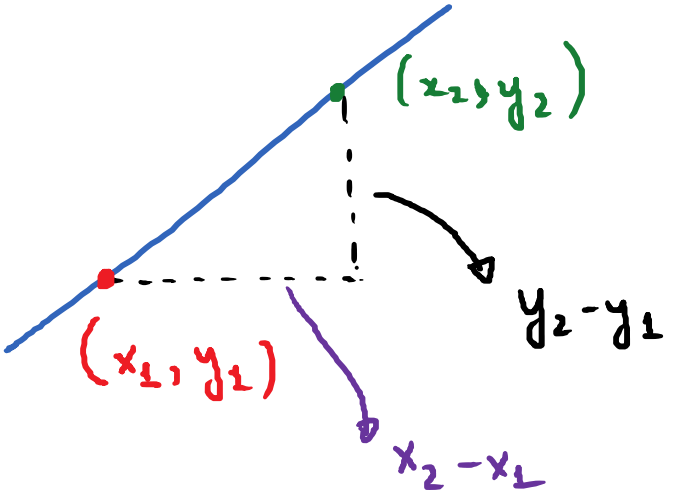
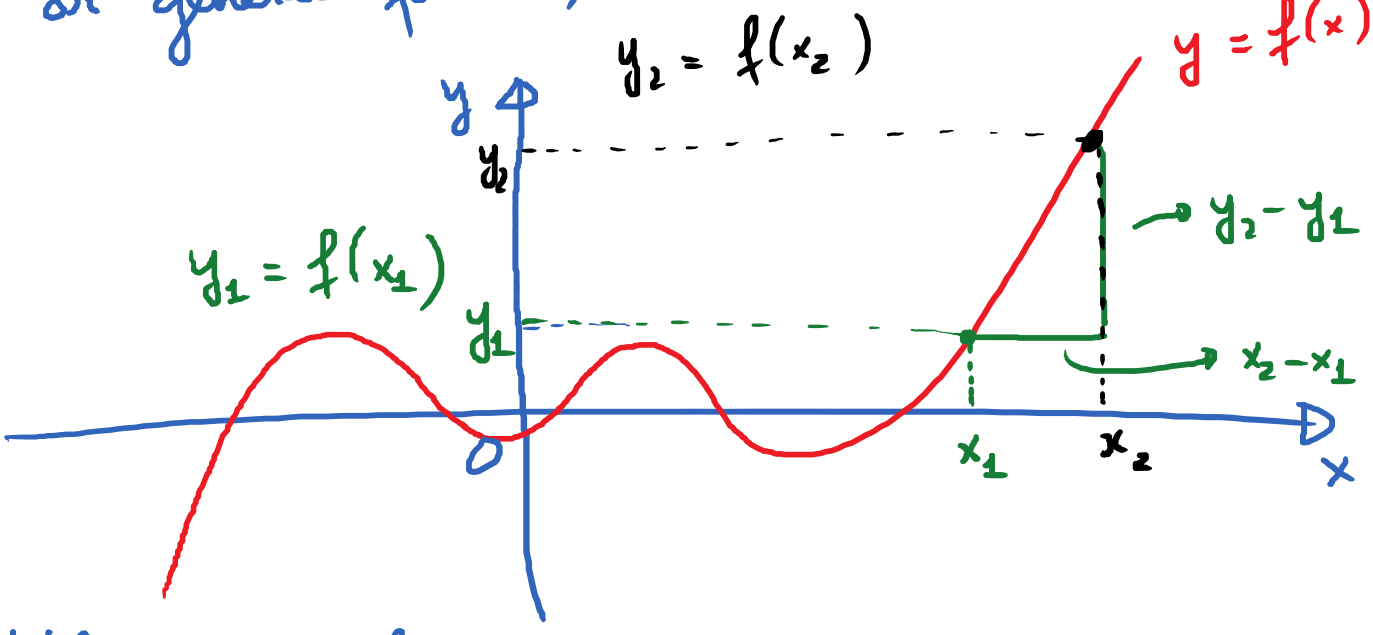
# Obj 3: Average Rate of Change of a function

**Recall:** Slope $= \dfrac{y_2 - y_1}{x_2 - x_1}$ → Ratio between the change in y and the change in x




} Rate of change of the function

For general function,




What is the $\dfrac{\text{change in } y}{\text{change in } x}$ of this function as x changes from $x_1$ to $x_2$?

$$\frac{\text{Change in } y}{\text{Change in } x} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{f(x_2) - f(x_1)}{x_2 - x_1}$$

The average rate of change of a function $y = f(x)$ from $x = x_1$ to $x = x_2$ is given by:

$$A.R.O.C = \frac{f(x_2) - f(x_1)}{x_2 - x_1}$$

Eg. $f(x) = x^2$.

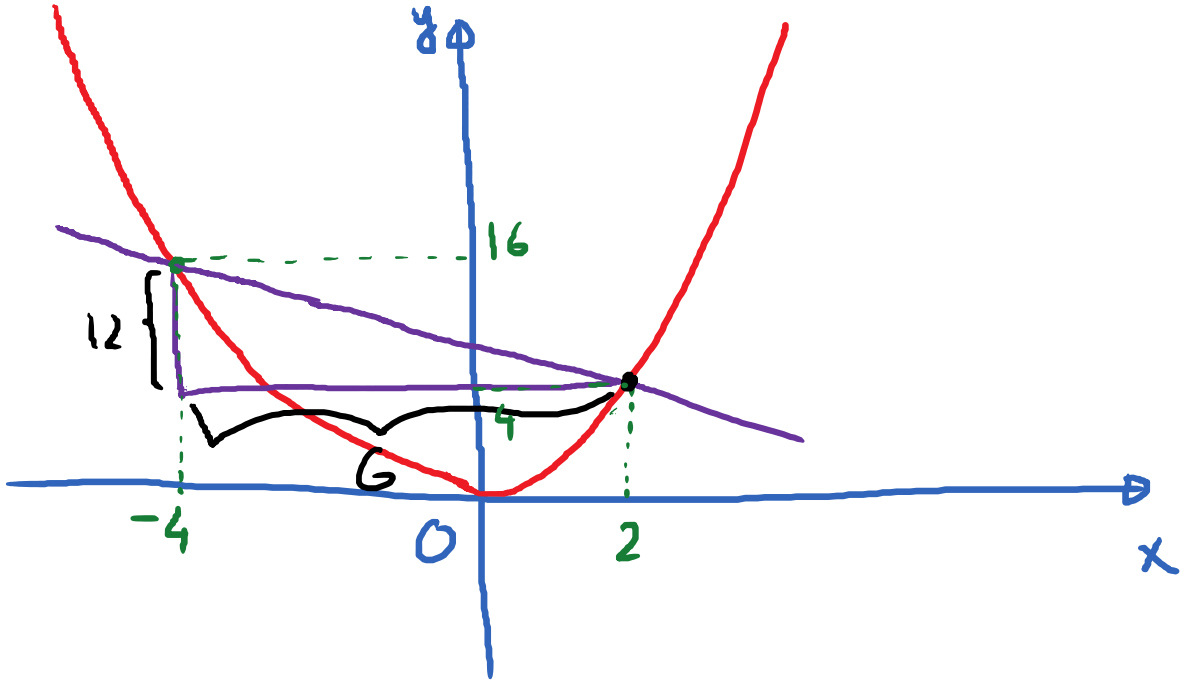
Find the A.R.O.C of $f(x) = x^2$ from $x = -4$ to $x = 2$.

$$A.R.O.C = \frac{f(2) - f(-4)}{2 - (-4)}$$

Change in output or change in y

Change in input or change in x

$$= \frac{4 - 16}{6} = \frac{-12}{6} = \boxed{-2}$$


y
16
12
4
G
-4
0
2
x

E.g. Find the average rate of change of the function from $x_1$ to $x_2$

(a) $f(x) = x^2 + 2x$ from $x = 3$ to $x = 5$.

(b) $f(x) = \sqrt{x}$ from $x = 4$ to $x = 36$.

(a) $$\frac{f(5) - f(3)}{5 - 3} = \frac{(5)^2 + 2\cdot(5) - \left((3)^2 + 2\cdot(3)\right)}{2}$$

$$= \frac{35 - 15}{2} = \boxed{10}$$

(b) $$\frac{f(36) - f(4)}{36 - 4} = \frac{6 - 2}{32} = \frac{4}{32} = \boxed{\frac{1}{8}}$$

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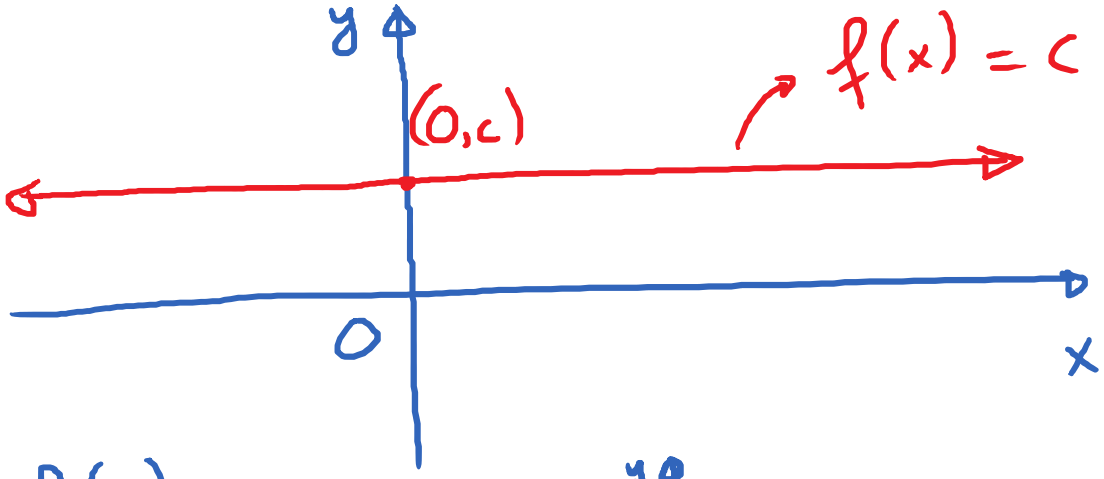
Preparation for Transformations of Graphs.

Functions that are frequently encountered in algebra. It is essential to know the graphs of these functions

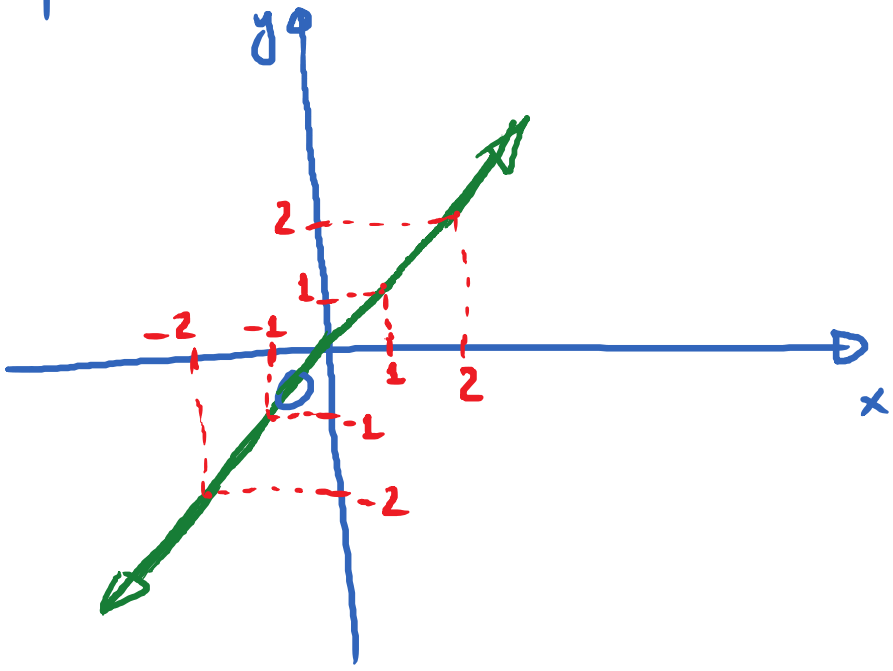
(1) $f(x) = c$, $c$ is a constant.

Graph is a horizontal line which passes through $(0, c)$ on the y-axis




(2) $f(x) = x$

| x | f(x) = x |
|---|---|
| -2 | -2 |
| -1 | -1 |
| 0 | 0 |
| 1 | 1 |
| 2 | 2 |



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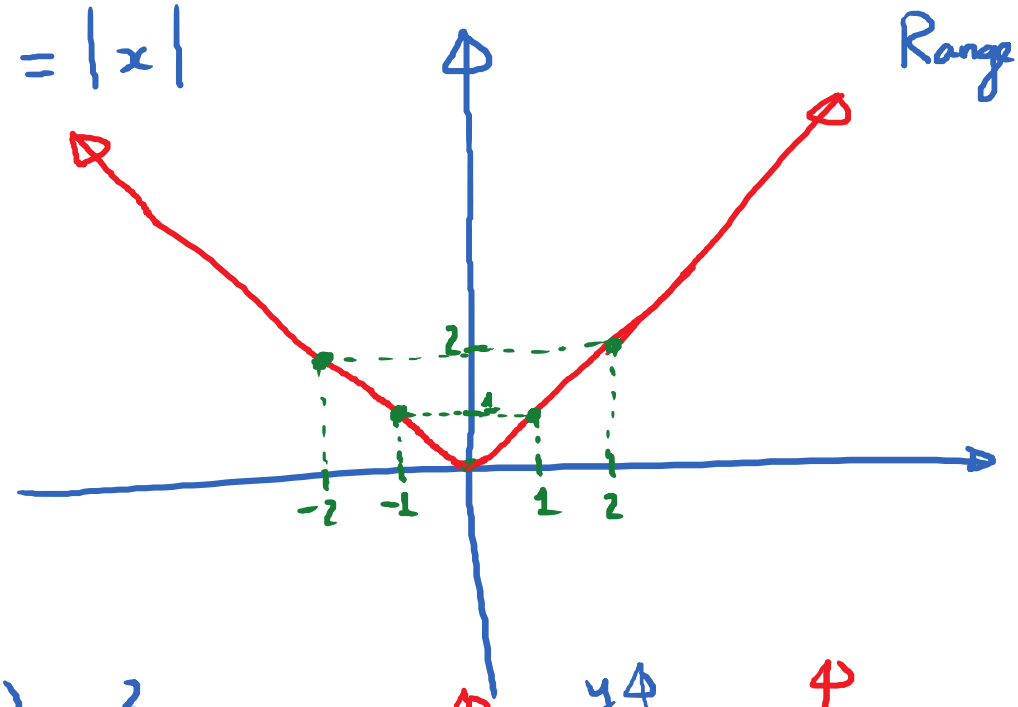
Domain: $(-\infty, \infty)$

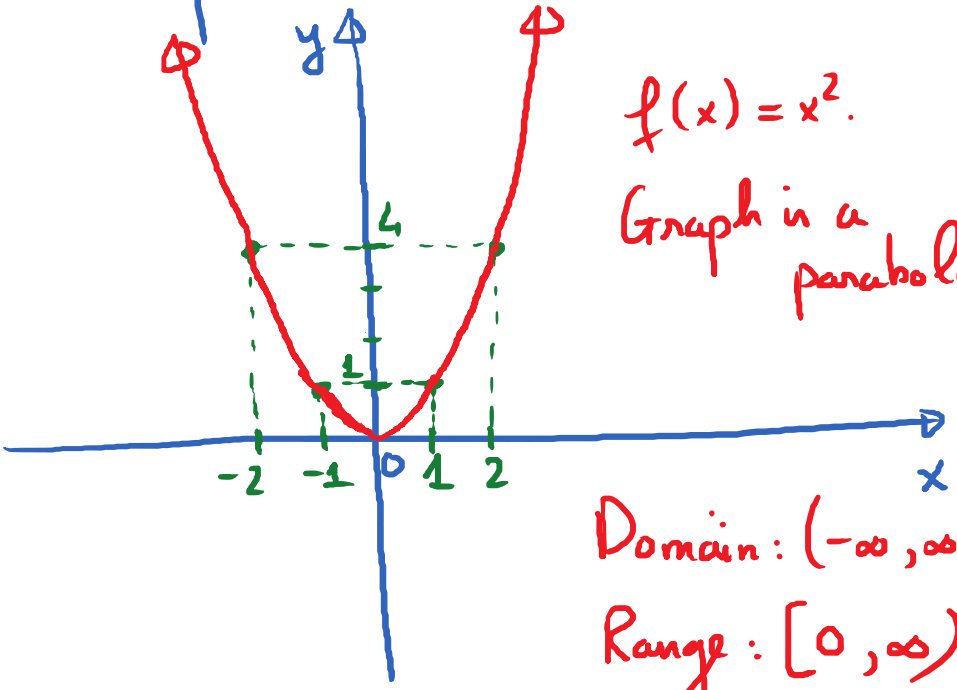
Range: $[0, \infty)$

③ $f(x) = |x|$




④ $f(x) = x^2$

| $x$ | $f(x) = x^2$ |
|---|---|
| $-2$ | $4$ |
| $-1$ | $1$ |
| $0$ | $0$ |
| $1$ | $1$ |
| $2$ | $4$ |




$f(x) = x^2$.

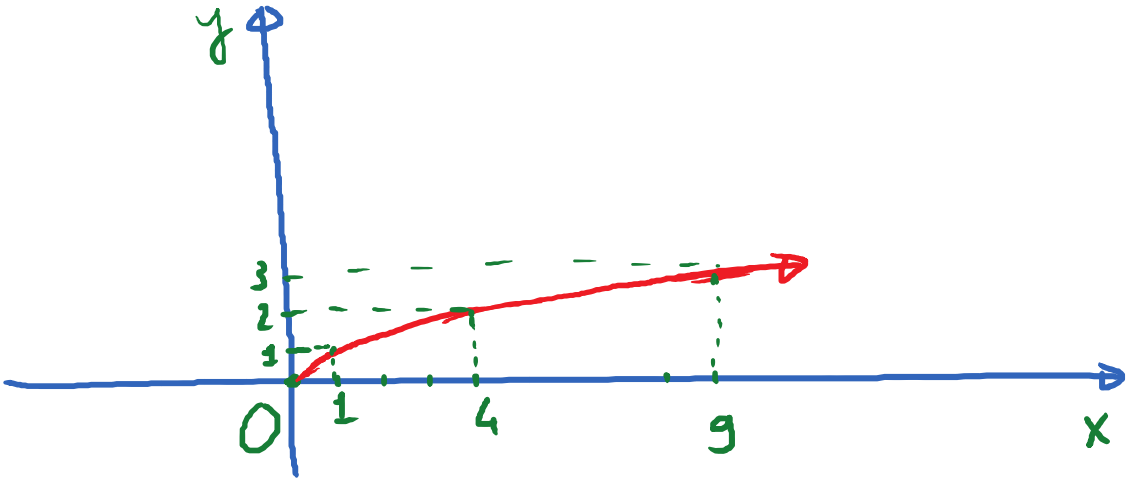
Graph is a parabola

Domain: $(-\infty, \infty)$

Range: $[0, \infty)$

(5) $f(x) = \sqrt{x}$

| $x$ | $f(x) = \sqrt{x}$ |
|---|---|
| 0 | 0 |
| 1 | 1 |
| 4 | 2 |
| 9 | 3 |
| 16 | 4 |




(6) $f(x) = x^3$

| $x$ | $f(x) = x^3$ |
|---|---|
| −2 | −8 |
| −1 | −1 |
| 0 | 0 |
| 1 | 1 |
| 2 | 8 |