge is where to put the image you inserted or where to move it.

Behind text:

This allows your image to be dragged and placed anywhere on your document but with all the text floating in front of it. It effectively makes your image look like a background.



In practice, inserting an image or any other material in your document is quite easy especially if the material already exist in your local storage device. It is just a matter of opening up the image file through the Microsoft word dialog box or wizard. Sometimes, if the image you would like to insert is on web page currently displayed on your screen, it could be copied and pasted. The real challenge is where to put the image you inserted or where to move it.

In front of text:

As it suggests, this setting allows your image to be placed right on top of the image as if your image was dropped right on it. That means whatever part of the text you placed the image on, it will be covered by the image.

In practice, inserting an image or any other material in your document is quite easy especially if the material already exist in your local storage. It is just a matter of opening up the image file through Microsoft Word dialog box or wizard. Sometimes, if the image currently displayed on the screen, it could be copied and pasted. The real challenge is where to put the image you inserted or where to move it.



Advanced PowerPoint

Highly innovative and versatile program that can ensure a successful communication whether you're presenting in front of potential investors, a lecture theatre or simply in front of your colleagues. Learn everything about these tips: they will improve your presentation skills and allow you to communicate your message successfully.

- Adding smart art
- Inserting shapes
- Inserting image
- Slide transitions
- Adding animations

Creating an effective presentation

1. Minimize
- Keep slide counts to a minimum to maintain a clear message and to keep the audience attentive. Remember that the presentation is just a visual aid. Most information should still come from the reporter.
2. Clarity
- Avoid being too fancy by using a font style that is easy to read. Make sure that it is also big enough to be read by the audience. Once you start making your presentation, consider how big the screen is during your report.
3. Simplicity
- Summarize the information on the screen to have your audience focus on what the speaker is saying than on reading the slide. Limit the content to six lines and seven words per line. This is known as the 6x7 rule.
4. Visual
- Use graphics to help in your presentation but not too many to distract the audience. In addition, instead of using table of data, use charts and graphs
5. Consistency
- Make your design uniform. Avoid having different font styles and backgrounds.
6. Contrast
- Use a light font on dark background or vice versa. This is done so that it is easier to read. In most instances, it is easier to read on screen if the background is dark. This is due to the brightness of the screen.

L. Video Editing

It is the process of manipulating and rearrange video shots to create a new work. Editing is usually considered to be one part of the post production process - other post-production tasks including titling, color correction, sound mixing, etc.

Many people use the term editing to describe all their post-production work, especially in non-professional situations. Whether or not you choose to be picky about terminology is up to you. In this tutorial we are reasonably liberal with our terminology and we use the word editing to mean any of the following:

- Rearranging, adding and/or removing sections of video clips and/or audio clips
- Applying color correction, filters and other enhancements
- Creating transitions between clips

Goals of editing

There are many reasons to edit a video and your editing approach will depend on the desired outcome. Before you begin you must clearly define your editing goals, which could include any of the following:

1. Remove unwanted footage
 - This is the simplest and most common task in editing. Many videos can be dramatically improved by simply getting rid of the flawed or unwanted bits
2. Choose the best footage
 - It is common to shoot far more footage than you actually need and choose only the best material for the final edit. Often you will shoot several versions (takes) of a shot and choose the best one when editing.
3. Create a flow
 - Most videos serve a purpose such as telling a story or providing information. Editing is a crucial step in making sure the video flows in a way which achieves this goal.
4. Add effects, graphics, music, etc.
 - This is often the "wow" part of editing. You can improve most videos (and have a lot of fun) by adding extra elements.
5. Alter the style, pace, or mood of the video
 - A good editor will be able to create a subtle mood prompts in a video. Techniques such as mood music and visual effects can influence how the audience will react.

Tips in editing a video

1. Create a beginning, a middle, and an end
 - A movie can be as simple as a slideshow set to music or as complex as a story. In any case, you need to create a movie that has a beginning, a middle, and an end, so you need to think about how to set the scene, have things happen early in your movie, sustain the action, and then create a rousing finale or find a natural ending
2. Select the clips you like best

- Go for the emotion. Look for moments where there's spontaneity or life! Great moments make great movies people enjoy watching. You can import all your best bits, even if you don't yet know how they will all fit together.
- 3. Learn how to edit audio
 - Editing audio is probably one of the biggest new skills to learn in making movies. Most of us have made photo albums or slideshows, but few of us have ever edited audio. Understanding how to use audio will make you a better movie maker.
- 4. Use music
 - Star Wars creator George Lucas once said that 50% of the movie experience is sound, and you'll quickly discover how powerfully music (or sound effects) can affect your movie.
 - Using music with your video or photos brings an emotional texture to your movie that wasn't there when you shot it, giving you a powerful tool to experiment with
- 5. Refine and tweak until the last minute
 - After you've made your edits and added music, titles, and/or closing credits, you should review your program and see whether there's anything that should be changed. Going from a rough cut to a fine cut is the heart of the editing process, so don't shortchange yourself (or your audience) at this stage of the game. If you're tired, take a break and come back to your project when you're fresher and more alert.
- 6. Get a second opinion
 - It's a good idea to have someone else look at your movie, to give you important feedback about what's working and what's not. Plus, it's fun to get some instant gratification from the parts your audience likes!
 - Of course, you don't have to take the advice you get about changes. but it's good to get a read on whether your movie makes sense or affected or inspired the viewer in the ways you intended.

M. Imaging and design for online environment

What is an image?

A representation of the external form of a person or thing in art.

Images may be 2-dimensional, such as a photograph or screen display, or 3-dimensional, such as a statue or hologram. They may be captured by optical devices - such as cameras, mirrors, lenses, telescopes, microscopes, etc. and natural objects and phenomena, such as the human eye or water.

Graphics

Are visual images or designs on some surface, such as a wall, canvas, screen, paper, or stone to inform, illustrate, or entertain.

Examples of graphics

- Photographs
- Drawings
- Line art
- Graphs

- Diagrams
- Typography

Basic principles of graphics and layout

1. Balance
 - The visual weigh of objects, texture, colors, and space is evenly distributed on the screen
2. Emphasis
 - An area in the design that may appear different in size, texture, shape, or color to distract the viewer's attention
3. Movement
 - How the eye moves through the composition leading the attention of the viewer from one aspect to another
4. Pattern, repetitions, and rhythm
 - These are the repeating visual element on an image or layout to create unity in the layout or image. Rhythm is achieved when visual elements create a sense of organized movement
5. Proportion
 - Visual elements create a sense of unity where they relate well with one another
6. Variety
 - This uses several design elements to draw a viewer's attention

Infographics

- Visual presentations of information that use the element of design to display content
- Express complex messages to viewers in a way that enhances their comprehension
- Basically, using pictures, objects, and images in a way for the viewers to easily understand the message of a topic

Reasons to use infographics

- To communicate a message
- To present in a way that is compact and easy to comprehend
- To analyze data in order to discover cause-and-effect relationships
- To periodically monitor the route of certain parameters

3 Elements of infographics

1. Visual elements
 - Includes color coding, graphics, and reference icons
2. Content elements
 - Includes time frames, statistics and references
3. Knowledge elements
 - Consists of facts

Types of infographics

1. Cause and effect

- Shows the cause and effects of certain topics

2. Chronological infographics

- Usually used to show a topic in a chronological or a step-by-step sequence

3. Quantitative

- Used to show statistics like charts, bar graphs, etc.

4. Directional

- Similar to chronological infographics where you use arrows to direct the viewers' attention to another aspect of the infographic

5. Product

- Used to promote products and service

Tips for creating infographics

- Simplicity rocks. Keep the infographic simple so it won't be an eyesore to the viewers
- Nothing takes effect without a cause. This just means that you need to show the viewers the cause of the topic before discussing the effect of said topic
- Draw your boundaries. Just don't overdo the pictures or images or it will look like a collage that looks like vomit
- Think in color. Match the colors in your infographic like making the text in white in a dark background and vice versa
- Layout is not just typography
- Make it appealing. Of course, make it look good so it would attract and keep the viewer's attention
- Be verifiable. And finally, the facts in the infographic should be verified and confirmed that they are indeed true.

N. Wix

It is an online website builder that gives users drag-and-drop simplicity when it comes to designing and publishing your portfolio, small business website, blog, or online store.

Website builders are the DIYer's dream. If you want to build a site without hiring a developer or learning to code

Points to ponder

Blog, news, and shopping websites use CMS which stands for Content Management System. CMS is a computer application that allows you to publish, edit, manipulate, organize, and delete web content. One of the most popular blogging platforms is Wix.

O. Pixlr Photo Editor

What is Pixlr Photo Editor

It is one of the best and most used online editing software.

Many of the features that Pixlr offers are very similar to Photoshop. With Pixlr, users get access to work with layers, magic wand tool, clone stamp tool, and many others.

It is web-based, it's free and you don't even need to create an account to sign up. Because all editing is done online, Pixlr is compatible with both Mac and PC computers.

Overall Pixlr is a great editing program for personal use. While it might not be as powerful or perfected as Photoshop, it's perfect for beginners that want to learn Photoshop basics.

Unlike most editing programs that require you to download their software in order to use it, Pixlr editor is online-based

Using web-based software to edit your photos will save space on your computer's memory, but you'll need a reliable internet connection in order to use it.

Getting started

You can access the Pixlr editor by going to the Pixlr home page. To open the program, click on the "Pixlr editor" tab on the top right corner or click on the giant "Open Pixlr Editor" button below. Both will lead to the Pixlr editing software where you can start working on your photos.

Once you launch Pixlr editor, click on "Open image from computer" to get started.

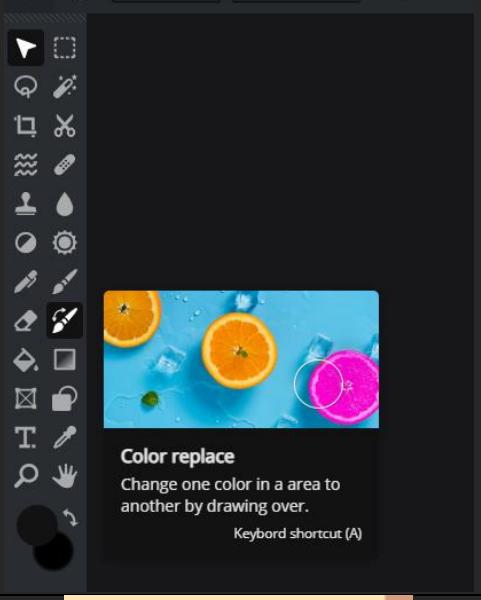


Color replace tool

The first tool is the Color Replace Tool, one of the most used tools in Pixlr.

The color replace tool is a fun tool that lets you re-paint any area in a photo in a different color. In our example, we'll repaint the crust of the bread into a lighter color.

Step	Image
------	-------

<p>Click the “Color replace tool” from the left side toolbar</p>	
<p>Choose the replacing color by holding down CTRL and click on any spot in the photo. In the example, we will select the light-brown inside of the bread.</p>	
<p>Select the brush option if you want to make the brush bigger or smaller. Here, a brush size of 100 is used to cover the surface faster.</p>	
<p>Start painting on the desired section and don't release until the section is done</p>	

The great thing about the color replace tool is that you don't have to paint perfectly around the borders. Even if you paint outside the lines, the tool should only paint the section within.

If something looks off, at any point you can click **CTRL+Z** to undo the last step

Once you're done with the image, don't forget to save the changes so you don't lose your edits.



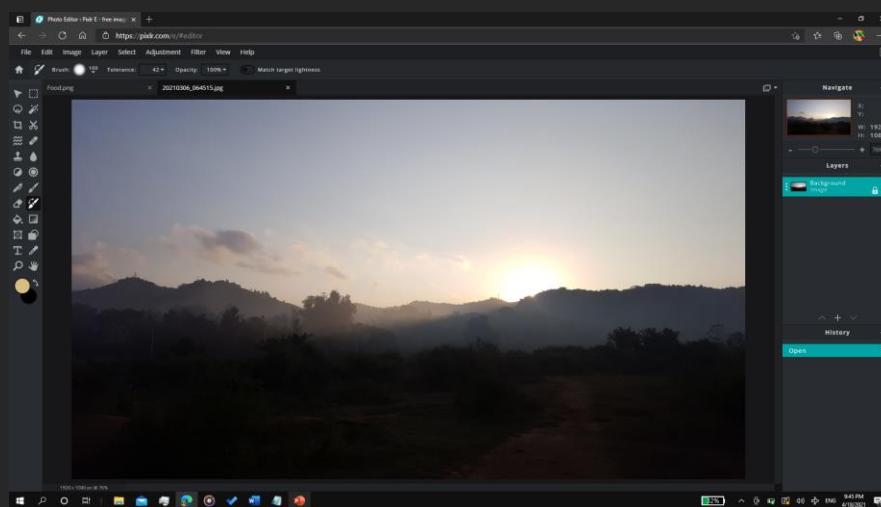
Layers

One of the most powerful functions of Pixlr is the ability to work with layers

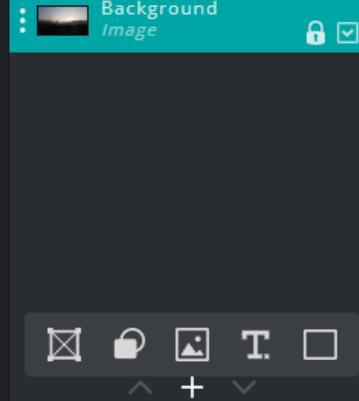
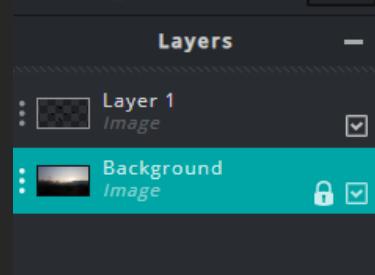
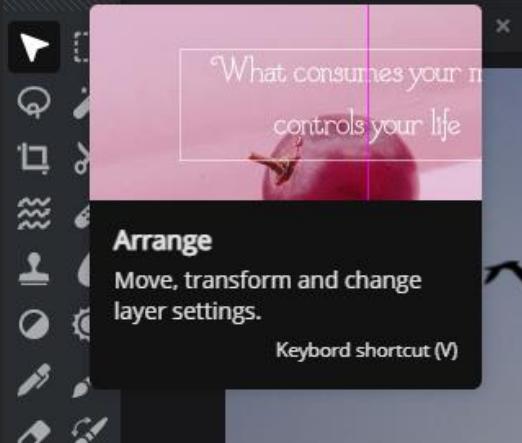
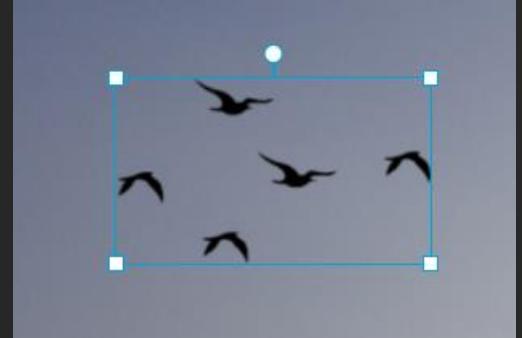
With layers, you can add text or a photo on top of another image, similar to how you would in Photoshop

In this example, we will add two new layers on top of the image. One layer will be the image of our generic birds, and another layer for text.

We'll be using this image as our background layer.



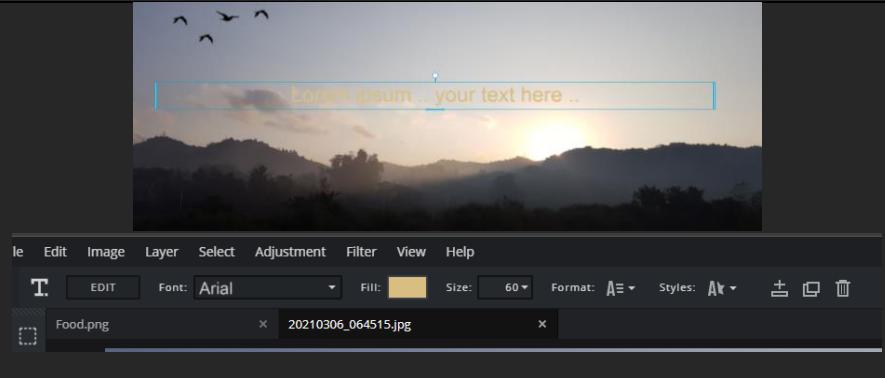
Notice the little square box named layers on the right-hand side of the screen. This box keeps track of all the work that goes on in the different layers.

Step	Image
<p>Start off by looking on the internet of images of birds flying. Make sure it's PNG (no background). Download the image and import it to the project.</p> <p>Click the plus button below the layers list and click the image icon.</p>	
<p>You'll notice that now the birds are referred to as "Layer 1" while the original photo is called "Background".</p>	
<p>Use the "Move/Arrange" tool to move the birds into your desired position. Once selected, select the layer for the birds in the layers list and start moving them around.</p>	
<p>You can resize the birds by using any of the corner boxes. You can also change the rotation of the image by using the top-middle circle.</p>	

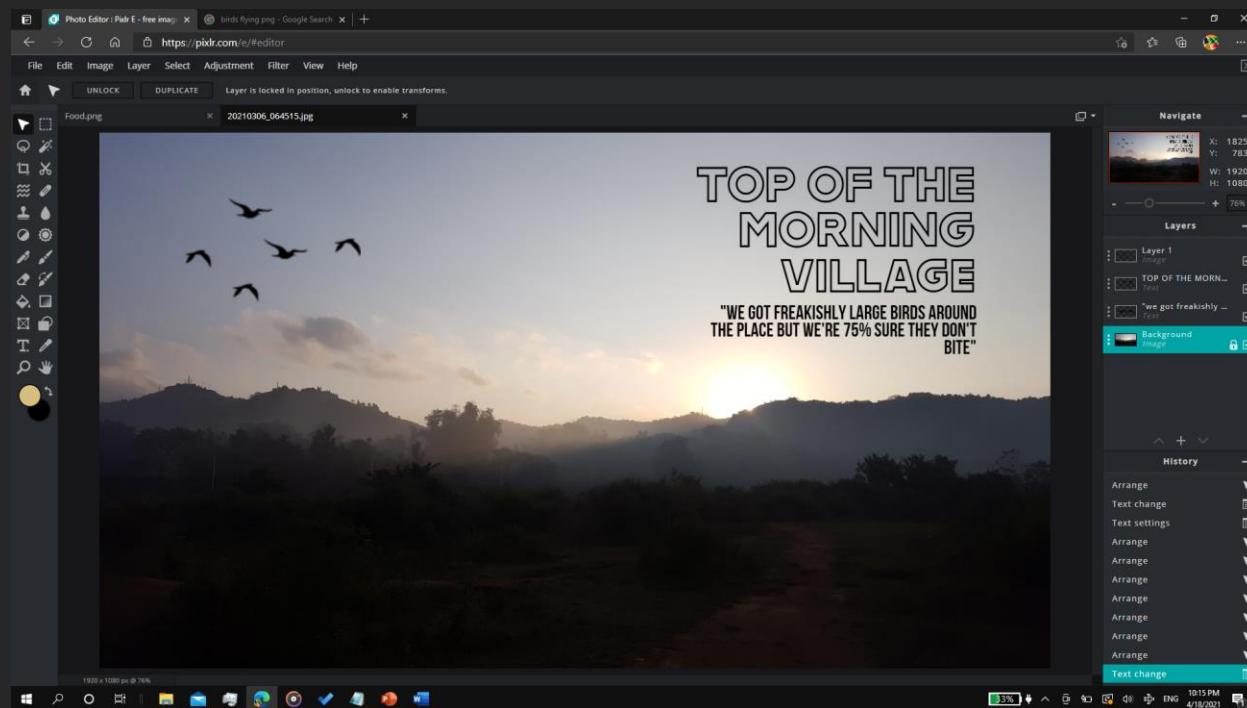
To add the text, select the “Type” tool from the tool bar.



It will ask for a confirmation. Press “Add”. A text box should appear. Drag them around to move them. Double-click to change the text.
You can change the font, size, color, and more in the top menu.



Don’t forget to save your project once you’re done.



Clone stamp

The clone stamp tool gives the user a lot more control on what and how to replace in the image.

To remove a person from a background, the Spot healing tool wouldn't be able to pick up the right pixels.

We'll use website's tutorial images in this section because I don't have any proper pictures with people.

Step	Image
<p>The person at the left side of the picture is caught in 4K photobombing the image, making it look quite busy. The “Spot Healing tool” wouldn't be able to pick up the right pixels.</p> <p>Instead, we'll use the “Clone Stamp Tool” and carefully select the areas around the person to remove him manually.</p>	

Zoom in by using CTRL and +. Select the Clone Stamp Tool and make the brush size smaller.



Hold down CTRL and click on the image to select a nearby spot that is similar in color or pattern to what you want to replace. In this example, we'll use a part of the blue wall, window, and sidewalk. Carefully start painting over the guy to remove him from the image (useful for old pictures of you with your ex).



Try selecting different areas and test out which ones better until the entire person is replaced with other pixels.



Zoom out by using CTRL and – to see the end result. As you can see, we have erased the man from the image. One thing to note is that this is not 100% flawless, and it may leave some smudges or lower the quality on that part of the image. Unless you are doing a big print of your image, you won't notice any little imperfections once you zoom out.



P. Cloud computing and cloud storage

Cloud computing

Cloud computing underpins a vast number of services. That includes consumer services like Gmail or the cloud back-up of the photos on your smartphone, though to the services which allow large enterprises to host all their data and run all of their applications in the cloud.

Examples of cloud computing

1. Amazon Web Services (AWS)

- It is a subsidiary of Amazon (a leading company in eCommerce). Under the umbrella term of AWS, Amazon provides on-demand cloud computing platforms like storage, data analysis, etc.

2. Google Cloud Platform
 - Google offers its public cloud computing solutions with the name of Google Cloud Platform. It offers services in all major spheres including computer, networking, storage, machine learning (ML) and internet of things (IoT)
3. Microsoft Azure
 - Formerly known as Windows Azure, it is the cloud computing service from Microsoft. Enabled primarily through Microsoft-managed data centers, this service proves to be a reliable solution, especially for Microsoft evangelists.
4. IBM Bluemix
 - IBM Bluemix is the cloud computing solution from IBM that comes with the platform (PaaS) as well as infrastructure as a service (IaaS) offering. With Bluemix IaaS, users can deploy and access virtualized computer power, storage and networking using the internet.
5. Alibaba Cloud
 - It is the cloud initiative of the Chinese eCommerce giant - Alibaba Group. The Alibaba services dominate the Chinese market and have roots all across the globe with headquarters in Hangzhou, China.

Cloud storage

It is a service model in which data is transmitted and stored on remote storage systems, where it is maintained, managed, backed up and made available to users over a network (typically the internet)

Types of cloud storage

1. Public cloud
 - Public cloud storage services provide a multi-tenant storage environment that is most suited for unstructured data on a subscription basis. This market sector is dominated by Amazon Simple Storage Service (S3), Google Cloud Storage, and Microsoft Azure.
2. Private cloud
 - Private cloud storage service is provided by in-house storage resources deployed as a dedicated environment protected behind an organization's firewall. Internally hosted private cloud storage implementations emulate some of the features of commercially available public cloud services
3. Hybrid cloud
 - Hybrid cloud is a mix of private cloud storage and third-party public cloud storage services with a layer of orchestration management to integrate operationally the two platforms. The model offers businesses flexibility and more data deployment options

General Biology

A. Introduction to Reproduction

Types of asexual reproduction

Fission/binary fission, fragmentation, budding, regeneration, spore formation, vegetative propagation

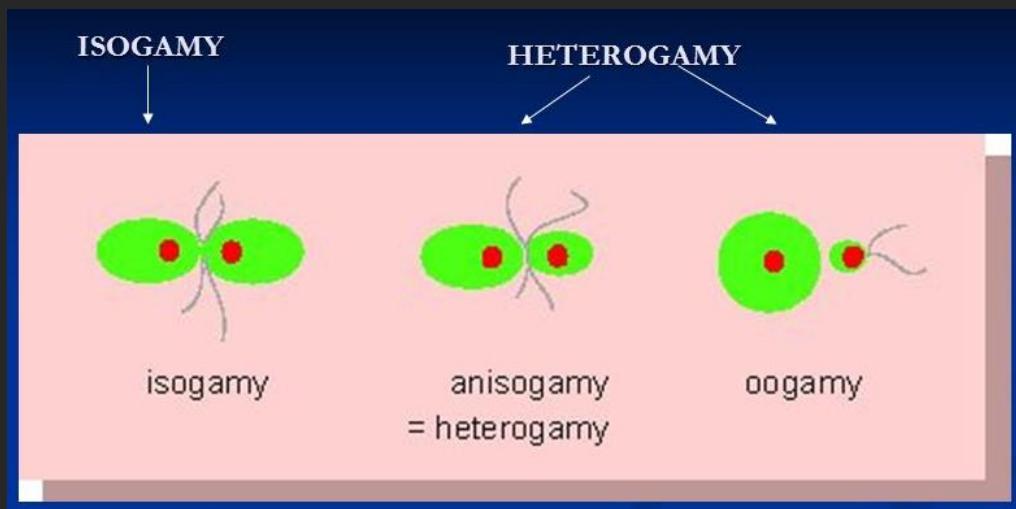
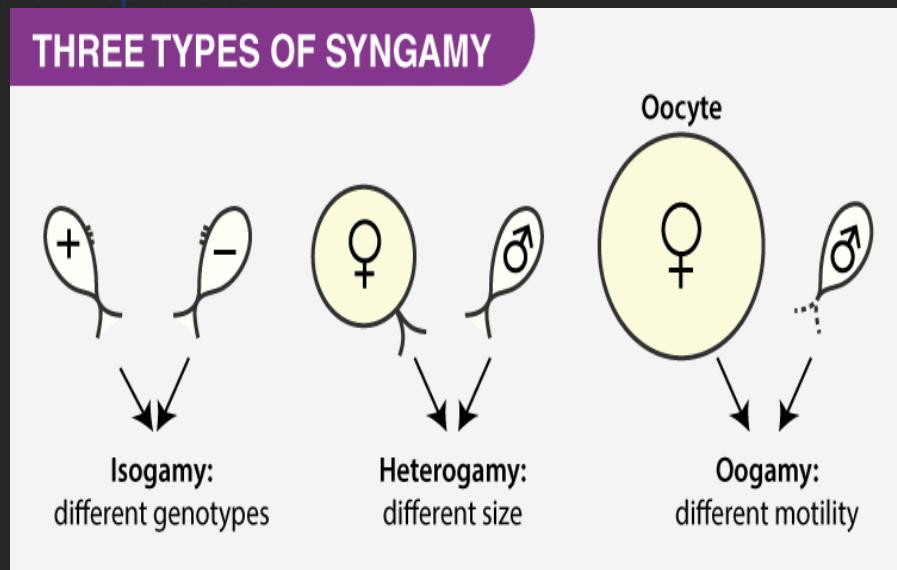
(Refer above)

Asexual reproduction	Mode of reproduction that doesn't involve the use of gametes
Sexual reproduction	Mode of reproduction that involves the use of gametes
Fission/binary fission	Type of asexual reproduction involves the division of the body into two or more equal parts. Example: Paramecium
Fragmentation	Where body breaks into two or more parts, with each fragment capable of becoming a complete individual; in animals, fragmentation is usually followed by regeneration where the missing parts are produced.
Budding	Where a new individual arises as an outgrowth (bud) from its parent, develops organs like those of the parent, and then detaches itself. Example: Hydra
Sporulation	A new individual forms from an aggregation of cells surrounded by a resistant capsule or spore, which later on germinates. Example: Fungi
Isogamy	Fusion of similar gametes which are usually motile [motile=moving]
Heterogamy	Fusion of dissimilar gametes. In oogamy, a large immotile gamete, the egg is fertilized by a small motile gamete, the sperm
Bisexual reproduction	Type of sexual reproduction involving the union of gametes from two genetically different parents
Hermaphrodite	An individual with both male and female reproductive tissues. In animals, "self-fertilization" is not common. In worms, a hermaphrodite needs a male to donate sperms in order to fertilize the oocytes in its body.
Vegetative reproduction	Vegetative reproduction is any form of asexual reproduction occurring in plants in which a new plant grows from a fragment of the parent plant or a specialized reproductive structure. Many plants naturally reproduce this way, but it can also be induced artificially. (Wikipedia)



Regeneration	Regeneration is asexual reproduction is the ability of a simple organism to re-grow its lost parts. Simple organisms are more successful with regeneration than complex organisms. For example, some crabs can grow new claws or body parts after the original parts are lost.
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Types of sexual reproduction



1. Isogamy
 - Different genotypes
 - 2 gametes of the same morphological structure unite
 - Example: algae
2. Heterogamy
 - Different size
 - 2 gametes of different morphological structures unite. There is a structural difference between sperm and egg but not too much
 - Examples: algae, fungi
3. Oogamy

- Different motility
- 2 gametes with 2 different structures unites. The sizes of the gametes are very different from each other.
- Examples: human

	Asexual reproduction	Sexual reproduction
Number of parents involved	1	2
Gametes	No	Yes
Genetic composition of the offspring	Identical	Unidentical

B. Stages of animal development

Development and life cycle

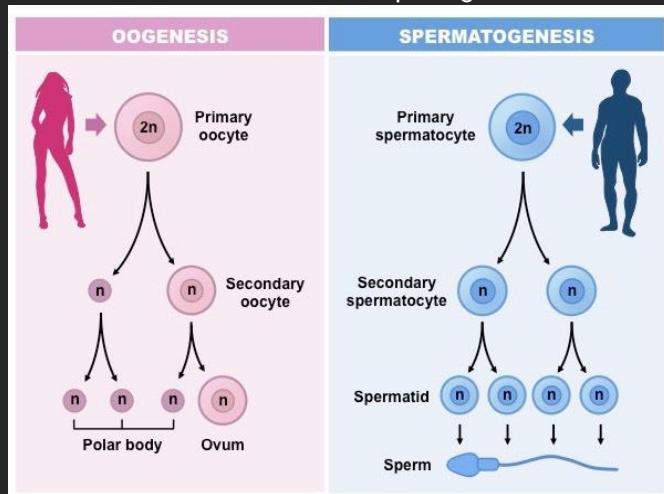
- A life cycle is defined as the developmental stages that occur during an organism's lifetime.
- Development starts with formation of sex cells and ends only by death. Until the old age of a person, for example, some cells still develop or divide.

Development	Involves formation of sex cells, zygote formation, subsequent stages in one's life span. Development is terminated by death.
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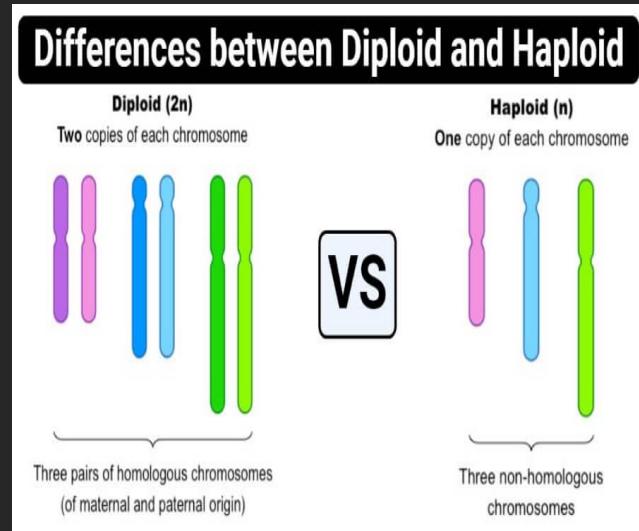
Stages of development

Gametogenesis

- It is a biological process by which diploid or haploid precursor cells undergo cell division and differentiation to form mature haploid gametes.



- Difference between a haploid and a diploid cell



Gametogenesis	Stage of development that yields haploid gametes.
Haploid (n) condition	When a cell has only half the chromosome number or only one set of chromosomes.
Diploid (2n) condition	When a cell has the full chromosome number or two sets of chromosomes.

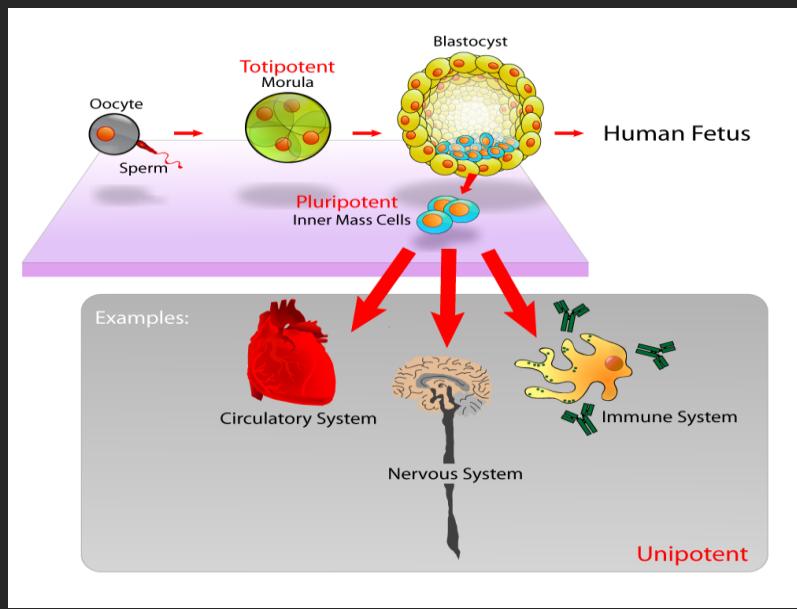
Fertilization

- It is the fusion of haploid gametes, egg and sperm, to form the diploid zygote.
- Note though there can be subtle differences in the fertilization process which occurs naturally within the body or through reproductive technologies outside the body, the overall product in both cases is a diploid zygote.

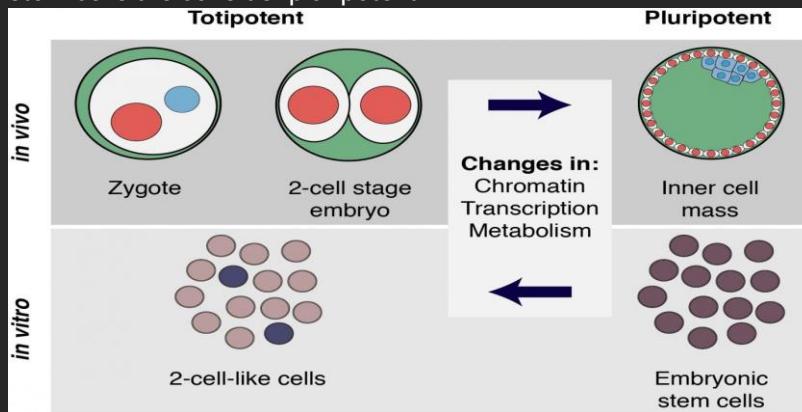
Fertilization	Stage of development that results in a unicellular diploid zygote.
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Cleavage

- Refers to the early cell divisions that occur as a fertilized egg begins to develop into an embryo.
- Totipotent cell is a single cell that can give rise to a new organism, given appropriate maternal support
- A totipotent cell is one that can give rise to all extraembryonic tissues, plus all tissues of the body and the germline.
- Is a totipotent cell the same as a blastocyst?



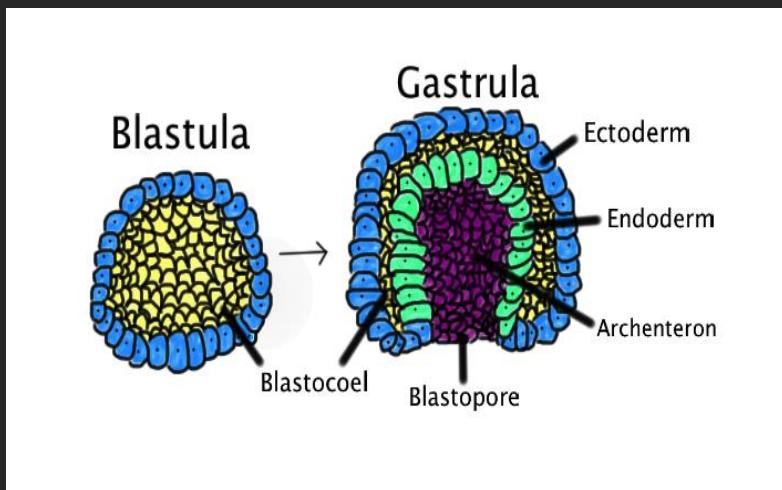
- Totipotent cells can form all the cell types in a body, plus the extraembryonic, or placental cells
- Pluripotent cells can give rise to all of the cell types that make up the body; embryonic stem cells are considered pluripotent.



Totipotent cell	A cell that is capable of differentiating to become any kind of cell.
Cleavage	Stage of development involving a series of mitotic divisions to produce a multicellular blastula from a unicellular zygote.

Gastrulation

- It is the process during embryonic development that changes the embryo from a blastula with a single layer of cells to a gastrula containing multiple layers of cells.
- Typically involves the blastula folding in upon itself or dividing, which creates two layers of cells.

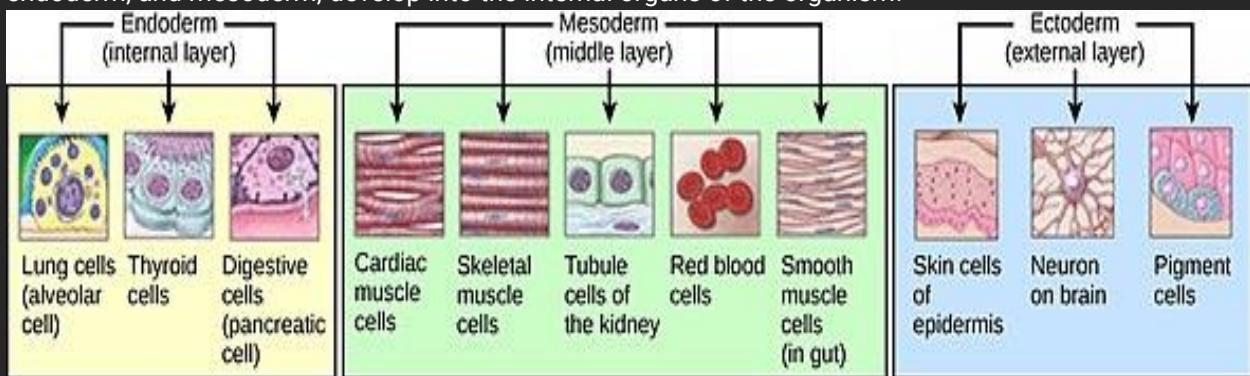


- During gastrulation, the fates of the cells are beginning to be determined. The cells started out as totipotent in cleavage, but as the cells are moved around through morphogenetic movements, they become more specialized in terms of their fates as they get assigned to specific germ layers.

Gastrulation	Stage of development involving morphogenetic movements of the cells to produce a gastrula with distinct germ cell layers; in vertebrates, this will result in three layers: the outermost ectoderm; the inner endoderm, and the middle layer, the mesoderm.
Morula	A human blastula made up of a solid ball of cells
Blastocyst	A human blastula composed of the inner cell mass, which becomes the embryo, and the trophoectoderm, which becomes the placenta
Implantation	Process where the blastocyst implants itself in the endometrium; this signals the start of pregnancy

Organogenesis

- It is the process by which the three germ tissue layers of the embryo, which are the ectoderm, endoderm, and mesoderm, develop into the internal organs of the organism.

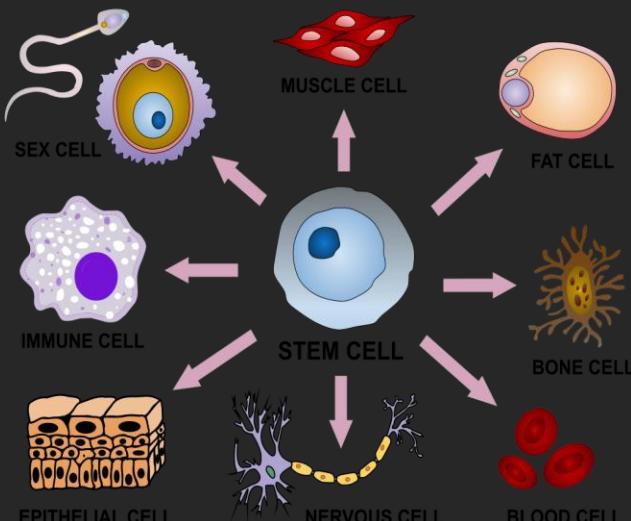


Organogenesis	Stage of development where the different germ layers differentiate into specific organ systems.
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Differentiation

- Cell differentiation
- The process through which a cell undergoes changes in gene expression to become a more specific type of cell.

- It allows multi-cellular organisms to create uniquely functional cell types and body plans.



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Growth

- Implies development, from the time of emergence or birth to the tie of maturity and for many species, beyond maturity to eventual senescence or death.
- Growth also implies increase in size resulting from cell multiplication and cell expansion, as well as maturation of tissues.

Growth	Stage of development characterized by an increase in size of an individual.

C. Twins and the reproductive system

Twins

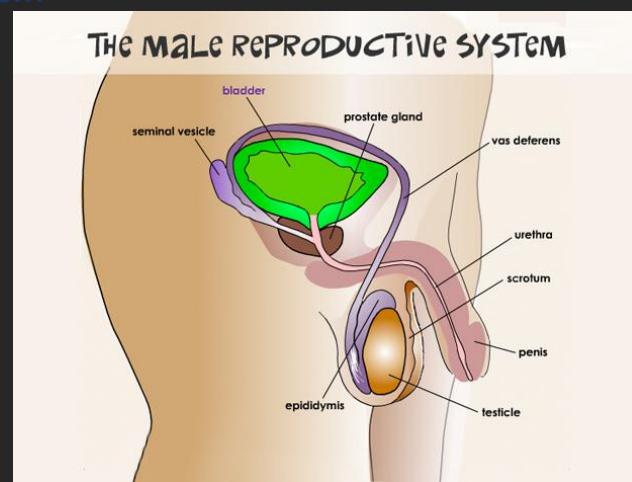
- Identical twins: result from an accident during cleavage when totipotent cells, whose fates have not yet been determined, are separated and continue with their development independently of each group of cells.
- Fraternal twins: are 2 separate fertilized eggs, they usually develop 2 separate amniotic sacs, placentas, and supporting structures.

Monozygotic Twins	Also known as identical twins; result from the union of a sperm and egg to form a single zygote that splits up during the first cleavage stage.
Dizygotic Twins	Also known as fraternal twins; results from the development of two or more separate fertilization events where the resulting zygotes develop almost simultaneously.

Multiple ovulation

- In some cycles, it's possible for both ovaries to release an egg cell. This is called multiple ovulation or hyper ovulation. There are a number of causes of multiple ovulations but it can only happen in a short window. When both eggs are fertilized, fraternal twins are conceived.

Reproductive system



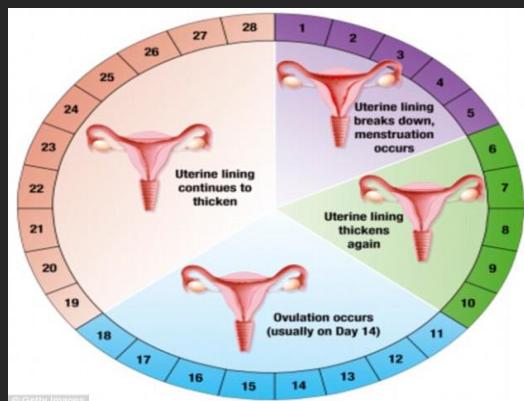
Testis	Where sperms are produced.
Epididymis	Where sperms are temporarily stored.
Scrotal sac/scrotum	Supports the testis and epididymis.
Vas deferens	Where the sperm passes through from the testis before it joins the urethra.
Urethra	Connected to the urethra and the urinary bladder; serves as passageway of both sperm and urine and terminates in the external urinary meatus of the penis.
Seminal Vesicle	Secretes fluid that forms part of the semen; secretion gives the semen its alkaline characteristic to counteract the acidity of the vaginal tract and therefore protect the sperm; the fluid also contains sugars like fructose.
Prostate gland	Secretes fluid that also provides alkalinity to the semen; it also contains proteolytic enzymes, citric acid, phosphatases, and lipids.
Bulbourethral glands	Paired glands that produce clear, viscous secretion known as pre-ejaculate that helps to lubricate the urethra for sperm to pass through, neutralizing traces of acidic urine in the urethra, and helps flush out any residual urine or foreign matter



Clitoris	The homologue (equivalent) of the penis in females
Vagina	Main entrance to the female reproductive tract; receives the penis during sexual intercourse
Cervix	Where the vagina ends; projection of the uterus into the vagina; leads to the uterus
Uterus	Also known as the womb; where the embryo develops; with thick muscular walls, blood vessels; and the endometrial lining
Endometrial lining/endometrium	Innermost lining of the uterus where the embryo implants and develop
Fallopian tubes	Also known as oviducts; paired tubes that are connected to the uterus and terminate near the ovaries; this is where fertilization takes place
Ovaries	Female gonads that release the oocytes during ovulation, which are then caught by the fimbriae of the fallopian tubes in order for the oocytes to pass on to the fallopian tubes

D. Menstrual cycle

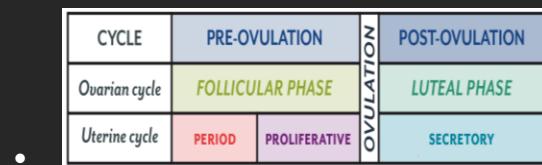
- It is the hormonal process a woman's body goes through each month to prepare for a possible pregnancy.
- Regular menstrual periods in the years between puberty and menopause are usually a sign that your body is working normally.
- Irregular or heavy, painful periods are not normal.
- Many women also get premenstrual syndrome (PMS) symptoms.
- Your periods are still "regular" if they usually come every 24 to 38 days. This means that the time from the first day of your last period up to the start of your next period is at least 24 days but no more than 38 days.



- The menstrual cycle can be described by the ovarian or uterine cycle
- The ovarian cycle describes changes that occur in the follicles of the ovary
- The uterine cycle describes changes in the endometrial lining of the uterus

Ovarian cycle

- Follicular phase - the time between the first day of the period and ovulation
- Ovulation phase - when your ovary releases a matured egg
- Luteal phase - it occurs after ovulation (when your ovaries release an egg) and before your period starts.



Follicular phase	Part of the menstrual cycle of the ovary in humans where the follicles begin to mature; it is marked by secretions of the follicle-stimulating hormone (FSH) and the luteinizing hormone (LH) by the anterior pituitary gland and the estrogen by the ovaries; both FSH and LH stimulate the maturation of the oocytes while estrogen stimulates uterine lining growth in preparation for implantation of the embryo
Luteal phase	Part of the menstrual cycle of the ovary after the oocytes are released from the follicles; the remains of the follicle become the corpus luteum, which then secretes progesterone, which stimulates the uterus to undergo final maturational changes that prepare it for gestation to house and nourish an embryo

Uterine cycle

- Menstrual phase - is the first stage of the menstrual cycle. It's also when you get your period
- Proliferative phase - of the uterine cycle when estrogen causes the lining of the uterus to grow or proliferate, during this time
- Secretory phase - always occurs from day 14 to 28 of the cycle. Progesterone stimulated by the LH (luteinizing hormone) is the dominant hormone during this phase to prepare the corpus luteum and the endometrium for possible fertilized ovum implantation

Menstrual phase	Part of the menstrual cycle of the uterus; also known as the "period"; corresponds to the early part of the follicular phase of the ovaries (days 1-5) when endometrium degenerates and sloughs off, producing the menstrual discharge
Proliferative phase	Part of the menstrual cycle of the uterus; corresponds to the latter part of the follicular phase of the ovaries (days 8-14) when the endometrium heals and begins to thicken as a consequence of estrogen secretion
Secretory phase	Part of the menstrual cycle of the uterus; corresponds to the luteal phase of the ovaries; the endometrium undergoes final changes before it receives the embryo during implantation

Pregnancy

- Pregnancy officially commences only when the embryo (blastocyst) has successfully implanted into the endometrium

Gestation	Carrying of the embryo inside the female reproductive tract, specifically the uterus; can last up to 9 months in humans
Human embryo	Corresponds to the first two months of gestation
Human fetus	Corresponds to the months 3-9 of human gestation

E. Contraception

Process that blocks any one of the following stages of reproduction in humans:

- Release and transport of gametes
- Fertilization

- Implantation
- Actual completion of development off of the embryo/fetus

Condom	Type of barrier method that is inserted on the male penis to prevent release of sperm into the female reproductive tract
Diaphragm	Type of barrier method that blocks the cervix, thereby preventing the passage of the sperm into the uterus
Cervical cap	Type of barrier method that covers the cervix and blocks passage of the sperm into the uterus
Spermicidal jelly or foam	Type of barrier method that kills the sperm on contact; they are placed inside the vaginal canal
Surgical methods	A special type of contraception preventing fertilization that involves surgery
Vasectomy	Type of surgical method for men; entails cutting the vas deferens
Tubal ligation	Type of surgical method for women; entails cutting the fallopian tubes
Implantation-suppressing methods	Type of contraception that prevents the blastocyst from being implanted in the endometrium
Intra-uterine device (IUD)	Type of implantation-suppressing method that physically blocks the blastocyst from implanting into the endometrium
Morning-after-pill	Type of implantation-suppressing method that blocks the action of hormones that prepare the uterus to receive the embryo
Abortion	Type of contraception that involves the deliberate removal of the embryo/fetus before it completes gestation
Coitus interruptus	Type of contraception that requires the man to remove the penis before ejaculation
Abstinence	Type of contraception where the man and the woman do not engage in sexual intercourse

Types of Contraception

Ovulation-suppressing methods

- Type of contraception that prevents the oocyte to mature
- Type of contraception taken in by women to prevent them from ovulating

Barrier Methods

- Type of contraception that prevents fertilization
- Physical (condom, diaphragm, cervical cap)
 - Condom
 - Type of barrier method that is inserted on the male penis to prevent release of sperm into the female reproductive tract
 - Male condoms
 - Advantages
 - Easy to buy
 - Inexpensive
 - Full personal control over use; no special procedures or exams
 - Side effects uncommon
 - Helps prevent pregnancy and most STDs

- Can be used with other methods
- Disadvantages
 - Can sometimes break
 - Need to plan ahead; have available when you have sex
 - Latex and/or spermicide allergies - other brands or types of plastic available for those who suffer
 - Loss of sensation
- Female condoms
 - Advantages
 - Available without prescription
 - No hormonal side effects
 - Can be used for people with latex sensitivities
 - Prevents STDs: chlamydia, gonorrhea, herpes, HPV, and HIV
 - Stays in place regardless of penis' hardness - cannot fall off
 - Disadvantages
 - Difficult to use
 - Can break or leak
 - More expensive than the male condom
 - Does not contain spermicide
- Diaphragm
 - Female condom
 - Blocks the cervix, thereby preventing the passage of the sperm into the uterus (30 hours)
- Cervical Cap
 - Type of barrier method that covers the cervix and blocks passage of the sperm into the uterus (smaller: 72 hours)

Surgical Methods

- A special type of contraception preventing fertilization that involves surgery
 - Vasectomy
 - Type of surgical method for men; entails cutting the vas deferens
 - Advantages
 - Permanent way of controlling birth, in fact, once your sperm count is zero, you don't have to use any other birth control methods.
 - Safest method for controlling birth in men, also it has lower costs, fewer complications when compared to tubal ligation in women.
 - Introduces one-time cost usually covered by your medical insurance.
 - Other birth control methods, like contraceptives, or condoms will cost more over time.
 - Disadvantages
 - Does not protect you from STDs like chlamydia, gonorrhea, herpes simplex, HIV/AIDS, HPV
 - Only condoms are the most effective way to prevent against such diseases. Even after a vasectomy, you must wear a condom during sex to protect yourself and your partner from STDs.
 - Tubal ligation

- Type of surgical method for women; entails cutting the fallopian tubes
- Advantages
 - Intended to be permanent
 - Highly effective
 - Safe
 - Quick recovery
 - Lack of significant long term side effects
 - Cost effective
- Disadvantages
 - Possibility of patient regret
 - Difficult to reverse
 - Future pregnancy could require assisted reproductive technology (such as In Vitro Fertilization)
 - More expensive than vasectomy

Implantation-suppressing method

- Type of contraception that prevents the blastocyst from being implanted in the endometrium
 - Intra-uterine device (IUD)
 - Type of implantation-suppressing method that physically blocks the blastocyst from implanting into the endometrium
 - Advantages
 - Once inserted, remains in place
 - Remains effective while in place
 - Prevents pregnancy for a long period of time
 - Does not interfere with sexual activity
 - Disadvantages
 - May cause bleeding and cramping
 - Increased risk of ectopic pregnancy
 - Doesn't prevent STDs.
 - Morning-after-pill
 - Type of implantation-suppressing method that blocks the action of hormones that prepare the uterus to receive the embryo
 - Birth control pills
 - Advantages
 - Studied for over 30 years - long-term safety well known
 - Periods become more regular
 - Less menstrual cramping, facial hair, acne, and menstrual flow
 - Reduces risk of ovarian and womb cancer and infections of tubes and ovaries
 - Strengthens bones by regulating hormones
 - Some protection from PID
 - Disadvantages
 - Must be taken daily; hard to remember to take
 - Side effects include irregular bleeding, weight gain or loss, changes in mood, nausea, breast tenderness and headaches
 - Increased health risks when used with smoking
 - Slight increase in the risk of blood clots
 - Doesn't protect against STDs.

Chemical Methods

- Spermicidal jelly or foam
 - Type of barrier method that kills the sperm on contact; they are placed inside the vaginal canal
 - Advantages
 - Variety of brands
 - Easy to use
 - Inexpensive
 - Available
 - No clinical visit required
 - No side effects
 - Good back-up method
 - Disadvantages
 - Not reliable when used alone
 - Messy
 - Must wait for spermicide to take action before having intercourse which can take away from spontaneity

Others

- Coitus Interruptus
 - Type of contraception that requires the man to remove the penis before ejaculation
- Abstinence
 - Type of contraception where the man and the woman do not engage in sexual intercourse
- Abortion
 - Type of contraception that involves the deliberate removal of the embryo/fetus before it completes gestation
- Contraceptive implants
 - Advantages
 - Can be fitted and forgotten
 - Doesn't interfere with sex
 - Can be used while breastfeeding
 - Is useful for women who cannot take estrogens
 - May reduce heavy, painful periods
 - Disadvantages
 - May cause irregular bleeding for the first few months
 - Can cause side effects such as headaches, tender breasts, changes in mood and sex drive, and bloating
 - Doesn't protect against STDs
 - May take a while until fertility is restored.

F. Reproduction and life cycle of plants

The life cycle of a plant is very different from the life cycle of an animal. Humans are made entirely of diploid cells (cells with two sets of chromosomes, referred to as "2n"). Our only cells that are haploid cells (cells with one set of chromosomes, "n") are sperm and egg cells. Plants, however, can live when they are at the stage of having haploid cells or diploid cells.

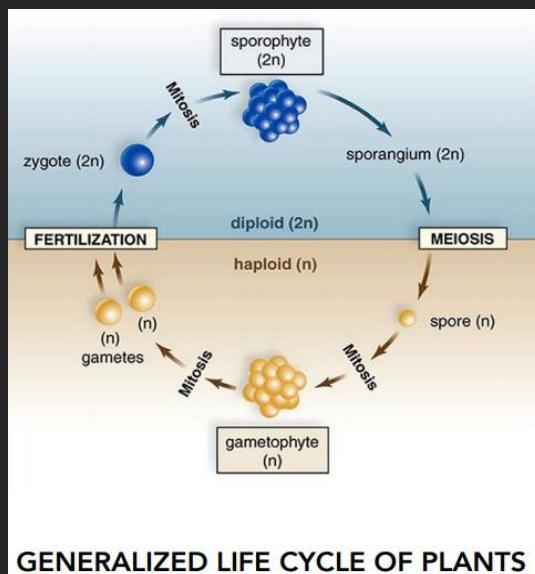
Alternation of Generations

Plants alternate between diploid-cell plants and haploid-cell plants. This is called alternation of generations, because the plant type alternates from generation to generation. In alternation of generations, the plants alternate between a sporophyte that has diploid cells and a gametophyte that has haploid cells.

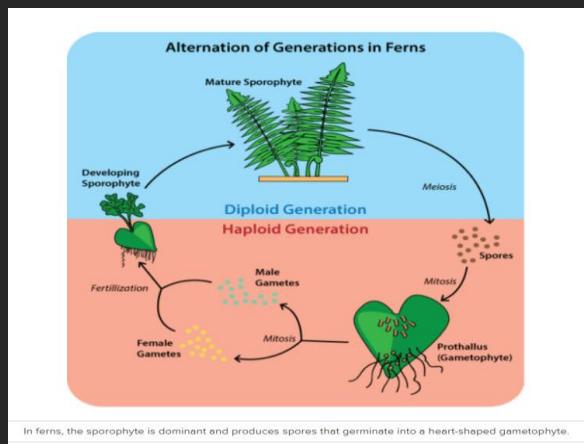
1. The haploid gametophyte produces the gametes, or sperm and egg, by mitosis. Remember, gametes are haploid, having one set of chromosomes.
2. Then, the sperm fertilizes the egg, producing a diploid zygote that develops into the sporophyte, which of course is a diploid.
3. The diploid sporophyte produces haploid spores by meiosis.
4. The haploid spores go through mitosis, developing into the haploid gametophyte.

General Life Cycle of Plants

- The mature, multicellular organism is a diploid sporophyte.
- Later, some cells undergo meiosis to produce haploid gametes which are then released.
- Gametes fuse and form the zygote which develops by mitosis to become the multicellular diploid sporophyte.

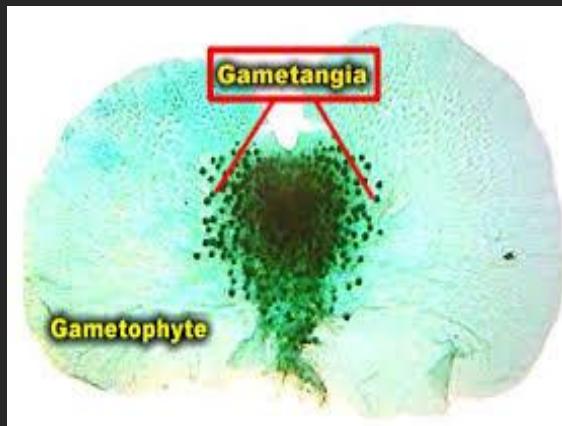


- In some plants, the dominant part of the life cycle is a multicellular, haploid gametophyte (all cells have a haploid chromosome number).
- Mitosis releases individual cells that can act like gametes (gamete are produced by mitosis).
- The generation in which the plant spends most of its life cycle is different between various plants.
- In the plants that first evolved, the gametophyte takes up the majority of the life cycle of the plant.
- During the course of evolution, the sporophyte became the major stage of the life cycle of the plant.



Gametophyte and gametangia

- Gametophyte: stage of the life cycle of a plant that is haploid; stage that produces gametes via mitosis; these gametes fuse to form a zygote that develops into a sporophyte.
- Gametangia: a specialized organ or cell in which gametes are formed in algae, ferns, and some other plants.



Sporophyte and sporangia

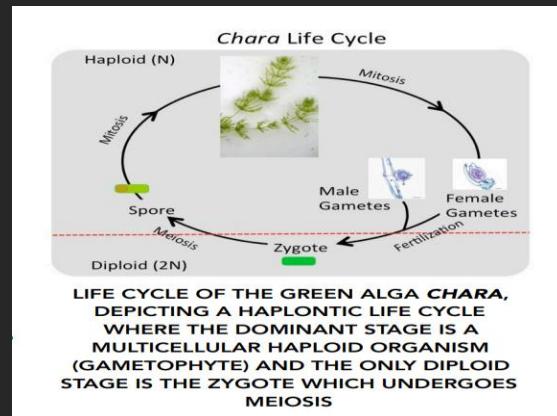
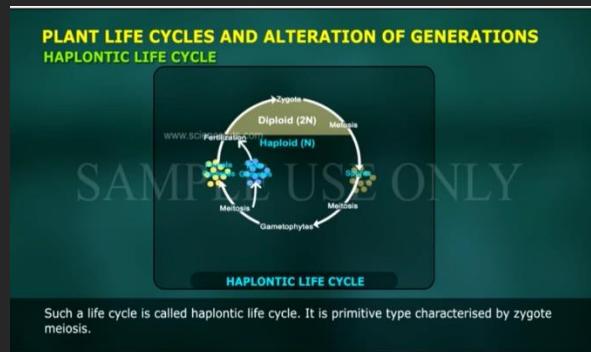
- Sporophyte is (botany) a plant (or the diploid phase in its life cycle) which produces spores by meiosis in order to produce gametophytes.
- Sporangium is (botany | mycology) a case, capsule, or container in which spores are produced by an organism



Different types of life cycles

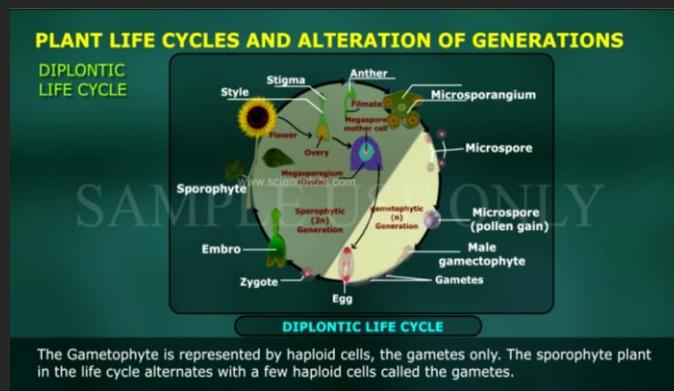
Haplontic

- Life cycle where the haploid stage (gametophyte) is multicellular and the only diploid stage is the fertilized egg cell



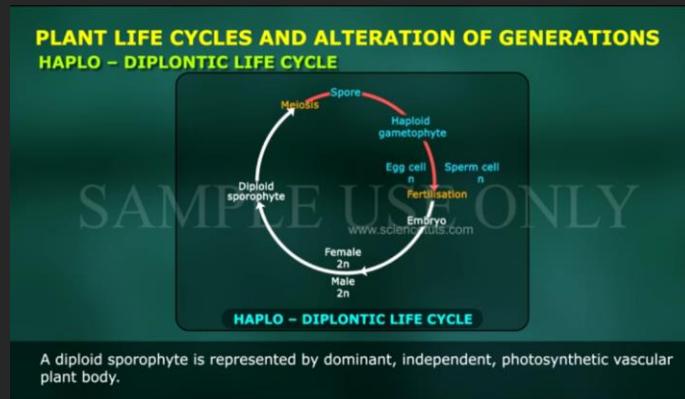
Diplontic

- Life cycle where the diploid stage (sporophyte) is multicellular and the haploid stage (gametophyte) is represented by the single-celled gametes. (humans)
- Type of life cycle found in flowering plants (and in most animals). The organism is in the diploid stage (all cells are diploid in chromosome number) except for mature, haploid sex cells which are called gametes.

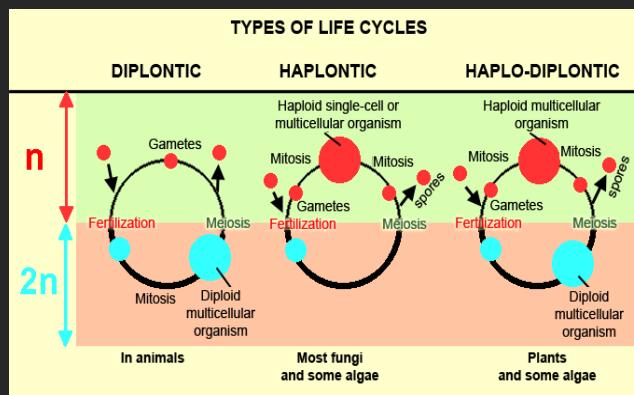
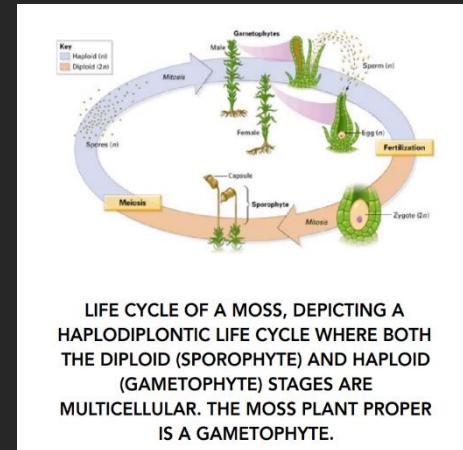


Haplodiplontic

- Life cycle that includes multicellular diploid (sporophyte)
- Sporophyte - life cycle that have diploid chromosomes; gametophyte - life cycle that have haploid chromosome

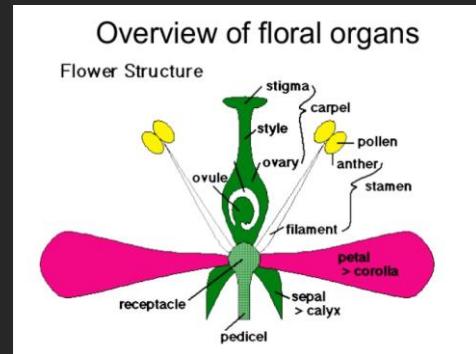
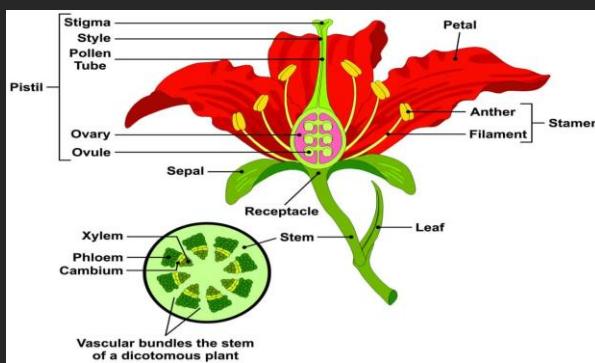


- A moss has a multicellular haploid (gametophyte) stage that produces gametes. These gametes fuse to produce a zygote that undergoes mitosis to produce a multicellular sporophyte. Within a part of the sporophyte called the capsule, cells undergo meiosis to produce meiospores. These spores are eventually released and germinate by dividing mitotically to become a multicellular gametophyte.



E. Flowers

Parts of a flower



Four Major Whorls

1. Sepals

- Outermost whorls of a flower; collectively called the calyx.
- During bud condition the petals are covered by a green leaf like part is called a sepal. Sepals form the calyx.



2. Petals

- Whorl inner to the sepals; may be brightly colored in some; collectively called the corolla.



3. Stamen

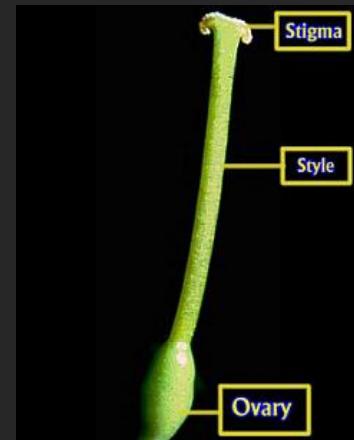
- Whorl inner to the petals; the male reproductive structure of the flower; bears the male sporangia (also known as microsporangia)



- The stamens are the male part of the flower.
- The plant makes pollen in the part of the stamen called the anther.
- Filament: Long stalk that holds up the anther.
- Anther: Produces and holds pollen.

4. Carpels/Pistil

- Innermost whorl of the flower; the female reproductive structure of the flower; bears the female sporangia (also known as the megasporangia)

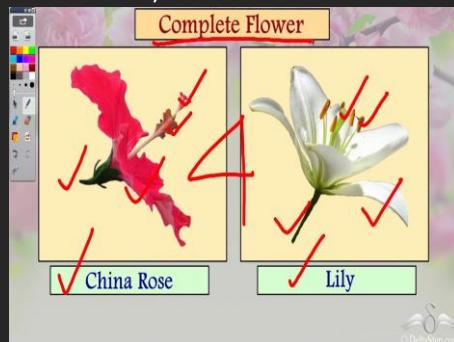


- Stigma: Top of the female part of the flower; pollen from another flower collects on the stigma's sticky surface; found at the end of the pistil
- Style: Neck of the pistil
- Ovary
 - Part of the pistil that contains the ovules
 - Protects the ovules
 - Pollen travels to the ovules and the fertilization takes place
 - Now the ovules will develop into seeds
- Ovule
 - Part of the flower in which the eggs are produced and seeds develop

Types of flowers

- Based on pollination
 - Entomophily (insects)
 - Anemophily (wind)
- Based on presence of floral whorls
 - Complete flower
 - All 4 floral whorls present

- It has all parts needed for reproduction
- Ex: Hibiscus, sunflower

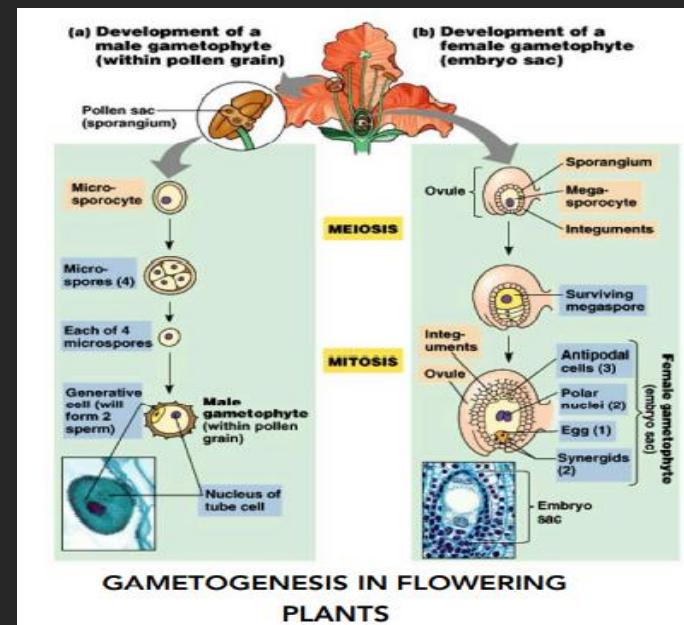


- Incomplete flower
 - Not all 4 floral whorls present
 - Doesn't have 1 or more of the parts needed
 - Ex: Any trees and hydrangeas, cactus, papaya
- Based on presence of sexes
 - Perfect/bisexual
 - Both sexes present
 - Contains both male and female reproductive organs in the same flower (perfect/monoecious plant)
 - Imperfect/unisexual
 - Not both sexes present
 - Contains male and female reproductive organs in separate flowers (imperfect/dioecious plant)
 - Staminate flower: has the stamen
 - Carpellate flower: has the pistil

F. Development of Flowering Plants

Gametophyte (gametogenesis)

- Male gametophyte - The microsporangium in the anther contains numerous microsporocytes. Each microsporocyte will undergo meiosis to produce 4 haploid microspores each microspore develops into a pollen grain (containing two sperm nuclei and one tube nucleus).
- Female gametophyte - The megasporangium in the ovule contains megasporocytes. One megasporocyte will undergo meiosis to produce 4 haploid megasporocytes three megasporocytes degenerate remaining megasporocyte divides mitotically three times, an embryo sac with eight haploid nuclei membranes partition to make the embryo sac multicellular.



Pollination

Transfer of pollen grains from the anther to the stigma

May be animal-aided or wind-aided

Pollen grains are immobile. They cannot reach the stigma by themselves. An external agent is required for this. It can be wind, water, animal, gravity, or growth contact.

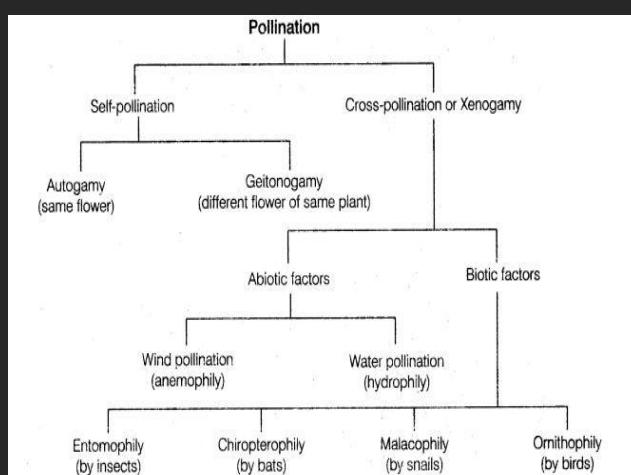
Types of Pollination

Self-pollination

- Pollination that occurs within the same flower

Cross pollination

- Pollination that occurs between two different flowers



Self-pollination

Autogamy

- Type of self-pollination in which an intersexual or perfect flower is pollinated by its own pollen.
- Occurs by 2 methods:
 - Homogamy: Anthers and stigmas of chasmogamous or open flowers are brought together by growth, bending or folding.
 - Cleistogamy: In cleistogamous flowers, the anthers dehisce inside closed flowers. Growth of style brings the pollen grains in contact with stigma. Pollination and seed set are assured. Pollinators are not required.



Geitonogamy

- Type of self-pollination in which the pollen grains of one flower are transferred to the stigma of another flower belonging to either the same plant or genetically similar part. In geitonogamy, the flowers often show modification to ones found in xenogamy or cross pollination.

Advantages

- Maintains the parental characters or purity of the race indefinitely.
- Self-pollination is used to maintain pure lines of hybridization experiments
- The plant doesn't need to produce large number of pollen grains.
- Flowers do not develop devices for attracting insect pollinators.

Disadvantages

- New useful characters are seldom introduced
- Vigor and vitality of the race decreases with prolonged self-pollination
- Immunity to diseases decreases
- Adaptability to changed environment are reduced.

Cross pollination

- AKA xenogamy, allogamy
- Cross pollination is the transfer of pollen grains from the anther of one flower to the stigma of a genetically different flower.
- Cross pollination is performed with the help of an external agency

Abiotic factors (non-living)

- Anemophily
 - It is a mode of cross pollination or transfer of pollen grains through the agency of wind.
 - Coconut palm, date palm, maize, many grasses, cannabis
 - Characteristics
 - Flowers are colorless, odorless and nectar less
 - Pollen grains are light, small, and winged or dusty, dry smooth, nonstick and unwettable.
 - Stigma is hairy, feather or branched to catch the wind-borne pollen grains
 - Pollen grains are produced in very large number
- Hydrophily
 - Transfer of pollen grains through the agency of water

- Zoosteria, valisneria
- Characteristics
 - Flowers are small and inconspicuous
 - Nectar and odor are absent
 - Pollen grains are light and unwettable due to presence of mucilage cover
 - Stigma is long, sticky, but unwettable

Biotic factors (living)

- Entomophily
 - - Pollen grains are transferred to a mature through the agency of insects like moths, butterflies, wasps, bees, beetles, etc.
 - - Characteristics
 - Showy or brightly colored
 - Most insect pollinated flowers have a landing platform
 - The pollen grains are spiny, heavy, and surrounded by a yellow oily sticky substance called pollenkit
 - Stigmas are often inserted and sticky
 - some flowers provide safe place to insects for laying eggs, e.g., Yucca.
- Ornithophily
 - Mode of allogamy performed by birds. Only a few types of birds are specialized for this. They usually have small size and long beaks
 - Characters
 - Ornithophilous flowers are usually brightly colored - red, orange, yellow or blue
 - Floral parts are commonly leathery
 - The ornithophilous flowers secrete abundant watery nectar or have edible parts
 - Scent is often absent.

Advantages

- Cross pollination introduces genetic recombination and hence variations in the progeny
- Cross pollination increases the adaptability of the offspring towards changes in the environment
- Makes the organisms better fitted in the struggle for existence
- Plants produced through cross pollination are more resistant to diseases

Disadvantages

- Factor of chance is always involved in cross pollination
- Less economical
- Some undesirable characters may creep in the race
- The very good characters of the race are likely to be spoiled.

Artificial Pollination

Used for the purpose of hybridization

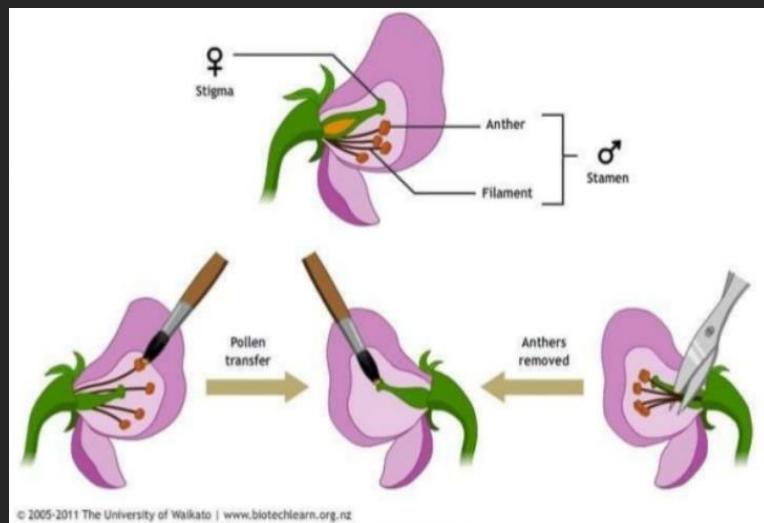
Involves pollination of desired female parents with pollen from the desired male parent, taking all precautions to prevent contamination of stigma with undesired pollen

In unisexual plants the procedure is simple but its complicated in bisexual ones

2 Processes that takes place in bisexual flowers: emasculation, bagging

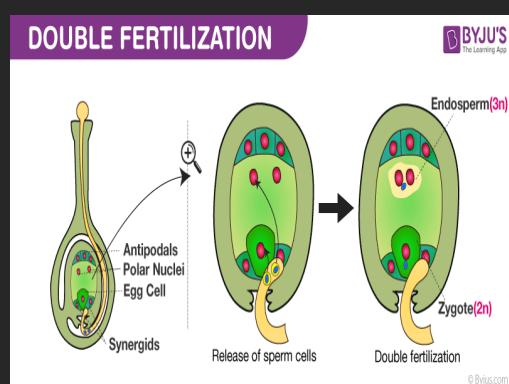
Coevolution of flower and its pollinator species

- Coevolution is the evolution in two species that interact extensively with one another so that each act as a major force of natural selection on the other.
- When one evolves a new feature or modifies itself, the other evolves new adaptations in response of it.
- This constant mutual feedback modification between two species is known as coevolution.
- The coevolution of the flower and its pollinator species are tightly linked with one another.



G. Double fertilization and embryo development in plants

Double Fertilizations



Inside the pollen grain there is a tube cell and generative cell

Generative cell divides to produce two sperm cells while the tube cells become the pollen tube

Pollen tube elongates along the style and penetrates the ovule in the ovary via the micropyle (an opening)

Pollen tube discharges the sperm cells into the embryo sac inside the ovule

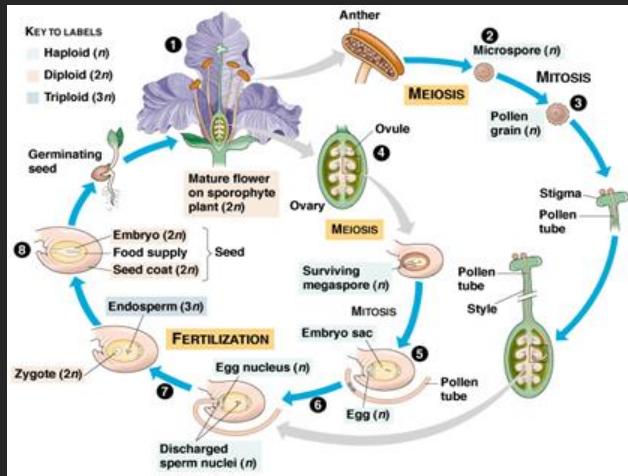
One sperm unites with the egg to form the zygote while the other sperm fuses with the polar nuclei to become the endosperm, which serves as food of the early embryo

Embryo Development (Embryogenesis)

Zygote divides mitotically to produce the proembryo and suspensor, which anchors the proembryo and transfers nutrients from the parent plant to it

Cotyledons (seed coat) appear on the proembryo (monocots have only one cotyledon whereas dicots have two)

Proembryo elongates into an embryo



Maturation of ovary and ovule

Ovary matures into fruit while the ovule becomes the seed.

The seed may become dormant for some time.

Seed germination

Conditions required for the growth of a seed :



- ◆ Moisture
- ◆ Warmth
- ◆ Nutrient rich soil
- ◆ Sunlight
- ◆ Good quality seed

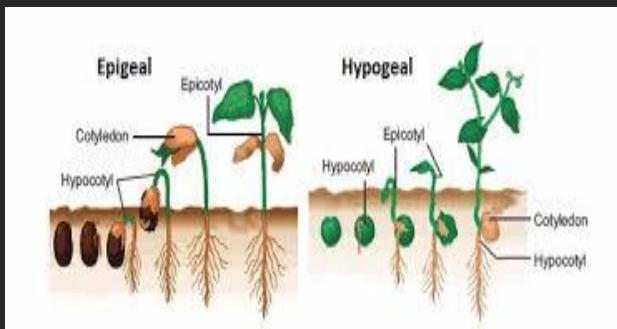
Once these conditions are satisfied,
the seed begins to grow

Transformation of seed to seedling

Seed undergoes imbibition to break dormancy

Nutrients stored in the endosperm or cotyledons are digested and transferred to the growing regions of the embryo to primary meristems (protoderm, ground meristem, procambium) develop to radicle emerges to plumule breaks through the soil surface

2 Types of seed germination



Epigeal germination

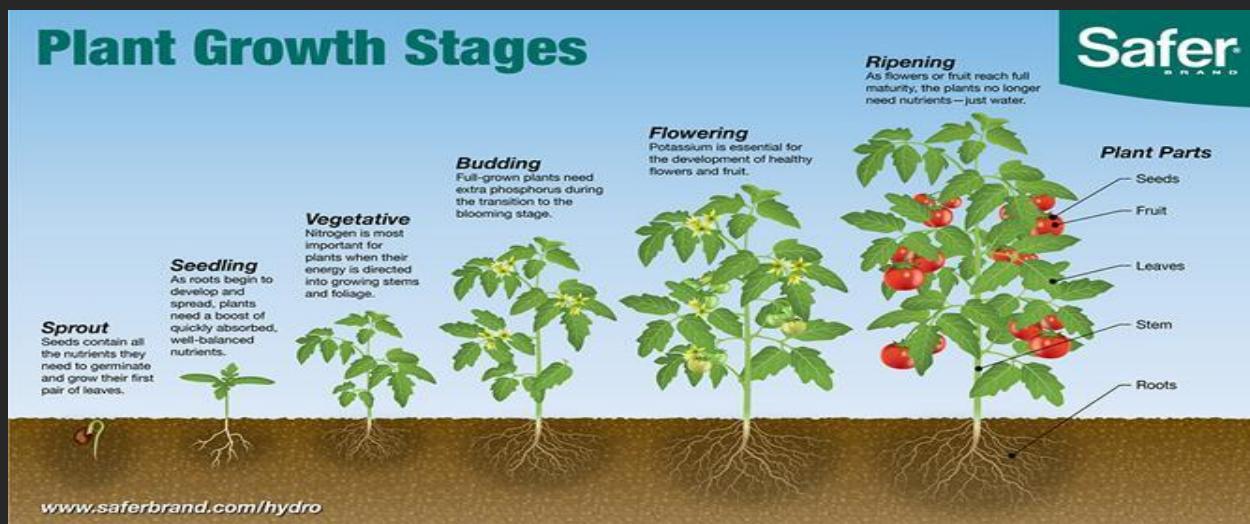
- Occurs when the cotyledon emerges above ground, thereby exposing the hypocotyl of the plumule

Hypogea germination

- Occurs when the cotyledon remains below ground, thereby concealing the hypocotyl

Seedling growth to mature plant

- Primary meristems differentiate to become the different plant tissues



Significance of plant and animal life cycles

The life cycles of plants and animals are often related. Although there are many variations on the basic life cycle of plants and animals, the similarities create relationships between both types of organisms. Plants are often heavily dependent on animals for their own reproduction, and animals could not live to maturity without feeding on plants or other organisms.

H. Nutrient procurement and processing

Nutrients: Refers to any substance required for the growth and maintenance of an organism

Types of organisms based on nutrition

Autotrophs

- Organisms that obtain energy from sunlight and chemicals to produce their own food
- Examples: Plants, chemosynthetic bacteria

Heterotrophs

- Organisms that cannot make their own food and obtain their energy from other organisms
- Examples: Animals, fungi

Nutritional requirements of plants

- Plants are photoautotrophs
- Water
- Carbon dioxide
- Essential nutrients or elements
 - Macronutrients and micronutrients
 - Macronutrients
 - Nutrients that the plant needed in big amounts
 - Amount required > 0.5% plant's dry weight
 - Carbon, hydrogen, oxygen, nitrogen, potassium, calcium, magnesium, phosphorus, sulfur
 - Micronutrients
 - Nutrients that the plant needed in small amounts

- Chlorine, iron, boron, manganese, zinc, copper, molybdenum

Routes for the absorption of water and minerals across plant roots

1. Symplast route
 - Through plasmodesmata
2. Apoplast route
 - Along cell walls

Absorption structures

- Root hairs – extension of epidermis
- Root nodules
 - Mutualism
 - Contain nitrogen fixing bacteria
 - Bacteria converts N₂ into forms plants can use
- Mycorrhizae
 - Symbiotic (mutualism)
 - Roots and fungus

Food processing in animals

Animals use different ways of getting and eating their foods. One of the reasons for this is the differences in their diets

1. Herbivores – eats plants
2. Carnivores – eats meat
3. Omnivores – eats both

Feeding mechanisms

- Fluid feeders: sucks nutrient rich fluids from host
- Deposit feeders: sifts through dirt and other deposit for food
- Suspension feeders (filter feeders): filter food from their water, so have to be aquatic animals
- Bulk feeders: eats large amounts and pieces – most animals are bulk feeders
- Substrate feeders: live on their food source and eat through it

Steps in food processing

1. Ingestion: taking in/eating of food
2. Digestion: breaking down food (mechanically/chemically) into nutrients
3. Absorption: taking in of nutrients by cells – transport of products into circulatory system and to the rest of the body
4. Elimination: removal of undigested solid wastes

I. Digestion and the human digestive system

Digestion

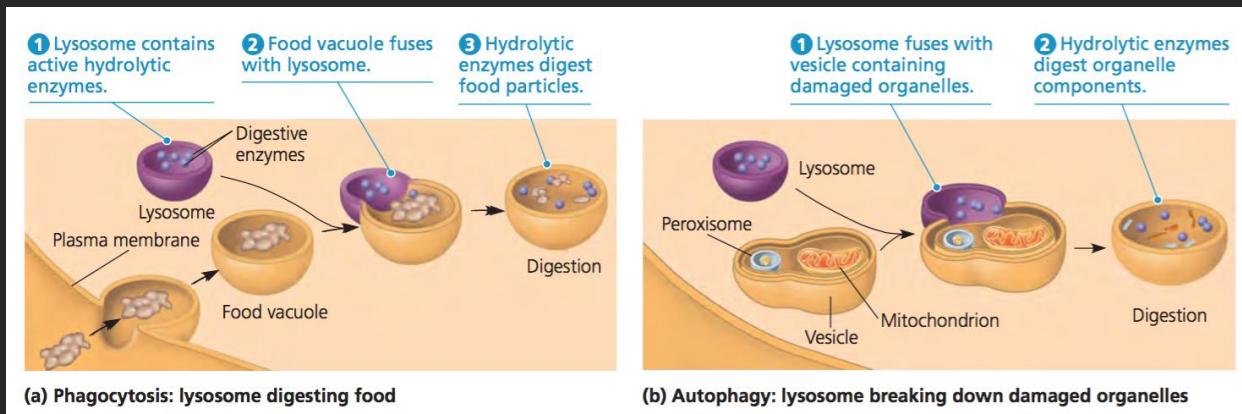
Animals use enzyme to break down food material

Digestion occurs in compartments surrounded by body cells but not within the body cells, hence avoiding self-digestion.

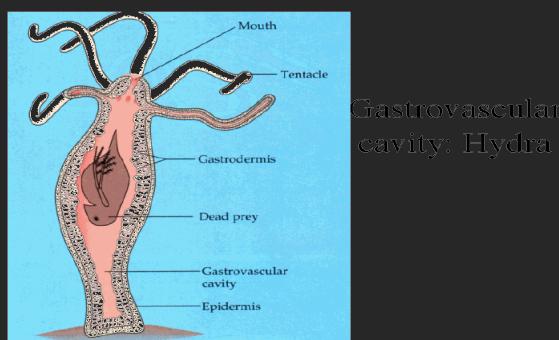
Digestion in single celled organisms

Protists and sponges digest their food inside food vacuoles.

These organelles fused with lysosomes which contains hydrolytic enzymes for food break down.



Digestion in other animals



Cnidarians and flatworms use a compartment called gastrovascular cavity (only the mouth as an opening)

Cells around the cavity produce enzymes that digest the food into smaller particles

Other cells with food vacuoles absorb the particles to further break them down, until the wastes are eliminated through the mouth

Alimentary canal

Type of digestive tract with two openings

This is advantageous because digestion can proceed in one direction: hence, there can be specialization in the different parts of the tract

Food is ingested in the mouth and proceeds to the pharynx

Different species have different names for the structure after esophagus

For some it is a crop which can be used to make food softer and store it

For others it is gizzard, for others it is stomach which can store food and mechanically break it down as well.

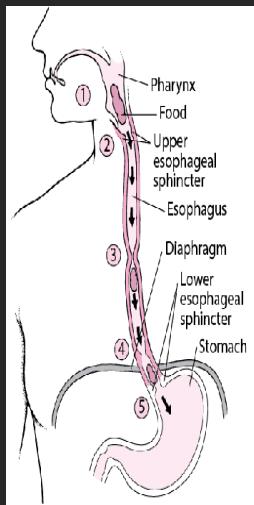
The intestine is responsible for chemical digestion and absorption while the anus is for waste elimination

Human digestive system

Digestion occurs through an alimentary tract and with the help of some accessory organs

1. Mouth

- Salivary glands
 - Amylase breaks down starches
 - Lingual lipase, which breaks down fats
- Food is called bolus



2. Pharynx

- Epiglottis (not an accessory organ) moves down when you swallow and moves up when you breathe

Food then moves from the pharynx to the esophagus when the esophageal sphincter opens

Sphincters help move the food in one direction only

Pyloric Sphincter (between stomach and small intestine)

Ileocecal Sphincter (ICS) (Small to large intestine)

Internal Anal Sphincter (IAS) (Anus)

3. Esophagus

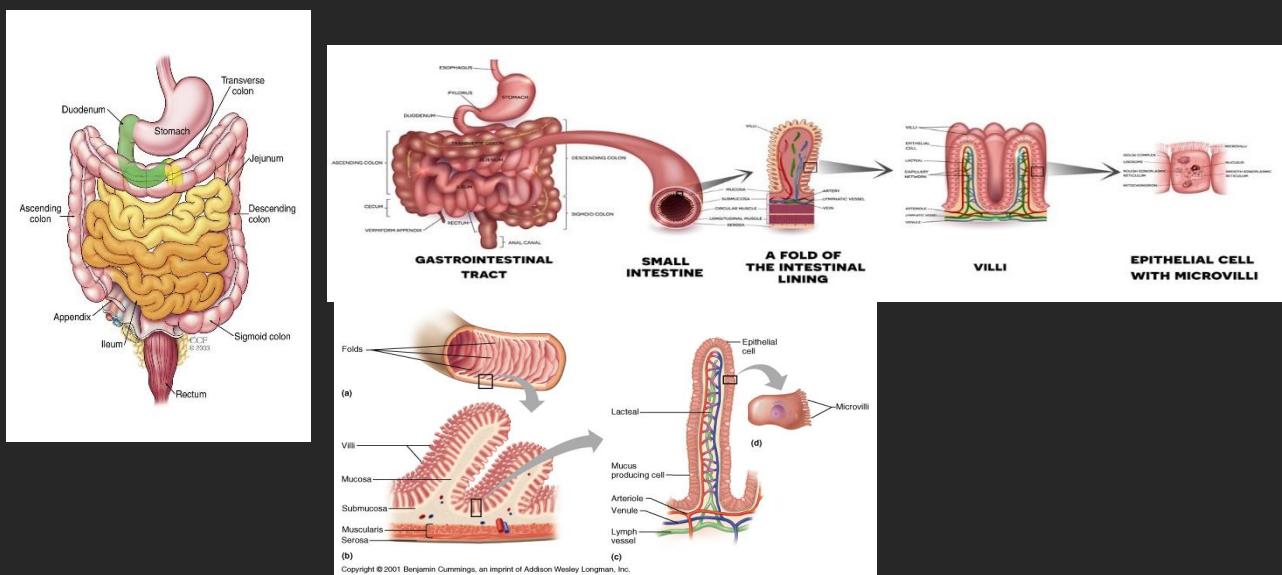
- Peristalsis (involuntary muscular contractions)
- Does not act in chemical digestion

4. Stomach

- 2L of food and fluid (has folds called rugae)
- Gastric juices, HCl (Hydrochloric acid), and pepsinogen (activated to become pepsin - digests protein)
- Food is called chyme

5. Small intestine

- Average length of 3m - 6m (2.5cm in diameter)
- Complete digestion of chyme
- Main site for absorption of nutrients
- Duodenum (receives bile (digests fats) from the liver and pancreatic juice (helps neutralize the acidic chyme))
- Jejunum
- Ileum



6. Large intestine

- Reabsorption of water
- Larger diameter (5cm) but shorter
- Appendix (contributes to immune system)
- Feces

7. Rectum

- Temporary storage of feces

8. Anus

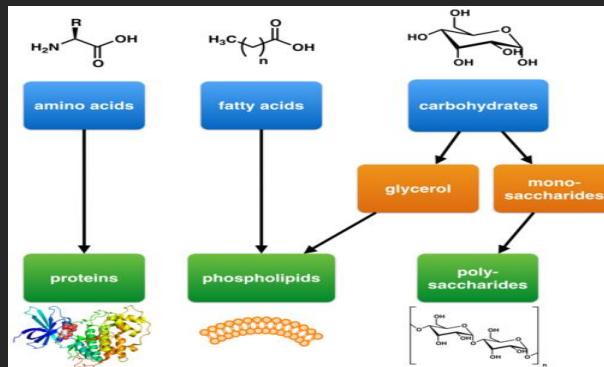
- Where the feces get eliminated

J. Proper nutrition

Macronutrients such as carbohydrates, fats, and proteins, are the three groups of molecules which can be obtained from different sources of food

These molecules are important because their components will be used to synthesize new molecules needed by the body.

Macronutrients



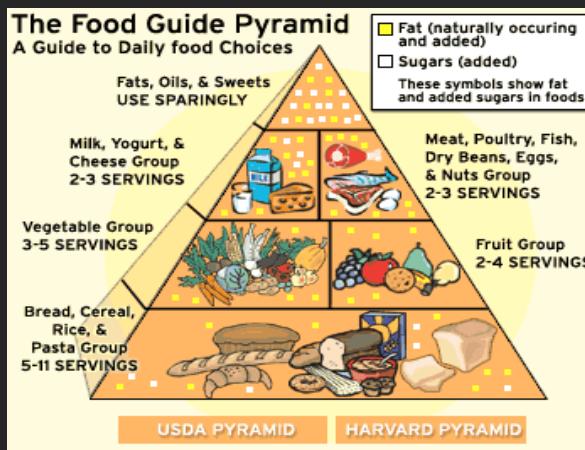
Micronutrients

Vitamins and minerals in small quantities are important for our metabolic needs

Hence, our diet must supply us with all three basic needs: sources of raw materials, energy, vitamins and minerals.

We can use the food pyramid as a guide on what and how much to eat on a daily basis

Moderation in everything we eat is the key



Are molecules which our bodies cannot make even if we have enough raw materials

They are called "essential" because we must obtain them in preassembled forms from our diet.

An example of essential fatty acid is the linoleic acid which is necessary for phospholipid membranes

When this acid is obtained readily from vegetables, seeds, grains, deficiencies from the lack of linoleic acid are seldom recorded.

Health concerns

In today's age, when food is readily available, a big number of people, mostly children, still die from hunger.

Malnutrition and undernutrition are still common.

Malnourishment

- This happens when a diet lacks calories (an amount of energy) or one or more essential nutrients
- Sodas and junk foods
- This may also happen on infants whose diet is switched from breastmilk to mostly starch or carbohydrates
- Can cause developmental problems

Undernutrition

- Occurs when a diet is not enough to provide the individual with chemical energy
- Food shortage

Over nourishment

- Fat accumulation causes obesity
- This happens when too much is ingested, a case of malnutrition called over nourishment
- Obesity in children is rising
- Studies show that obesity has now surpassed smoking in causing diseases and shortening lifespan.

Healthy diet

Food pyramid

Average amount for most vitamins ranges from 0.01 to 100 mg

Minerals (1mg to 2,500 mg)

Consuming higher dosage of vitamins and minerals can also have bad side effects

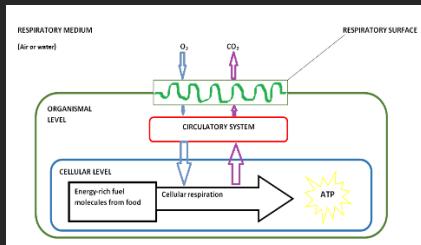
Vitamins	Deficiency disease	Food sources
Vitamin A	Night-blindness	Leafy vegetables, carrots, pumpkin
Vitamin B1	Beriberi	Pork, brown rice, potatoes, eggs
Vitamin B2	Ariboflavinosis	Dairy products, bananas
Vitamin B3	Pellagra	Meat, fish, mushrooms, tree nuts
Vitamin B5	Paresthesia	Meat, broccoli, avocados
Vitamin B6	Dermatitis & Anemia	Meat, vegetables, tree nuts, bananas
Vitamin B7	Dermatitis, enteritis	Raw egg yolk, liver, peanuts, leafy green vegetables
Vitamin B12	Megaloblastic anemia	Meat and other animal products
Vitamin C	Scurvy	Many fruits and vegetables, liver
Vitamin D	Rickets	Fish, eggs, liver, mushrooms
Vitamin E	Very rare; Sterility in males and abortions in females.	
Vitamin K	Bleeding diathesis	Leafy green vegetables such as spinach.
Vitamin P	Internal Bleeding	Green Vegetables, Citrus fruits

ESSENTIAL MINERALS				
MINERALS	SOURCES	FUNCTIONS	DEFICIENCY	DAILY REQUIREMENT
IRON HAEM NON HAEM	Liver, meat, poultry, fish Cereals, leafy veg, jaggery	Hb formation, brain dev, temperature regulation	Anaemia, impaired cell-mediated immunity	Males=0.84mg Woman=2.8mg Preg.=3.5mg Lactation:2.4mg
CALCIUM	Milk & milk products, eggs, fish, leafy veg, cereals, millets	Bones & teeth, blood coagulation, muscle contraction	Rickets, osteomalacia	600 mg/day
PHOSPHOR US	vegetables	Bones & teeth, Other metabolism	rare	Equal to calcium
FLOURINE	Drinking water, Sea fish, cheese, tea	Mineralisation of bones, Dental enamel	Dental caries	0.5 to 0.8 mg per litre of water
IODINE	Sea foods, Cod liver oil, milk, vegetables, cereals	Thyroid hormone synthesis	Hypothyroidism , Retarded physical & mental dev	150 mcg / day Preg: 250 mcg/day

K. Gas exchange

Animals breathe in oxygen from the environment and expel carbon dioxide to the environment

Cellular respiration



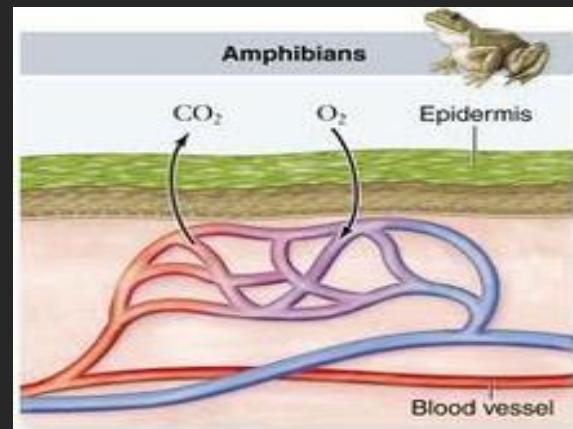
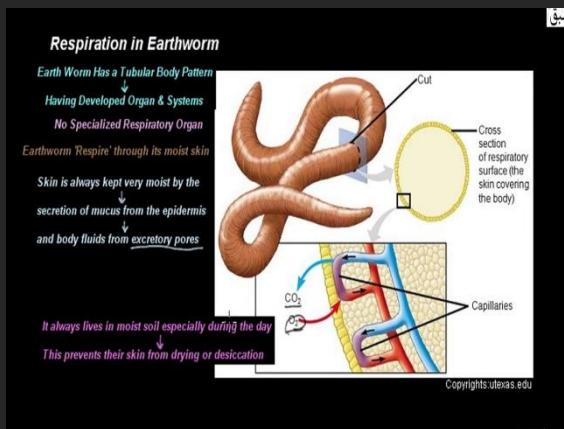
It is a process through which the body takes in oxygen to break down sugar from the food we eat, producing energy (adenosine triphosphate) and by-products such as water and carbon dioxide

Respiration in different animals

Different animals use different structures for gas exchange with the environment

Respiratory surfaces

- Always moist
- Large and thin surface area (to facilitate diffusion)

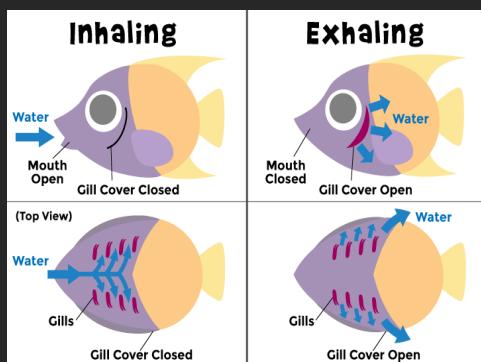


The skin surface of most animals doesn't have enough surface area for gas exchange

These animals have evolved structures that includes gills, trachea, and lungs.

All these respiratory surfaces are highly branched to ensure large area for efficient gas exchange.

Gills

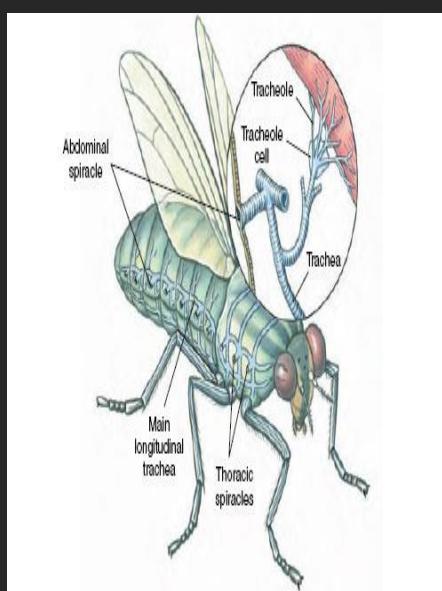


Are outfoldings that extend from the body and are immersed in water

The surface area of gills is larger than the animal's body

Fishes, sea stars, mollusks, crustaceans and young amphibians

Tracheal System



Land and animals use tracheal system and lungs which are found inside the body

Both structures are connected with the environment through small tubular openings to prevent dehydration on the respiratory surface

Tracheal system of insects

- Made up of highly branched tubes called tracheae which lie along the length of the insect's body
- Circulatory system is not involved in gas exchange since it occurs directly between the smallest tracheae branches and body cells

Lungs

Made up of internal sacs (alveoli) which are heavily subdivided and are found in most land vertebrates

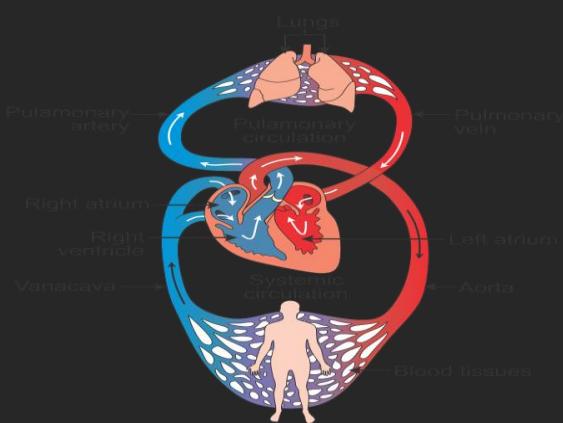
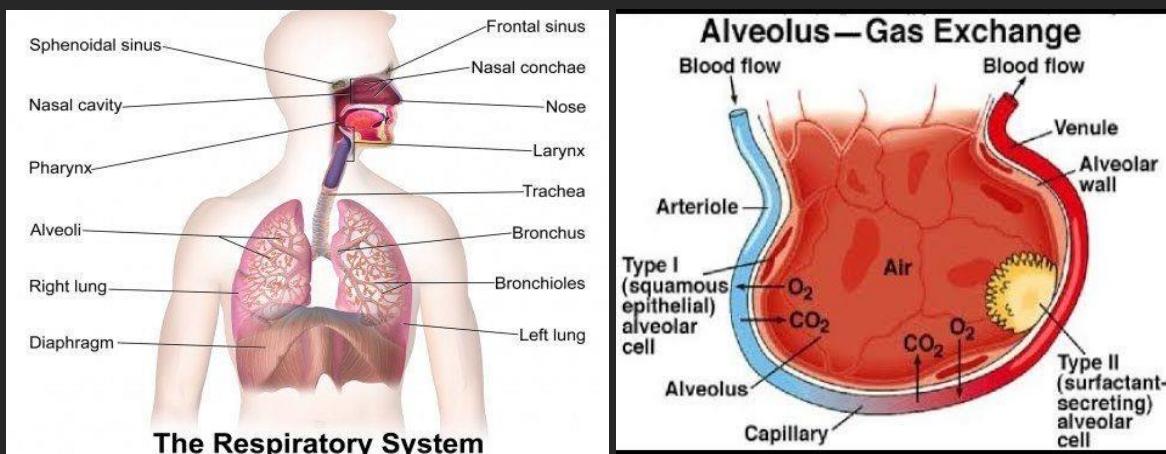
Gas exchange occurs in moist epithelium lining the sacs

The circulatory system transports the gases from the lungs to the body cells and vice versa

Human respiratory system

Lungs is the major organ found in the chest called thoracic cavity and is protected by the rib cage

Below this is the diaphragm which aids in ventilation (increasing the flow of air or water in the respiratory area)



L. Circulatory systems

Helps an organism transport nutrients, gases, and waste materials – all of which are necessary for life

Hydra

Its body thickness is only two to three cells can use diffusion alone to digest food and transport nutrients to all its cells from the environment

It uses gastrovascular cavity for these functions

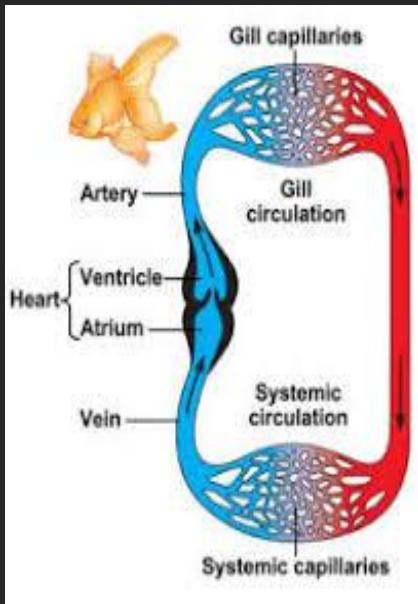
Open and closed circulatory system

Open circulatory system

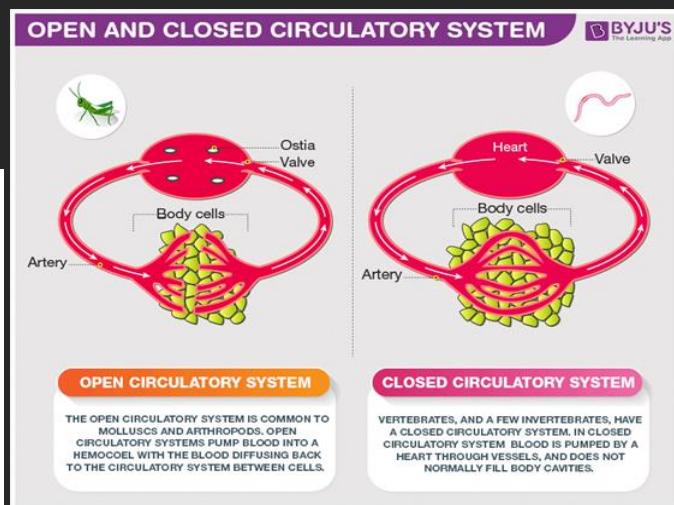
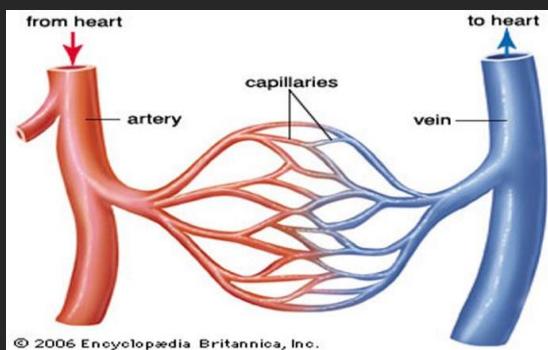
- The circulatory fluid is not restricted to the vessels
- It flows out of the vessels into the tissues
- There is no separate circulatory and interstitial fluid (bathes body cells)
- Invertebrates, mollusks, and arthropods
- In insects:
 - A heart pumps to distribute the nutrients to the body using body movements, during which the exchange of materials occur



Closed circulatory system

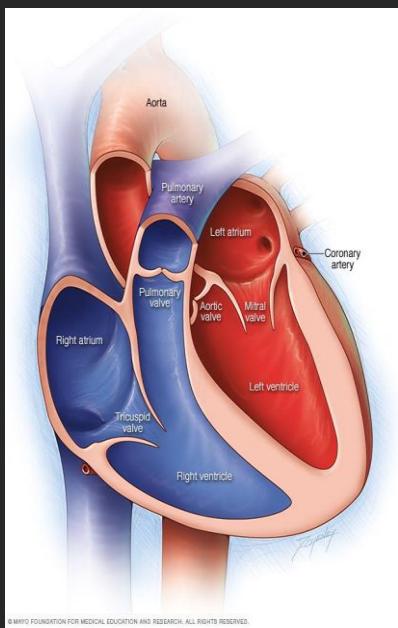


- It has a circulatory fluid called blood
- Blood is restricted inside the vessels and is different from the interstitial fluid
- Earthworms, octopuses, and vertebrates
- 3 types of blood vessels
 - Arteries: brings blood away from the heart to the different tissues
 - Veins: carry the blood back to the heart
 - Capillaries: brings blood from arteries and veins to the tissues (thin walls for diffusion)



Human circulatory system

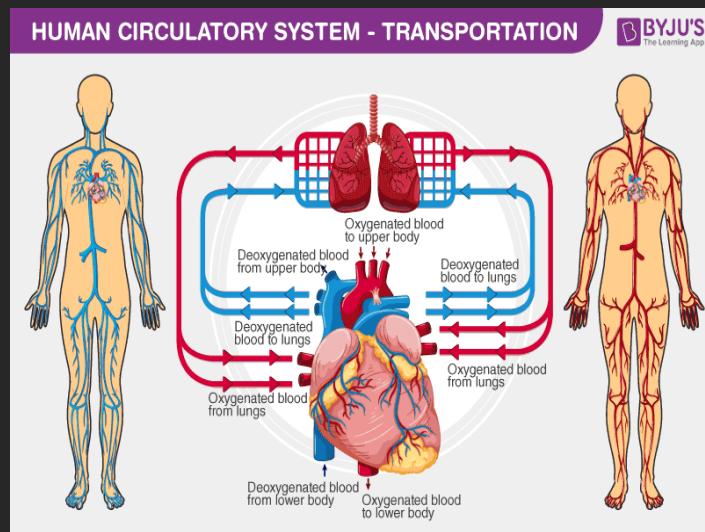
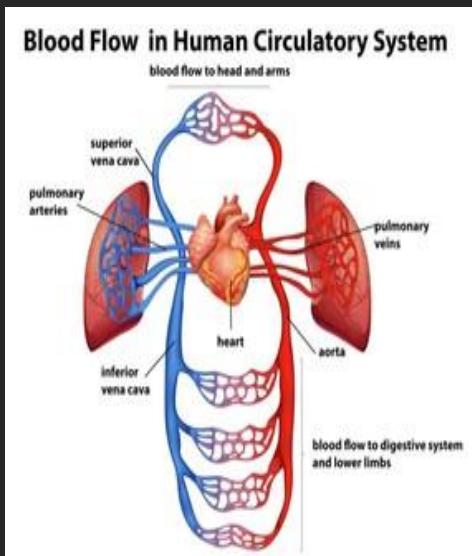
Heart

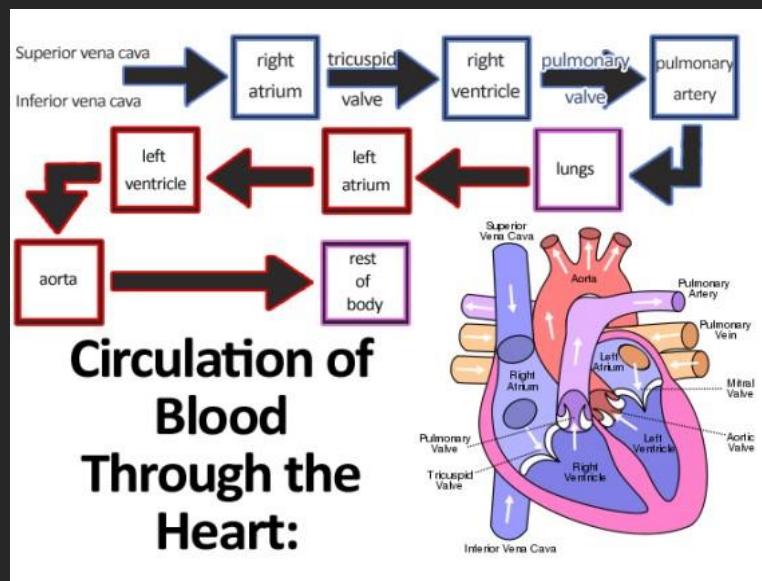


- Has 4 chambers
- Atria receives blood
- Ventricles pump blood to lungs and the body
- 4 valves
- Atrioventricular valve (between atria and ventricles)
- Semilunar valve (between the left ventricle and aorta)

Blood flow in humans

- The oxygen poor blood from the body goes back to the heart, then, pumped to the lungs, where gas exchange occurs
- Oppositely, the oxygen-rich blood flows back to the heart to be pumped to the rest of the body

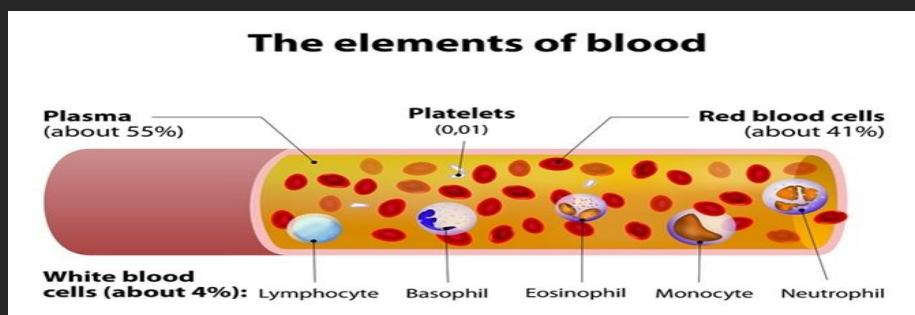




M. Blood

A connective tissue composed of 55% plasma liquid and 45% blood cells and other cells dissolved in the fluid

Plasma is 90% water with different types of molecules in it. (Ions, proteins, gases, hormones, nutrients and organic salts)



Blood cells

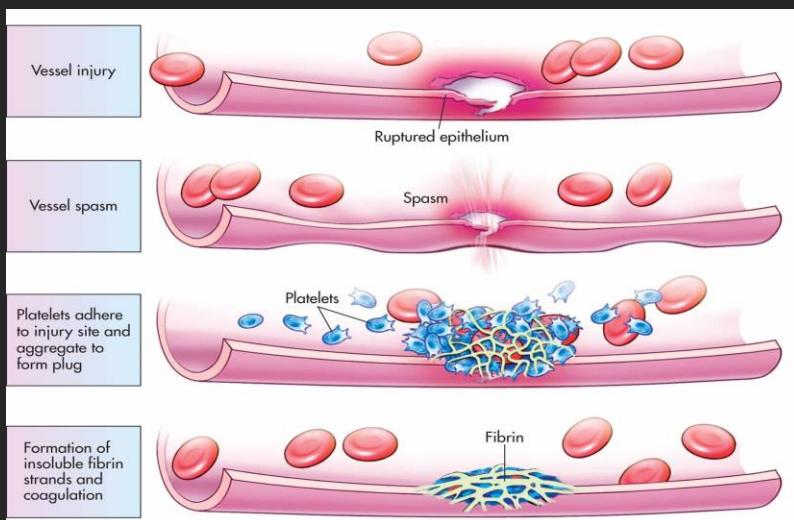
Red blood cells

- Structure:
 - Large surface area
 - Contains hemoglobin which picks up oxygen
 - Has no nucleus to make room for more oxygen
- Function:
 - Carries oxygen from the lungs to the body and carbon dioxide from the body back to the lungs

White blood cells

	A Blood cell type	B Lifespan in blood	C Function
1	Neutrophil	7 hours	Immune defenses
2	Eosinophil	8 to 12 days	Defense against parasites
3	Basophil	a few hours to a few days	Inflammatory response
4	Monocyte	3 days	Immune surveillance
5	B-lymphocyte	memory cells may live for years	Antibody production
6	T-lymphocyte	memory cells may live for years	Cellular immune response

Platelets



Heart conditions

Heart contraction and relaxation occurs in a rhythmic cycle called the cardiac cycle

Contraction (systole) pumps blood while relaxation (diastole) receives blood

One cycle lasts for 0.08 second and your heart rate is at 72 beats per minute (normal adult at rest)

Blood pressure

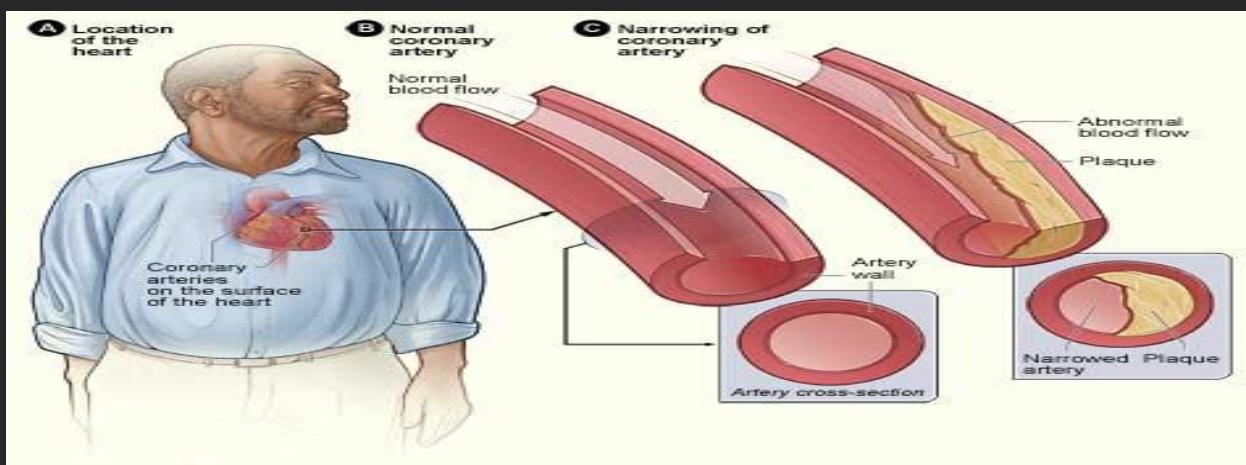
It is measured using sphygmomanometer

120/70 is the normal blood pressure; 120 refers to the systolic pressure, 70 refers to the diastolic pressure

Blood pressure higher than normal is typically indicative of cardiovascular disease such as hypertension ($>120/\geq90\text{ mmHg}$)

Cardiovascular diseases

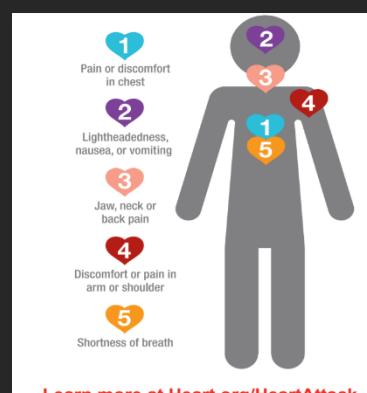
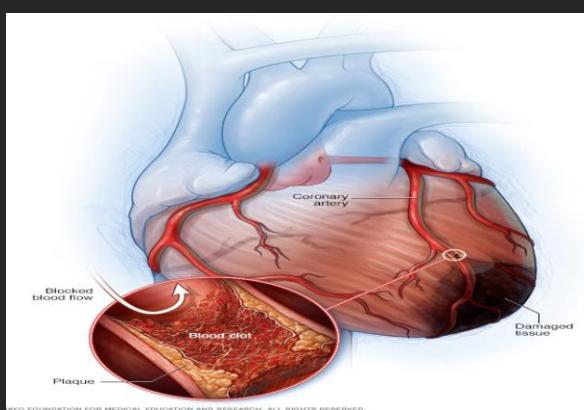
Occurs when the heart and blood vessels accumulate fat deposits called plaques which affect the flow of blood



Heart attack

Occurs when the coronary arteries (blood vessels that supply oxygen and nutrients to the heart) are blocked

The affected muscle dies



Stroke

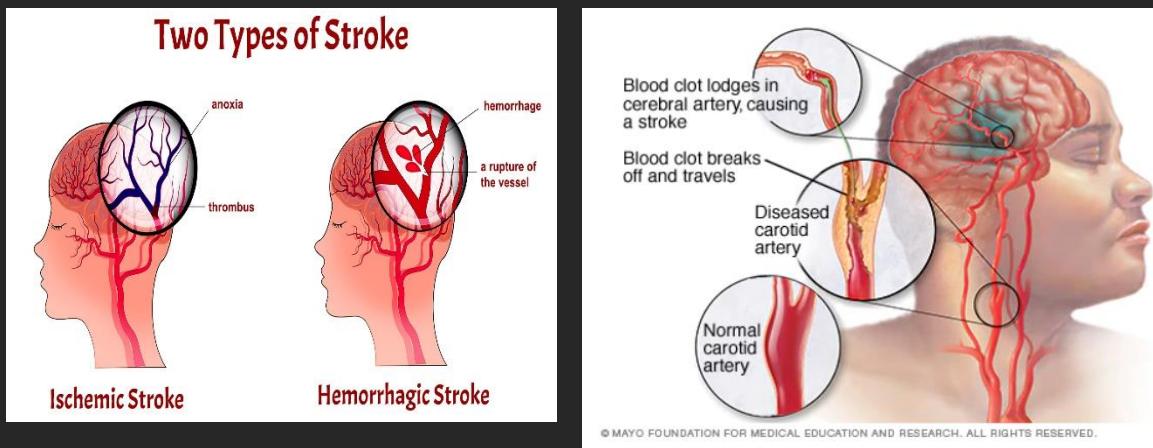
It is the blockage or damage of blood vessels that supply blood to the brain

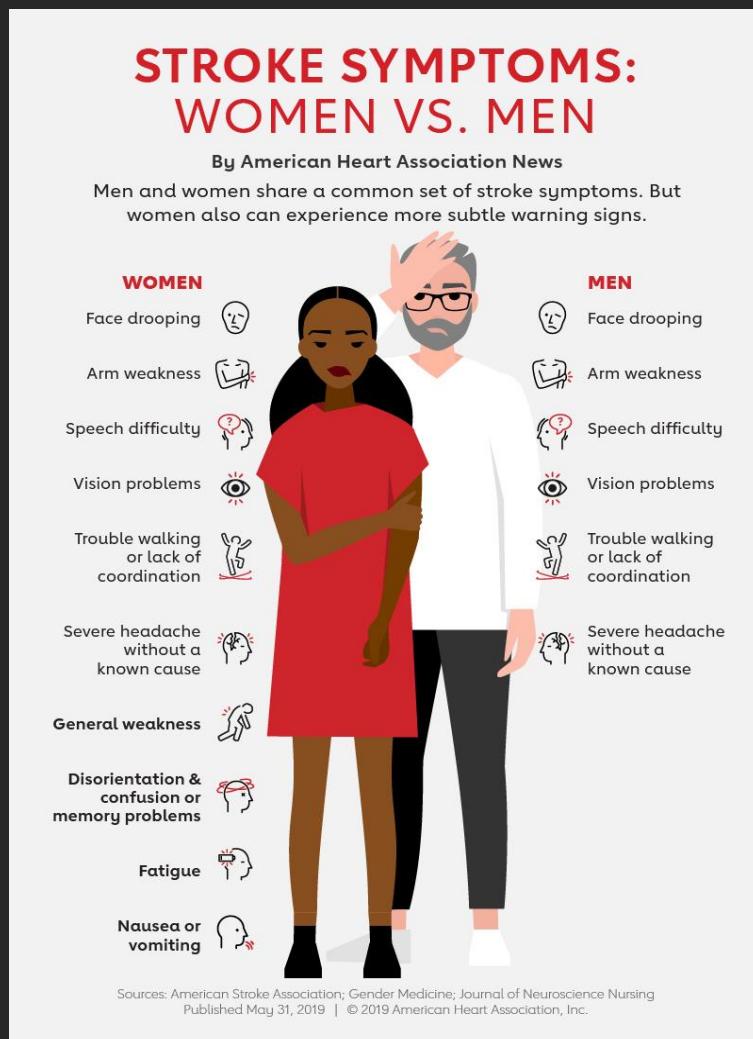
Heredity factors, smoking and bad eating habits worsen the risk

Exercise and proper diet lessen it

Two types of Stroke

- Ischemic stroke: blockage in the vessels to the brain
- Hemorrhagic stroke: rupture of the vessels





N. Plant Transportation

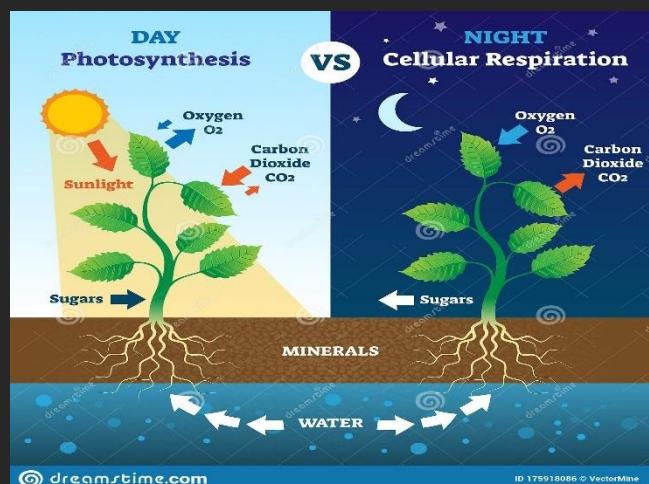
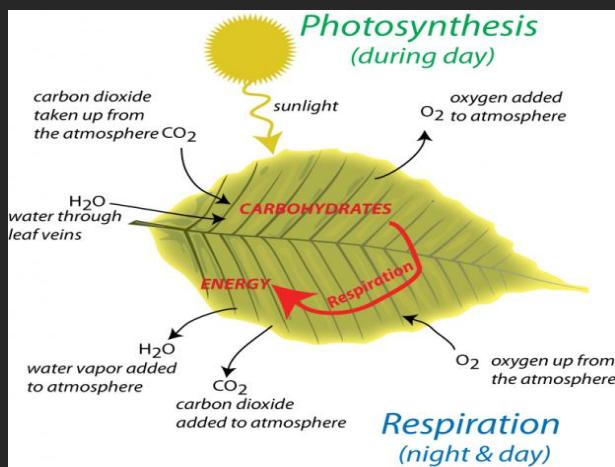
Plants produce their own food, but this doesn't mean that they also produce the nutrients that they need in order to do that.

Through photosynthesis, plants produce their own sugar made up of carbon, oxygen, and hydrogen elements. Glucose ($C_6H_{12}O_6$)

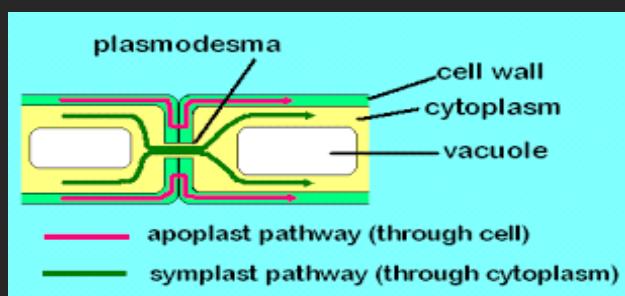
Where do they get these raw materials? Carbon and oxygen? Hydrogen?

The sugar products are then used as sources of raw materials for the synthesis of other organic molecules, mainly carbohydrates

Plants also undergo cellular respiration or the breakdown of sugar for energy production



Water and solute transport

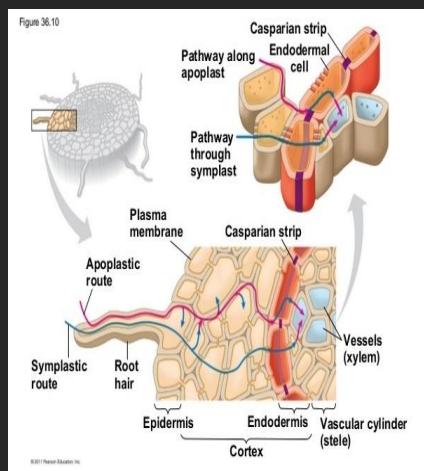


Water and solutes from the soil enter the root hairs and travel in different routes

One route passes through the cell walls and extracellular spaces (apoplast) while another route goes through the plasmodesmata (cell wall openings) of one cell to another

Another route leads from one cell wall to another

To prevent toxins and other harmful substances from reaching the vascular tissue through the first two routes, a waxy belt-like material called Caspary strip is located inside the endodermis



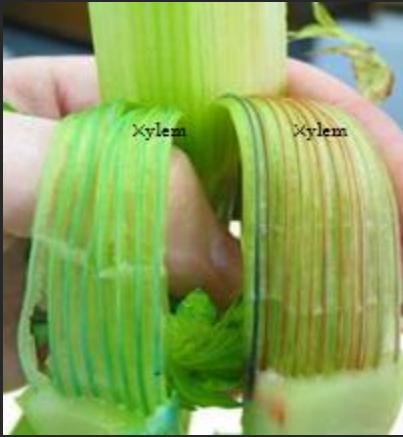
Vascular plants

Vascular plants like celery have a specialized system for transporting water and nutrients throughout their systems

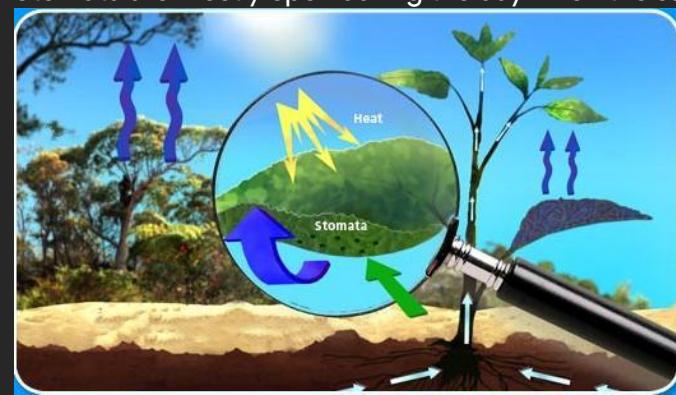
The stem of a plant has two main highways of transportation: xylem and phloem

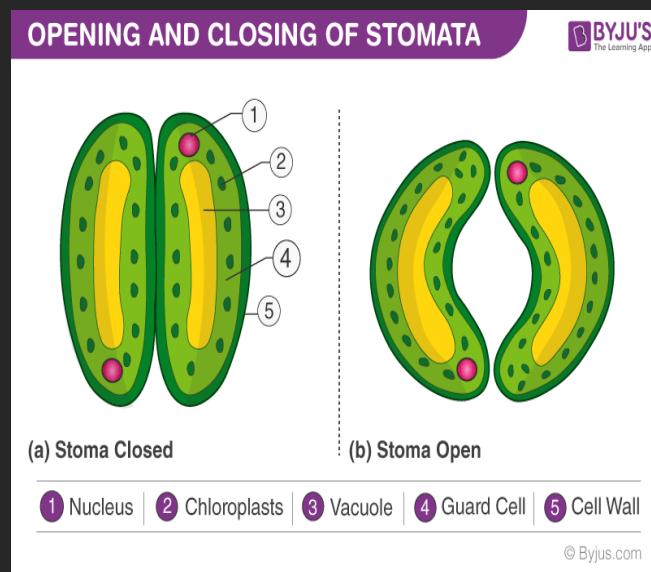
Xylem

- It is made up of tube-like cells that die at maturity
- The cells are made up of cell walls arranged from end to end, forming a continuous tube where water and minerals can pass through
- Water and dissolved minerals are called xylem sap



- Longitudinal view of the xylem in celery
- How does the xylem sap move upwards?
 - Transpiration
 - Evaporation of water molecules from the surface of leaves
 - Cohesion
 - Bonding of similar molecules
 - Adhesion
 - Happens when unlike molecules attach to each other (water molecules get attached to the cellulose)
 - Transpiration-cohesion-tension mechanism or transpirational pull
- Continuous transpiration in plants may lead to death
 - Hence, plants need to control the rate of transpiration to minimize water loss. How do plants do this?
 - Plants have openings on the leaf called stomata which are controlled by guard cells.
 - Stomata are mostly open during the day when the sun is out



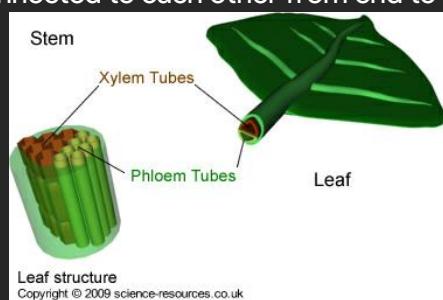


- ○ **Stomata**

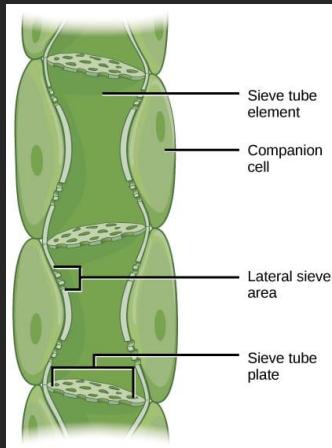
- They facilitate photosynthesis and allow carbon dioxide to enter and water to leave
- However, during nighttime, photosynthesis stops with the absence of light; hence there is no need for the stomata to open, thereby conserving water

Sugar transport

- Photosynthetic products are transported through the phloem tissue made up of living cells connected to each other from end to end

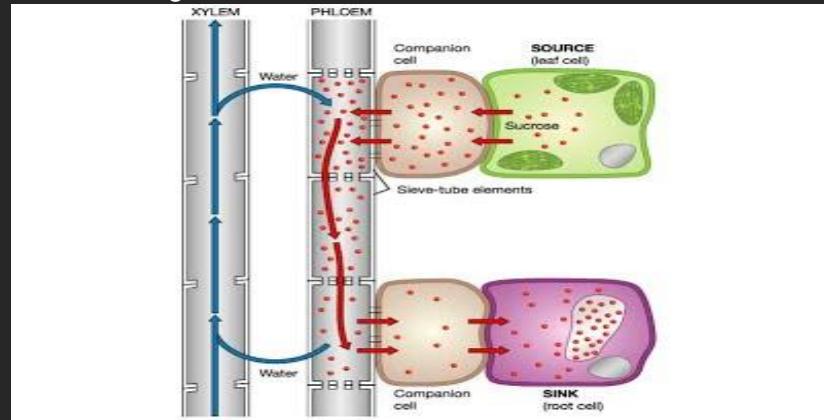


Phloem



- Have sieve plates on their ends but with holes that allow the sugary liquid, called phloem sap, to move continuously
- Phloem sap contains amino acids, hormones, and inorganic ions
- Sugar source is an organ that produces or stores sugar while sugar sink is an organ which breaks down sugar or stores it
- Source and sink
 - Source is the part of a plant where substances are produced (e.g., leaves for sucrose, amino acids) or enter the plant. Sink refers to the part of the plant where the substrate can be stored (e.g., roots or stem for starch)

- The points of sugar delivery, such as roots, young shoots, and developing seeds, are called sinks. Seeds, tubers, and bulbs can be either a source or a sink, depending on the plant's stage of development and the season. The products from the source are usually translocated to the nearest sink through the phloem.
- Flow of phloem sap
 - Diffusion is not enough
 - Pressure flow is responsible for the phloem sap movement
 - A photosynthetic cell moves its sugar products into the phloem tube, causing an increase in sugar concentration at the source end
 - This triggers the water molecules to migrate from the xylem tubes towards the sugar source, further increasing the pressure
 - The phloem sap and water then move from the sugar source (high concentration) to sink (low concentration) in order to relieve the pressure buildup
 - The phloem sap then enters the cells of the source organ with water
 - However, water molecules move out of these cells and return to xylem tubes
 - This mechanism explains why the phloem sap is always transported from sugar source to sugar sink



How does a plant transport food, water, and nutrients?

- Xylem
 - The plant cells that move water and nutrients from the roots to the leaves
 - Xylem is in the center and phloem is on the outer edge
- Phloem
 - The plant cells that move food from the leaves to the rest of the plant



O. Immunity and Nervous Control

Definition of terms

Immunology

- It is the branch of biomedical science that deals with the response of an organism to antigenic challenge and its recognition of what is self and what is not
- It deals with the defense mechanisms including all physical, chemical, and biological properties of the organism that help it to combat its susceptibility to foreign organisms, material, etc.

The word immunity was derived from the Latin word (immunis) meaning to be free

In medical terms, it denotes resistance to reinfections

Immunity

- It is the capability of multicellular organisms to resist harmful microorganisms from entering it.
- Immunity involves both specific and nonspecific components.

The immune system

- It is a complex defense system, physiological function is to
 - Prevent infections
 - Eradicate established infection and
 - Self/non-self-discrimination
- It is the collection of cells, tissues, and molecules that mediate resistance to infection

Immune response

- It is the coordinated reaction of these cells and molecules to infectious microbes

Immunology

- It is the study of the immune system and its response to invading pathogens

Antigens

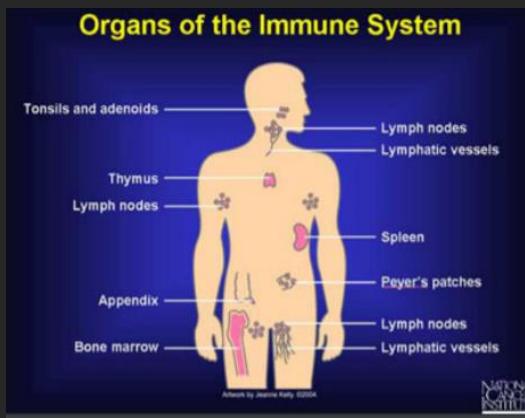
- Substances recognized by the cells and molecules of the immune system and to which the system responds

How does the immune system protect us from diseases?

Phagocytosis

- It is the process of engulfing and ingesting foreign particles, such as bacteria, by the white blood cell

Functions of the immune system



- Recognize, destroy and clear a diversity of pathogens
- Initiate tissue and wound healing processes
- Recognize and clear damaged self-components
- Exhibit "tolerance" to innocuous material including self

Normal Immune Response

The normal immune response is best understood in the context of defense against infectious pathogens, the classical definition of immunity

Innate immunity refers to defense mechanisms that have evolved to specifically recognize microbes and protect individuals against infections

Adaptive immunity consists of mechanisms that are stimulated and are capable of recognizing microbial and nonmicrobial substances

Innate and adaptive immunity

Innate and adaptive immunity represent two different arms of the immune system that work together in host defense

Innate immunity (natural/native)

- Provides immediate protection from infection
- It is broadly specific to microbes and tissue damage products
- Does not change in response to reinfection (non-adaptive)
- Initiates processes that lead to activation of adaptive immune responses

Adaptive immunity (specific/acquired)

- Appears to adapt to a variety of non-self-components (acquired)
- It is highly specific to a particular molecule "antigen"
- Responses upon reinfection are faster, better, and stronger (memory)
- Generates proteins and cells that enhance innate immune function

Innate immunity

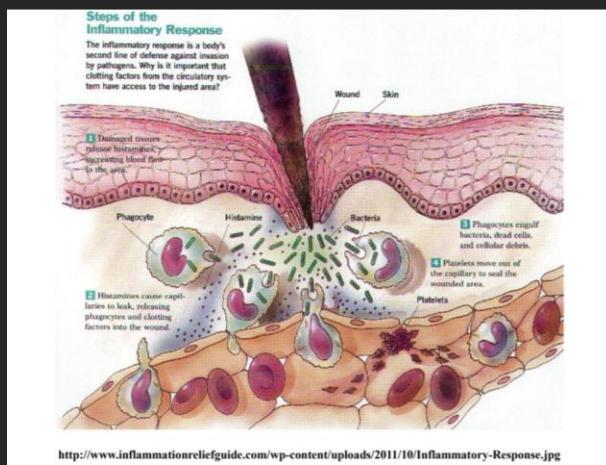
- Made up of external and internal defenses
- It has the same response to all types of pathogens even if these have been encountered before

Vertebrate Immunity		
Innate Immune System		Adaptive Immune System
Physical Barriers	Internal Defenses	
<ul style="list-style-type: none"> • Skin, hair, cilia • Mucus membranes • Mucus and chemical secretions • Digestive enzymes in mouth • Stomach acid 	<ul style="list-style-type: none"> • Inflammatory response • Complement proteins • Phagocytic cells • Natural killer (NK) cells 	<ul style="list-style-type: none"> • Antibodies and the humoral immune response • Cell-mediated immune response • Memory response

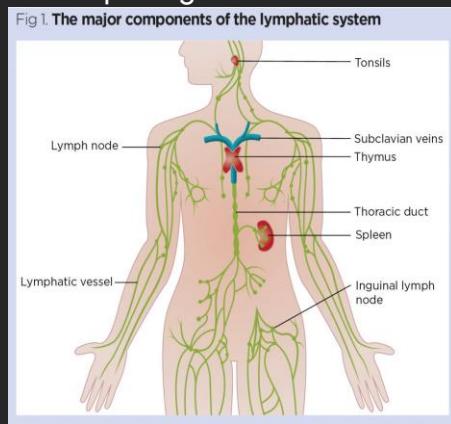
Neutrophil		Immune defenses
Eosinophil		Defense against parasites
Basophil		Inflammatory response
Monocyte		Immune surveillance
B-lymphocyte		Antibody production
T-lymphocyte		Cellular immune response

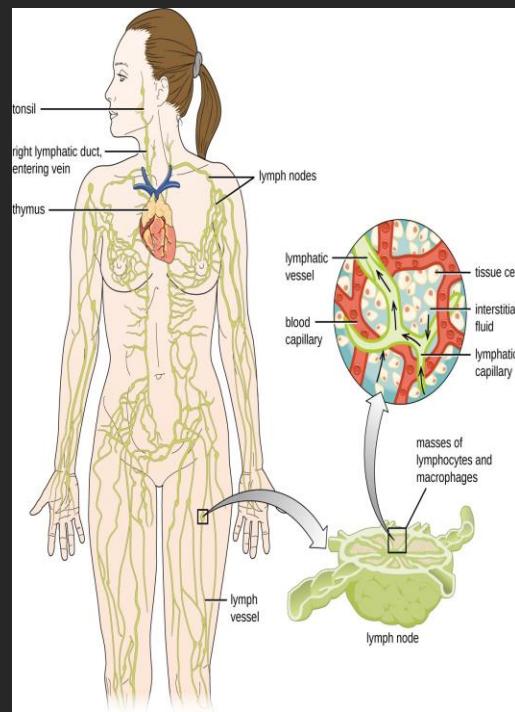
- When a wound is incurred, microbes can enter the body but they can only cause diseases if they survive the attacks of different white blood cells and the interstitial fluid which are part of the internal defenses of innate immunity
- Neutrophils defend the body by ingesting pathogens in a process called phagocytosis
- Macrophages look for cells infected with bacteria or virus and phagocytose which consumes the,
- Cancer cells can also be killed by natural killer (NK) cells through the chemicals that kills the cells.
- Proteins such as interferon kills the virus infected cells and help nearby cells to defend themselves

- Inflammatory response
 - Wounds trigger inflammatory responses
 - This is characterized by swelling and redness on the surrounding area
 - Signaling molecules such as histamine trigger increased blood flow which then results in the arrival of phagocytic WBC
 - Pus is the debris of dead cells, including WBC that die in the process
 - Platelets form clots to prevent microbes from infecting other areas
 - Widespread infection leads to widespread inflammation
 - This facilitates heightened immune response by increasing the WBC
 - Prolonged fever with 38C is not good, but moderate fevers may enhance immune response
 - The lower body temperature, anti-inflammatory medicines are taken to slow down the body's defenses



- Lymphatic system
 - Also helps in both innate and adaptive immunity by filtering the circulatory fluid to remove the pathogens and returning the fluid back to the circulatory system
 - Parts of the lymphatic system
 - Lymph fluid is clear one which contains less nutrients and oxygen
 - Lymph nodes house lymphocytes and macrophages which kill the pathogens found in the blood





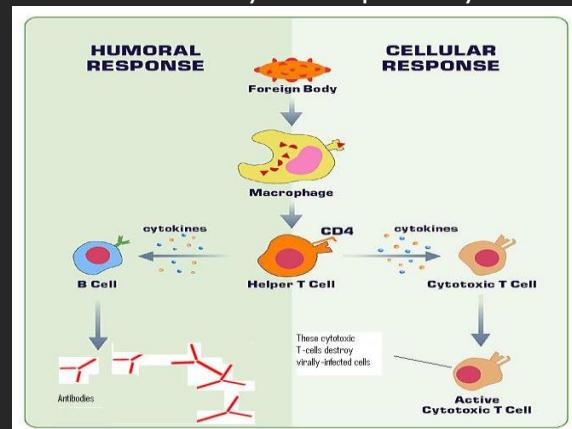
Adaptive immunity

- Or acquired immunity mounts defenses against specific pathogens, including those that have been encountered in the past
- It works when the innate immunity fails and triggers a strong and specific immune response
- However, since it is specific, the same response will not work on other pathogens
- Antigens and antibodies
 - Antigens: substances found on the surface of molecules such as viruses, bacteria, pollen, dust, or transplanted organ which triggers adaptive response.
 - Antibodies: they are proteins in the blood plasma which neutralize the effects of antigens (immunoglobulin)
- Adaptive immunity and vaccination
 - Adaptive immunity can remember previously encountered pathogens and mount a faster and stronger defense the second time
 - That is why exposure to varicella-zoster virus will no longer cause chickenpox, which is how the vaccination works
 - A vaccine, which contains a harmless part, variant, or piece of a pathogen or a weakened microbe, is given to trigger the adaptive immune response
- Types of adaptive immunity
 - Antibody-mediated immunity (AMI) or humoral immunity
 - B lymphocytes
 - Cell-mediated immunity (CMI) or cellular immunity
 - T lymphocytes
 - Note: B and T cells, blood, lymph, lymphoid tissues such as spleen, lymph nodes, etc.

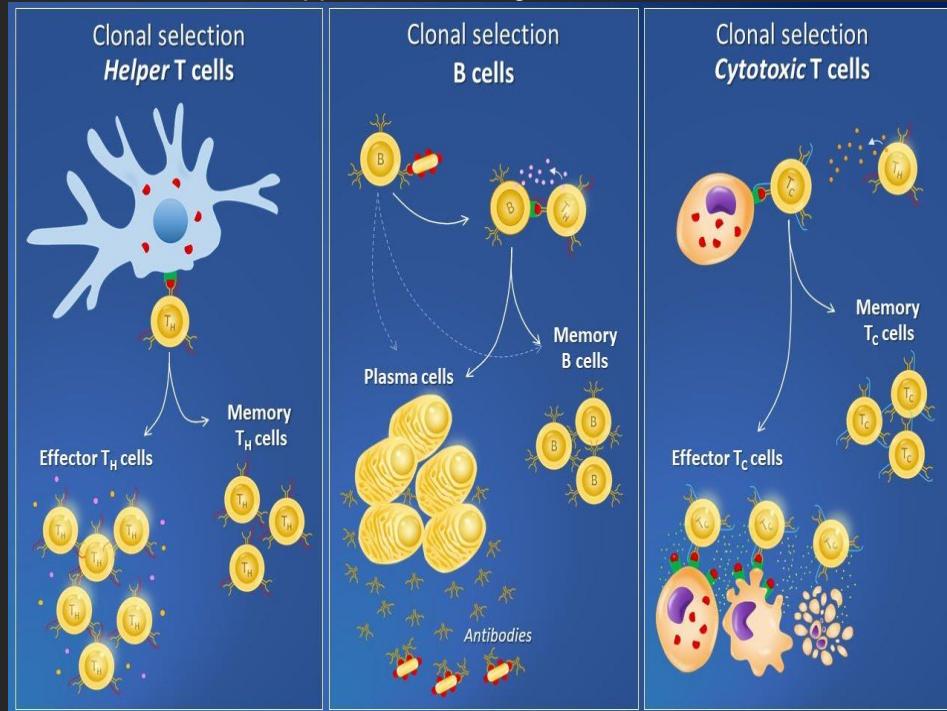
T CELLS VERSUS B CELLS	
T cells	B cells
Generated in the bone marrow from the lymphoid common progenitor.	Generated in the bone marrow from the lymphoid common progenitor.
Undergo maturation in the thymus, hence the term thymocytes.	Undergo maturation in the bone marrow, hence the term B cells.
Migrate to the bloodstream after maturation and circulate while inactive between peripheral lymphoid organs.	Migrate to the bloodstream after maturation and circulate while inactive between peripheral lymphoid organs.
Two types of active T cells exist: cytotoxic T cells responsible for the destruction of cells infected by intracellular pathogens, and helper T cells responsible for activating cytotoxic T cells, macrophages, and B cells.	One type of active B cells exists: plasma cells capable of secreting antigen-specific antibodies.
Activated T cells present antigen receptors on their membrane and are not capable of secreting antibodies	Activated B cells are responsible for antibody secretion.

Difference Between.net

- Humoral immune response
 - Protects the body from bacteria and viruses in the blood through the action of antibodies in the blood and lymph
 - Antibody binding makes it easier for phagocytic cells to target the pathogens
 - The antibodies are produced by B cells
 - Humor refers to the body fluids
- Cell-mediated immune response
 - Employs T cells which responds to pathogens through three different actions
 - Kill the infected cells
 - Promote phagocytosis by other WBC
 - Induce B cells to secrete antibodies
 - The B and T in these cells refers to the organs where the cells mature - the bone marrow and the thymus respectively



- Clonal selection
 - The body has a small number of different sets of lymphocytes which differ in their receptors
 - These receptors are the ones that recognize the antigens
 - Starts when an antigen activates a set of lymphocytes that divide and produce clones into two
 - Effector cells: Attacks the pathogens, produce antibodies, and die in the process
 - Memory cells: For the second time around. It can last for years or a lifetime
- this is what happens after being vaccinated



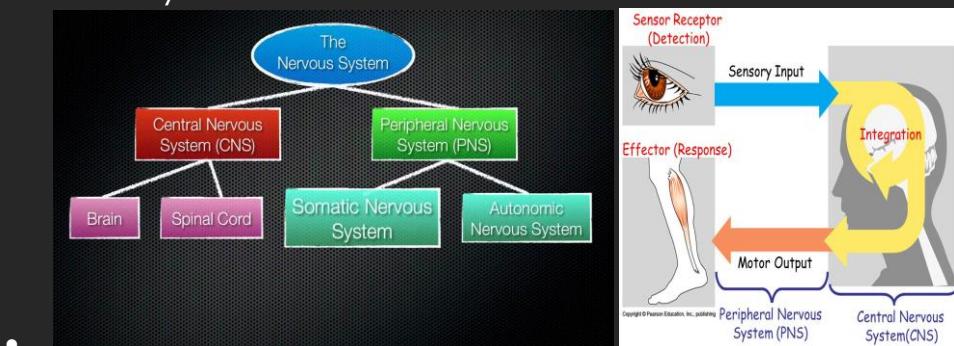
- First phase is called primary immune response (includes the activation of set of lymphocytes until the action of effector cells)
- Second phase is secondary immune response (starts the action of memory cells and starts another round of clonal selection and production of effector cells)
 - Secondary immune response produces faster and in bigger magnitudes (immunity)
- Antibodies
 - Like superheroes of the immune system, but they do not kill the pathogens directly
 - They make the work easier for killer cells
 - Facilitates phagocytosis
 - Neutralization (antibodies attach themselves to the surface of the pathogen, making it possible for these pathogens to attract other cells)
 - Induce agglutination (it is the process that occurs if an antigen is mixed with its corresponding antibody)
 - Dissolved antigens float freely in the body fluids, making it difficult for phagocytes to capture them

- Antibodies string several antigens together to immobilize them
- Antibodies also promotes death of invaders through cell lysis (breaking down of cell) with the presence of complement proteins
- Types of immunity provided by antibodies
 - Active immunity: exhibited when antibodies are produced by one's own body as a response to antigen
 - Passive immunity: passed from one person to another (breastmilk or immunization)

P. The Nervous System I

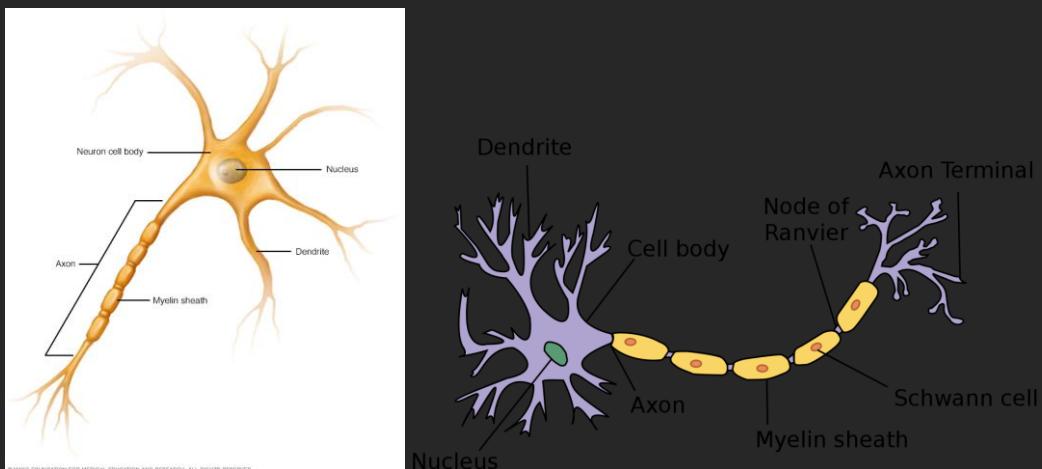
Two main divisions of the nervous system

- Central Nervous System (CNS)
 - The central nervous system (CNS) is made up of the brain and the spinal cord.
Invertebrates have no spinal cord
- Peripheral Nervous System (PNS)
 - On the other hand, brings signals to and from the CNS through the nerves and the ganglia
 - In vertebrates the ganglion is a cluster of neural bodies outside the central nervous system

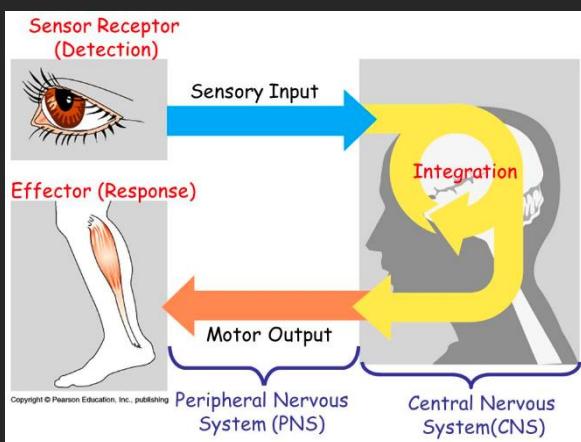
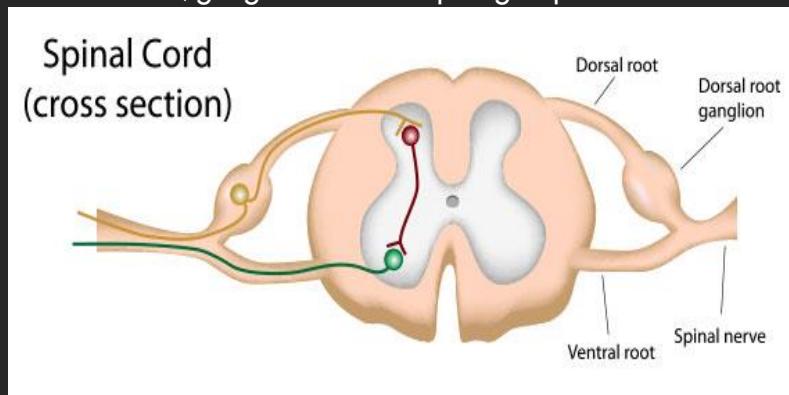


Nerves and ganglia

- Nerves are neurons tightly bound to each other by a connective tissue
- A neuron has a cell body containing a nucleus and other organelles; it also has extensions which are responsible for passing signals
- Basic unit of the nervous system



- Other the other hand, ganglia are made up of groups of cell bodies



The stages of processing information are summarized on the picture beside.

Sensory receptors convey signals in a process called sensory input.

The signals are then processed and interpreted, and a response is determined through integration.

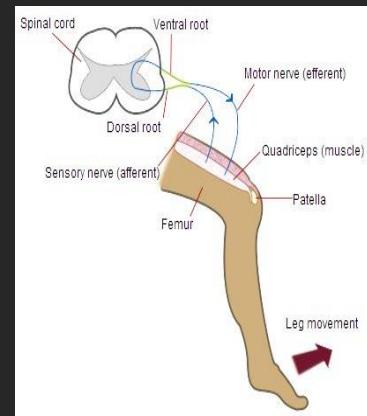
The response is passed on as signals to the effector cells which carry out the response through motor output

The knee-jerk reflex is a classic example of how information processing is facilitated by different nerves and how nervous control works

When the knee is tapped, muscles are stretched in that area

Reflex action is a sudden and involuntary response to stimuli. It helps organisms to quickly adapt to an adverse circumstance that could have the potential to cause bodily harm or even death.

In reflex action, the stimulus doesn't reach the brain



This information is received by the sensory receptors and passed on the sensory neurons which then conduct the signals to the spinal cord

The CNS then directs the message to a motor neuron and interneuron

Function of the nervous system and the neurons involved

Function of Nervous System

- Sensory
- Integration
- Motor

Types of neurons

- Sensory neuron (sense organs)
- Interneuron (brain and spinal cord)
- Motor neurons (muscle or gland)
- Muscle - movement
- Gland - secrete hormones

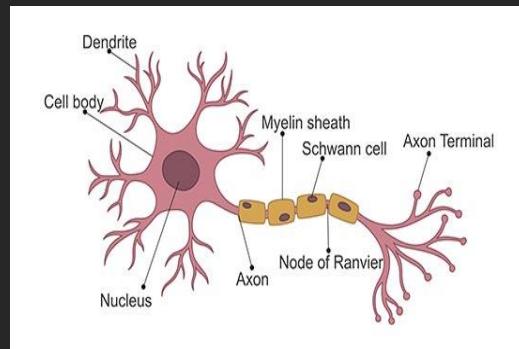
Neurons

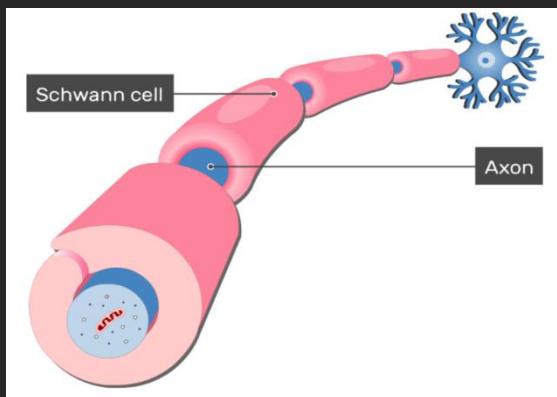
A neuron's cell body as previously mentioned, contains the nucleus and other cell organelles

Extending from the cell body are two types of projections: the dendrites and the axons

Dendrites are extensively branched short extension which receive information from other neurons and pass it on to the cell body

Axons, in contrast, are long projections which pass on the signals to other neurons





Glia is also part of the nervous system

Glia cells are very important partners of the neurons because these cells are the ones that supply neurons with nutrients and keep them insulated

An example of the glial cell in PNS is called a Schwann cell

Each white bead-like structure in the axon is a Schwann cell surrounded by layers of insulating material called the myelin sheath

Importance of myelin

- Many neurons have axons that are covered in a fatty substance called myelin. This insulates the axons so it stops impulses jumping from one axon into others next to it. The myelin sheath also increases impulse speeds
- A diagram of a myelinated axon. It shows a pink Schwann cell body on the left with a nucleus. An axon extends to the right, wrapped in a series of white, segmented myelin sheath segments. The axon ends in red synaptic terminals. A blue arrow below the axon points to the right, labeled 'Direction of impulse'.

In between Schwann cells are gaps called nodes of Ranvier

Those nodes make conduction along the axon faster since it is only these nodes where signals have to be regenerated and not along its whole length

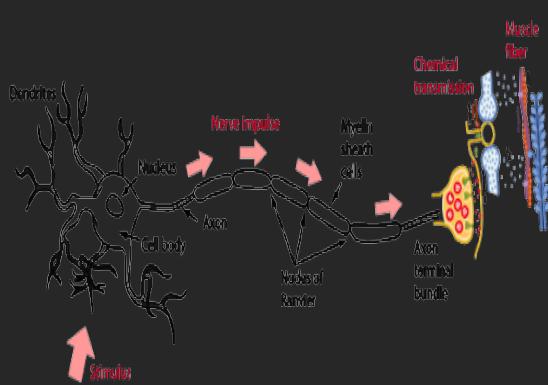
Unmyelinated axons convey signals 10 times slower

The ends of axons have small branches. The tips of these branches are called synaptic terminals

The terminals connected to other neurons form a synapse where the passing on of information occurs.

Nerve signal transmission

All cells have potential energy



But the energy in neurons can be used to generate work in the form of signal transmission

This energy in neurons is called membrane potential

This is created by the difference in electrical charge along three plasma membrane

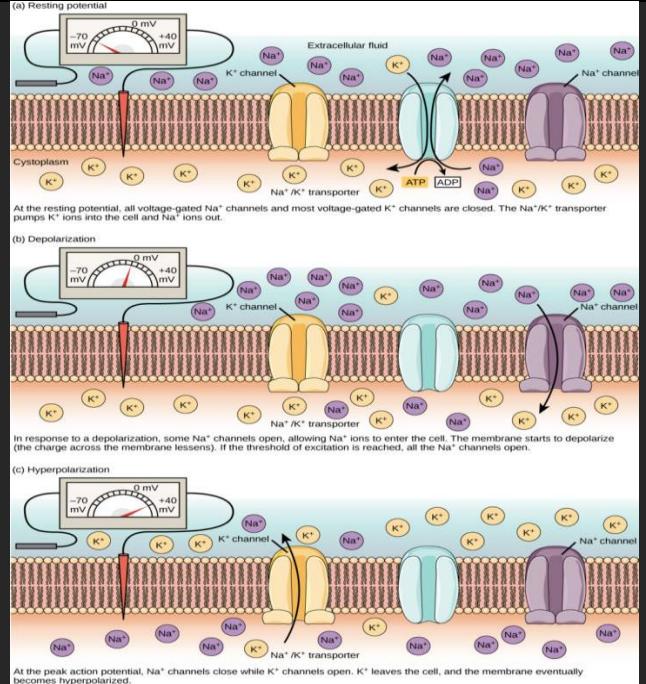
The inside of the cell is more negatively charged compared with the outside because of the unequal distribution of charge ions like sodium (Na^+) and potassium (K^+)

Ion channels are protein pumps that control the entry and exit of inorganic ions through the plasma membrane

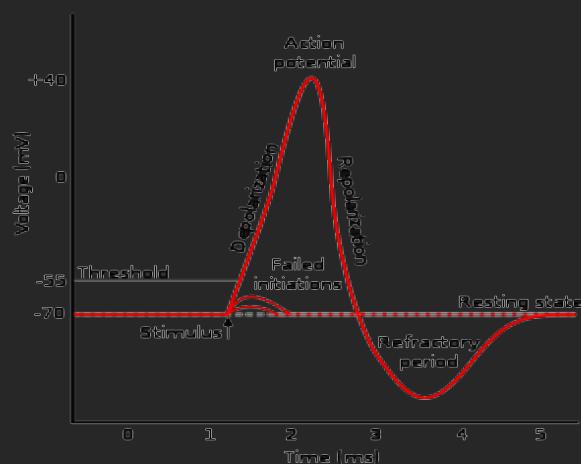
The picture beside illustrates how a resting potential (electrical charge of a neuron at rest) is established

More K⁺ than Na⁺ channels open, and more K⁺ ions move out of the cell than Na⁺ ions which enter the cell

This makes the inside of the cell less positive (more negative). This electrical charge difference or voltage is further established by sodium-potassium (Na⁺ K⁺)



A change in the resting potential beyond its threshold (minimum requirement) generates an action potential, conveying a nerve signal along an axon



This change is triggered by a stimulus which can be a light, sound, or chemical change

The stimulus triggers Na channels to open Na⁺ channels to open leading to the entry of Na ions into the cell and making the cell more positive

If the threshold is reached, an action potential is generated. The change in electric charge inside the cell is short-lived as K⁺ channels open shortly after causing K⁺ ions to move out of the cell

This coincides with the closing of the Na⁺ channels, restoring the cell's resting potential

This whole process occurs very fast in a few milliseconds, making it possible for one neuron to generate hundreds of action potentials in a second. One action potential sends one signal

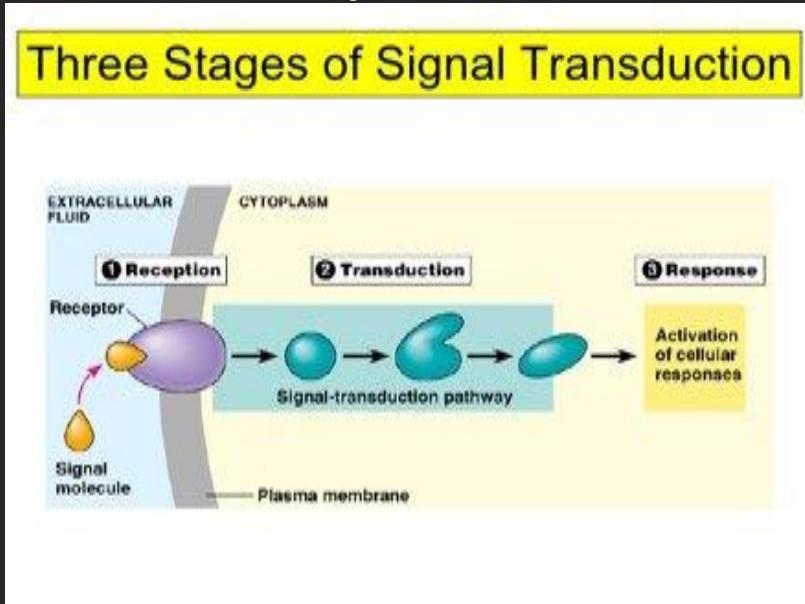
Resting potential - inside the cell is negative/more K⁺

Action potential - inside the cell is positive/more Na⁺

How then is the signal passed on from the cell body to the synaptic terminals?

- The mechanism is similar to a domino effect.

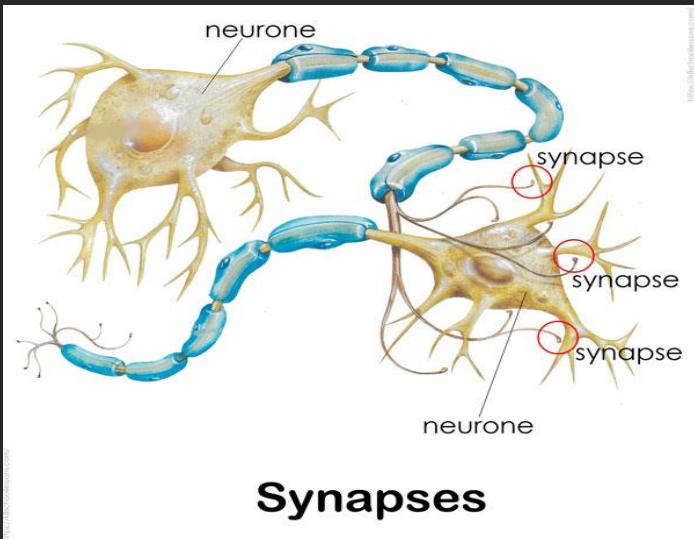
- An action potential that is established in one region spreads to the neighboring region until it reaches the ends of an axon.
- As the Na^+ channels open in one region, an action potential is triggered.
- Then, the K^+ channels open and Na^+ channels close, and the resting potential is reestablished in the first region.



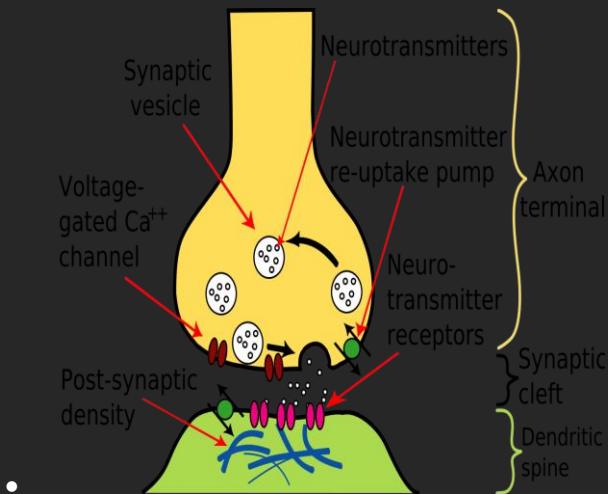
- Changes in resting potential which do not meet the threshold level do not produce action potentials.
- This is because action potentials are all-or-nothing events.
- A weak or strong stimulus which have both reached the threshold will both produce action potentials.
- How does the nervous system differentiate a puppy's bark from a dog's bark?
- The answer lies in the intensity of the stimulus. More action potentials will be generated in response to a big dog's bark and fewer for a puppy's bark.

Synapses

- How is the nerve signal (action potential) passed on from a sending neuron to a receiving cell?
- A *receiving cell* can be another neuron or a motor cell or another effector cell. The point where the synaptic terminal of a sending cell meets the receiving cell is called a *synapse*. This is where message relay occurs.
- The action potential can be conveyed either in an electrical or chemical synapse.
- An electrical synapse conveys the signal in a very fast manner and in similar intensity as the sending neuron's action potential. This is because the message is sent as an electric current



- A chemical synapse, in contrast, relays the action potential in the form of chemical messengers called neurotransmitters.
- The neurotransmitters are packaged in vesicles and once an action potential reaches the synaptic terminal, these messengers are released into the synapse.
- They then bind to the receptors of the receiving cell. This binding generates an action potential in the receiving cell and passes the message forward. In this manner, chemical synapses occur more slowly and more precisely than electrical synapses



Q. The Nervous System II

The nervous system is very important in helping to maintain the homeostasis (balance) of the human body

A series of sensory receptors work with the nervous system to provide information about changes in both the internal and external environments

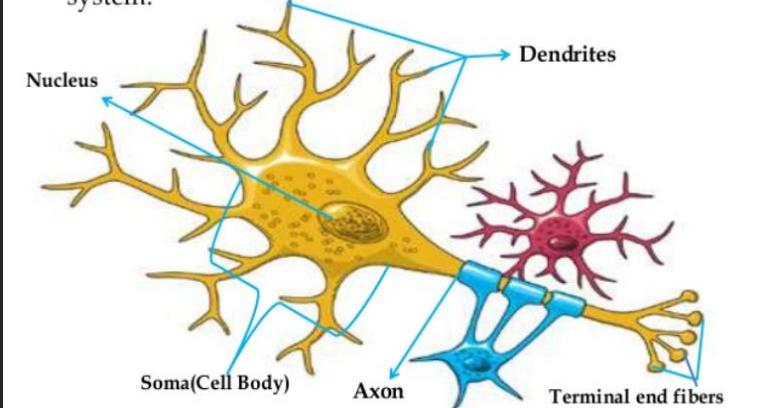
The human nervous system is a complex of interconnected systems in which larger systems are comprised of smaller subsystems each of which have specified structures with specific functions

Structure and function

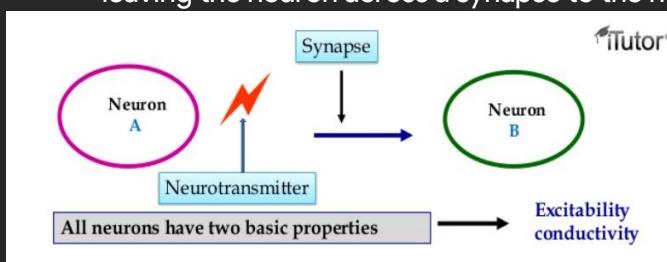
Neurons

- A.k.a. nerve cells are the basic elements of the nervous system

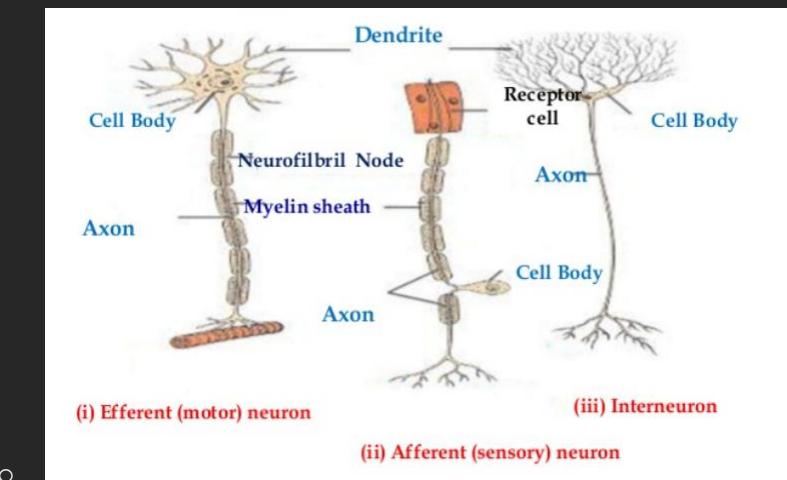
Neurons (nerve cells) are the basic elements of the nervous system.



- Cell body
 - The main processing center of the cell
- Dendrites
 - Thin branching extensions of the cell body that conduct nerve impulses toward the cell body
- Axon
 - A single branch (in most neurons) which conducts nerve impulses away from the cell body; myelin sheath and neurilemma are coverings
- Impulse transmission
 - Terminal end fibers are located at the ends of the axon and they transmit impulses leaving the neuron across a synapse to the next neuron

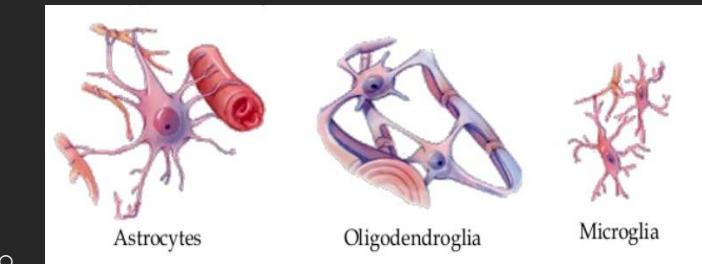


- Three types of neurons
 - Efferent (motor)
 - Conveys information from the CNS to muscles and glands
 - Afferent (sensory)
 - Carry information from sensory receptors to the CNS
 - Interneuron
 - Carry and process sensory information



Neuroglia

- Support, protect, connect, and remove debris from the nervous system
- Types



All body activities, voluntary and involuntary, are controlled by the nervous system

Two major components

- Central nervous system (CNS)
 - Made up of the brain and spinal cord
- Peripheral nervous system (PNS)
 - Made up of all the nerves that lead into and out of the CNS

Central Nervous System

The central nervous system is composed of two major interconnected organs: the brain and the spinal cord

These organs work together to integrate and coordinate sensory and motor info for the purpose of controlling the various tissues, organs, and organ systems of the body

The CNS is responsible for higher neural functions, such as memory, learning, and emotion

Brain

- Weighs about 3 pounds in adults
- 75% water
- 20% of oxygen
- Contains over 100 billion neurons

- Controls bodily functions and interactions with the outside world
- Four parts
 - Cerebrum
 - Located above the cerebellum
 - Contains two hemispheres with an outer portion called the cerebral cortex
 - The two hemispheres are connected by a bridge of nerve fibers that relay information between the two hemispheres called the corpus callosum
 - The left and right lobes are each divided into four lobes or parts
 - Frontal lobe
 - Temporal lobe
 - Occipital lobe
 - Diencephalons
 - The deep portion of the brain containing
 - Thalamus
 - Hypothalamus
 - Epithalamus
 - Ventral thalamus
 - Serves as relay center for sensations like Heart rate, blood pressure, temperature control, behavioral responses, digestive functions, water and electrolyte balance
 - Brain stem
 - Made up of the midbrain (involved with visual reflexes); pons (located between the midbrain and the medulla oblongata; controls certain respiratory functions) and the medulla oblongata (contains centers that regular heart and lung functioning, swallowing, coughing, vomiting, and sneezing)
 - Cerebellum
 - Area that coordinates musculoskeletal movement to maintain posture, balance, and muscle tone
 - Inferior to the occipital lobes of the cerebrum
 - Posterior to the pons and medulla oblongata

Spinal cord

- Extends from the medulla oblongata of the brain to the area around the first lumbar vertebra in the lower back
- Nerves from the peripheral nervous system extend out from the spinal cord
- Protected by: vertebral column, cerebrospinal fluid, meninges
- Meninges are three layers of membranes that covers the brain and spinal cord
- Layers of the meninges
 - Dura mater
 - Outer tough fibrous membrane
 - Arachnoid mater
 - Middle weblike membrane containing CSF
 - Pia mater

- Innermost layer containing several blood vessels

Peripheral Nervous System

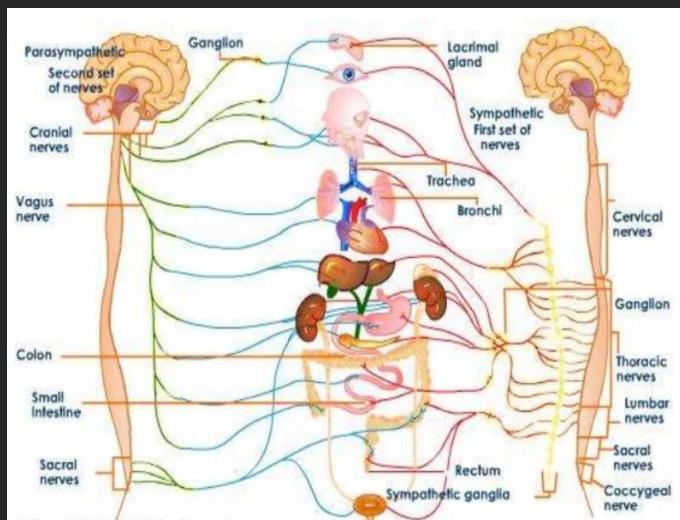
PNS is a collection of the peripheral nerves, ganglia and specialized sensory structures that, as a system, carries sensory and motor information between the central nervous system and all other organs and tissues of the body

The PNS is functionally divided into 2 major divisions

- The sensory or afferent division
- The motor or efferent division
 - The somatic nervous system
 - The automatic (visceral) nervous system

Consists of 12 pairs of cranial nerves and 31 pairs of spinal nerves

	Cranial Nerves	Function
1	Olfactory	Sense of smell
2	Optic	Sense of vision
3	Oculomotor	Eye movements
4	Trochlear	Aids muscles that move the eyes
5	Trigeminal	Eyes, tear glands, scalp, forehead, teeth, gums, lips, and mouth muscles
6	Abducens	Muscle conditioning
7	Facial	Taste, facial expressions, tear and salivary glands
8	Vestibulocochlear	Hearing and equilibrium
9	Glossopharyngeal	Pharynx, tonsils tongue and carotid arteries; stimulates salivary glands
10	Vagus	Speech, swallowing, heart muscle, smooth muscle and certain glands
11	Accessory	Muscles of the soft palate, pharynx, larynx, and neck
12	Hypoglossal	Tongue movement

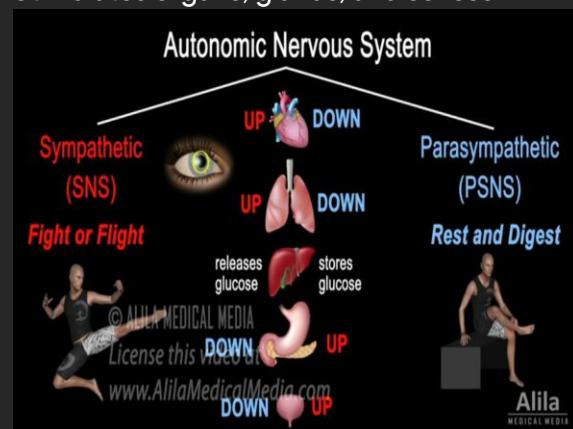


Somatic nervous system

- Responsible for receiving and processing sensory input from the skin, muscles, tendons, joints, eyes, tongue, nose and ears as well as excite the voluntary contraction of skeletal muscles

Autonomic nervous system

- Carries impulses from the CNS to glands, various smooth muscles, cardiac muscle and various membranes
- Stimulates organs, glands, and senses



External Links

Plant transport	https://www.howplantswork.com/2009/02/16/plants-dont-convert-co2-into-o2/
Lymphatic system	https://www.youtube.com/watch?v=oO-1OknbO3M
Immune system	https://www.youtube.com/watch?v=PSRJfaAYkW4 https://www.youtube.com/watch?v=PzunOgYHeyg https://www.youtube.com/watch?v=uWGTciX795o
Antigens and antibodies	https://www.youtube.com/watch?v=Cvu1ApHkhYM

Action potential	https://www.youtube.com/watch?v=b2ctEsGEpe0
Nervous system	https://www.slideshare.net/itutor/nervous-system-22589837

Pagbasa at Pagsusuri ng Iba't Ibang Teksto tungo sa Panaliksik

A. Tekstong Informatibo

- Tinatawag ding tekstong ekspositori
- Naglalayong magpaliwanag at magbigay ng impormasyon
- Kadalasang sinasagot nito ang tanong na ano, kalian, saan, sino, at paano
- Magpaliwanag sa mga mambabasa ng anumang paksa na matatagpuan sa tunay na daigdig
- Uri ng babasahing di-piksiyon
- Biyografiya, diksyonaryo, encyclopedia, almanac, papel-pananaliksik, balita, siyentipikong ulat, journal
- Elemento ng tekstong informatibo
 - Layunin ng may-akda
 - Pangunahing ideya
 - Pantulong na kaisipan
 - Mga estilo sa pagsulat, kagamitan/sangguniang magtatampok sa mga bagay na binibigyang-diin
- Hindi isinasama ang sariling opinyon sa teksto

B. Tekstong Deskriptibo

Ang tekstong deskriptibo ay isang pagpapahayag ng impresyon o kakintalang likha ng pandama. Sa pamamagitan ng pang-amoy, panlasa, pandinig at pansalat, itinatala ng sumusulat ang paglalarawan ng mga detalye na kanyang nararanasan.

Ito ay naglalayong magsaad ng kabuoang larawan ng isang bagay, pangyayari, o kaya naman ay magbigay ng isang konseptong biswal ng mga bagay-bagay, pook, tao, o pangyayari.

Layunin at kahalagahan

Layunin

- Ang paglalarawan ay may layuning makapagpamalas sa isip ng tagapakinig o mambabasa ng isang malinaw at buong larawan.

Kahalagahan

- Mahalaga ang paglalarawan sa teksto dahil mas nakatutulong ito upang mas malawak na maitindihin ng mambabasa ang mga imahe na nais ipaisip o iparating ng manunulat. Nakakatulong ito upang mas malawak na maipagana ang imahinasyon ng mambabasa. Mas madaling maintindihin ang tekstong binabasa kung malinaw ang pagkakalarawan ng manunulat.

Paraan ng paglalarawan

Deskriptibo ang isang teksto kung ito ay nagtagay ng mga impormasyong may kinalaman sa pisikal na katangian ng isang bagay, lugar, at maging ng mga katangiang taglay ng isang tao o pangkat ng mga tao, kalimitang tumutugon ito sa tanong na ano.

- Batay sa pandama – nakita, naamoy, nalasahan, nahawakan, at narinig

- Batay sa nararamdaman – bugso ng damdamin o personal na saloobin ng naglalarawan
- Batay sa obserbasyon – batay sa obserbasyon ng mga nangyayari

Uri ng paglalarawan

Karaniwan

- Paglalarawan kung nagbibigay ng impormasyon ayon sa pangkalahatang pagtingin o pangmalas
- Ang damdamin at opinyon ng tagapaglarawan ay hindi dapat isinasama
- Gumagamit lamang ito ng mga tiyak at karaniwang salitang panlarawan at itinatala ang mga bagay o ang mga particular na detalye sa payak na paraan
- Halimbawa: Maganda si Matet. Maamo ang mukhang lalo pang pinatitingkad ng mamula-mula niyang pisngi. Mahaba ang kanyang buhok na umaabot hanggang sa baywang. Balingkinitan ang kanyang katawan na binagayan naman ng kanyang taas.

Masining

- Ito ay nagpapahayag ng isang buhay na larawan batay sa damdamin at pangmalas ng may-akda. Karaniwang pili ang mga ginagamit na salita sa paglalarawan, kabilang na ang paggamit ng mga pang-uri, pang-abay, tayutay, at idyoma.
- Ang mga detalyeng inihahayag dito ay nakukulayan ng imahinasyon, pananaw, at opinyong pansariling tagapagsalaysay.
- May layunin itong makaantig ng kalooban ng tagapagpakinig o mambabasa para mahikayat silang makiisa sa naguniguni o sadyang naranasan nitong damdamin sa inilalarawan.
- Halimbawa: Muling nagkabuhay si Venus sa katauhan ni Matet. Ang maamo nyang mukhang tila anghel ay sadyang kinahuhumalingan ng mga anak ni Adan. Alon-alon ang kanyang buhok na bumagay naman sa kainggit-inggit nyang katawan at taas.

Kasangkapang ginagamit sa malinaw na paglalarawan

Wika

- Kung ang isang pintor ay pinsel ang ginagamit upang mailarawan nya ang kagandahan ng kanyang modelo, ang isang manunulat naman ay wika ang ginagamit upang makabuo ng isang malinaw at mabisang paglalarawan. Karaniwang ginagamit dito ang pang-uri at pang-abay.

Maayos na detalye

- Dapat magkaroon ng masistemang pananaw sa paglalahad ng mga bagay na makatutulong upang mailarawang ganap ang isang tao, bagay, pook, o pangyayari. Kapag maayos ang pagkalahad ng detalye, ang mga bumabasa o nakikinig ay nagkakaroon ng pagkakataon na pakilusin ang kanilang imahinasyon upang mailarawan sa isip ang mga bagay-bagay na inilalarawan.

Pananaw na paglalarawan

- Maaaring magkaiba-iba ang paglalarawan ng isang tao, bagay, pook, o pangyayari salid na rin sa karanasan at saloobin ng taong naglalarawan. Ang isang pook, halimbawa, ay maaaring maganda sa isang naglalarawan habang ang isa naman ay hindi kung ito ay nagdulot sa kanya ng isang di magandang karanasan.

Isang kabuoan o impresyon

- Dahil ang layunin ng paglalarawan ay makabuo ng malinaw na larawan sa imahinasyon ng mga mambabasa, mahalaga sa isang naglalarawan na mahikayat ang kanyang mga mambabasa o tagapakinig nang sa gayon ay makabuo sila ng impresyon hinggil sa inilalarawan. Dito ay sama-sama na ang bisa ng wika, maayos na paglalahad ng mga detalye, at ang pananaw ng naglalarawan.

C. Tekstong Naghihikayat

Pagpapahayag na may layuning mahikayat ang mga mambabasang makiayon o tanggapin ang pananaw ng manunulat. Mabilang dito ang mga advertisements.

Tatlong Paraan ng panghihikayat ayon kay Aristotle

Inilalarawan ng Griyegong Pilosopong si Aristotle ang tatlong paraan ng panghihikayat o pangungumbinsi:

Ethos

- Tumutukoy sa gamit ng emosyon o damdamin upang mahikayat ang mambabasa.

Pathos

- Tumutukoy sa gamit ng emosyon o damdamin upang mahikayat ang mambabasa.

Logos

- Tumutukoy sa paggamit ng lohika upang makumbinsi ang mambabasa.

Mga elemento sa pagbuo ng mahusay na tekstong naghihikayat

- Pagbuo ng makakatotohanang kaisipan
- Pagtukoy ng damdamin, saloobin, na audience (know your audience)
- Pagkakasunod sunod ng kaisipang may katotohanan at damdamin
- Buo ang pagpapahayag ng konklusyon
- Mapaniwala ang mambabasa na ang konklusyon ay mula sa napagkasunduang katotohanan
- Dapat naniniwala ka sa sarili mo upang maniniwala din sila sayo.

Mga hakbang sa pagbuo ng tekstong naghihikayat

- Buuin ang teksto; alamin ang mga dapat na ebidensyang isasama. Alamin kung sino ang babasa ng teksto
- Magsaliksik sa paksa; suriin ang impormasyon
- Pag-aranan ang mga mambabasa
- Piliin ang posisyon; alamin ang layunin; dapat mahihikayat ang mga mambabasa

D. Tekstong Naratibo

Uri

ormal

- May seleksyon at organisasyon

Di-ormal

- Simpleng kuwentuhang pang-araw-araw

Porma

Pagsasalaysay na nagpapabatid

- Kasaysayan, pakikipag-sapalaran, anekdota, kathang salaysay

Masining na pagsasalaysay

- Alamat, pabula, maikling-kuwento, dula, nobela

Pananaw

Unang panauhan

- Personal ang tono

Ikatlong tauhan

- May distansiya

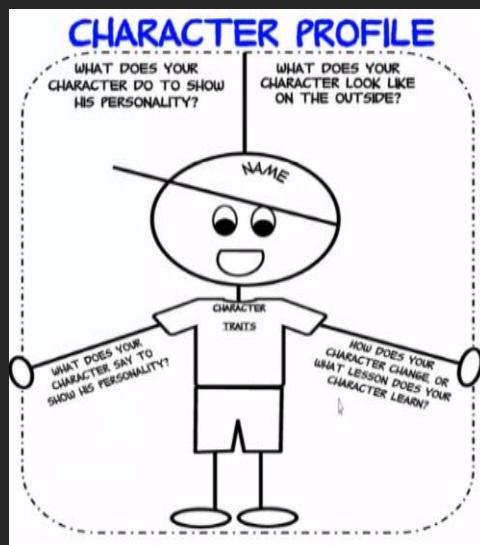
Katangian ng mabisang tekstong nagsasalaysay

- Nakapupukaw-pansin na pamagat
- Ginagamitan ng sanhi at bunga
- Tempo
- Punto ng pagsasalaysay
- Ayos ng pagsasalaysay
- Kaisahan
- Kakintalan
- Kasukdulan
- Wakas

Narrative Organizer

The Narrative Organizer is a visual tool for mapping out a story. It features a central box labeled "NARRATIVE ORGANIZER" with a book icon. At the top, there are fields for "Title:", "Author:", and "Theme:". Below these are two boxes: "Setting+Character(s)" and "Problem X". "Problem X" contains a small illustration of a zigzag path with a dot labeled "Goal". The next section, "Attempts to Reach Goal or Solve Problem", is divided into three columns: "Beginning", "Middle", and "End". Each column has a corresponding box: "Setting+Character Start of Problem", "Action (Events)", and "Solution". Below these columns is a bracket labeled "(PLOT)". Underneath the "Beginning" and "Middle" sections is a box labeled "-Outcome-". The final section is "Resolution:", which includes a key icon and a box labeled "MESSAGE What story taught us".

Character Profile



E. Tekstong Prosidyural

Uri ng teksto tungkol sa serye ng mga gawaing may layuning nais makamit ang inaasahan hangganan o resulta. Ito ay nagbibigay ng kaalaman para sa maayos na pagkakasunod-sunod ng mga hakbang sa pagsasagawa ng isang gawain o proyekto.

Mga hakbang

1. Gumamit ng mga payak o simpleng salitang madaling maitindihin
2. Maging tiyak sa paglalahad ng mga panuto o hakbang na dapat sundin
3. Bigyang diin ang mga detalyeng kinakailangan upang masunod ang mga gawain
4. Pagtuunan ng pansin ang wastong pagkakasunod-sunod ng mga hakbang

F. Reaksyong papel

Reaksyon

Personal na ekspresyon

- Pakikilahok o pagsang-ayon
- Pagbibigay ng kahulugan ukol sa isang paksa
- Masusing pagsisiyasat

Mga bahagi ng reaksyong papel

1. Panimula
2. Katawan
3. Wakas

Mga gabay sa pagsulat ng reaksyong papel

1. Siguraduhing maayos ang estruktura ng panimula na nagtatapos sa tesis na pahayag
2. Magkaroon ng malinaw na panimulang talata
3. Isulat ang paksang pangungusap sa bawat talata
4. Bawat talata ay naglalaman ng mga katibayan (Hal. direktang sipi, katotohanan)

5. Magdagdag ng kawili-wiling pangungusap sa bawat talata para makabuo ng komprehensibong konklusyon
6. Isulat ang bawat talata sa mga sinundang pahayag
7. Siguraduhing makikita ang katotohanan ng tesis na pahayag kapag nabasa ang kabuuan ng sulatin

G. Pilipinong Pananaliksik

Pananaliksik

Ang pananaliksik ay paraan ng pagtuklas ng mga kasagutan sa mga partikular na katanungan ng tao tungkol sa kanyang lipunan o kapaligiran - Susan B. Neuman (1997)

Maka-Pilipinong Pananaliksik

Ang maka-Pilipinong pananaliksik ay gumagamit ng wikang Filipino at/o mga katutubong wika sa Pilipinas at tumatalakay sa mga paksang mas malapit sa puso at isip ng mga mamamayan

Komunidad ang laboratoryo ng maka-Pilipinong pananaliksik

Pagpili ng Paksa

Ano ang iyong mga katanungan sa iyong kapaligiran?

Mga kaganapan sa lipunan? Sa buhay-buhay?

May sapat bang sanggunian na pagbabatayan ang napiling paksa?

- Sa mga magsisimulang mananaliksik o magsasagawa ng pananaliksik nararapat na pumili ng paksang may sapat nang pundasyon

Paano lilimitahan o paliliitin ang isang paksang malawak ang saklaw?

- Maaaring haatiin ang isang malaking paksa sa maliliit na bahagi at pumili lamang ng isang aspekto nito na tiyak na sasaklawin

Makapag-aambag ba ako ng sariling tuklas at bagong kaalaman sa pipiliing paksa?

- Kahit luma ang isang paksa, depende sa pagtingin sa ibang anggulong mananaliksik, ay maaari itong makapagbigay ng bagong tuklas na kaalaman

Gagamit ba ng sistematiko at siyentipikong paraan upang masagot ang tanong?

- Ano ang makabagong teknolohiya ng Stem Cell? Paano isinasagawa o saan nagagamit ang Stem Cell?
- Gaano na kalawak o kalalim ang pananaliksik hinggil sa teknolohiyang Stem Cell ng unibersidad ng Pilipinas-Manila?

H. Tentatibong Balangkas

Karaniwan itong binubuo ng tatlong-pahinang papel na naglalaman ng mga plano at tunguhin ukol sa pananaliksik ng isang tiyak na paksa

Ito rin ang pinakakalansay ng sulatin na nagsisilbing hulmahan ng kalalabasang bahagi:

- Rasyunal

- Siyentipiko at malinaw na paglalahad ng batayang saligan kung bakit kailangang pag-aralan ang nasabing paksa. Binibigyang linaw nito ang tanong na "Ano ang saysay ng pag-aaral at pananaliksik?"
- Pangkalahatang layunin
 - Ang malawak at pambungad na paglalatag ng nais na tunguhin ng pag-aaral kaugnay ng rasyunal na pananaliksik. Nagbibigay kasagutan ito sa tanong na "ano ang mayroon sa pananaliksik na ito?"
- Tiyak na layunin
 - Dito iniisa-isa ang mga tiyak at iba't ibang aspeto ng dahilan sa pag-aaral ng paksa ng pananaliksik. Maaaring mayroong tatlo o higit pang layunin ang isang pag-aaral. Nagbibigay linaw ito sa tanong na "ano ano ang gustong matuklasan ng pag-aaral na ito?"
- Mga suliranin sa pag-aaral
 - Makikita sa bahaging ito ang mga batayang suliranin, isyu, mg apangyayari. hakahaka at kasalukuyang kalagayan ng paksa na syang nabibigay paliwanag upang ito ay bigyan ng pansiñ at pagtuunan ng pananaliksik. Nagpapaliwanag ito sa tanong na: "ano ang mga isyu at suliranin lulutasin ng pananaliksik na ito?"
- Mga hypotesis
 - Ang pinakalohikal o pinakamatuwirang mga palagay ukol sa isyu na inilalagay sa unang bahagi ng pananaliksik nang huli ay mapatunayan, mapatibay, masusugan o mapasubalian. Sinasagot nito ang tanong na "ano ano ang mga makatwirang pagpapalagay ng mananaliksik ukol sa kanyang paksa?"

Uri ng balangkas

Pamaksang balangkas (topic outline)

- Ito ay binubuo ng salita o parirala lamang dahil matipid ito sa pananalita o pahayag. Madalas ginagamitan ito ng mga pangngalang –diwa (gumagamit ng panlaping makanganan na –pag)

Pangungusap ng balangkas (sentence outline)

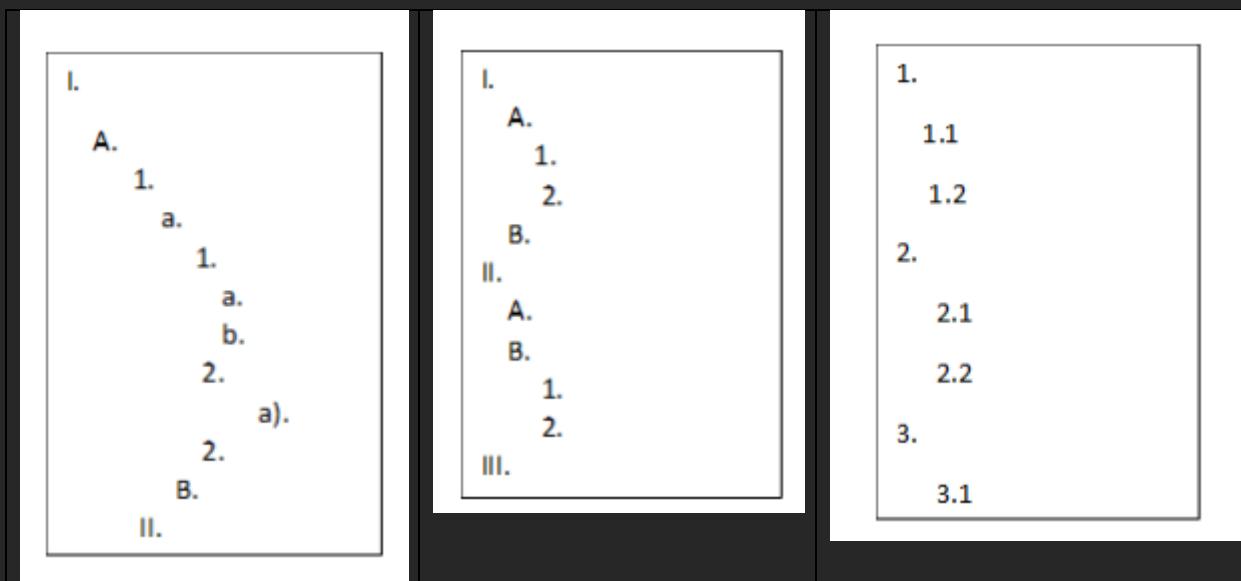
- Binubuo ito ng mga buong pangungusap na naglalaman ng pangungunahing ideya at maynor na ideya.

Patalatang balangkas (paragraph outline)

- Binubuo ng mga pangungusap na naglalahad ng nilalaman ng buong mga talata ng sulatin

Format ng balangkas

Balangkas na may animanga antas	Balangkas na may tatluhang antas	Balangkas ng bilang
---------------------------------	----------------------------------	---------------------



Mga tuntunin sa pagsulat ng balangkas

- Piliin ang mga pangunahing paksa. Gamitin ang bilang Romano tulas ng I, II, III o IV. Ayusin ang mga bilang nang magkakapantay.
- Isulat ang maliliit na paksa tungkol sa pangunahing paksa. Gamitin ang malalaking titik tulad ng A, B, C o D. Lagyan ng tuldok ang malaking titil at isulat nang may kaunting pasok ang maliliit na paksa.
- Para sa mga detalye ng bawat maliit na paksa, gamitin ang mga bilang na 1, 2, 3, 4 at iba pa.
- Gamitin ang malaking titik sa simula ng pangunahing paksa, maliliit na paksa at mga detalye.

Mga dapat isaalang-alang sa paggawa ng balangkas

- Suriin ang pagkakaayos ng mga ideya sa binasang teksto. Ito ba ay nasa ayos kronolohikal, mula sa simple patungo sa kumplikadong mga ideya, sanhi at bunga at malawak na paksa tungo sa tiyka na paksa.
- Pag-aralan kung ano ano ang mahalaga o pangunahing ideya at ang mga pantulong na ideya.
- Tiyakin kung anong uri ng balangkas ang angkop na gamitin sa paksa.
- Gumamit ng wastong bantas
- Tandaan na ang balangkas ay maaaring baguhin o palitan kung kinakailangan.

Pagbuo ng konseptual at teyoritikal na balangkas

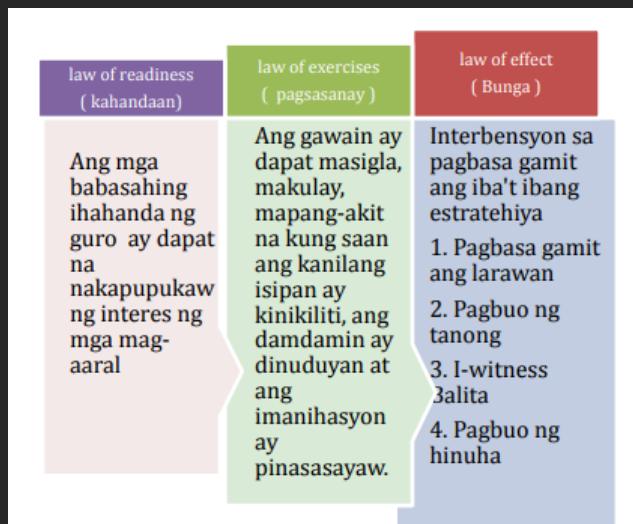
- Konseptual, batayan mula sa sarili ng mananaliksik at maaring ilahad upang makita ang kaugnayan sa teorya ng iba pang mananaliksik.
- Teyoritikal, ang mga konseptong nabasa sa mga literatura na maaring gabay at mailapat sa isinasagawang pag-aaral.
- Konsepto, ideyang binuo mula sa mga pinagsama-samang naobserbahang katangian
- Konseptual na balangkas, naman ay ang pangkalahatang paglalawaran na nagpapakita ng mga ugnayan ng mga konseptong aaralin

Paradaym sa pag-aaral

Ang teyoretikal at konseptual na mga balangkas ay susundan ng pagpapakilala sa prosesong pagdadaanan ng saliksik upang ganap na mabuo. Ito ay mailalarawan sa pamamagitan ng bubuoing paradyam/paradigma

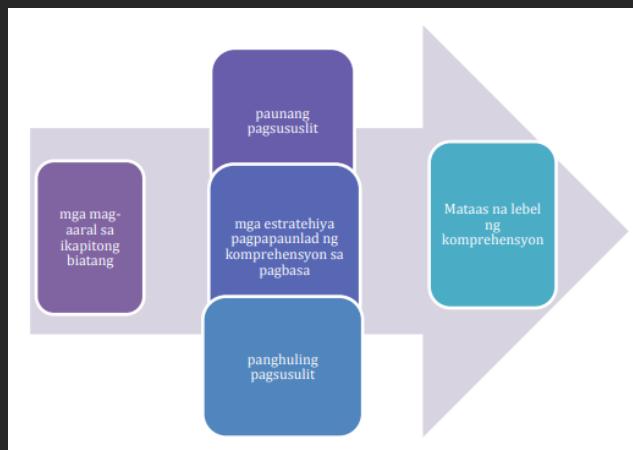
Halimbawa:

Teyoritikal na balangkas



- Ang Balangkas teyoretikal na makikita sa itaas na nakabatay sa teoryang ipinakilala ni E. Thorndike, isinaalang-alang ng mananaliksik ang teorya ni thorndike na nauugnay sa kanyang isinagawang pag-aaral na pinamagatang “ Paggamit ng iba’t ibang estratehiya sa Pagbasa upang mapaunlad ang Lebel ng Komprehensyon ng mag-aaral sa ikapitong taon

Konseptual na balangkas



- Makikita sa pigurang ito konsepto kung ano ang pamamaraan kung paano palalakasin at patataasin ang lebel ng interes ng mga mag-aaral sa pagbasa

I. Sitasyon

Panunulad o plahiyo

- Ang pag-angkin at paggamit ng gawa o ideya ng iba ng walang permiso

Sitasyon

- Kung gagamit ng salita, sulat, o ideya ng iba, kailangang bigyan ng kredito ang orihinal na may-ari ng mga ito.
- Para maiwasan ang panunulad, kailangang maglagay ng tamang sitasyon

Uri ng mga sitasyon

MLA (Modern Language Association)

- Ang MLA ay malimit na ginagamit sa mga kursong humanities. Sa mga kursong ito, nabibigyan ng malaking pokus ang awtor. Kaya naman, sa MLA, palaging nauuna ang pangalan ng awtor sa pahina ng bibliyo.

APA (American Psychological Association)

- Ang APA ay madalas na ginagamit sa mga dokumento sa mga kursong aglipunan (social science). Kung ang MLA ay may pokus sa awtor, ang APA naman ay mas pinahahalagahan ang petsa. Sa pahina ng “references”, ang petsa ay inilalagay pagkatapos ng pangalan ng awtor.

CMS (Chicago Manual of Style)

- Ang CMS ay malimit na ginagamit sa mga klase at kursong may kinalaman sa kasaysayan. Sa kasaysayan, ang pinahahalagahan ng lubos ay ang pinagmulan ng ideya o ng kinokopya. Samakatuwid, kapag gagamit ng istayl na CMS, kailangang ilagay ang pinanggalingan ng impormasyon sa footnote o sa endnote.

Mga halimbawa

LIBRO		
MLA	APA	CMS
Pollan, Michael. <i>The Omnivore's Dilemma</i> . New York: Penguin Group, 2006. Print.	Pollan, M. (2006). <i>The omnivore's dilemma</i> . New York, NY: Penguin Group, 2006.	Pollan, Michael. <i>The Omnivore's Dilemma</i> . New York: Penguin Group, 2006.
DYORNAL		
MLA	APA	CMS
Bagchi, Alaknanda. "Conflicting Nationalisms: The Voice of the Subaltern in Mahasweta Devi's <i>Bashai Tudu</i> ." <i>Tulsa Studies in Women's Literature</i> 15:1 (1996): 41-50. Print.	Bagchi, A. (1996). Conflicting nationalisms: The voice of the subaltern in Mahasweta Devi's <i>Bashai Tudu</i> . <i>Tulsa Studies in Women's Literature</i> 15.1 (1996): 41-50.	Bagchi Alaknanda. "Conflicting Nationalisms: The Voice of the Subaltern in Mahasweta Devi's <i>Bashai Tudu</i> ." <i>Tulsa Studies in Women's Literature</i> 15.1 (1996):

Online Sources		
MLA	APA	CMS
Awtor. <i>Titulo ng website</i> . Petsa ng pagkakagawa (gumamit ng n.d. kung hindi ito nakalagay). Titolo ng artikulo o pahina. <i>Larger Publication Title</i> , volume o numero ng isyu. Retrieved from http://url address	Awtor. (Taon [gamitin ang n.d. kung hindi ito nakalagay]). Titolo ng artikulo o pahina. <i>Larger Publication Title</i> , volume o numero ng isyu. Retrieved from http://url address	Awtor. Titulo ng dokumento. URL or DOI

J. Tentatibong Bibliyografiya

Ang kabatiran tungkol sa mga bahagi ng pananaliksik ay mahalagang malaman ng isang magsasagawa ng pananaliksik, sapagkat ang bawat bahagi ay mahalaga tungo sa ikatatacgumpay ng mga layunin ng isinasagawang pag-aaral

Halimbawa

- Ang unang bahagi ng pananaliksik ay binuubuo ng sumusunod
- Kaligirang pangkasaysayan

- Paglalahad ng suliranin
- Saklaw at limitasyon
- Kahalagahan ng pag-aaral
- Balangkas teoritikal
- Balangkas konseptwal
- Kahulugan ng mga terminong ginamit

Bibliograpgi

- Listahan ng mga ginamit na sanggunian; mababasa rito ang pangalan ng/ng mga may akda; pamagat ng aklat o anumang ginamit na reperensya; publikasyon; at lugar at petsa ng pagkakalimbag. Ito ay makikita sa bandang hulihan ng aklat o ng anumang proyektong isinulat gaya ng pananaliksik. Nakaayos ito nang paalpabeto upang madaling hanapin ang sangguniang ginamit.

Kahalagahan ng bibliograpgi

- Sa pagsulat ng isang pananaliksik ay hindi maaaring mawala ang bahagi ng bibliograpgi, sapagkat ito ay isa sa mga nagbibigay ng magandang impresyon sa binuong pag-aaral. Mayoong mahahalagang dahilan kung bakit kailangang ilakip ang bibliograpgi sa aklat at pananaliksik. Narito ang ilan:
 - Ipinapakita ng bibliograpgi ang lawak ng isinasagawang pananaliksik
 - Nagbibigay ng magandang impresyon sa isinasagawang pananaliksik, lalo pa kung maraming nakatalang sangguniang ginamit
 - Maiiwasang magduda sa nilalaman ng isinasagawang pananaliksik ang mambabasa
 - Magagawang hanapin ng sinumang mambabasa ang ginamit na sanggunian
 - Madaling balikan ng mananaliksik ang sangguniang ginamit kung muli niyang kakailanganin
 - Maiiwasan ang isyu ng plagiarism

Paggamit ng online database

- Mayoong tamang hakbang sa pananaliksik upang ito ay mas maging madali, lalo pa kung ito ay isasagawa sa silid-aklatan
- Mahalagang unahin munang tignan ang talaan ng bibliograpgi ng lahat ng aklat, tesis, disertasyon, at iba pang nasa aklatan
- Ang talaang ito ay tinatawag noong card catalog, ngunit sa kasalukuyan ay mas ginagamit na ang online database
- Gaya ng card catalog, ang online database ay inaayos ayon sa tatlong paraan – talaan ng mga may-akda, talaan ng mga pamagat ng paksa, at talaan ng mga pamagat ng aklat
- Ang paraang ito ay malaking tulong sa mananaliksik upang maging mas madali sa kanya ang paghahanap

Tentatibong bibliograpgi

- Sa paghahanap ng kakailanganing sanggunian sa online database ng silid-aklatan ay mahalagang bumuo ang mananaliksik ng tentatibong bibliograpgi

- Ang tentatibong bibliograpgi ay talaan ng mga sanggunian ng mananaliksik sa kanyang isinasagawang pag-aaral
- Ito ay isinusulat sa 3x5 na laki ng index card

External Links

Tekstong Deskriptibo	https://www.slideshare.net/NicoleGala/tekstong-deskriptibo-filipino
Sitasyon	https://www.slideshare.net/laducla/presentasyon-tungkol-sa-sitasyon

PE & Health 2

A. Common Sports Injuries

1. Strains
 - Are by far the most common of all sports-related injuries simply because we use so many muscles when we exercise or play. These moving parts are all susceptible to stretching farther than they should, or moving in ways they shouldn't move, leaving them torn, damaged and in pain.
 - Needs rest
2. Sprains
 - Sprains are to ligaments what strains are to muscles. Ligaments are the tissues that connect bone to bone. When these ligaments turn in a wrong way, they can pull or tear. Sprains can be painful, take longer to heal than strains, and sometimes require immobilization to protect against further injury.
 - Needs rest
3. Knee injuries
 - The knee is a very complicated joint, and it endures a lot of impact and wear during most sports activities - and for this reason, we've given it its own category for possible injuries. Tears of the Anterior Cruciate Ligament (ACL) are quite common, as are cartilage tears, dislocation and fractures.
 - May require surgery; needs rest
4. Fractures
 - Impact and contact sports often lead to fractures of the bone (mostly arms, legs, and feet), all of which can be painful, takes weeks of immobilization to heal and may sometimes require surgery to correct. Also, don't "play through the pain", as sometimes the pain is a sign of a strain/sprain that if left untreated can make the bone vulnerable to fracture.
5. Tennis Elbow
 - You don't have to play tennis to get tennis elbow (gold is also a common culprit). Tennis elbow is one of several "injuries of repetition" - a straining of the ligaments in the elbow due to overuse and repetitive activity. The best way to avoid it is to pace yourself. Take breaks, do other activities, and always warm up and stretch before playing.
6. Plantar Fasciitis/shin splints
 - We've grouped these together also as injuries of repetition because they are both related to overactivity of the feet and legs, combined with a lack of proper support. Plantar fasciitis is an inflammation of a tendon in the arch of the foot, causing sharp pain with

every step. Shin splints describe an inflammation of the muscles in the lower leg caused by repeated stress and high impacts of running, dodging or quick stops and starts.

- Needs rest
 - Wear shoes with good soles
7. Back injuries/back pains
- Your back and spinal column undergoes some level of stress with almost every sports activity. Over time, this stress may accumulate into inflammation around the vertebrae and back muscles, sometimes causing injuries to the discs and frequently causing upper or lower back pain. Sometimes a sudden jarring impact may also cause an acute injury to the back.
8. Concussions
- May be mild to severe, with symptoms ranging from headache and dizziness to sleepiness and temporary loss of consciousness. Always seek a medical evaluation from a spine-and-brain specialist with any blow to the head, as sometimes more serious symptoms may occur after the fact. Never continue to play sports if symptoms of a concussion exists.
 - Wear helmet; protect head from impact

Causes

1. Uneven leg length
2. Excessive pronation (flat feet)
3. Cavus foot (over-high arches)
4. Bowlegged or knock-knee alignment
5. Lumbar lordosis
6. Patella alta
7. High Q Angle

B. Prevention of Sports Injuries

- Warm up thoroughly by gently going through the motions of your sport and performing slow, sustained stretches.
- Wear appropriate footwear.
- Tape or strap vulnerable joints, if necessary.
- Use the appropriate safety equipment, such as mouth guards, helmets and pads.
- Drink plenty of fluids before, during, and after the game.
- Try to avoid exercising in the hottest part of the day, between 11 AM and 3 PM
- Maintain a good level of overall fitness, particularly in the off season (in the months between playing seasons for a sport)
- Cross-train with other sports to ensure overall fitness and muscle strength
- Ensure training includes appropriate speed and impact work so muscles are capable of the demands of a game situation
- Don't exert yourself beyond your level of fitness. Gradually increase intensity and duration of training.
- Use a good form and technique
- Cool down after sport with gentle, sustained stretches
- Allow adequate recovery time between sessions
- Have regular medical check-ups
- Do stretches before and after
- Warm up and don't do much repetitions

Runner's knee

- Be mindful on the shoes you wear

Broken bone/fracture

- May require surgery

Lower back pain

- Stretch correctly

Small burn/skald

- Apply cold running water to burnt area for 20 minutes
- Apply gauze/wrap burn with cloth

Nosebleed

- Sit and lean forward slightly
- Pinch nostrils
- Breath through mouth

Splinter

- Remove with puller carefully

Fainting

- RICE
- Fan the victim

Bleeds

- Apply pressure to the wound and wrap with gauze to prevent bleeding

RICE

R – Rest

I – Immobilize

C – Cold

E – Elevate

C. Athletics

Athletics

Branch of sports otherwise known as track and field involving different events in running, jumping, and throwing.

Running, jumping, and throwing have been sporting activities since the beginning of history. These skills were used both in hunting and in war.

History

Athletics, also known as track and field or track and field athletics, is a collection of sports events that involve running, throwing, and jumping

The name is derived from the Greek word “Athlon” meaning contest

Athletics was the original even at the first Olympics in 776 BC where the only event held was the stadium-length foot race or “stade”

The ancient Olympic games were a sporting event held every four years at the sacred site of Olympia, in the Western Peloponnese, in honor of Zeus, the supreme god of Greek religion.

Spectators

Spectators came from not only the Greek mainland but also the islands, Ionia and Magna Graecia. To facilitate the movement of spectators and athletes and in respect of religious importance of the games a sacred truce was called across Greece

Women were not permitted to participate in or watch the events although young girls were allowed in the crowd.

Athletes

Athletes trained under the watchful eye of a professional trainer (gymnastes) or physical trainer (paidotribes) who knew how to best develop particular muscles, the best diet and the correct number of exercises to be done

The athletes competed naked, probably for complete freedom of movement

Stadion footrace

For the first 12 Olympics the stadion foot-race was the only event and it remained the most prestigious event throughout the history of the games. The race was running over one length (a stadion) of the stadium tract, 600 ancient feet or 192 meters and preliminary heats were held with heat winners going into the final

Other sporting events

Diaulos - two stadium length foot race

Dolichos - longer foot races

Wrestling - combative sport

Pentathlon - combination of jumping, throwing

Boxing - wrestling, basically

Tethrippon - needs the horse (4-horse chariot race)

Keles - horse race

Pankration - mix of boxing and wrestling

Hoplitodromos - race: helmet, shield, and spear

Apene, kalpe, synoris - horse races

Competitions for trumpeteers and heralds

Competition rules and judges

The events were supervised by trained judges from Elis, the hellanodikai (or agonothetai) who also had various assistants such as the alytai (police officers)

Rules were very rarely broken and when they were penalties were imposed ranging for exclusion and fines to flogging. Fines were paid both to the sanctuary and the wronged athlete. If an offender did not pay the fine then the city he represented had to or else be excluded from the next games.

Olympic prizes

The hellanodikai also gave out the victory crown (kotinos) of wild olive leaves and an olive branch cut from the scared tree (kallistephanos) to each event winner. The olive was significant because the trees of Olympia were believed to have been originally planted by Hercules. Another prize could be a red woolen ribbon which was worn on the upper arm or around the head, especially for chariot racers as it was the horse owner who actually received the olive crown.

Famous Olympians

Kroton

Phanas of Pellene

Leonidas of Rhodes

Milon of Kroton

Herodoros of Megara

The first woman to win the crown of victory was Kyniska in 392 BCE. Although women were not permitted to compete, they could own horses and it was the owner who won the olive crown prize

End of the games

The games continued through the Hellenistic period with more buildings added to the site, greater comforts offered for the spectators and an increase in the professionalism and event specialization of the athletes

During this period, first national athletics associations have been established and shortly after that first national competitions took place

AAA - Amateur Athletic Association

One of the biggest milestones for the development of the athletics came back in 1896 at the summer Olympic games. In those games in Athens, track and field together with a marathon comprised the majority of the sporting events at that games.

In 1912, the second milestone in the development of the athletics occurred when the international amateur athletic federation or IAAF was founded and as such it became the international governing body for track and field

Dates and sites of modern Olympics

- 1896 – ATHENS, GREECE
- 1964 – TOKYO, JAPAN (1ST PHILIPPINE PARTICIPATION)
- 1900 – PARIS, FRANCE
- 1968 – MEXICO CITY, MEXICO
- 1904 – ST. LOUIS, U. S. A.
- 1972 – MUNICH, WEST GERMANY
- 1908 – LONDON, ENGLAND
- 1976 – MONTREAL, CANADA
- 1912 – STOCKHOLM, SWEDEN
- 1980 – MOSCOW, RUSSIA (MOST TRAGIC INCIDENT, MASSACRE OF JEW ATHLETES)
- 1916 – WORLD WAR I
- 1984 – LOS ANGELES, CALIFORNIA
- 1920 – ANTWERP, BELGIUM
- 1988 – SEOUL, SOUTH KOREA

- 1924 – PARIS, FRANCE
- 1992 – BARCELONA, SPAIN
- 1928 – AMSTERDAM, NETHERLANDS
- 1996 – ATLANTA GEORGIA, U.S.A (SILVER MEDALIST BOXING – ONYOK VELASCO)
- 1932 – LOS ANGELES, CALIFORNIA
- 2000 – SYDNEY, AUSTRALIA
- 1936 – BERLIN, GERMANY
- 2004 – ATHENS, GREECE
- 1940/1944 – WORLD WAR II
- 2008 – BEIJING, CHINA
- 1948 – LONDON, ENGLAND
- 2012 – LONDON, ENGLAND
- 1952 – HELSINKI, FINLAND
- 2016 – RIO DE JANEIRO, OLYMPICS
- 1956 – MELBOURNE, AUSTRALIA
- 1960 – ROME, ITALY

Olympic rings

The five rings colored blue, black, yellow, green, and red represents the 5 major regions of the world: Africa, Asia, Oceania, Americas, Europe

Standard Competition Layout

The field events are evenly distributed over the arena to avoid congestion and to satisfy the needs of the spectators. This layout avoids unique disruption of events by ceremonies and counterbalances the concentration of interest in the finish area

Types of events

Track events

- Variety of running events held on the track
- Sprints
 - Running over a short distance in a limited period of time
 - There are three sprinting events which are currently held at the summer Olympics and outdoor world championships: 100 meters, 200 meters, and 400 meters.
 - 100 meters
 - 200 meters
 - 400 meters

- Middle-distance
 - Events are track races longer than sprints, up to 3000 meters. The standard middle distances are the 800 meters, 1500 meters and mile run, although the 3000 meters may also be classified as a middle-distance event.
 - 800 meters
 - 1500 meters
- Long-distance
 - Continuous running
 - 3000 meters
 - 5000 meters
 - 10,000 meters
- Relay race
 - A track and field event in which athletes run a preset distance carrying a baton before passing it onto the next runner. Often the relay team is a team of four sprinters.
 - 4x100 meters
 - 4x400 meters
- Hurdling
 - The act of running and jumping over an obstacle at speed. In these events, a series of barriers known as hurdles are set at precisely measured heights and distances which each athlete must pass by running over.
 - 100-meter hurdles women
 - 110-meter hurdles men
 - 400-meter hurdles

Field events

- The field events come in two types - jumping and throwing competitions
- Throwing events
 - Shot put - a track and field event involving "throwing"/"putting" a heavy spherical object - the shot - as far as possible
 - Discus throw - a track and field event in which an athlete throws a heavy disc - called a discus - in an attempt to mark a further distance than their competitors.
 - Hammer throw - one of the four throwing events in regular track and field competitions, along with the discus throw, shot put and javelin. The hammer consists of a metal ball attached by a steel wire to a grip
 - Discuss throw
 - Shot put
 - Javelin throw
 - Hammer
- Jumping events
 - Pole vault - a person uses a long, flexible pole (which today is usually made either of fiberglass or carbon fiber) as an aid to jump over a bar.
 - Long jump - a track and field event in which athletes combine speed, strength and agility in an attempt to leap as far as possible from a take-off point

- Triple jump - sometimes referred to as the hop, step and jump or the hop, skip and jump, is a track and field event, similar to the long jump. The competitor runs down the track and performs a hop, a bound and then a jump into the sand pit.
- Long jump
- High jump
- Triple jump
- Pole vault
- Multiple events
 - Decathlon
 - Heptathlon

External Links

Athletics	https://www.youtube.com/watch?v=AVnoYWg1x-w
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Personal Development

A. Human development

What is personal development?

- One's own development and growth within the context of the three aspects of human development.

Three domains in human development

1. Physical development
 - Covers the growth of the body and the brain, motor and sensory skills, and even the physical health.
2. Cognitive development
 - Covers our capacity to learn, to speak, to understand, to reason, and to create.
3. Psychosocial development
 - Includes our social interactions with other people, our emotions, attitudes, self-identity, personality, beliefs and values.

Influences to human development

1. Heredity
 - Inborn traits passed on by the generations of offspring from both sides of the biological parent's families.
2. Environment
 - World outside of ourselves and the experiences that result from our contact and interaction with this external world.
3. Maturation
 - The natural progression of the brain and the body that affects the cognitive, psychological, and social dimensions of a person. The influence of physical maturation over a person's development is most pronounced during his or her childhood and adolescence stages.

Personality vs. personal development

Personality development

- The development of the organized pattern of behaviors and attitudes that makes a person distinctive. Personality development occurs by the ongoing interaction of temperament, character, and environment.

Personal development

- The process of improving oneself through such activities as enhancing employment skills, increasing consciousness and building wealth. The growing success of the self-help and personal development movement has assisted many business managers in obtaining more qualified and motivated personnel for their companies, and it has also encouraged more people to go into business for themselves.

B. Knowing oneself

Defining the “self”

- Approach to personal development is holistic, we will integrate the various definitions of “self” from the philosophical, spiritual, and psychological realms, but we will focus and give more emphasis on its psychological definition.
- When the "self" is defined as the cognitive and affective representation of one's identity, it is then described in terms of human characteristics such as behavior and thought.

Personality

- Is referred to as the set of behaviors, feelings, thoughts, and motives that identifies an individual. Personality is usually described in behavioral terms that are observable and measurable.

Trait theories

- An approach in identifying types of personalities based on certain traits and attributes, which vary from one person to the other.
- Costa and McCrae developed a categorized scheme that described personality. They discovered the existence of five universal and widely agreed – upon dimensions of personality, it is called the Big Five or Five-Factor Model.

Big Five / Five-Factor Model		
	Low scores	High scores
Extraversion	Loner, quiet, passive, reserved	Joiner, talkative, active, affectionate
Agreeableness	Sus, critical, ruthless, irritable	Trusting, lenient, soft-hearted, good-natured
Conscientiousness	Negligent, lazy, disorganized, late	Conscientious, hardworking, well-organized, punctual
Neuroticism	Calm, even-tempered, comfortable, unemotional	Worried, temperamental, self-conscious, emotional
Openness to experience	Down-to-earth, uncreative, conventional, uncurious	Imaginative, creative, original, curious

Measuring personality

Personality can be measured using different kinds of tests like the Rorschach Inkblot Test, Myers-Briggs Type Indicator (MBTI), and the Keirsey Temperament Sorter. A popular personality test used is the Myers-Briggs Type Indicator, developed based on four preferences of individuals.

Myers-Briggs Type Indicator

a. E or I (Extraversion or Introversion)

- How an individual prefers to channel his/her energy when dealing with people, whether it is inward (introversion) or outward (extraversion)
- b. S or I (Sensing or Intuition)
- How one prefers to process information, whether through the use of senses such as being able to describe what one sees, or intuitively like dealing with ideas.
- c. T or F (Thinking or Feeling)
- How an individual prefers to make decisions, either thinking or using logic and analysis, or feeling which uses the cognitive senses based on values or beliefs.
- d. J or P (Judgement or Perception)
- How an individual prefers to manage one's life, whether through judging, which means a planned and organized life, versus perception, which has a more flexible approach to living.

C. Developing the Whole Person

Holism and Gestalt

Holism and Gestalt is evident in music. A symphony cannot be defined by one of its notes alone. Even the clusters of sums of these different notes do not make up the whole symphony nor characterize the whole symphony.

Parallelism between a symphony and humans in terms of being a unified entity follows the principle of holism. In understanding humans, it is important to see the person in his entirety and not just his parts.

Aspects of holistic development of persons

Physiological

- The physical attributes including the five physical senses.

Cognitive

- The intellectual functions of the mind: thinking, recognizing, reasoning, analyzing, projecting, synthesizing, recalling, and assessing.

Psychological

- How thinking, feeling, and behaving interact and happen in a person.

Social

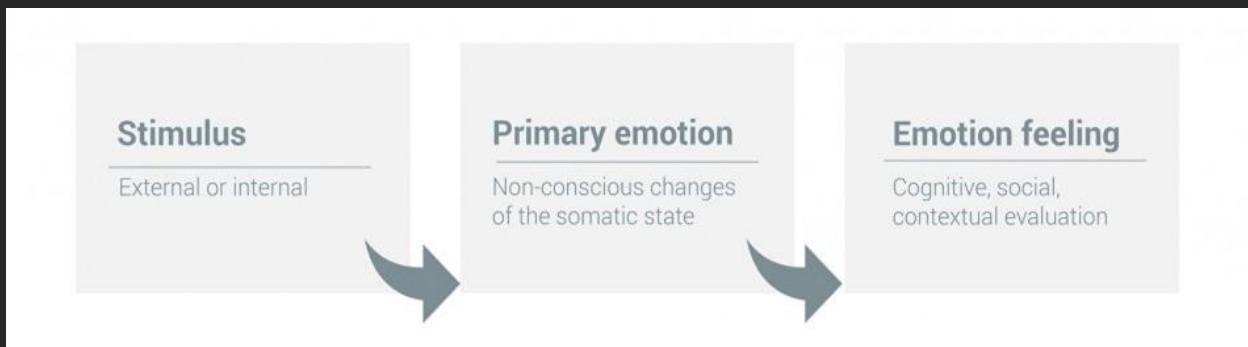
- The manner by which an individual interacts with other individuals or groups of individuals.

Spiritual

- The attribute of a person's consciousness and beliefs, including the values and virtues that guide and put meaning into a person's life.

Feelings and emotions

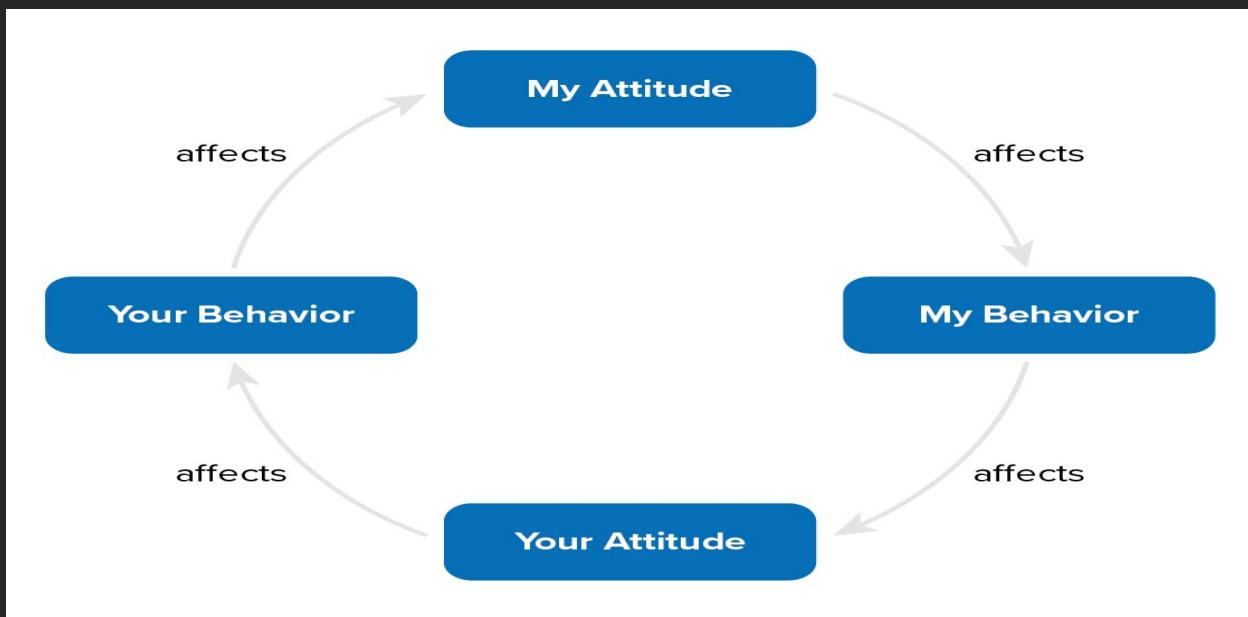
Feelings arises from the brain as it interprets and emotion, which is usually caused by physical sensations experienced by the body as a reaction to a certain external stimulus. An example of this would be the emotion of fear which produces a feeling of being afraid.



Attitudes and behavior

Attitudes are a person's thoughts, feelings, and emotions about another person, object, idea, behavior, or situation. Attitude is a result of a person's evaluation of an experience with another person, object, idea, behavior, or situation.

Beliefs and certain values, therefore, affect the attitude of a person. Behavior is a manifestation or acting out of the attitudes an individual has.



Values

At the core of every person lies a system of beliefs that adheres to the highest ideals of human existence. These ideals are called values.

Universal human values transcend culture and race. There are different sets of values identified by different sets of values identified by different people and organizations, depending on what their order of priorities are, and what they intend to achieve.

Virtues

In the Catechism of the Catholic Church, virtue is defined as "a habitual and firm disposition to do the good. It allows the person not only to perform good acts, but also to give the best of himself/herself. The virtuous person tends toward the good with all his sensor and spiritual powers; he pursues the good and chooses it in concrete action."

The Catechism teaches four cardinal virtues: prudence, justice, fortitude, and temperance.

D. Developing Stages in middle and late adolescence

Stages of Psychosocial Development

Erik Erikson, believed that we work on constructing psychosocial identities throughout our whole lives. By 'psychosocial,' he meant an interplay between our inner, emotional lives (psycho), and our outer, social circumstances (social).

Erikson believed that as we grow and age, we pass through eight distinct stages of development. He thought that each stage was defined by a specific conflict between a pair of opposing impulses or behaviors. The resolution (or inability to resolve) these conflicts affect our personalities and identities.

Erikson's Stage Theory

Erikson's Stage Theory in its Final Version			
<i>Age</i>	<i>Conflict</i>	<i>Resolution or "Virtue"</i>	<i>Culmination in old age</i>
Infancy (0-1 year)	Basic trust vs. mistrust	Hope	Appreciation of interdependence and relatedness
Early childhood (1-3 years)	Autonomy vs. shame	Will	Acceptance of the cycle of life, from integration to disintegration
Play age (3-6 years)	Initiative vs. guilt	Purpose	Humor; empathy; resilience
School age (6-12 years)	Industry vs. Inferiority	Competence	Humility; acceptance of the course of one's life and unfulfilled hopes
Adolescence (12-19 years)	Identity vs. Confusion	Fidelity	Sense of complexity of life; merging of sensory, logical and aesthetic perception
Early adulthood (20-25 years)	Intimacy vs. Isolation	Love	Sense of the complexity of relationships; value of tenderness and loving freely
Adulthood (26-64 years)	Generativity vs. stagnation	Care	Caritas, caring for others, and agape, empathy and concern
Old age (65-death)	Integrity vs. Despair	Wisdom	Existential identity; a sense of integrity strong enough to withstand physical disintegration

E. Cognitive and Moral Development

There are some theories developed that explain the cognitive and moral development of a person. These theories are developed by well-renowned psychologists. Jean Piaget, a Swiss Psychologist, explained cognitive development through his Stage Theory of Intellectual Development while Lawrence Kohlberg offered an explanation of moral development through what became known as Kohlberg's Stages of Moral Development.

Stages of Cognitive and Moral Development

The development of our cognitive abilities also has stages ranging from the time we are born to what we are now.

According to Piaget, an individual undergoes distinct stages of intellectual development. Piaget's stage theory of intellectual development has four distinct stages: sensorimotor, the pre-operational, concrete operational, and the formal operational stage.

1. Sensorimotor Stage (0-2 years)

- The infant explores the world through direct sensory and motor contact. Our cognitions were mainly focused on learning how to interact with our environment.
 - Our brain's capacity of function only reached out to moving our limbs, breathing, perceiving the world, and having the still-developing primary senses we had.
2. Preoperational Stage (2-6 years)
 - The child uses symbols (words and images) to represent objects but doesn't reason logically. The child also has the ability to pretend. During this age, the child is egocentric.
 - This is the stage when we learned how to pretend play or symbolic play yet still, we would still have struggled with logic and taking other people's point of view, implying that we lacked empathy for others.
 - This is also the stage of our cognition when we learn to imitate our parents or our guardians, associating them with roles based on how they act around us.
 3. Concrete Operational (7-12 years)
 - The child can think logically about concrete objects and can thus add and subtract.
 - Children begin to process other individual's perceptions, thoughts, and feelings and realize that they themselves have their distinct opinions, feelings, and thoughts.
 - However, they still struggle with concepts of the abstract and hypothetical.
 4. Formal Operational (12-adult years)
 - The adolescent can reason abstractly and think in hypothetical terms.
 - It involves huge progress with regards to logical thinking, deductive reasoning, and the comprehension of abstract ideas.
 - How they view the world can also be more critical.
 - Developmental delays can also happen during each stage because of other factors that highly influence development like the environment, upbringing, nutrition, and generic factors. Everyone has a particular pace.

F. Moral Development

According to Lawrence Kohlberg

Level 1: Preconventional Morality

Age 9

Kohlberg theorized that preconventional morality begins around the age of 9 years in the average

Our code of morality is not personal but is instead shaped externally-implying that our morality at this level is based on the standards of adults and the consequences of obeying and disobeying the rules they have set.

2 Stages

1. Obedience and punishment orientation
 - Children avoid punishment by being in good order. Being punished meant something wrong was done
2. Individualism and exchange
 - Children realize that different persons have different beliefs or viewpoints regarding a deed

Level 2: Conventional Morality

Teenage years

Individuals begin to internalize the learned moral standards they have with their valued adult role models. Even though authority has become internalized, it is not questioned or doubted.

Reasoning is derived from the norms of a particular group in which the individual belongs

2 Stages

1. Good interpersonal relationships
 - The growing individual is good based on the approval of others in his or her group
2. Maintaining social order
 - The individual becomes aware of a broader set of rules in society resulting to judgment concerning rule compliance to uphold the law system and avoid guilt

Level 3: Postconventional Morality

Adulthood

An individual's basis of his or her morality rests on self-chosen principles

2 Stages

1. Social Contract and individual rights
 - The individual becomes aware that while the laws and rules of society exist for the good of the majority, there will be instances that these may work contradictory to the preferences of particular individuals or minority group
2. Universal principles
 - Implies that individuals have developed their own set of moral guidelines which may not at all times fit the law of society.
 - These set of principles apply to everyone like in the case of human rights, justice, and equality
 - The individual would be able to go against the majority even the entire society to defend his or her morals.

G. Changes and issues among adolescents

Physical appearance

One of the challenges that adolescents like you have to face is the changes in physical appearance. Some may become overly conscious of his/her appearance.

Adolescents fresh off of puberty or still going through it, face a lot of changes regarding their physical appearance. Add that to the variety of new emotions, sensations, and perceptive abilities and one would be able to understand why adolescents are conscious of their looks.

It helps to know that everyone goes through puberty differently from a lot of aspects - time, nature, and degree. Every human being has a unique set of genes, therefore, different predispositions.

Everyone has his/her own pace - be it physically, mentally, or psychologically.

Everybody goes through puberty through in different ways. Whatever happens, it is important that you embrace your self-worth regardless of other people's opinions. They are not you.

Do not depend on other's identities, demands, and expectations. Be your own person. Do not worry that it takes time.

Identity Development

Who are you? What do you want to be? How are you going to reach your goals? What is the best or worst of you? What are your weaknesses and strengths?

We should monitor ourselves for behaviors that might go over the top. It isn't enough to have knowledge but it will ensure victory if you apply it as well. You have formal operations at this point. Internalize it so it manifests to your behavior.

Gender identity

You need to know what your gender orientation is personally. Self-betrayal is a silent chain that weighs you down on your potential. It acts as a big wall from being the best person you can ever achieve.

As it goes as well in identity development, it helps an adolescent more to be true to him/herself

Do not depend on other people's demand and expectations, develop your own

It can be struggle, especially being in a collectivistic country that is predominantly patriarchal. This may cause conflicts and family strains that will either be resolved or kept in the open. Despite the challenges, try to keep a strong and positive outlook on the matter.

Social Cognition: Personal fable and imaginary audience

The adolescent believes is having an imaginary audience - that a group of followers exist to continuously watch and judge their every move, verbalization, and public or personal behavior. This relates, like personal fable, to the bigger concept of adolescent egocentrism

An imaginary audience would amplify certain moods, which can explain the moodiness of some teenagers.

The personal fable, however, is an adolescent belief that he or she is highly special and unlike anyone else who has ever walked the Earth. The adolescent thinks that because others could be obviously amazed by him/her, he/she must be a very distinct brand of human.

The personal fable may be detrimental to one's well-being that is why it helps to know about it ahead of time for due self-reflection and self-assertion

Since adolescents with strong personal fables feel highly special, they tend to feel invincible which results to trying dangerously risky behaviors such as unprotected sex, substance abuse, or breaking the law.

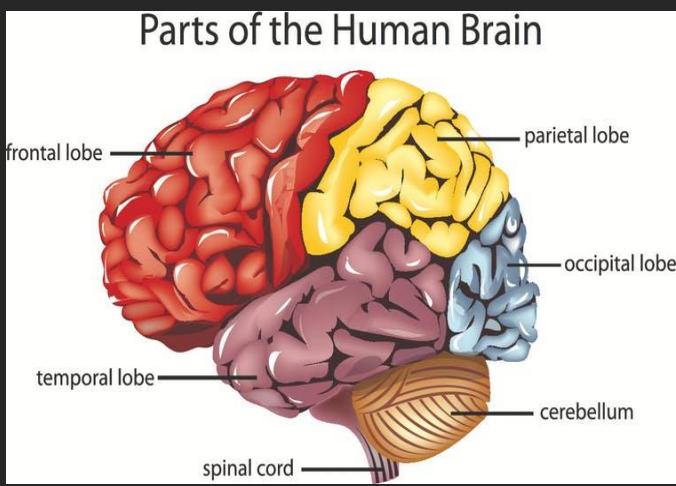
Having high self-esteem, doesn't equate with a high belief of the personal fable. Even adolescents with low self-esteem manifest their belief in their personal fable by stating that their critical self-judgements are evidences of just how special they are.

H. The Brain

As early as 1664, Thomas Willis is an English doctor, concluded that the brain is responsible for mental functioning.

The human brain consists of three main structures—the cerebrum, the cerebellum, and the brain stem.

Parts of the brain

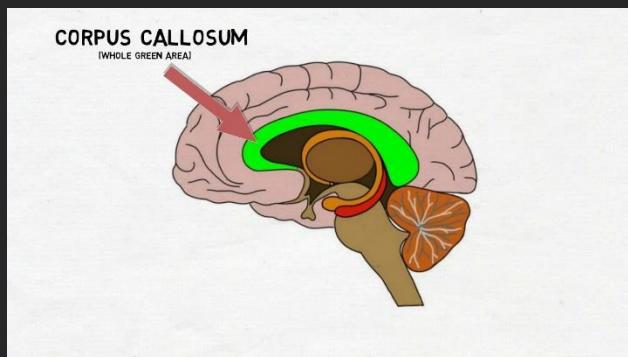


Cerebrum

- The largest portion of the brain, responsible for most of the brain's functions such as thought and movement.
- It's divided into 4 areas
 - Temporal lobe
 - Occipital lobe
 - Located at the back of the brain and is responsible for vision
 - Parietal lobe
 - Frontal lobe
 - Takes charge of our thoughts, language, memory, learning, and perception

Sulcus (plural: sulci)

- Divides the cerebrum into two halves, the left and right hemispheres, which look mostly symmetrical but not quite
 - The right hemisphere is often associated with creativity
 - The left hemisphere is associated with logical abilities
- The structure that connects both hemispheres is the corpus callosum, a bundle of axons that sends messages from one side to the other
 - Researches show that females have thicker corpus callosum than males
- Damage to the left hemisphere is associated with speech abnormalities.
- The left hemisphere is also correlated with handedness while the right hemisphere is more associated with spatial reasoning, especially in doing visual-spatial tasks



Neurons

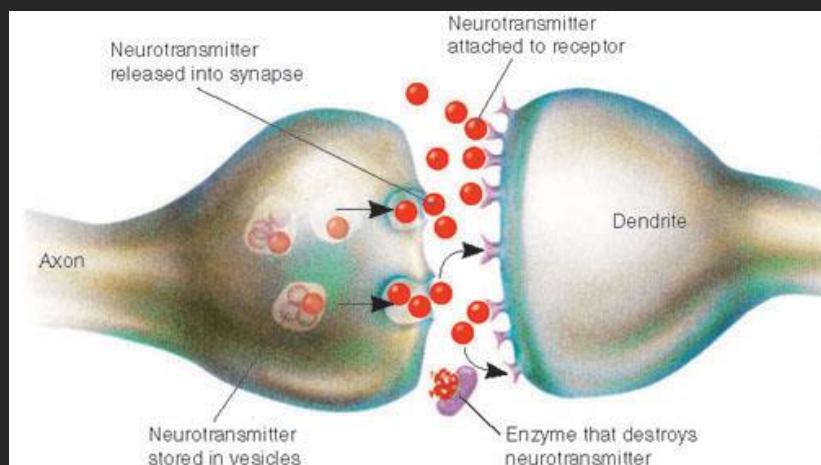
- Another term for nerve cell

Neurotransmitters

- Chemical substances that transmit messages from one neuron to the next neuron

Synapse

- The space between two neurons where neurotransmitters are released



Information about the brain

The human brain which weighs about 3 lbs. is a collection of nerve cells or neurons consisting of about 10 million cells.

Most neurons are found in the cerebral cortex, a three-millimeter-thick mantle with six layers that cover the surface of the brain

Neurons communicate with each other and it is the strength of these connections between neurons that determine storage of knowledge

Connections between neurons are possible because of chemical substances called neurotransmitters that are found in the synapse, a space between the trail end of one neuron and the dendrites of another neuron

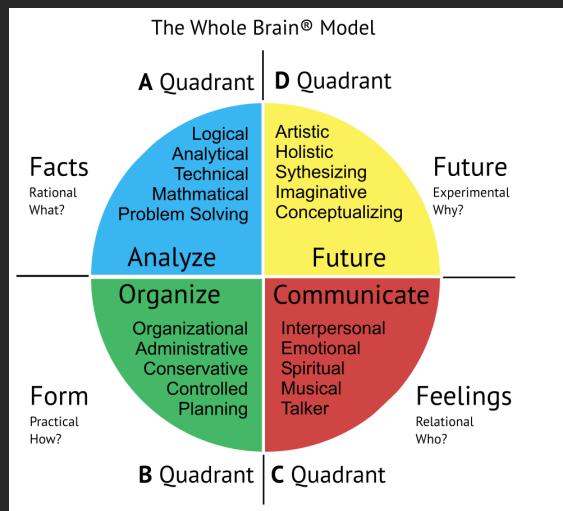
- An increase or decrease in the level of our neurotransmitters can affect the way we behave
- The neurotransmitter dopamine has been associated with attention, memory, and cognition while endorphins are known to fight stress and pain.

Brain lateralization

Left	Right
Analytical thought	Intuitive thought
Detail oriented perception	Holistic perception
Ordered sequencing	Random sequencing

Rational thought	Emotional thought
Verbal	Non-verbal
Cautious	Adventurous
Planning	Impulse
Math/Science	Creative writing/art
Logic	Imagination
Right field vision	Left field vision
Right side motor skills	Left side motor skills

The whole brain model



I. Multiple Intelligence

Howard Gardner (2004), an American developmental psychologist, challenges the classical view of intelligence which depends on a single dominant ability as indicated by an IQ score.

Intelligence has been viewed as the capacity to understand the world, think rationally, and use resources effectively when faced with challenges (Wechsler, 1975).

For Gardner, intelligence is the ability to solve problems or to produce something in particular setting.

In his theory of multiple intelligences, he believes these innate intelligences are expressed in different sensory modalities. Based on research in physiology, anthropology, as well as personal and cultural history, Gardner came up with 8 distinct intelligences such as: linguistic, spatial, musical, intrapersonal, logico-mathematical, bodily-kinesthetic, interpersonal, naturalist



He believes that these intelligences do not operate independently. They are used at the same time and complement each other as people develop skills and solve problems

Gardner's theory of multiple intelligences made a strong impact on the field of education. Schools have picked up his ideas in determining students' learning styles and acknowledge their natural talents and abilities and design their curriculum accordingly.

In support to the theory of multiple intelligences, Gilhooly (1995) explains certain assumptions. He states that intelligence is not fixed or static at birth because environmental, cultural, and socialization factors affect the development of intellectual abilities. Secondly, intelligence can be learned, taught and enhanced because it has a neurobiological base such as that at any age, mental ability can be improved. Lastly, intelligence is multidimensional at various levels of our brain, mind, and body. There are many ways in which we know, understand, perceive, learn, and process information

Gardner's Eight Intelligences

Linguistic intelligence

- Linguistic intelligence is the ability to use words in both oral and written communication. People with this ability think in words rather than visuals. They are good in listening, speaking, writing, discussing, and other language skills.

Logico-mathematical

- Logico-mathematical intelligence is the ability to reason, apply logic, and work with numbers. They think in logical and numerical patterns, making connections between pieces and information. Their skills include problem solving, classifying and categorizing information, thinking logically, questioning, carrying out investigations, performing mathematical calculations, and working with geometrical shapes

Visual-spatial

- It is the ability to perceive the visual. They tend to think in pictures and need to create vivid mental images to retain info. Their skills include understanding charts and graphs, sketching, painting, creating visual images, and constructing and fixing design.

Musical intelligence

- It is the ability to produce and appreciate music. These musically inclined people think in sounds, rhythms, and patterns. They immediately respond to music either appreciating or criticizing what they hear. Their skills include singing, playing musical instruments, recognizing sounds and tonal patterns, composing music, and remembering melodies.

Bodily-kinesthetic

- It is the ability to control body movements and handle objects skillfully. They express themselves through movement because of their good sense of balance and hand-eye coordination. Through interacting with the space around them, they are able to remember and process information. Their skills include dancing, physical coordination, sports, crafts, acting, miming, and using their hands to create or build

Interpersonal

- It's the ability to relate to and understand other people. They can sense feelings, intentions, and motivations and are adept to recognizing nonverbal language, for example, body language. Their skills include seeing things from other perspectives, listening, using empathy, understanding other people's moods and feelings, and communicating both verbally and nonverbally.

Intrapersonal

- The ability to understand ourselves, who we are, and what makes us the way that we are. They recognize their own strengths and weaknesses and have a capacity for self-analysis, awareness of their inner feelings, desires and dreams, evaluating their thinking patterns and reasoning with themselves

Naturalistic intelligence

- It is the ability to recognize and categorize things. They are lovers of nature and see patterns on how nature works.

Thinking

Thinking is difficult to define. Everyday thinking does not require effort because we deal with the familiar, day-to-day routine. However, we engage effortful thinking when we work on puzzles, solve geometry problems, translate passages into another language, or write essays. Different problems require different ways of thinking. We make plans and predictions, and achieve complex goals because we carry out a sequence of actions in our mind before carrying them out. Thinking involves manipulating mental representation and prevents us from making a mistake (Robertson, 1999).

There are kinds of effortful thinking, however, that can help us navigate the world that offer us too much information. Creative thinking makes us produce something novel based on what we already know. Critical thinking requires reasoning and judgment to see a better picture of the information presented to us.

Creative thinking

- It may be defined as the production of effective novelty through the operation of our mental process (Halford, 2004). Creativity depends not only on our ability to do things but to represent what has been done. It depends on the procedural as well as declarative process. Boden (1996) suggests that creativity entails “breaking out” of old conceptual frameworks and creating new ones. To carry this out, we should know the rules under which we operate and at the same time, be able to articulate these rules and modify them.
- In creative thinking, one must be able to represent relations. A creative person can see relationships of things around. He can show things through art, music, dance and movement, and any other forms of creative activity. A person with creative thought is capable of carrying out an analogy. He can see how two different things relate with each other. A neurological basis of creativity is explained by a distinctive wave pattern using the computation approach of creativity (Dartnell, 2002).

Critical thinking

- It requires logic and coherence as we try to analyze, synthesize, evaluate, and interpret information rather than simply apply technical abilities (Andolina, 2001). In critical thinking, we try to evaluate whether we should be convinced that some claim is true or some argument is good. We also formulate good arguments as we evaluate ideas, information, and the sources that provide them. Then, we arrange this information in a coherent way by making connections to other ideas, considering alternative sources, and assessing their implications.
- Examples of exercises in critical thinking are looking for cause and effect and making generalizations. To determine cause and effect, we need to check possible unstated claims that are needed to establish the relationship between purported cause and purported effect in order to make the claim valid and strong. Cause precedes effect, if we make a mistake, then we reverse cause and effect. In making generalization, for instance, we claim something about a population based on our claims about a sample of cases, but sometimes, the general claim is already the conclusion or the whole argument. Thus, critical thinking is necessary to avoid such mistakes.

Reading and Writing

A. Four Macro skills in Communication

When we learn a language, there are 4 macro skills that we need for successful communication, these are reading, writing, speaking, and listening. We need to learn these 4 skills in order for us to communicate with other people. We usually listen first, then we will learn to speak, then we will learn how to read then write.

1. Listening
 - Process of using the sense of hearing, in order for the person to know what is happening around them. There are three types of listening
 - Passive: person listens to the speaker without any response at it.
 - Active: Person listens to the speaker while also acknowledging the information given by the speaker

- Competitive: person listens to the speaker in order to give their own opinion to the speaker
- 2. Speaker
 - Process of conveying a message to a receiver verbally, or a process where the listener applies to themselves the information they have heard.
 - A listener applies all the information he received while listening in order for him to communicate with other persons, or to share their feeling and thought with each other,
- 3. Reading
 - Process of analyzing symbols for you to understand the message conveyed by the sender. A person learns to read by memorizing the alphabets, analyzing the sounds per letter make and applying it in order for them to decode the message given to him by the sender.
 - It takes a lot of practice in order for an individual to decode the message given by the sender.
- 4. Writing
 - Takes time and practice for you to master the said skill. Can be practiced by knowing the strokes of each letter in the alphabet.
 - Is also a process in which a person can share their thoughts and feelings through symbols.
 - Can also be a tool to develop and strengthen human connections and the society.

B. Text: A connected discourse

Discourse

- Utterance, talk, speech, discussion, and conversation.
- An extended expression of thoughts or ideas.
- The ideas in discourse are not connected or do not have a particular structure.

Text

- A large unit of written language
- A group of ideas put together to make a point or one central idea
- Has a structure which requires the ideas in the discourse to be relevant to each other
- An actually connected discourse

Properties of a well-written text

1. Organization
 - Refers to the arrangement of ideas in a text
 - Creating an outline of ideas before you start writing can help your work become organized.
 - Outline: provides a format in which ideas can be arranged in a hierarchy - that is, it distinguishes the general ideas from the specific or subordinating ideas
2. Coherence and cohesion
 - Refer to the connection of ideas and connection between sentences and between paragraphs
 - In order for you to assure coherence and cohesion, you need to use transitional or cohesive devices
3. Appropriate language use
 - Refers to the acceptable style of language for a particular form of text
4. Proper mechanics
 - Refers to the conventions of writing which includes capitalization, punctuation, spelling, numerals, abbreviations, acronyms and contractions

Words

Morphology

- The study of words, how they are formed, and their relationship to other words in the same language
- Analyzes the structure of words and parts of words, such as root words, prefixes, and suffixes

Morpheme

- The smallest grammatical unit in a language
 - Free morpheme
 - Can function independently as a word
 - Example: house, cat, blood
 - Bound morpheme
 - A word element attached to a root word (the main part of a word) to give it another meaning
 - Cannot function independently as a word
 - Example: affixes (prefixes and suffixes)
 - Affix: A morpheme that is attached to a root word to form a new word
 - Prefix: a morpheme that comes before a root word; Example: auto- (AUTObile)
 - Suffix: a morpheme that comes after a root word; Example: -ful (forgetFUL)
 - Two varieties of suffixes
 - Inflectional: modify the grammatical class of words by signaling a change in number, tense, degrees of comparison, and so on, but they do not shift the base form into another word class
 - Derivational: modify either the part of speech or the actual meaning of a word

Inflectional Morphemes	Added to	Examples
-s plural	Nouns	She got two guitars.
's possessive	Nouns	Zeynep's hair is too long.
-er comparative	Adjectives	Zeynep hair is longer than Derya.
-est superlative	Adjectives	Zeynep has the longest hair.
-s 3rd person singular present tense	Verbs	Zeynep plays the guitar.
-ed past tense	Verbs	She played the guitar at the party.
-ing progressive	Verbs	She is playing the guitar at the party.
-en past participle	Verbs	She has taken the guitar at the party.

Derivational Morpheme	Meaning	Examples
-al	relating to	formal, postal, practical
-less	without	homeless, hopeless
-ous	full of	famous, cautious
-hood	state, condition, quality	brotherhood, neighborhood

- ○ Compound words
 - Combination of two different words
 - Example: back+ward = backward

Context clues

Are words, phrases, and sentences that surround an unfamiliar word and help you recognize the meaning of an unknown word

1. Synonyms
 - Used when the text has words or phrases that are similar in meaning to the unknown word
 - Ex: The narrator in the poem was euphoric at his son's victory, for he cried out triumphantly when the boy came home. Euphoric - victorious; triumphant; very happy and excited
2. Antonyms
 - Words that reveal the opposite meaning in relation to the unknown word
 - Ex: Although Mary was willing to play in the snow, Jack was reluctant because he was so cold. Reluctant - not willing to do something
3. Examples
 - Specific details in a text that are used to clarify the meaning of a word
 - Ex: Projectiles include those items that are shot forward such as a cannon shell, bullet, or rocket. Projectiles - things (such as bullet or rocket) that are shot from weapon
4. Definition
 - Is usually signaled by a form of the verb to be (am, is, are, was, were) or by commas or dashes
 - Ex: The prisoner was in a state of wrath-a feeling of intense anger. Wrath - extreme anger
5. Explanation
 - Words or phrases that explain the unfamiliar word's meaning
 - Ex: An evanescent ring surrounded the moon as it rose. It was there for a moment, and then it disappeared. Evanescent - lasting a very short time; brief; momentarily

Simile and metaphor

Simile

- Identified by the use of "like", "as", "similar to", and the like. They compare dissimilar objects that share certain characteristics
- Ex. When he walked up into the room, the entire audience looked up, like flowers turning towards the sun.

Metaphor

- Directly refers to the object being described as being or previously being the object, it is compared or connected to
- Ex: The boom of his voice, all thunder and lightning, echoed through the entire hall.

Summing up

A text is a connected discourse, which means that all ideas in the text must be related in the sense that they would express only one main idea, or that the text must have unity by combining all ideas to emphasize central idea.

C. Techniques in organizing information

Techniques are approaches or methods you as a writer may use to organize the information you have gathered, to accomplish your desired aim in writing and to improve your writing craft

Basic techniques in organizing information

1. Brainstorming
 - It is a group creativity technique by which efforts are made to find a conclusion from a specific problem by gathering a list of ideas spontaneously contributed by its members
 - The term was popularized by Alec Faickney Osborn in the 1953 book "Applied Imagination" (Wikipedia.org). He developed this technique when he got frustrated that his employees could not come up with useful techniques as they worked individually
 - 4 Brainstorming tips suggested by March Nichol in daily writing tips
 - Cubing
 - In this strategy, a topic or idea is examined in 6 viewpoints
 - What is the topic? What is it like or unlike? What does it make you think of? What constituent parts is it made of? How can it be used? How can you support or oppose it?
 - Free writing
 - In this technique, just keep on writing and not minding errors in spelling and grammar. The objective here is to just write what comes to your mind. Have a quantitative goal like coming up with 500 words or more. Then review what you have written later and hopefully come up with a specific topic that would interest you.
 - c. Listing
 - List down what comes to your mind. If your intention is to come up with topic to write about, enumerate them. An important reminder in using this technique is not to list your ideas in an outline form because an outline will require you to organize items and your thoughts which is a principle contrary to brainstorming.
 - d. Mapping
 - Also known as clustering and webbing, is a graphic form of listing that simply involves jotting down ideas on a large writing surface and then making connections by associating similarly themed ideas with color-coded circles or underlines of distinct patterns and then indicating other relationships by linking with lines.
2. Graphic organizers
 - Also known as knowledge map, concept map, story map, cognitive organizer, advance organizer, or concept diagram, is a communication tool that uses visual symbols to express knowledge, concepts, thoughts and ideas and the relationship between them.
 - The main purpose of a graphic organizer is to provide a visual aid to facilitate learning and instruction (Wikipedia.org)

- It is easier for the writer to explain his/her ideas if s/he is able to present the graphic devices in such a way that can help others focus on the relationships of the ideas presented with other details.
- Types of graphic organizers which you can use in writing
 - Concept maps
 - Graphically illustrate relationships between two or more concepts and are linked by words to describe their relationships.
 - Webs
 - Shows how different categories of information relate to one another.
 - Mind maps
 - Visual representations of hierarchical information that include a central idea or image surrounded by connected branches of associated topics or ideas
 - Flow diagram/sequence chart
 - Shows a series of steps or events in the order in which they will take place. They can be used in outlining the events in the story, or showing a procedure in a scientific process.
 - Venn diagram
 - Is used to identify similarities and differences between two or more concepts
 - Organizational chart or diagram
 - A chart that shows the structures of an organization
 - Pie chart
 - It is a type of circular graph, which is divided into slices to illustrated a numerical proportion
 - Can also be a chart made of pies
 - Graph
 - A collection of all points whose coordinates satisfy a given relation. The most commonly used graphs are the line and bar graph.
 - Table
 - It is a systematic arrangement of data usually in rows and in columns for ready reference

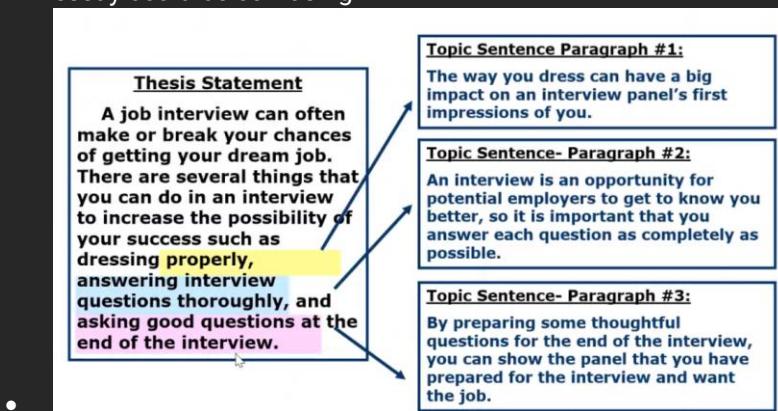
3. Outline

- Is the general plan of what you intend to write. In preparing the outline, you have to classify each information and its connection to your topic or subject. The sorted information may be grouped according to content. From this grouped information, you can already provide headings - main and subheadings - which are parallel in structure. In an outline, have at least two topics after each heading and two for the subheadings.
 - Topic outline
 - Is a form of outline that uses parallel phrases for the heading all throughout.
 - Sentence outline
 - Is a form of outline that uses sentences for the heading all throughout.
- Two formats of outlining
 - Number-letter format
 - It is the use of the number, then letter in an outline. You use the Roman numerals for the main heading. You start with Roman "I" for the heading, under are the subheadings or supporting details which are indented and are marked by capital letters. If there are subheadings under letter "A", indent further and use Arabic numbers "1" and so on. In case of information not as important as the subheading, indent and mark it with a small letter instead.
 - b. Decimal outline format

- Makes use of decimal numbers in place of the number-letters use. Arabic number "1" is used instead of Roman "I" for the main heading. Number "1.1" is used in case there is a subheading; number "1.2" if there is another subheading that follows it.
- Before you begin writing the first draft of your essay, it is best to make an outline.
- An outline is a general plan of what you are going to write.

Essay Outline

- | | | |
|------|---|--|
| I. | Introduction | Thesis: _____ |
| II. | Body Paragraph #1- Topic Sentence: _____ | A. supporting idea
B. supporting idea |
| III. | Body Paragraph #2- Topic Sentence: _____ | A. supporting idea
B. supporting idea |
| IV. | Body Paragraph #3- Topic Sentence: _____ | A. supporting idea
B. supporting idea |
| V. | Conclusion | |
- In a formal outline, Roman numerals can be used to represent paragraphs. Capital letters can be used to represent supporting details for the paragraphs.
 - To begin an outline, you need to start with your thesis statement. The thesis statement will be your guide throughout the process of writing your essay. From the thesis statement, you can begin writing the topic sentences for the body paragraphs in the outline.
 - The topic sentence for each body paragraph should support the thesis statement. The topic sentences need to agree with the main idea or subpoints in the thesis statement; otherwise, the essay could be confusing.



Example Outline	
<p>I. Introduction- Thesis Statement: A job interview can often make or break your chances of getting your dream job. There are several things that you can do in an interview to increase the possibility of your success such as, dressing properly, answering interview questions thoroughly, and asking good questions at the end of the interview.</p> <p>II. Body Paragraph #1:</p> <p>Topic Sentence: The way you dress can have a big impact on an interview panel's first impressions of you.</p> <ul style="list-style-type: none"> A. Men and women should consider wearing dark suits. B. Conservative dress will show the interview panel you are serious about what you do. C. Don't carry too many things into the interview. A notebook, pens, and/or laptop computer should be carried in a briefcase. D. Hair and nails should be clean and neat. <p>III. Body Paragraph #2:</p> <p>Topic Sentence: An interview is an opportunity</p>	<p>for potential employers to get to know you better, so it is important that you answer each question as completely as possible.</p> <ul style="list-style-type: none"> A. Ask interviewers to repeat questions you don't understand. B. Take some time to think about the questions before you answer. C. A notebook to write down key words in interview questions is sometimes helpful. <p>IV. Body Paragraph #3:</p> <p>Topic Sentence: By preparing some thoughtful questions for the end of the interview, you can show the panel that you have prepared for the interview and want the job.</p> <ul style="list-style-type: none"> A. Research the job and/or company before you go to the interview. B. The interview is your opportunity to get to know your potential employer. Ask questions about company goals, mission, expectations of employees, etc. C. Don't ask questions about benefits or salary during the interview. You should try to get this information before you apply for the job. <p>IV. Conclusion: Don't underestimate the importance of a good interview.</p>

D. Properties of a well-written text

Organization

Oneness in purpose and in content. This can be achieved by selecting materials wisely and carefully and by taking into consideration the following:

- a. The material must treat one thing at a time;
- b. Materials that belong to the same category are grouped together
- c. Target audience of your writing
- d. Flow of information
- e. Writing structure

Coherence and cohesion

It means the orderly arrangement of the sentences in the paragraph

- "Holding together" of the sentences
- Coherence and cohesion must come together, coherence means that all ideas in your writing flows together, which include developing and supporting arguments, organizing and clarifying ideas and synthesizing and integrating readers. On the other hand, cohesion focuses on the grammatical aspects of writing.

Use of language

Refers to the level of language and consideration for the colloquial terms that will be used sparingly. Colloquialism must be used towards the familiar terms, while informal language should be utilized to achieve clarity of the text.

Mechanics

Set of conventions on how to spell, abbreviate, punctuate, and capitalize.

Punctuation marks

Symbols that are used to gain declarative and comprehension of written language.

- Period (.) - used at the end of declarative and imperative sentences.
- Comma (,) - used to separate elements and set off an element.

- Question mark (?) - used at the end of a direct question.
- Apostrophe (') - usually together with -s to show possessive form of a noun or pronoun.
 - Used in place of letters omitted in contractions.
- Quotation marks ("") - used to enclose a direct quotation
 - Used to enclose titles of short works
- Hyphen (-) - used after prefixes such as ex-, all, self-.

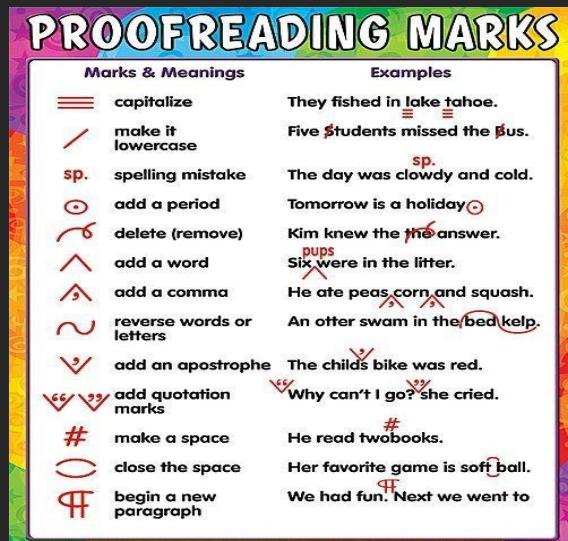
Capitalization

The action of writing in capital letters or with an initial capital.

- Capitalize the pronoun 'I'.
- Capitalize the first letter of the first word in sentences.
- Capitalize the proper nouns and proper adjectives. (Names of persons, places, things (brand names), days, months, planets...)
- Capitalize a title/abbreviation of a title used before a person's name.

Proofreading

Means examining the text carefully to find and correct typographical errors and mistakes in grammar, style, and spelling.



E. Patterns of development in writing

It is considered as techniques and principles that you can use to guide you based on your intentions.

Narration

- Tells a story or depicts a series of events, usually in chronological order. It is usually told in time sequence with a definite beginning, middle, and end.
- Uses the same elements found in a story: setting, characters, plot, POV, theme.
- The most common kind of transition used in narrative writing is the time relationship transition.
- Time relationship transition examples: after, first, next, once, second, soon, then, today, now, when, meanwhile, later, in the meantime, suddenly, in the beginning, since, lastly, soon, during, etc....

Example:

I had an enjoyable summer vacation this year since I filled each day with my favorite sports activities. On the first day, I went to the beach and swam, I got a wonderful sun tan. The next day, I went sailing with a friend. We took our lunch, and we anchored in an isolated cove for a swim in the late afternoon. On the third day, since it rained all day, I stayed inside the cabin and read a good book about my favorite sports star. On the fourth day, my friend and I rented a rubber raft and went down the river in it. We even capsized the raft and got soaking wet. On the last day, my friend and I decided to climb a mountain. We packed our lunch, and we ate as we sat on the top of the mountain while enjoying the view. After that, we went home exhausted but feeling satisfied.

Description

Creates a picture word. It aims to re-create an image of a person, a place, or a thing in the reader's mind. It "paints" either the external physical features or inner appearance (such as emotions) in any given subject.

Two types of description

- Objective - provides a factual picture of something (Ex. Water boiled at 100 degrees Celsius)
- Subjective - shares an impression or feeling (Ex. Water boiled angrily at 100 degrees Celsius)

When writing descriptive paragraphs, you should appeal to the reader's five senses: sight, smell, taste, touch, and hearing. You should also use vocabulary that clarifies your ideas, and colorful language such as specific nouns, and active and vigorous verbs. (Sorenson, 1994)

Example:

Sunset is the time of day when our sky meets the outer space solar winds. There are blue, pink, and purple swirls, spinning and twisting, like clouds of balloons caught in a blender. The sun moves slowly to hide behind the line of horizon, while the moon races to take its place in prominence atop the night sky. People slow to a crawl, entranced, fully forgetting the deeds that still must be done. There is a coolness, a calmness, when the sun does set.

Definition

Is said to be the most basic way to clarify or to explain things. It combines other methods of paragraph development such as giving examples and providing descriptions.

Example:

Deja vu is a French word meaning "already seen", it has also been described as a feeling or experience that one has seen or done something before. For example, you are waiting in line to check out at the grocery store and the lady behind you asks you to hand her a pack of gum. Suddenly, you get an overwhelming feeling that you have been there in that exact same spot, talking to the same lady, even the same brand of gum. Even though everything seems so familiar you know there is no way that could have happened before. There are many theories as to why and how this phenomenon happens. One theory is that Deja vu is connected with temporal-lobe epilepsy, but people without a history of epilepsy have also experienced Deja vu. Psychiatrists believe it is something in your brain that confuses an event that happened in the past with the present. Another theory is parapsychologists think it is connected with past life experiences. Whether Deja vu is an experience of the paranormal or simply some confusion in the brain, it is a perplexing feeling of having "already seen."

Classification/exemplification

It refers to categorization. It divides the subject into parts; classification by dividing means looking at the parts of a subject in order to understand the subject as a whole.

Example:

There are three kinds of law that make men and society good. These are the Divine Law of God, the Natural Law of Human Beings and the Human Law of Society. First, the Divine Law is eternal law of God. It is the divine wisdom that dictates all our acts and movements in life. Second, Natural Laws of human beings are reflected in the human awareness of God's Law conducting the areas of human life and interpretation of God's Law in the natural law of life. Third, Human Laws, which are laws of our society, government, and community, compromise our civil laws. International laws and national laws. Ultimately, good Human laws are derived from the Natural Law of intelligent and morally upright human beings, and from the Divine Law of God.

Comparison and contrast

Comparison attempts to help the reader understand a new concept by likening it to one that the reader already knows. Contrast may be used to explain how the new concept is different from the old one, how it has its own identity.

Example:

Oceans and lakes have much in common, but they are also quite different. Both are bodies of water, but oceans are very large bodies of salt water, while lakes are much smaller bodies of fresh water. Lakes are usually surrounded by land, while oceans are what surround continents. Both have plants and animals living in them. The ocean is home to the largest animals on the planet, whereas lakes support much smaller forms of life. When it is time for a vacation, both will make a great place to visit and enjoy.

Cause and effect

A cause tells us the reason why something happened while an effect tells us the results. A topic for a cause-effect paragraph starts with a situation or condition.

In writing this type of paragraph, a writer may be guided by the following questions in order to gather the needed information.

Causes

- What are the obvious causes?
- Are there any hidden causes?
- Is there a main or most important cause?
- What is the most recent cause?

Effects

- What are the obvious effects?
- Are there any hidden effects?
- What effects might occur in the future?

Example:

I do well in school, and people think I am smart because of it. But it's not true. In fact, three years ago I struggled in school. However, two years ago I decided to get serious about school and made a few changes. First, I decided I would become interested in whatever was being taught, regardless of what other people thought. I also decided I would work hard every day and never give up on any assignment. I decided to never, never fall behind. Finally, I decided to make school a priority over friends and fun. After implementing these changes, I became an active participant in classroom discussions. Then my test scores began to rise. I still remember the first time that someone made fun of me because "I was smart." How exciting! It seems to me that being smart is simply a matter of working hard and being interested. After all, learning a new video game is hard work even when you are interested. Unfortunately, learning a new video game doesn't help you get into college or get a good job.

Problem - solution

It is a method of analyzing and writing about a topic by identifying a problem and proposing one or more solutions.

Example:

People often install a kitty door, only to discover that they have a problem. The problem is their cat will not use the kitty door. There are several common reasons why cats won't use kitty doors. First, they may not understand how a kitty door works. They may not understand that it is a little doorway just for them. Second, many kitty doors are dark and cats cannot see to the other side. As such, they can't be sure of what is on the other side of the door, so they won't take the risk. One last reason cats won't use kitty doors is because some cats don't like the feeling of pushing through and then having the door drag across their back. But don't worry—there are solutions to this problem.

The first step in solving the problem is to prop the door open with tape. This means your cat will now be able to see through to the other side; your cat will likely begin using the kitty door immediately. Once your cat has gotten used to using the kitty door, remove the tape. Sometimes cats will continue to use the kitty door without any more prompting. If this does not happen, you will want to use food to bribe your cat. When it's feeding time, sit on the opposite side of the door from your cat and either click the top of the can or crinkle the cat food bag. Open the door to show your cat that it is both you and the food waiting on the other side of the door. Repeat this a couple times, and then feed your cat. After a couple days of this, your kitty door problem will be gone.

Persuasive paragraphs

Are paragraphs that try to convince the reader to agree with something. They are aimed to persuading the reader into taking a particular action or adopting a certain point of view. They should be devoid of descriptive content and rely on the imperative mode instead.

Example:

The school fair is right around the corner, and tickets have just gone on sale. We are selling a limited number of tickets at a discount, so move fast and get yours while they are still available. This is going to be an event you will not want to miss! First off, the school fair is a great value when compared with other forms of entertainment. Also, your ticket purchase will help our school, and when you help the school, it helps the entire community. But that's not all! Every ticket you purchase enters you in a drawing to win fabulous prizes. And don't forget, you will have mountains of fun because there are acres and acres of great rides, fun games, and entertaining attractions! Spend time with your family and friends at our school fair. Buy your tickets now!

F. Implicit and explicit claims & types of claims

Implicit claims

- Completely clear and includes details
- Directly stated and spelled out
- To fully and clearly express something, leaving nothing implied
- Example: If you don't show more appreciation, I'll review my options.

Explicit claims

- Implied or understood
- Not stated directly but implied or hinted at
- Indirect

- Example: If you don't give me a pay rise, I'll leave this place you call your office wonderland.

Types of claims

1. Claim of fact
 - Asserts an empirical truth (verifiable truths)
 - Determined carefully observation of past, present, and future
 - Example: Excessive consumption of alcohol can lead to many illnesses. Obesity can cause heart disease
2. Claim of policy
 - Asserts action should be taken
 - Keywords: "should", "ought", "must"
 - Example: To attract more nontraditional students, this college must review and revise its course offerings. The government should create more jobs for Filipinos.
3. Claim of value
 - Also known as "claim of judgement"
 - Asserts judgment by defending one side of comparing two terms
 - Keywords: good, well, better, useful, kind, desirable, etc.
 - Example: Honesty is the best policy. Apples is the most nutritious fruit, for one apple a day keeps the doctors away.

G. Context of Text Development

Context is defined as the social, cultural, political, historical, and other related circumstances that surround the text and from the terms from which it can be better understood and evaluated

In discovering a text's context, you may ask questions like:

- When was the work written?
- What were the circumstances that produced it?
- What issues deal with it?

Intertextuality

Intertextuality is the modeling of a text's meaning by another text. It is defined as the connections between language, images, characters, themes, or subjects depending on their similarities in language, genre or discourse.

This view recognizes that the text is always influenced by previous texts.

A text contains many layers of accumulated, cultural, historical, and social knowledge, which continually adds to and affects one another

The function and effectiveness of intertextuality can often depend quite a bit on the reader's prior knowledge and understanding before reading the secondary text; parodies and allusions depend on the reader knowing what is being parodied or alluded to.

The definition of intertextuality was created by French semiotician Julia Kristeva in the 1960s. She created the term from the Latin word *intertexto*, which means "to intermingle while weaving".

Kristeva argued that all works of literature being produced contemporarily are intertextual with the works that came before it.

In other words, any text is considered a work of intertextuality because it builds on the structures that existed before it.

Common examples of intertextuality

1. He was lying so obviously; you could almost see his nose growing.
2. He's asking her to the prom. It's like a happy version of Romeo and Juliet
3. It's hard being an adult! Peter Pan had the right idea.

Hypertextuality

Text displayed on a computer display or other electronic devices with references (hyperlinks) to other text that the reader can immediately access which are typically can be activated by a mouse click.

Selecting a piece of hypertext can take you to more hypertext, books, movies, sounds and images.

When you type the link of the website you would like to quickly send the reader. Hyperlink looks like this: www.google.com or "Facebook" that links to the Facebook page.

The most implementation of hypertext is World Wide Web. Basically, any text you can click in World Wide Web is Hypertext.

World Wide Web (www) is a global hypertext system of information residing on servers linked across the internet.

On clicking these links, you can move to different pages and even move to different pages of other files as well. Cursors changes to a hand while hovering over a hyperlink. On clicking the link, the corresponding page opens up.

H. Forming Evaluative Statements

Evaluative statement

A statement that presents a value of judgment on a set of criteria

It is a way of giving a better explanation to show the strengths and the weaknesses of something through writing.

How to form evaluative statements

Formulate assertions about the content and the properties of a text you have read

- Assertions: these are statements used to make a declaration or to express strong belief on a particular topic.
- Types of assertion
 - Fact: statement that can be proven objectively by direct experiences, testimonies or witnesses, verified observations, or the results of researches

- Example: The roots of sampaguita are used for medicinal purposes such as an anesthetic and a sedative
- Convention: A statement that can be verified by reference to historical precedent, laws, rules, usage, and customs; may be verified by dictionaries and encyclopedias
 - Example: The sampaguita belongs to the genus jasminum of the family Oleaceae
- Opinion: Based on facts, but is difficult to objectively verify because of the uncertainty of producing satisfactory proofs of soundness
 - Example: The popularity of sampaguita flowers is most evident in places of worship
- Preference: based on personal choice; therefore, they are subjective and cannot be objectively proven or logically attached
 - Example: Sampaguitas are the most beautiful and most fragrant of all flowers

Formulating meaningful counterclaims in response to a claim made in the text read

- Claim: main argument of the text; a sentence that summarizes the most important thing that the writer wants to say as a result of his/her thinking, reading, or writing
- A claim persuades, argues, convinces, proves, or provocatively suggests something to a reader who may or may not initially agree with you.
- Characteristics of a good claim
 - Argumentative and debatable
 - Specific and focused
 - Interesting and engaging
 - Logical
- Determining the writer's claim
 - What is the author's main point?
 - What is the author's position?
- Opinion vs claim
 - Opinion: supported by more opinion
 - Example: Fudgee bars are delicious
 - Claim: supported by evidence, which can be debated or challenged. Addresses the "so what" questions
 - Fudgee bars taste better than other snack cakes because of their texture, their creamy filling, and their golden appearance

I. Purposeful Writing in the Disciplines and for Professions

Standard parts of a letter

1. Heading
- Should contain the return address (usually written 2 or 3 lines, followed with the date on the last line)
 - May be optional in case a letterhead is available
 - Avoid writing any abbreviation (spell out words like street, avenue, or boulevard)

- An optional line for the contact number, fax, and email address may be included
 - A space is required before the date line
2. Recipient's address
 - Name of the recipient
 - Leave enough space for the recipient's address before the situation
 3. Salutations
 - A greeting usually begins with a word "Dear," followed by the name and title of the addressee
 - Use the last name of the person (Dear Mr. Cruz)
 - If the gender is unknown, you may address him by his title or position in the company (Dear Hiring Manager or Dear Sir/Madam)
 - Leave space before the body of the letter
 4. Body
 - It contains the main text or message written
 - Begin with a short introduction, follow it up with full message
 - Provide other details in your letter
 - Thank the recipient and ask for some kind of action to be taken
 - Put a space before the closing line
 - Parts of a letter remains the same, but its body differs on its purpose
 5. Complimentary close
 - Leave a space before writing the words "Sincerely, Regards, and Yours," among others, and end it with a comma
 6. Signature line
 - Skip 2 to 4 spaces before typing in your full name, including your middle initial, and follow it with a title (optional) (Jane de la Cruz, MA, Ed.)
 - Affix your signature in blue or black ink directly above the signature line (this line is always aligned with the heading)
 7. Enclosure (optional)
 - If there will be any document included, it should be indicated under this title and written as enclosures
 - Indicate the name of each document to be included

Standard formats in writing a letter

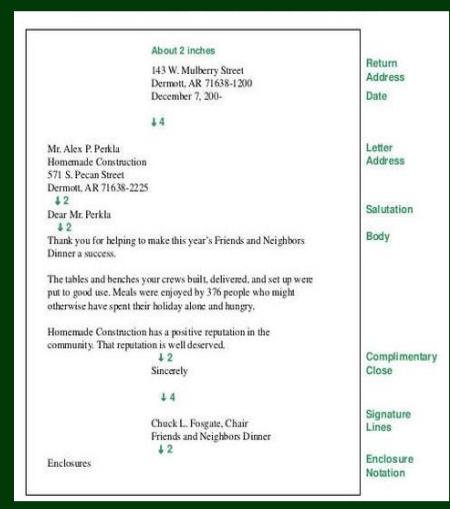
Block style

- All the sections of the letter begin on the left margin or are left justified, and has a single space, except in between parts and paragraphs. This is the most common of all the styles



Modified block style

- This style is as popular as the block style, but the difference is it has the author's address, date of writing, and closing in the center point of the page line



Applying for college admission

It is a necessity for you to fit in the school environment where you will be studying for the next 4 years or so in order for you to grow further. Your plans can be guided by a checklist for you to complete all the tasks needed for college education.

The following are some tips you can take into consideration if you want to have greater chances in getting admitted into college.

- Make a list of your prospective colleges and universities
- Read thoroughly the syllabus and brochures provided by your chosen colleges or universities in order to know the variety of courses they offer
- Reach or exceed the GPA or grade point average required by the school you are aiming to enroll in
- Prepare a letter of recommendation from your adviser or principal in the high school where you graduated from. It may come in the form of a certification for Good Morals and Right Conduct
- You must complete and submit all application forms needed for your application
- You must pass the entrance exam or admission test required by the school or university first to be accepted
- Be ready for essay-type tests, which are sometimes given as part of the admission requirements (Vocabulary and grammar will be challenged)
- Expect and prepare for interviews
- There is a possibility that you will be asked to submit a written application letter
- A curriculum vitae (CV) is required in some courses. Write a letter of intent which narrates some background pertinent to your application

Letter of intent

Your main goal in writing this letter is to express your intention for dealing with a particular organization or institution. Here are some important points that you may include in your letter.

Note the goals and directions that you would like to take

- Indicate why you belong in your prospective school according to their mission and vision
- Include strong evidences or proof of your diligence and hard work in school. Mention your academic achievements
- Mention your interests and advocacies, as well as your extracurricular and community activities to show your participation in good causes

Resume

It is of French origin meaning "summary". It is a brief summary of skills, and your academic and work background. The resume is a tool that employers require to help them choose who they should hire for a vacancy in their company

As the famous saying goes, "first impression lasts," so it is important to make your resume strong and impressive to be remembered by the interviewer in a positive light

You need to provide details and information in the right places, specifically your skills pointing out to your strengths. The resume's task is to get your prospective employer's interest and to keep that interest strong until you get accepted. It is through your resume's that your education and work experiences will be highlighted, which will convince your prospective employer that you possess the necessary background and intellect that would make you fit for your desired job position.

Parts of a resume

- Personal information

- Includes the name, address, zip code, mobile phone number, telephone number, email address, formal picture (2x2)
- Objective
 - This is where you will mention what you are trying to accomplish in your career life. If you are aiming for a particular position in the company, you may add your formal objective statement particularly referring to the job opening.
- Work history
 - This section should include your work experiences for which you were paid. Include both full time and part time jobs, internships, and even projects for which you have been a part of. It has to be structured carefully, with your most recent work experience on the top.
- Educational background
 - Include here your school or university name, location, awards, achievements, prominent positions held while earning a degree, and certifications. List them in chronological order
- Interests, hobbies, and advocacies
 - This section is where the applicant states what he does during his spare time, what hobbies he engages in, what his affiliations are, and his participations in social and community activities
- Other relevant data/training and seminar
 - This indicates if one had any professional training in other areas of specialty

Dos and don'ts in resume writing

- Do use a sensible email like jdlacrus@yahoo.com instead of bhoxzmaster@yahoo.com
- Do highlight your strengths to promote yourself
- Do attach a cover letter for hand-carried or emailed resume
- Do update your resume regularly
- Do not put I's in your resume
- Do not abbreviate
- Do not add a date; place it instead on the cover letter

Cover letter

Accompanies the resume is the cover letter. It is another document that can highlight one's strengths and abilities further. It provides added emphasis and seals good points about you as an applicant. A cover letter is just a one-page attachment to either a resume or curriculum vitae. It addresses the employer's requirements and explains how fit you are for the job you are applying for.

First paragraph

- Should contain the introduction
- Should say where or how you found out about the job opening, Mention any referrals
- This should grab the attention of your employer
- You may give details about the company that sparked your interest

- You may present your core competencies that encourage you to apply for that certain job in the company

Second paragraph

- Should contain the detailed support or evidence why you are qualified to apply for that certain job in company
- Part where you need to hook your reader
- This serves as your brief pitch so you may include proposals or project you have been involved in
- You may cite improvements, achievements, and events that transpired in your life recently
- Make your cover letter strong and assertive

Third paragraph

- Should show your knowledge about the company you are applying to
- A summary of your skills and abilities, and explanation of how you can be an asset to the company
- Indicate in your letter the possible ways on how and where they can reach you

External Links

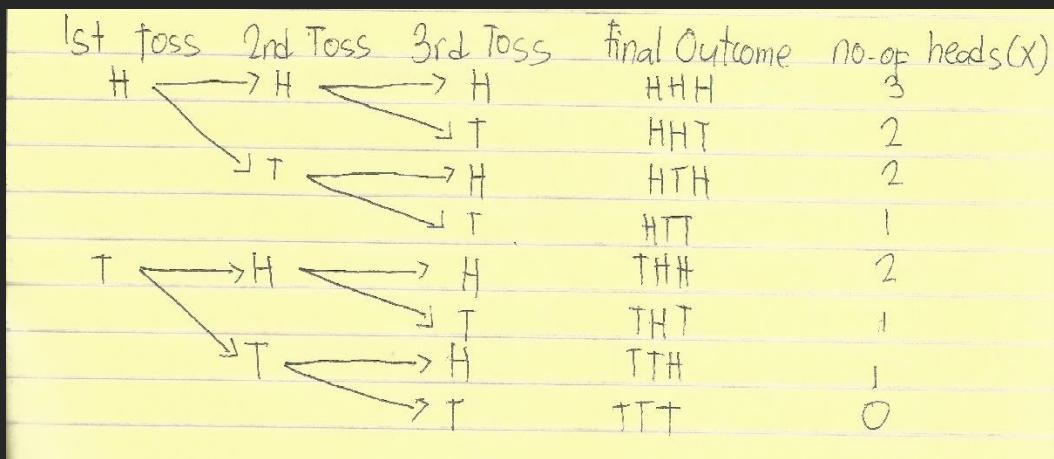
Text: A connected discourse	https://www.slideshare.net/mobile/tinelachica04/readinglesson-2-text-as-connected-discourse
Techniques in organizing information	https://www.slideshare.net/mobile/marykatrinebelino/techniques-in-organizing-information

Statistics

A. Discrete probability distribution

Random Variable

- A random variable is a variable whose possible values are determined by chance.
- A random variable is typically represented by an uppercase letter, usually X , while its corresponding lowercase letter in this case, x , is used to represent one of its values.
- Example: A coin is tossed thrice. Let the variable X represent the number of heads that result from this experiment.



- The value of the variable can X be 1, 2, or 3. Then in this example X is a random variable.
- The sample space for the possible outcomes is $S = \{HHH, HHT, HTH, HTT, THH, THT, TTH, TTT\}$

Discrete and continuous

Random variables can either be discrete or continuous.

	Discrete Random Variable	Continuous Random Variable
	Finite (countable number)	Infinite (these values are often result of measurements.)
Examples	Number of students randomly selected to be interviewed by a researcher.	The weights in kilograms of randomly selected students.
	Number of left-handed teachers randomly selected in a faculty room.	The lengths in centimeters of randomly selected shoes of senior students.
	Number of defective light bulbs among the randomly selected light bulbs.	The hourly temperature last Sunday.
	Number of women randomly selected in a political rally.	The heights of daisy plants in the backyard.

Discrete probability distribution

A discrete probability distribution is made up of discrete variables. Specifically, if a random variable is discrete, then it will have a discrete probability distribution.

The discrete probability distribution can be presented in tabular, graphical, or formula form.

The following properties must both be satisfied before a distribution can be considered a discrete probability distribution.

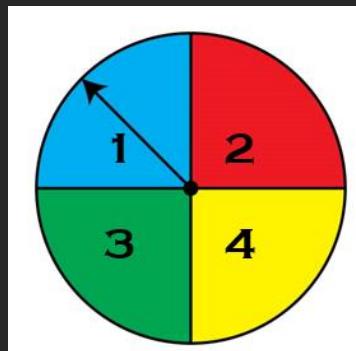
- The probability of each value of a discrete random variable is between 0 and 1 inclusive.

$$0 \leq P(x) \leq 1$$

- The sum of all possibilities is 1.

$$\sum P(x) = 1$$

Example 1: The given spinner is divided into four sections. Let X be the score where the arrow will stop (numbered as 1, 2, 3, and 4, in the drawing below).



- a.) Find the probability that the arrow will stop at 1, 2, 3, and 4.
 b.) Construct the discrete probability distribution of the random variable X.

a.) Find the probability that the arrow will stop at 1, 2, 3, and 4.

To find the probability of an event, use this formula:

$$P(E) = \frac{\text{Number of favorable outcome}}{\text{Total number of favorable outcome}}$$

- Ang kapalit ng E ay ang number na pwedeng pag-tigilan ng arrow sa wheel. Kung hahanapin ang probability na titigil ang arrow sa number 1, and magiging kapalit ng E ay 1.
- Ang number of favorable outcomes ay ang bilang ng 1 sa wheel. In this case, isa lang.
- Ang total number of favorable outcome ay ang bilang ng lahat ng pwedeng pag-tigilan ng arrow sa wheel. In this case, apat.

$$P(1) = \frac{1}{4}$$

$$P(2) = \frac{1}{4}$$

$$P(3) = \frac{1}{4}$$

$$P(4) = \frac{1}{4}$$

Check if both properties are satisfied.

1. Are all probabilities between 0 and 1? $\frac{1}{4}$ is 0.25, so it is between 0 and 1. ✓

2. Is the sum of all probabilities equal to 1? $\frac{1}{4} + \frac{1}{4} + \frac{1}{4} + \frac{1}{4} = 1$. ✓

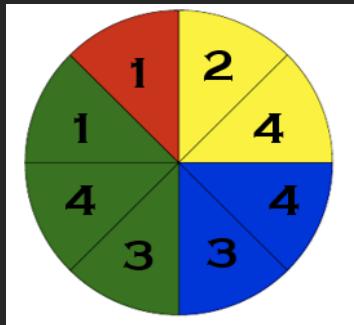
If both conditions are met, then it is a discrete probability distribution.

Since both conditions are met, then it is a discrete probability distribution.

b.) Construct the discrete probability distribution of the random variable X.

x	1	2	3	4
P(x)	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$

Example 2: The spinner below is divided into 8 sections. Let X be the score where the arrow will stop (numbered as 1, 2, 3, and 4) in the drawing below.



- a.) Find the probability that the arrow will stop at 1, 2, 3, and 4.
 b.) Construct the discrete probability distribution of the random variable X.

a.) Find the probability that the arrow will stop at 1, 2, 3, and 4.

To find the probability of an event, use this formula:

$$P(E) = \frac{\text{Number of favorable outcome}}{\text{Total number of favorable outcome}}$$

$P(1) = \frac{2}{8} \rightarrow \frac{1}{4}$	$P(2) = \frac{1}{8}$	$P(3) = \frac{2}{8} \rightarrow \frac{1}{4}$	$P(4) = \frac{3}{8}$
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Check if both properties are satisfied.

1. Are all probabilities between 0 and 1? All probabilities are between 0 and 1. ✓

2. Is the sum of all probabilities equal to 1? $\frac{1}{4} + \frac{1}{8} + \frac{1}{4} + \frac{3}{8} = 1$. ✓

Since both conditions are met, it is a discrete probability distribution.

b.) Construct the discrete probability distribution of the random variable X.

x	1	2	3	4
P(x)	$P(1) = \frac{1}{4}$	$P(2) = \frac{1}{8}$	$P(3) = \frac{1}{4}$	$P(4) = \frac{3}{8}$

B. Mean, variance, and standard deviation of a discrete random variable

Mean	Variance	Standard deviation
<ul style="list-style-type: none"> The average of the numbers Expected value $E(x)$ or μ 	<ul style="list-style-type: none"> Measures the average degree from which each point differs from the mean σ^2 	<ul style="list-style-type: none"> The measure of dispersion of a set of data from its mean σ

Mean

The mean of a discrete random variable is computed using this formula:

$$E(X) = \sum [xP(x)]$$

"The summation of the product of the value of the random variable and the probability of the given outcome."

Where:

X	x	P(x)
Discrete random variable	Outcome/value of the random variable	Probability of the outcome x

Example 1: A researcher surveyed the households in a small town. The random variable X represents the number of college graduates in the households. The probability distribution of X is shown below:

x	0	1	2
P(x)	0.25	0.50	0.25

Find the mean or expected value of X.

Solution:

x	P(x)	xP(x)	
0	0.25	0	
1	0.50	0.50	
2	0.25	0.50	
$\sum [xP(x)] = 1.00$			The expected value is 1. So, the average number of college graduates in the household of the small town is 1.

- Multiply x to P(x). $0 \times 0.25 = 0$; $1 \times 0.50 = 0.50$; $2 \times 0.25 = 0.50$.
- Add all of xP(x) together. $0 + 0.50 + 0.50 = 1$.

Example 2: A random variable X has this probability distribution. Calculate the expected value.

x	1	2	3	4
P(x)	0.10	0.20	0.45	0.25

Solution:

x	P(x)	xP(x)	
1	0.10	0.10	
2	0.20	0.40	
3	0.45	1.35	
4	0.25	1.00	
	$\sum [xP(x)] = 2.85$		The expected value is 2.85.

Example 3: A security guard recorded the number of people entering the bank every hour during one working day. The random variable X represents the number of people who entered the bank. The probability distribution of X is shown below. What is the expected number of people who enters the bank every hour?

X	0	1	2	3	4	5
P(x)	0	0.1	0.2	0.4	0.2	0.1

Solution:

x	P(x)	xP(x)	
0	0	0	
1	0.1	0.1	
2	0.2	0.4	
3	0.4	1.2	
4	0.2	0.8	
5	0.1	0.5	
		$\sum [xP(x)] = 3$	

The expected value is 3. Therefore, the average number of people entering the bank every hour during that working day is three.

Example 4: A random variable X has this probability distribution. Let $X = 1, 2, 3, 4, 5$ and 6 . Find the expected value.

Since there is no table given, we will have to find P(x) ourselves. Use this formula:

$$P(E) = \frac{\text{Number of favorable outcome}}{\text{Total number of favorable outcome}}$$

$P(1) = \frac{1}{6}$	$P(2) = \frac{1}{6}$	$P(3) = \frac{1}{6}$	$P(4) = \frac{1}{6}$	$P(5) = \frac{1}{6}$	$P(6) = \frac{1}{6}$
----------------------	----------------------	----------------------	----------------------	----------------------	----------------------

x	P(x)	xP(x)	
1	$\frac{1}{6}$	$\frac{1}{6}$	
2	$\frac{1}{6}$	$\frac{2}{6}$	
3	$\frac{1}{6}$	$\frac{3}{6}$	
4	$\frac{1}{6}$	$\frac{4}{6}$	
5	$\frac{1}{6}$	$\frac{5}{6}$	
6	$\frac{1}{6}$	$\frac{6}{6}$	
		$\sum [xP(x)] = 3.5$	

The expected value is 3.5.

Variance and Standard Deviation

The variance is computed using this formula:

$$\sigma^2 = \sum [(x - \mu)^2 P(x)]$$

"The sum of the product of the difference of the square of the outcome and the population mean and the probability of the outcome."

Where:

x	μ	$P(x)$
Outcome	Population mean	Probability of the outcome

The larger the value of the variance, the farther are the values of X from the mean.

The standard deviation is computed using this formula

$$\sigma = \sqrt{\sum [(x - \mu)^2 P(x)]}$$

"The square root of the sum of the product of the difference of the square of the outcome and the population mean and the probability of the outcome."

Where:

x	μ	$P(x)$
Outcome	Population mean	Probability of the outcome

It is the square root of the variance.

Example 1: Determine the variance and the standard deviation of the following probability mass function.

X	$P(x)$
1	0.15
2	0.25
3	0.30
4	0.15
5	0.10
6	0.05

Step 1: Find the expected value

x	$P(x)$	$xP(x)$			
1	0.15	0.15			
2	0.25	0.50			
3	0.30	0.90			
4	0.15	0.60			
5	0.10	0.50			
6	0.05	0.30			
		$\sum [xP(x)] = 2.95$			

Step 2: Subtract x to μ .

X	$P(x)$	$xP(x)$	$x - \mu$		
1	0.15	0.15	$1 - 2.95 = -1.95$		
2	0.25	0.50	$2 - 2.95 = -0.95$		
3	0.30	0.90	$3 - 2.95 = 0.05$		
4	0.15	0.60	$4 - 2.95 = 1.05$		

5	0.10	0.50	$5 - 2.95 = 2.05$		
6	0.05	0.30	$6 - 2.95 = 3.05$		
$\sum [xP(x)] = 2.95$					

Step 3: Square the results of $x - \mu$.

X	P(x)	xP(x)	$x - \mu$	$(x - \mu)^2$	
1	0.15	0.15	$1 - 2.95 = -1.95$	3.8025	
2	0.25	0.50	$2 - 2.95 = -0.95$	0.9025	
3	0.30	0.90	$3 - 2.95 = 0.05$	0.0025	
4	0.15	0.60	$4 - 2.95 = 1.05$	1.1025	
5	0.10	0.50	$5 - 2.95 = 2.05$	4.2025	
6	0.05	0.30	$6 - 2.95 = 3.05$	9.3025	
$\sum [xP(x)] = 2.95$					

Step 4: Multiply $(x - \mu)^2$ with P(x)

x	P(x)	xP(x)	$x - \mu$	$(x - \mu)^2$	$(x - \mu)^2 P(x)$
1	0.15	0.15	$1 - 2.95 = -1.95$	3.8025	0.570375
2	0.25	0.50	$2 - 2.95 = -0.95$	0.9025	0.225625
3	0.30	0.90	$3 - 2.95 = 0.05$	0.0025	0.000750
4	0.15	0.60	$4 - 2.95 = 1.05$	1.1025	0.165475
5	0.10	0.50	$5 - 2.95 = 2.05$	4.2025	0.420250
6	0.05	0.30	$6 - 2.95 = 3.05$	9.3025	0.465125
$\sum [xP(x)] = 2.95$					

Step 5: Find the sum of all the results of $(x - \mu)^2 P(x)$

x	P(x)	xP(x)	$x - \mu$	$(x - \mu)^2$	$(x - \mu)^2 P(x)$
1	0.15	0.15	$1 - 2.95 = -1.95$	3.8025	0.570375
2	0.25	0.50	$2 - 2.95 = -0.95$	0.9025	0.225625
3	0.30	0.90	$3 - 2.95 = 0.05$	0.0025	0.000750
4	0.15	0.60	$4 - 2.95 = 1.05$	1.1025	0.165475
5	0.10	0.50	$5 - 2.95 = 2.05$	4.2025	0.420250
6	0.05	0.30	$6 - 2.95 = 3.05$	9.3025	0.465125
$\sum [xP(x)] = 2.95$					$\sum [(x - \mu)^2 P(x)] = 1.8475$

The variance is the value of $\sum[(x - \mu)^2 P(x)]$. In this case, 1.8475. Therefore,

$$\sigma^2 = 1.8475 \approx 1.85$$

Step 6: To get the standard deviation, square root the variance.

$$\sigma = \sqrt{1.8475} = 1.359227$$

$$\sigma = 1.359227 \approx 1.36$$

Example 2: Determine the variance and the standard deviation of the following probability mass function.

X	P(x)

0	0.1
1	0.2
2	0.3
3	0.3
4	0.1

x	P(x)	xP(x)	$x - \mu$	$(x - \mu)^2$	$(x - \mu)^2 P(x)$
0	0.1	0	-2.1	4.41	0.441
1	0.2	0.2	-1.1	1.21	0.242
2	0.3	0.6	-0.1	0.01	0.003
3	0.3	0.9	0.9	0.81	0.243
4	0.1	0.4	1.9	3.61	0.361
$\sum [xP(x)] = 2.1$			$\sum [(x - \mu)^2 P(x)] = 1.29$		
$\sigma^2 = 1.29$			$\sigma = 1.14$		

C. Normal Distribution

Areas under the normal curve

Areas Under the Standard Normal Curve Table

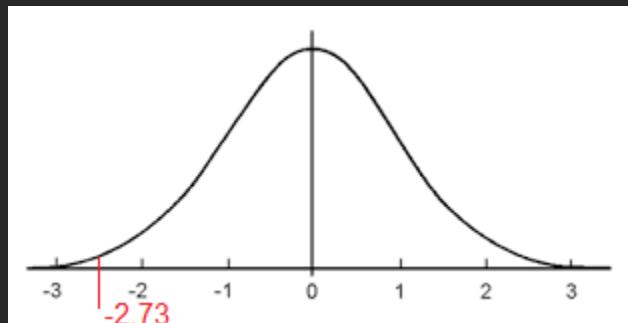
This table shows the standard normal area between 0 and z .

Example: $p(0 < z < 1.93) = 0.4732$

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0753
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
0.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
0.5	.1915	.1950	.1985	.2019	.2054	.2088	.2123	.2157	.2190	.2224
0.6	.2257	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2517	.2549
0.7	.2580	.2611	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852
0.8	.2881	.2910	.2939	.2967	.2995	.3023	.3051	.3078	.3106	.3133
0.9	.3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389
1.0	.3413	.3438	.3461	.3485	.3508	.3531	.3554	.3577	.3599	.3621
1.1	.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	.3810	.3830
1.2	.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3980	.3997	.4015
1.3	.4032	.4049	.4066	.4082	.4099	.4115	.4131	.4147	.4162	.4177
1.4	.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306	.4319
1.5	.4332	.4345	.4357	.4370	.4382	.4394	.4406	.4418	.4429	.4441
1.6	.4452	.4463	.4474	.4484	.4495	.4505	.4515	.4525	.4535	.4545
1.7	.4554	.4564	.4573	.4582	.4591	.4599	.4608	.4616	.4625	.4633
1.8	.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	.4699	.4706
1.9	.4713	.4719	.4726	.4732	.4738	.4744	.4750	.4756	.4761	.4767
2.0	.4772	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4812	.4817
2.1	.4821	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857
2.2	.4861	.4864	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4925	.4927	.4929	.4931	.4932	.4934	.4936
2.5	.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952
2.6	.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964
2.7	.4965	.4966	.4967	.4968	.4969	.4970	.4971	.4972	.4973	.4976
2.8	.4974	.4975	.4976	.4977	.4977	.4978	.4979	.4979	.4980	.4981
2.9	.4981	.4982	.4982	.4983	.4984	.4984	.4985	.4985	.4986	.4986
3.0	.4987	.4987	.4987	.4988	.4988	.4989	.4989	.4989	.4990	.4990
3.1	.4990	.4991	.4991	.4991	.4992	.4992	.4992	.4992	.4993	.4993
3.2	.4993	.4993	.4994	.4994	.4994	.4994	.4994	.4995	.4995	.4995
3.3	.4995	.4995	.4995	.4996	.4996	.4996	.4996	.4996	.4996	.4997
3.4	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4998
3.5	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998

Case 1: Negative Z value to the left

Example 1: $z = -2.73$



Step 1: Locate -2.73 on the distribution curve

Step 2: Look for the area of -2.73 on the "Areas under the normal curve" table.

$Z = -2.73 \rightarrow$ On the leftmost column look for $2.7 \rightarrow$ On the first row look for $.03 \rightarrow$ Where the two intersects is the area. In this case, .4968.

Step 3: Look at the distribution curve. Kapag shinadeden ba ang left side ng -2.73 ay lalampas sa boundary (line sa 0)? In this case, it does not collide with the boundary. Subtract 0.4968 to 0.5.

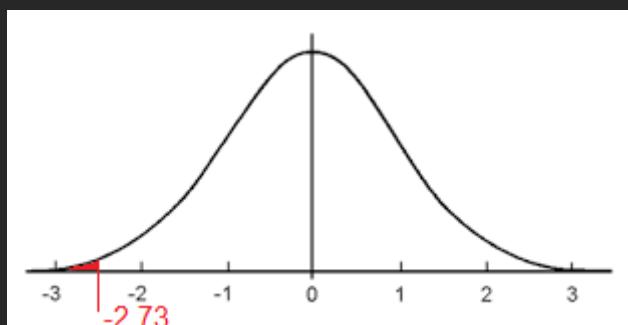
$$0.5 - 0.4968 = 0.0032$$

Step 4: Convert 0.0032 into percent form.

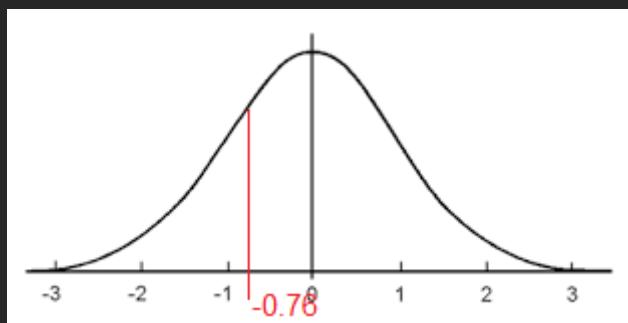
$$(0.0032)(100) = 0.32\%$$

Step 5: 0.32% is the percentage.

Step 6: Shade the area to the left of -2.73 on the graph.



Example 2: $z = -0.76$ to the left



Step 1: Locate -0.76 on the distribution curve

Step 2: Look for the area of -0.76 on the table.

$$z = -0.76 \rightarrow 0.2764$$

Step 3: The shade to the left of -0.76 does not cross the boundary, subtract 0.2764 to 0.5.

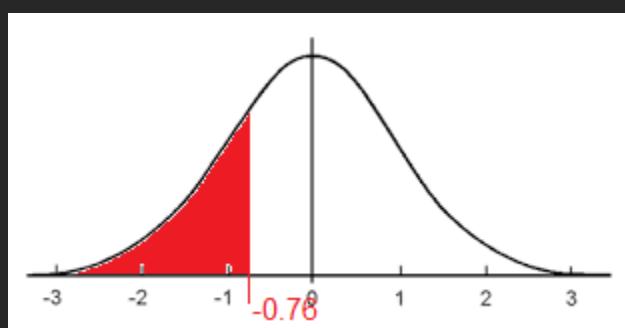
$$0.5 - 0.2764 = 0.2236$$

Step 4: Convert into percent form.

$$(0.2236)(100) = 22.36\%$$

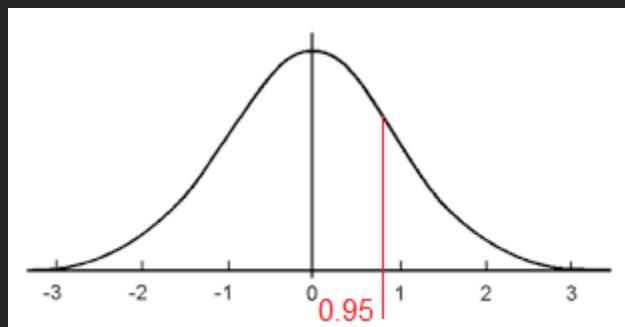
Step 5: 22.36% is the percentage.

Step 6: Shade the area to the left of -0.76.



Case 2: Positive Z value to the left

Example 1: $z = 0.95$ to the left



Step 1: Locate 0.95 on the distribution curve

Step 2: Look for the area of 0.95 on the table.

$$z = 0.95 \rightarrow 0.3289$$

Step 3: The shade to the left of 0.95 crosses the boundary, instead of subtracting, add 0.3289 to 0.5.

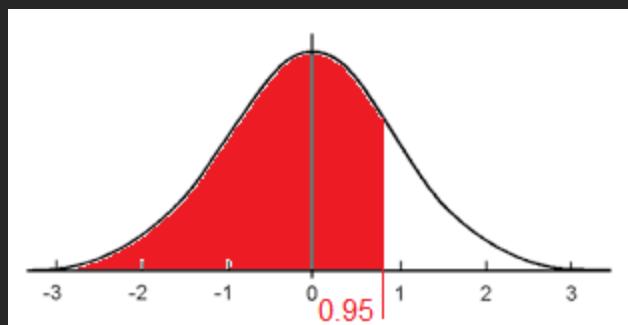
$$0.5 + 0.3289 = 0.8289$$

Step 4: Convert into percent form.

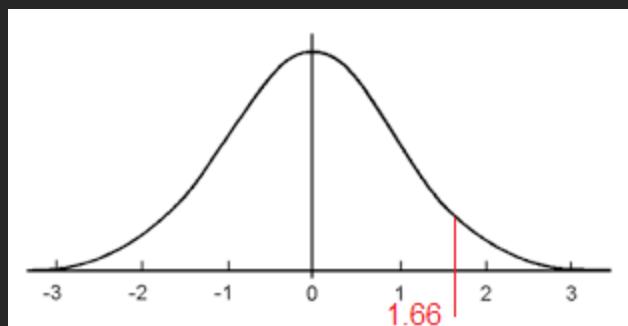
$$(0.8289)(100) = 82.89\%$$

Step 5: 82.89% is the percentage.

Step 6: Shade the area to the left of 0.95.



Example 2: $z = 1.66$ to the left



Step 1: Locate 1.66 on the distribution curve

Step 2: Look for the area of 1.66 on the table.

$$z = 1.66 \rightarrow 0.4515$$

Step 3: The shade to the left of 1.66 crosses the boundary, instead of subtracting, add 0.4515 to 0.5.

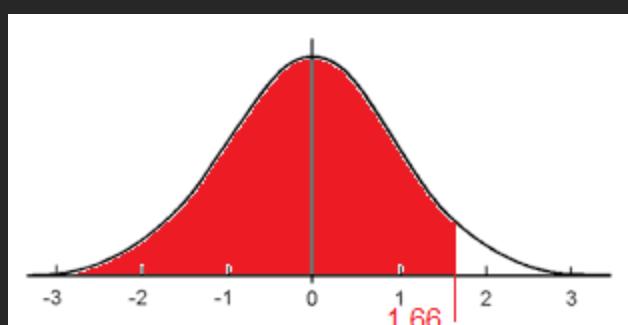
$$0.5 + 0.4515 = 0.9515$$

Step 4: Convert into percent form.

$$(0.9515)(100) = 95.15\%$$

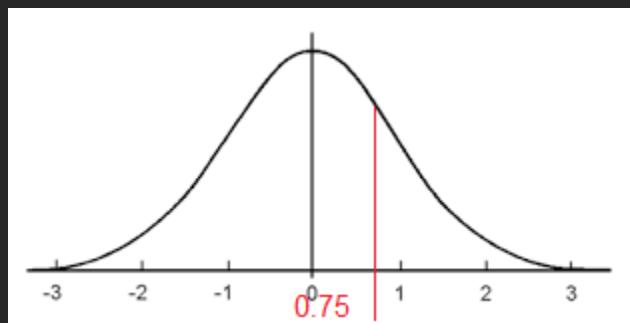
Step 5: 95.15% is the percentage.

Step 6: Shade the area to the left of 1.66.



Case 3: Positive Z value to the right

Example 1: $z = 0.75$ to the right



Step 1: Locate 0.75 on the distribution curve

Step 2: Look for the area of 0.75 on the table.

$$z = 0.75 \rightarrow 0.2734$$

Step 3: The shade to the right of 0.75 does not cross the boundary, subtract 0.2734 to 0.5.

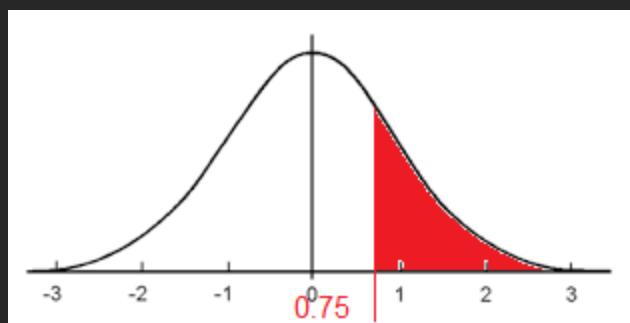
$$0.5 - 0.2734 = 0.2266$$

Step 4: Convert into percent form.

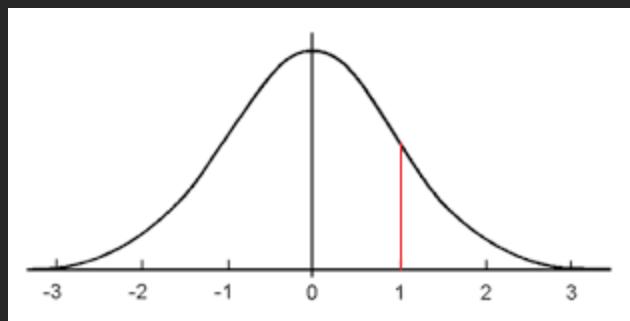
$$(0.2266)(100) = \mathbf{22.66\%}$$

Step 5: 22.66% is the percentage.

Step 6: Shade the area to the right of 0.75.



Example 2: $z = 1.00$



Step 1: Locate 1.00 on the distribution curve

Step 2: Look for the area of 1.00 on the table.

$$z = 1.00 \rightarrow 0.3413$$

Step 3: The shade to the right of 1.00 does not cross the boundary, subtract 0.3413 to 0.5.

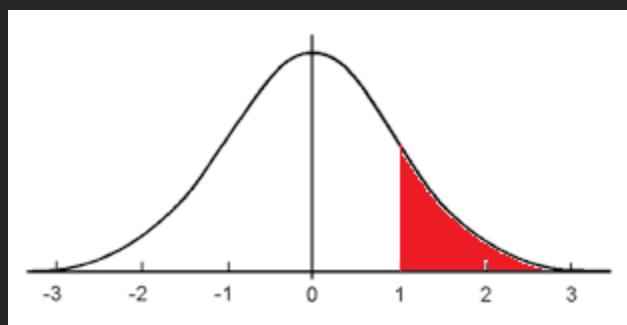
$$0.5 - 0.3413 = 0.1587$$

Step 4: Convert into percent form.

$$(0.1587)(100) = \mathbf{15.87\%}$$

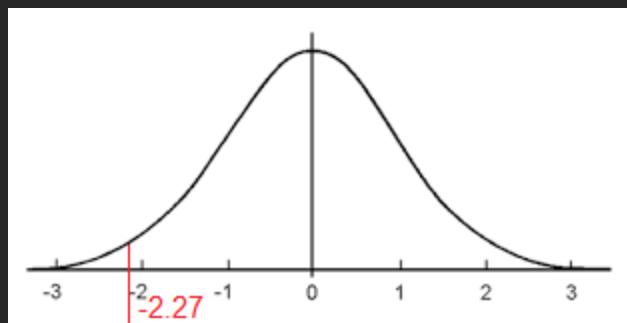
Step 5: 15.87% is the percentage.

Step 6: Shade the area to the right of 1.00.



Case 4: Negative Z value to the right

Example 1: $z = -2.27$ to the right



Step 1: Locate -2.27 on the distribution curve

Step 2: Look for the area of -2.27 on the table.

$$z = -2.27 \rightarrow 0.4884$$

Step 3: The shade to the right of -2.27 crosses the boundary, add 0.4884 to 0.5.

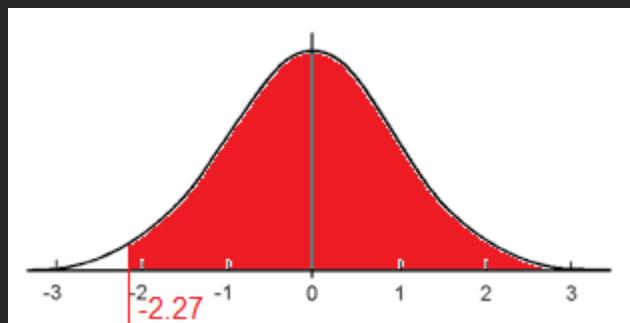
$$0.5 + 0.4884 = 0.9884$$

Step 4: Convert into percent form.

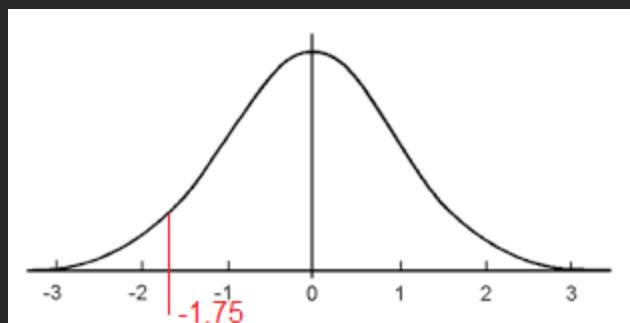
$$(0.9884)(100) = \mathbf{98.84\%}$$

Step 5: 98.84% is the percentage.

Step 6: Shade the area to the right of -2.27 .



Example 2: $z = -1.75$ to the right



Step 1: Locate -1.75 on the distribution curve

Step 2: Look for the area of -1.75 on the table.

$$z = -1.75 \rightarrow 0.4599$$

Step 3: The shade to the right of -1.75 crosses the boundary, add 0.4599 to 0.5.

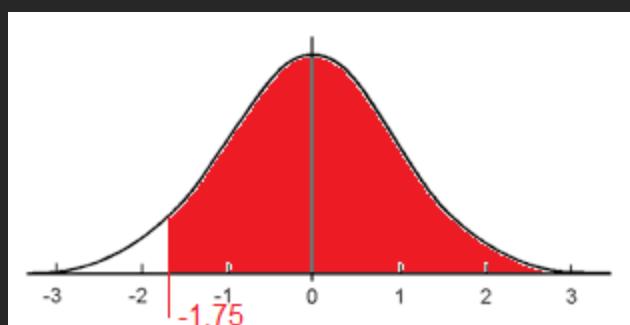
$$0.5 + 0.4599 = 0.9599$$

Step 4: Convert into percent form.

$$(0.9599)(100) = 95.99\%$$

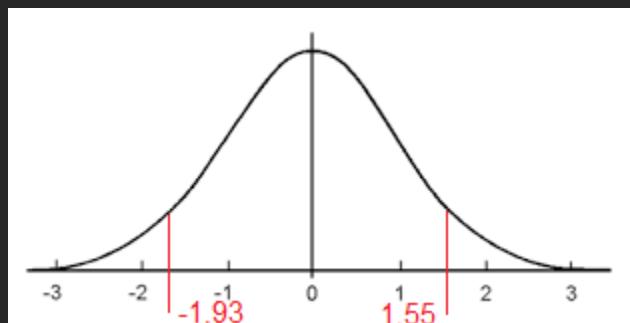
Step 5: 95.99% is the percentage.

Step 6: Shade the area to the right of -1.75 .



Case 5: Between each pair of Z values

Example 1: $z = -1.93$, $z = 1.55$



Step 1: Locate both z values on the distribution curve.

Step 2: Get the area of both z values.

$$z = -1.93 \rightarrow 0.4732$$

$$z = 1.55 \rightarrow 0.4394$$

Step 3: Since the shade between the two z values crosses the boundary, add the two areas together.

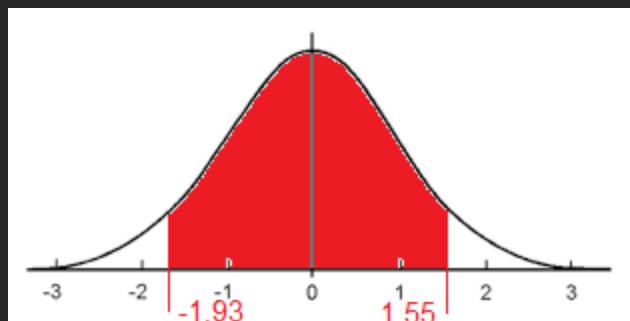
$$0.4732 + 0.4394 = 0.9126$$

Step 4: Convert into percent form.

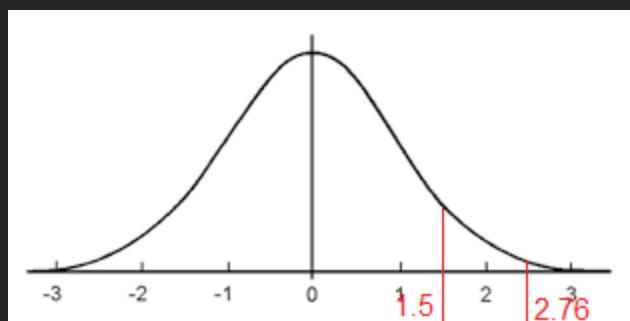
$$(0.9126)(100) = \mathbf{91.26\%}$$

Step 5: 91.26% is the percentage.

Step 6: Shade the area between the two z values.



Example 2: $z = 1.5$, $z = 2.76$



Step 1: Locate both z values on the distribution curve.

Step 2: Get the area of both z values.

$$z = 1.5 \rightarrow 0.4332$$

$$z = 2.76 \rightarrow 0.4971$$

Step 3: Since the shade between the two z values does not cross the boundary, subtract the two areas together.

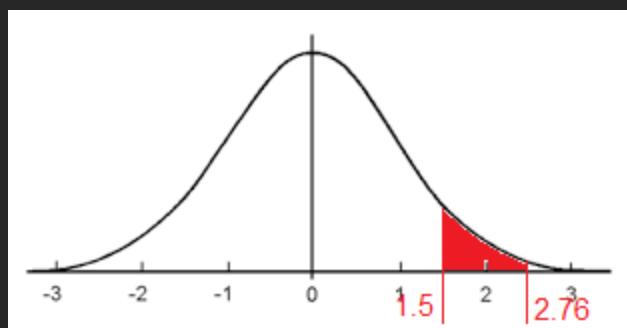
$$0.4332 - 0.4971 = -0.06391$$

Step 4: The area must not be a negative. Convert the absolute value of the answer above into percent form. (Just remove the negative sign before multiplying to 100)

$$(| -0.06391 |)(100) = 6.39\%$$

Step 5: 6.39% is the percentage.

Step 6: Shade the area between the two z values.



D. Standard Scores (Z-scores)

Determines the proportion of the total area greater than, in between, or less than the mean.

- A positive z-score indicates that the score or observed value is above the mean.
- A negative z-score indicates that the score or observed value is below the mean.

The z-score is found by using the following equations:

For sample	For population
$z = \frac{x - \bar{x}}{s}$	$z = \frac{x - \mu}{\sigma}$
$z = \text{standard score}$	$z = \text{standard score}$
$x = \text{raw score or observed value}$	$x = \text{raw score or observed value}$
$\bar{x} = \text{sample mean}$	$\mu = \text{population mean}$
$s = \text{sample standard deviation}$	$\sigma = \text{population standard deviation}$

Example 1: On a final examination in Biology, the mean was 75 and the standard deviation was 12. Determine the standard score of a student who received a score of 60 assuming that the scores are normally distributed.

Step 1: Use the formula

$$z = \frac{x - \bar{x}}{s}$$

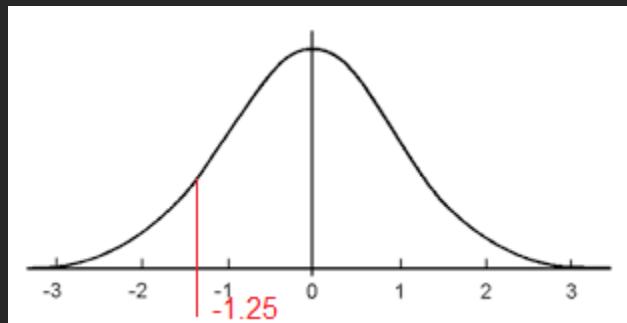
Step 2: Substitute the values

$$z = \frac{60 - 75}{12}$$

Step 3: Solve

$$z = -1.25$$

Step 4: Locate -1.25 on the distribution curve graph



"This indicates that 60 is -1.25 standard deviations below the mean."

Example 2: On the first periodic exam in statistics, the population mean was 70 and the population standard deviation was 9. Determine the standard score of a student who got a score of 88 assuming that the scores are normally distributed.

Step 1: Use the formula

$$z = \frac{x - \bar{x}}{s}$$

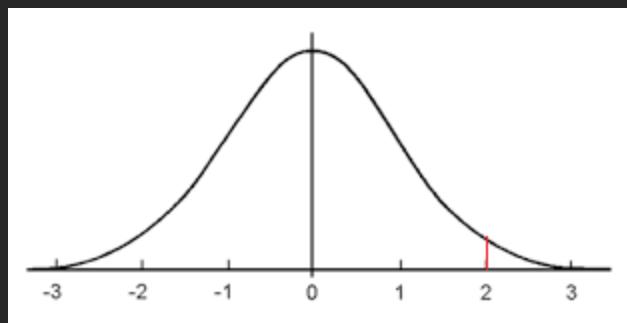
Step 2: Substitute the values

$$z = \frac{88 - 70}{9}$$

Step 3: Solve

$$z = 2$$

Step 4: Locate 2 on the distribution curve graph



Example 3: Luz scored 90 in English test and 70 in Physics test. Scores in the English test have a mean of 80 and a standard deviation of 10. Scores in the Physics test have a mean of 60 and a standard deviation of 8. In which subject was her standing better assuming that the scores in her English and Physics class are normally distributed?

Solution: English	Solution: Physics
$z = \frac{x - \bar{x}}{s}$ $z = \frac{90 - 80}{10}$ $z = 1$	$z = \frac{x - \bar{x}}{s}$ $z = \frac{70 - 60}{8}$ $z = 1.25$

"Her standing in Physics was better than her standing in English. Her score in English was one (1) standard deviation above the mean of the scores in English whereas in Physics, her score was 1.25 standard deviations above the mean of the scores in Physics."

Example 4: In science test, the mean score is 42 and the standard deviation is 5. Assuming the scores are normally distributed, what percent of the score is:

- a) Greater than 48?
- b) Less than 50?
- c) Between 30 and 48?

Solution: Greater than 48

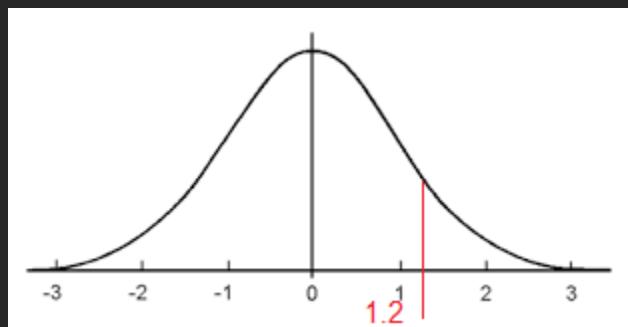
Step 1: Convert the score 48 to z-score.

$$z = \frac{x - \bar{x}}{s}$$

$$z = \frac{48 - 42}{5}$$

$$z = 1.2$$

Step 2: Locate 1.2 on the curve.



Step 3: Look for the area of 1.2 on the table.

$$z = 1.2 \rightarrow 0.3849$$

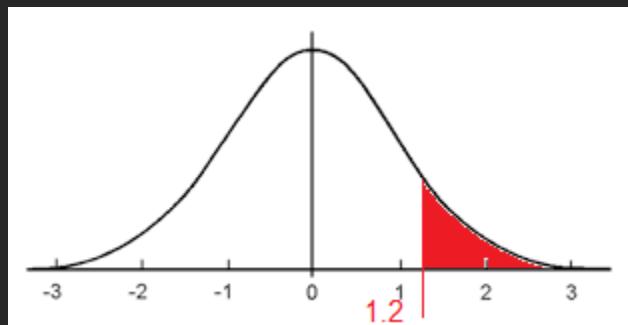
Step 4: Since what is asked is greater than 48, the shade starts to the right side of 1.2. Subtract 0.3849 to 0.5.

$$0.5 - 0.3849 = 0.1151$$

Step 5: Convert into percent form.

$$(0.1151)(100) = 11.51\%$$

Step 6: Shade.



"Hence, 11.51% of the scores is greater than 48."

Solution: Less than 50

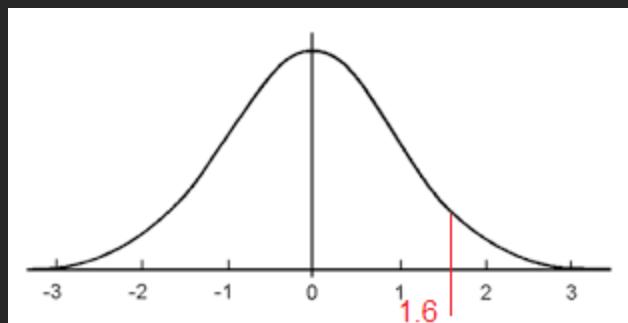
Step 1: Convert the score 50 to z-score.

$$z = \frac{x - \bar{x}}{s}$$

$$z = \frac{50 - 42}{5}$$

$$z = 1.6$$

Step 2: Locate 1.6 on the curve.



Step 3: Look for the area of 1.6 on the table.

$$z = 1.6 \rightarrow 0.4452$$

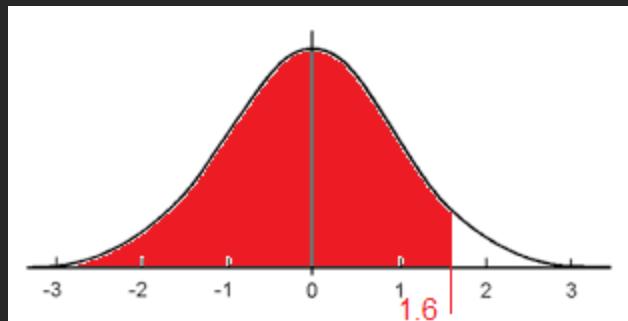
Step 4: Since what is asked is less than 50, the shade starts to the left side of 1.2. Add 0.4452 to 0.5.

$$0.5 + 0.4452 = 0.9452$$

Step 5: Convert into percent form.

$$(0.9452)(100) = 94.52\%$$

Step 6: Shade.

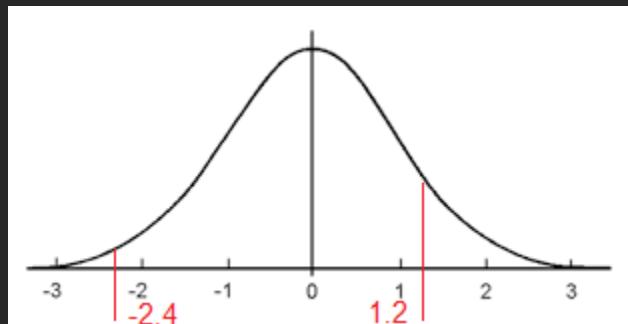


Solution: Between 30 and 48

Step 1: Convert both scores into z-score.

30	48
$z = \frac{x - \bar{x}}{s}$	$z = \frac{x - \bar{x}}{s}$
$z = \frac{30 - 42}{5}$	$z = \frac{48 - 42}{5}$
$z = -2.4$	$z = 1.2$

Step 2: Locate -2.4 and 1.2 on the curve.



Step 3: Look for both areas on the table.

$$z = -2.4 \rightarrow 0.4918$$

$$z = 1.2 \rightarrow 0.3849$$

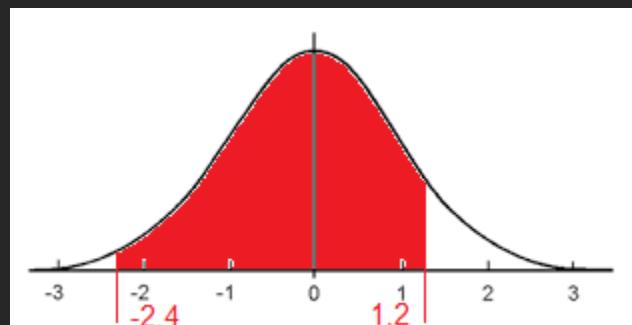
Step 4: Since what is asked is between 30 and 48, the shade is between -2.4 and 1.2. Add 0.4918 and 0.3849.

$$0.4918 + 0.3849 = 0.8767$$

Step 5: Convert into percent form.

$$(0.8767)(100) = 87.67\%$$

Step 6: Shade.



E. Random Sampling

Selecting subjects so that all members of a population have an equal and independent chance of being selected

Types of random sampling

Simple random sampling

- Giving everyone a chance to be chosen

Stratified random sampling

- Collecting sample from a group or strata

Cluster sampling

- Dividing population into groups

Multi-stage sampling

- Using different sampling techniques to create a sample

F. Sampling distribution of a sample mean

A sampling distribution is a probability distribution of a statistics obtained from a larger number of samples drawn from a specific population

It is the distribution of the statistics if we were to repeatedly draw samples from a population

Steps in constructing the sampling distribution of the means

1. Determine the number of sets of all possible random samples that can be drawn from the given population by using the formula nCr .
2. List all possible samples and compute the mean of each sample.
3. Construct the sampling distribution.
4. Construct a histogram of the sampling distribution of the means.

Examples

Example 1: A population consists of the numbers **2, 4, 9, 10, and 5**. Let us list all possible sample size of **3** from this population and compute the mean of each sample.

Step 1: Determine the number of sets of all possible random samples that can be drawn from the given population by using the formula nCr .

$$nCr = \frac{n!}{r!(n-r)!}$$

n – number of items in the set

r – number of items selected from the set

- Look for the nCr button in the calculator.
- N corresponds to the **number of items in the set** (in this case, 5)
- R corresponds to the **number of items selected from the set** (sample size, which is 3)
- Type **5**, then nCr , then **3**, in the calculator it should look like this: **5C3**
- The result is **10**. There are **10 possible samples**.

Step 2: List all possible samples and compute the mean of each sample.

- Write the numbers **2, 4, 9, 10, and 5**.
- Write all possible combinations of **3** for the numbers above.
- The table should look like this:

Sample	2, 4, 9	2, 4, 10	2, 4, 5	2, 9, 10	2, 9, 5	2, 10, 5	4, 9, 10	4, 9, 5	4, 10, 5	9, 10, 5
Mean										

- To get the mean of each sample, add the three together, then divide by 3. (Example: 2, 4, 9
→ $2+4+9 = 15 \rightarrow 15/3 = 5 \leftarrow \text{Mean}$)

Sample	2, 4, 9	2, 4, 10	2, 4, 5	2, 9, 10	2, 9, 5	2, 10, 5	4, 9, 10	4, 9, 5	4, 10, 5	9, 10, 5
Mean	5	5.33	3.67	7	5.33	5.67	7.67	6	6.33	8

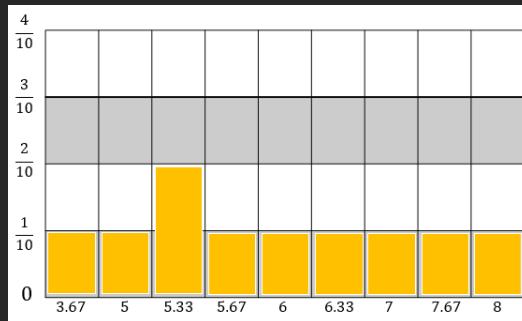
Step 3: Construct the sampling distribution.

- Sample mean: The mean from table A arranged from the least to the highest.
- Frequency: The number of times the sample mean was found in table A.
- Probability: Frequency divided by the total number of possible samples (10).
- The total for frequency should be the number of possible samples (10).
- The total for probability should be 1.

Table A		Table B		
Sample	Mean	Sample Mean	Frequency	Probability
2, 4, 9	5	3.67	1	1/10 = 0.10
2, 4, 10	5.33	5	1	1/10 = 0.10
2, 4, 5	3.67	5.33	2	2/10 = 0.20
2, 9, 10	7	5.67	1	1/10 = 0.10
2, 9, 5	5.33	6	1	1/10 = 0.10
2, 10, 5	5.67	6.33	1	1/10 = 0.10

4, 9, 10	7.67	7	1	1/10 = 0.10
4, 9, 5	6	7.67	1	1/10 = 0.10
4, 10, 5	6.33	8	1	1/10 = 0.10
9, 10, 5	8	Total		1

Step 4: Construct a histogram of the sampling distribution of the means.



Example 2: Allan receives **82 or 83** as his grade on his **three major subjects**. Construct the sampling distribution of his mean grade.

Step 1: List all the possible samples.

a. Do this method

 	<table border="1"> <thead> <tr> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr><td>82</td><td>82</td><td>82</td></tr> <tr><td>82</td><td>82</td><td>83</td></tr> <tr><td>82</td><td>83</td><td>82</td></tr> <tr><td>82</td><td>83</td><td>83</td></tr> </tbody> </table> <table border="1"> <thead> <tr> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr><td>83</td><td>82</td><td>82</td></tr> <tr><td>83</td><td>82</td><td>83</td></tr> <tr><td>83</td><td>83</td><td>82</td></tr> <tr><td>83</td><td>83</td><td>83</td></tr> </tbody> </table>	A	B	C	82	82	82	82	82	83	82	83	82	82	83	83	A	B	C	83	82	82	83	82	83	83	83	82	83	83	83
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Step 2: Compute the mean of each sample.

a. Add A, B, C, then divide the sum by 3. (Example: 82, 82, 82 \rightarrow 82+82+82=246 \rightarrow 246/3 = 82 \leftarrow x)

A	B	C	x
82	82	82	
82	82	83	
82	83	82	
82	83	83	
83	82	82	
83	82	83	
83	83	82	
83	83	83	

A	B	C	x
82	82	82	82
82	82	83	82.33
82	83	82	82.33
82	83	83	82.67
83	82	82	82.33
83	82	83	82.67
83	83	82	82.67
83	83	83	83

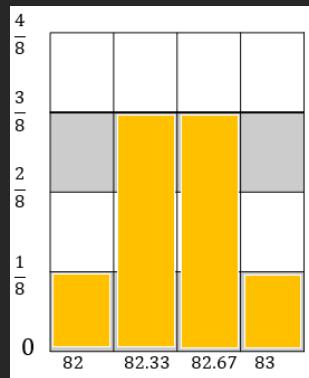
Step 3: Construct the sampling distribution

- a. Sample mean: The mean from table A arranged from the least to the highest.
- b. Frequency: The number of times the sample mean was found in table A.

- c. Probability: Frequency divided by the total number of possible samples (8).
- d. The total for frequency should be the number of possible samples (8).
- e. The total for probability should be 1.

Table A				Table B		
A	B	C	x	Sample mean	Frequency	Probability
82	82	82	82	82	1	1/8 = 0.125
82	82	83	82.33	82.33	3	3/8 = 0.375
82	83	82	82.33	82.67	3	3/8 = 0.375
82	83	83	82.67	83	1	1/8 = 0.125
83	82	82	82.33	Total	8	1
83	82	83	82.67			
83	83	82	82.67			
83	83	83	83			

Step 4: Construct a histogram of the sampling distribution of the means



Question 1: What is the probability that his mean grade is lower than 83?

- a. Using the table below, find the probability of all the sample means that are below 83 (82, 82.33, 82.67)

Sample mean	Frequency	Probability
82	1	1/8 = 0.125
82.33	3	3/8 = 0.375
82.67	3	3/8 = 0.375
83	1	1/8 = 0.125
Total	8	1

$$P(x < 83) = 0.125 + 0.375 + 0.375$$

$$P(x < 83) = 0.875$$

$$P(x < 83) = 87.5\%$$

Question 2: What is the probability that his mean grade is greater than 82.33?

Sample mean	Frequency	Probability
82	1	1/8 = 0.125
82.33	3	3/8 = 0.375
82.67	3	3/8 = 0.375
83	1	1/8 = 0.125
Total	8	1

82	1	$1/8 = 0.125$
82.33	3	$3/8 = 0.375$
82.67	3	$3/8 = 0.375$
83	1	$1/8 = 0.125$
Total	8	1

$$P(x>83) = 0.375 + 0.125$$

$$P(x>83) = 0.5$$

$$P(x>83) = 50\%$$

Question 3: What is the probability that his mean grade is 82.67?

Sample mean	Frequency	Probability
82	1	$1/8 = 0.125$
82.33	3	$3/8 = 0.375$
82.67	3	$3/8 = 0.375$
83	1	$1/8 = 0.125$
Total	8	1

$$P(x=82.67) = 0.375$$

$$P(x=83) = 37.5\%$$

G. Hypothesis

Hypothesis

A premise or claim that we want to investigate.

It is a tentative explanation, a claim, or assertion about people, objects, or events.

The hypothesis can be:

- The mean grade of Engineering students of ABC University enrolled in Calculus II is 1.85
- There is a significant difference in the proportion of consumers who purchased Brand A tooth paste before and after the advertising campaign in the television station.
- There is no significant difference between the mean performance of ABC University and XYZ University in the June and December Dental Board Examinations

Such statements are subjected to statistical testing in order to determine whether these statements are true or false.

If the statement is true, then it is accepted. If the statement is false, then it is rejected.

Types of hypothesis

Null hypothesis

- Denoted by H_0 (H stands for hypothesis and subscript 0 stands for no difference)

Alternative hypothesis

- Denoted by H_a (H stands for hypothesis and subscript a stands for alternative hypothesis)
- Is what the researcher believed to be true when the null hypothesis turned out false

Types of errors

Type I error

- Type of error rejects the null hypothesis when in fact it is true. Type I error is also known as Alpha α error

Type II error

- Type of error fails to reject the null hypothesis when in fact it is false. Type II error is also known as Beta β error

There is also a possibility of committing an error in deciding whether to accept or reject the null hypothesis

Decision	Facts	
	H_0 is true	H_0 is false
Accept H_0	Correct decision	Type II error
Reject H_0	Type I error	Correct decision

Terminologies

Test statistic

- Used as a basis for deciding whether the null hypothesis should be rejected

Rejection region

- Set of values of the test statistic that leads to rejection of the null hypothesis

Non-rejection region

- Set of values of the test statistic that leads to acceptance of the null hypothesis

Critical value

- Set of values of the test statistic that separates the rejection and non-rejection regions

Examples

Example 1: Pop Soda claims that each bottle of their soft drinks is filled at 8oz all the time.

Let μ be the average of soda content

H_0 : Each bottle is filled with 8oz of soda

$H_0: \mu = 8\text{oz}$

H_a : Each bottle is filled with less than/greater than 8oz of soda

$H_a: \mu < 8\text{oz} \text{ or } \mu > 8\text{oz} \text{ or } \mu \neq 8\text{oz}$

Example 2: Boyong's Car gas mileage averages 26 mpg. He switches to a new brand of motor oil that is advertised to increase gas mileage. After driving 3000 miles with the new oil, he wants to determine if the average gas mileage has increased. State your appropriate hypothesis.

Let μ be the gas mileage of Boyong's car

H_0 : Boyong's car's gas mileage is 26 mpg

$H_0: \mu = 26 \text{ mpg}$

H_a : Boyong's car's gas mileage is more than 26 mpg

$H_a: \mu > 26 \text{ mpg}$

Example 3: The cashier department of QT University claims that the mean monthly salary of their employees is Php22,500.00 with a standard deviation of Php7,000.00. A researcher takes a random sample of 80 employees and found out that they have a mean monthly salary of Php18,750. Do the 80 selected employees have lower salaries than the rest?

Let μ be the monthly salary of the college professors at QT University

H_0 : The monthly salary of the college professors of QT University is PHP 22,500.00

$H_0: \mu = \text{PHP } 22,500.00$

H_a : The monthly salary of the college professors of QT University is less than PHP 22,500.00

$H_a: \mu > \text{PHP } 22,500.00$

Example 4: The mean weight of the baggage carried into an airplane by individual passengers at ABC International airport is 19.18 kilograms. A statistician takes a random sample of 40 baggage and obtains a sample mean weight of 18.5 kilograms with a standard deviation of 6 kilograms.

Let μ be the weight of the baggage carried into an airplane by individual passengers at ABC International Airport

H_0 : The mean weight of the baggage carried into an airplane by individual passengers at ABC International Airport is 19.18 KG

$H_0: \mu = 19.18 \text{ KG}$

$H_a:$ The mean weight of the baggage carried into an airplane by individual passengers at ABC International Airport is less than 19.18 KG

$H_a: \mu < 19.18 \text{ KG}$

H. Hypothesis Testing about a population mean when the variance is known

Hypothesis Testing

It is a procedure/process used by statisticians to determine whether or not to reject a statement about a population.

Steps in hypothesis testing

1. State the null hypothesis
2. Choose the level of significance
3. Compute the test statistic
4. Determine the critical value or p-value
5. Draw a conclusion

The appropriate statistic for testing a claim about population mean when the population variance is known and $n \geq 30$ is

$$z = \frac{\bar{x} - \mu}{\frac{\sigma}{\sqrt{n}}}$$

\bar{x} = sample mean

μ = population mean

σ = standard deviation

n = sample size

Examples

Example 1: The leader of the association of jeepney drivers claims that the average daily take home pay of all jeepney drivers in Pasay City is Php400.00. A random sample of 100 jeepney drivers in Pasay City was interviewed and the average daily home pay of these drivers is found to be Php425. Use a 0.05 significance level to find out if the average daily take home pay of all jeepney drivers in Pasay City is different from Php400.00. Assume that the population variance is Php8,464.00

Step 1: State the null hypothesis

$$H_0: \mu = 400$$

$$H_a: \mu \neq 400$$

Step 2: Choose the level of significance

$$\alpha = 0.05$$

Step 3: Compute the test statistic

	$z = \frac{\bar{x} - \mu}{\frac{\sigma}{\sqrt{n}}} \rightarrow z = \frac{425 - 400}{\frac{92}{\sqrt{100}}}$
\bar{x} = sample mean = PHP 425	$z = \frac{25}{92}$
μ = population mean = PHP 400	$z = \frac{10}{92}$
σ = standard deviation (standard deviation is the square root of the variance) = PHP 92	$z = \frac{25}{9.2}$
n = sample size = 100	$z = 2.72 \leftarrow$ We'll use this later

Step 4: Determine the critical value or p-value

$$H_a: \mu < > \leftarrow \text{One-tailed}$$

$$H_a: \mu \neq \leftarrow \text{Two-tailed}$$

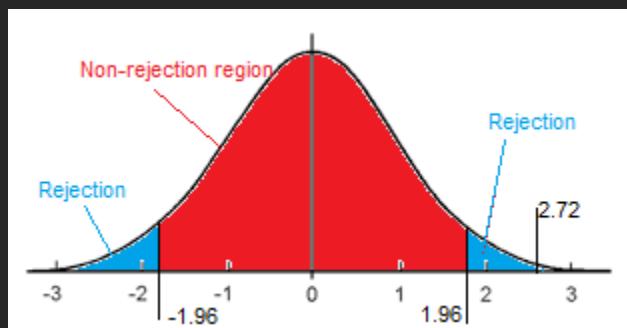
- a. Since the sign for H_a is \neq , we'll use two-tailed
- b. Divide the level of significance (α) by 2 and subtract the quotient from 0.5

$$\frac{\alpha}{2} \rightarrow \frac{0.05}{2} = 0.025 \rightarrow 0.5 - 0.025 = 0.4750$$

- c. Using the Areas Under The Normal Curve Table, the area 0.4750 is under column 0.06 and row 1.9. Because of that:

$$z_{\frac{\alpha}{2}} = \pm 1.96$$

Step 5: Draw a conclusion



The rejection and non-rejection region depend on the critical values (in this case ± 1.96)

Since 2.72 falls in the rejection region of the curve, the final conclusion is to **reject the null hypothesis and accept the alternative hypothesis**.

Example 2: According to a study done last year, the average monthly expenses for cell phone loads of high school students in Manila was Php350.00. A statistics student believes that this amount has increased since January of this year. Is there a reason to believe that this amount has really increased if a random sample of 60 students has an average monthly expenses for cell phone loads of Php380.00? Use a 0.05 level of significance. Assume that the population standard deviation is Php77.00

Step 1: State the null hypothesis

$$H_0: \mu = 350$$

$$H_a: \mu > 350$$

Step 2: Choose the level of significance

$$\alpha = 0.05$$

Step 3: Compute the test statistic

	$z = \frac{\bar{x} - \mu}{\frac{\sigma}{\sqrt{n}}}$ → $z = \frac{380 - 350}{\frac{77}{\sqrt{60}}}$
\bar{x} = sample mean = PHP 380	$z = \frac{30}{77}$
μ = population mean = PHP 350	$z = \frac{7.75}{7.75}$
σ = standard deviation = PHP 77	$z = \frac{30}{9.94}$
n = sample size = 60	$z = 3.02$

Step 4: Determine the critical value or p-value

$$H_a: \mu < > \leftarrow \text{One-tailed} \quad H_a: \mu \neq \leftarrow \text{Two-tailed}$$

- a. Since the sign for H_a is $>$, we'll use one-tailed
- b. Subtract the level of significance (0.05) from 0.5

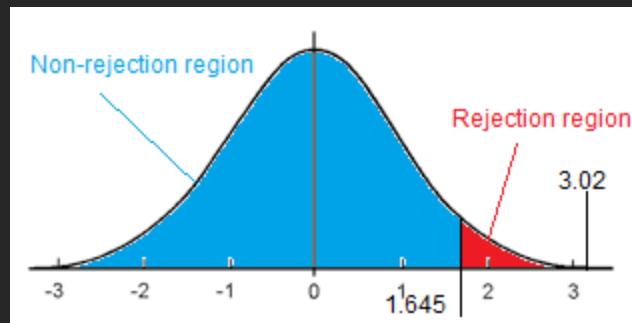
$$0.5 - 0.05 = 0.45$$

- c. Using the Areas Under The Normal Curve Table, find an area that when you add and divided into two the quotient will result to exactly **0.45**.

$$z = \frac{(1.64 + 1.65)}{2}$$

$$z = 1.645$$

Step 5: Draw a conclusion



The rejection and non-rejection region depend on the critical values (in this case 1.645)

Since 3.02 falls in the rejection region of the curve, the final conclusion is to **reject the null hypothesis and accept the alternative hypothesis.**

I. Scatter plots

Bivariate data are data that comes from two variables.

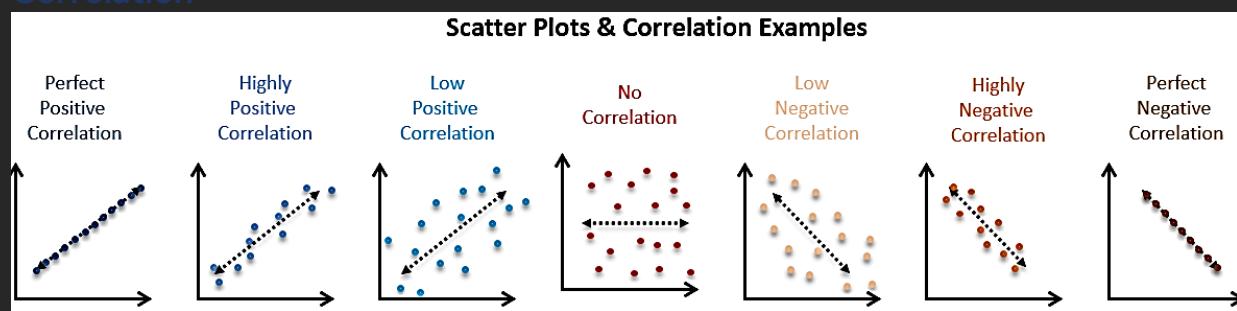
Scatter plots are diagrams that are used to show the degree and pattern of relationship between the two sets of data.

They are constructed on the xy coordinate plane.

Each data point on a scatter plot represents two values (abscissa, ordinate)

The abscissa of the point is a value of the independent variable and the ordinate value is a value of the dependent variable.

Correlation



It represents how closely the two variables are connected. There can be three such situations to see the relation between the two variables

Positive correlation

- Perfect positive: represents a perfectly straight line

- High positive: all points are nearby
- Low positive: all points are scattered

Negative correlation

- Perfect negative: form an almost a straight line
- High negative: points are near to one another
- Low negative: points are in scattered form

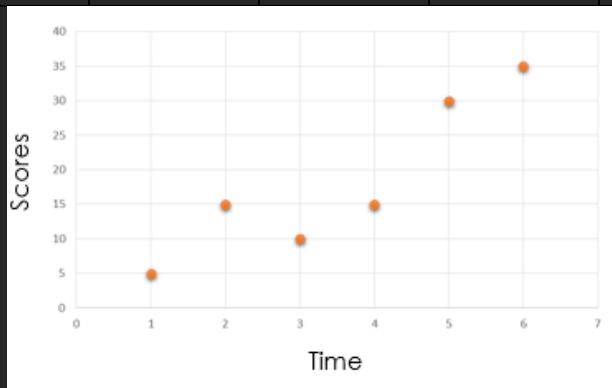
No correlation

- The points are scattered all over the graph and it is difficult to conclude whether the values are increasing or decreasing, then there is no correlation between the variables.

Examples

Example 1: The table below shows the time in hours (x) spent by six Grade 11 students in studying their lessons and their scores (y) on a test. Construct a scatter plot.

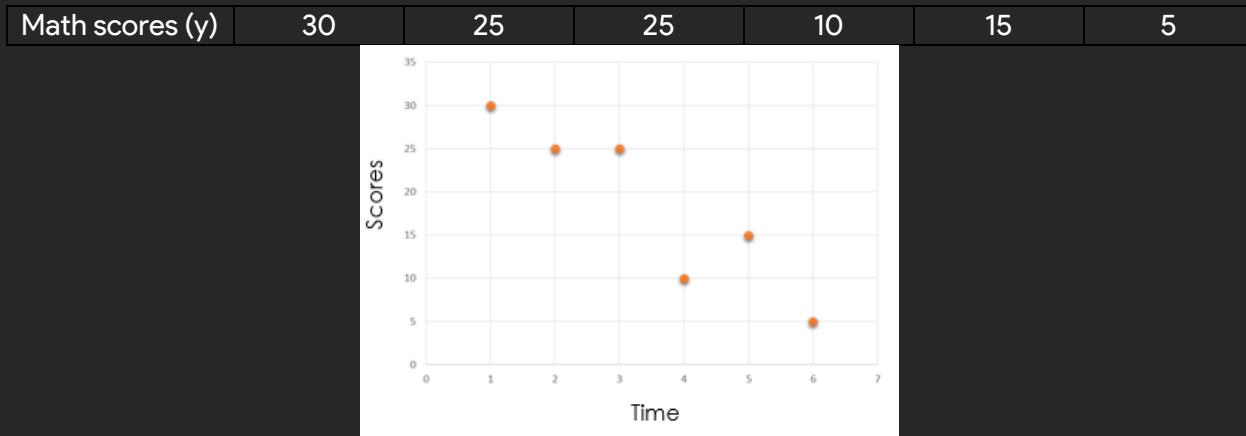
Time spent (x)	1	2	3	4	5	6
Score (y)	5	15	10	15	30	35



- The points plotted on xy coordinates seem to follow a straight line that points **upward to the right**.
- The scatter plot represents a **positive correlation**.
- There is a **high positive correlation** between the two variables.
- It describes a positive trend since as the time spent in studying increases, the score also increases.

Example 2: The table below shows the time in hours spent by six students in playing computer games and the scores of these students got on a math test. Construct a scatter plot.

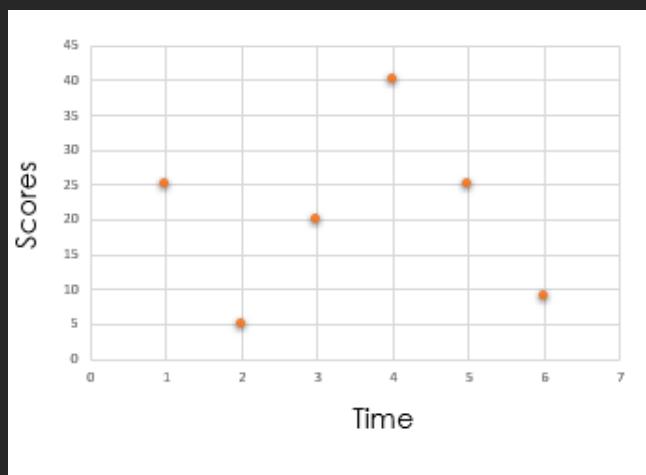
Time spent (x)	1	2	3	4	5	6
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- The points plotted on xy coordinates seem to follow a straight line that points **downward to the right**.
- The scatter plot represents a **negative correlation**.
- There is a **high negative correlation** between the two variables.
- It describes a negative trend since as the amount of time spent in playing computer games increases, the score in math decreases.

Example 3: The table below shows the number of selfies (x) posted online of students and the scores (y) they obtained from a Science test. Construct a scatter plot.

Time spent (x)	1	2	3	4	5	6
Science scores (y)	25	5	20	40	25	9



- It can be noticed that the plotted data points are neither following a straight line pointing upward or downward to the right nor have a pattern.
- There is **no correlation** between the number of selfies posted online and the scores obtained in a Science test.

J. Pearson Product Moment Correlation Coefficient

Pearson Product Moment Correlation Coefficient, denoted by r , measures the strength of the linear relationship.

$$r = \frac{n(\sum xy) - (\sum x)(\sum y)}{\sqrt{[n(\sum x^2) - (\sum x)^2][n(\sum y^2) - (\sum y)^2]}}$$

n = number of paired values

$\sum x$ = sum of x -values, $\sum y$ = sum of y -values

$\sum xy$ = sum of the products of paired values x and y

$\sum x^2$ = sum of squared x -values, $\sum y^2$ = sum of squared y -values

The following table for interpretation of r can be used in interpreting the degree of linear relationship existing between the two variables.

Values for r	Strength of correlation	Values for r	Strength of correlation
+1	Perfect positive	-0.01 to -0.30	Negligible negative
+0.71 to +0.99	Strong positive	-0.31 to 0.50	Weak negative
+0.51 to 0.70	Moderately positive	-0.51 to -0.70	Moderately negative
+0.31 to 0.50	Weak positive	-0.71 to -0.99	Strong negative
+0.01 to +0.30	Negligible positive	-1	Perfect negative
	0	No correlation	

Examples

Example 1: The table below shows the time in hours spent studying (x) by six Grade 11 students and their scores on a test (y). Solve for the Pearson Product Moment Correlation Coefficient r .

Time spent (x)	1	2	3	4	5	6
Scores (y)	5	10	15	15	25	35

x	y	xy	x^2	y^2
1	5	5	1	25
2	10	20	4	100
3	15	45	9	225
4	15	60	16	225
5	25	125	25	625
6	35	210	36	1225
$\sum x = 21$	$\sum y = 105$	$\sum xy = 465$	$\sum x^2 = 91$	$\sum y^2 = 2425$

$$r = \frac{n(\sum xy) - (\sum x)(\sum y)}{\sqrt{[n(\sum x^2) - (\sum x)^2][n(\sum y^2) - (\sum y)^2]}}$$

$$r = \frac{6(465) - (21)(105)}{\sqrt{[6(91) - (21)^2][6(2,425) - (105)^2]}}$$

$$r = \frac{2,790 - 2,205}{\sqrt{[546 - 441][14,550 - 11,025]}}$$

$$r = \frac{585}{\sqrt{370,125}}$$

$$r = 0.96157 \text{ or } 0.96$$

Values for r	Strength of correlation	
+1	Perfect positive	
+0.71 to +0.99	Strong positive	
+0.51 to 0.70	Moderately positive	
+0.31 to 0.50	Weak positive	
+0.01 to +0.30	Negligible positive	

The value r-0.96 is between +0.71 to +0.99. It indicates that there is a **Strong Positive Correlation** between the time in hours spent studying and the scores on the test.

Example 2: The table below shows the time in hours spent by six students in playing computer games and the scores of these students got on a math test. Solve for the Pearson Product Moment Correlation Coefficient r.

Time spent (x)	1	2	3	4	5	6
Scores (y)	30	25	25	10	15	5

x	y	xy	x ²	y ²
1	30	30	1	900
2	25	50	4	625
3	25	75	9	625
4	10	40	16	100
5	15	75	25	225
6	5	30	36	25
$\sum x = 21$	$\sum y = 110$	$\sum xy = 300$	$\sum x^2 = 91$	$\sum y^2 = 2500$

$$r = \frac{n(\sum xy) - (\sum x)(\sum y)}{\sqrt{[n(\sum x^2) - (\sum x)^2][n(\sum y^2) - (\sum y)^2]}}$$

$$r = \frac{6(300) - (21)(110)}{\sqrt{[6(91) - (21)^2][6(2,500) - (110)^2]}}$$

$$r = \frac{1,800 - 2,310}{\sqrt{[546 - 441][15,000 - 12,100]}}$$

$$r = \frac{-510}{\sqrt{304,500}}$$

$r = 0.92422$ or -0.92

Values for r	Strength of correlation	
-0.01 to -0.30	Negligible negative	
-0.31 to 0.50	Weak negative	
-0.51 to -0.70	Moderately negative	
-0.71 to -0.99	Strong negative	The value $r=0.92$ is between -0.71 to -0.99. It indicates that there is a Strong Negative Correlation between the time in hours spent studying and the scores on the test.
-1	Perfect negative	

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