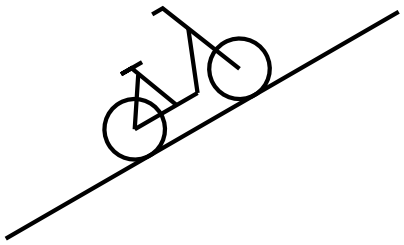
LINE EQUATIONS

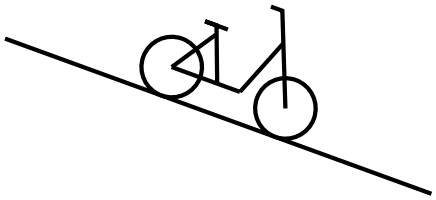
A SLOPES

Discover: The **slope** (or **gradient**) of a line describes its direction and steepness. It is represented by a number that indicates how much the y-coordinate of a point on the line changes for a corresponding change in the x-coordinate.

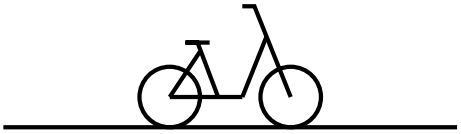
- A positive slope indicates that the line goes up (ascends) as you move to the right.



- A negative slope indicates that the line goes down (descends) as you move to the right.



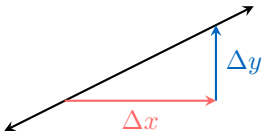
- A slope of zero means the line is horizontal: there is no vertical change.



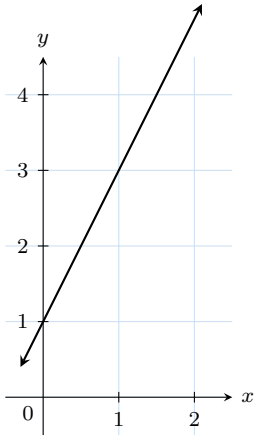
Definition **Slope**

The **slope** (or **gradient**) of a line is defined as the ratio of the change in the vertical direction (Δy) to the change in the horizontal direction (Δx):

$$\text{slope} = \frac{\Delta y}{\Delta x} = \frac{\text{vertical change}}{\text{horizontal change}}$$

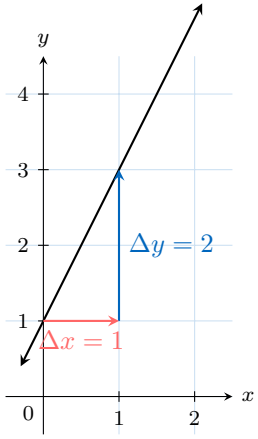


Ex:



Find the slope of the line.

Answer:



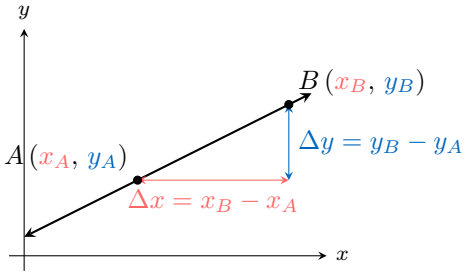
- $$\begin{aligned} \text{slope} &= \frac{\Delta y}{\Delta x} \\ &= \frac{2}{1} \\ &= 2 \end{aligned}$$

B SLOPE FORMULA

Proposition Slope Formula

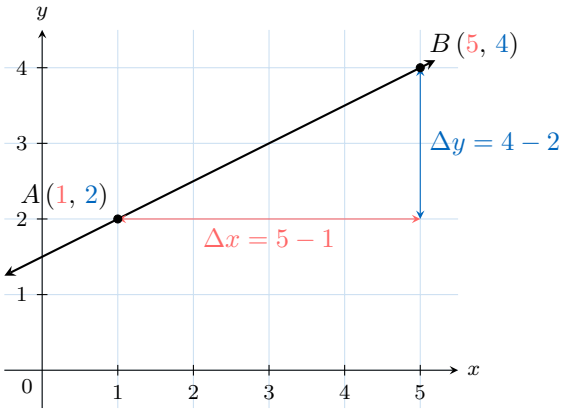
The slope of a line through $A\,(x_A, y_A)$ and $B\,(x_B, y_B)$ is

$$\text{slope} = \frac{y_B - y_A}{x_B - x_A}$$



Ex: Find the slope of the line $\overleftrightarrow{AB}$ for $A\,(1, 2)$ and $B\,(5, 4)$.

Answer:



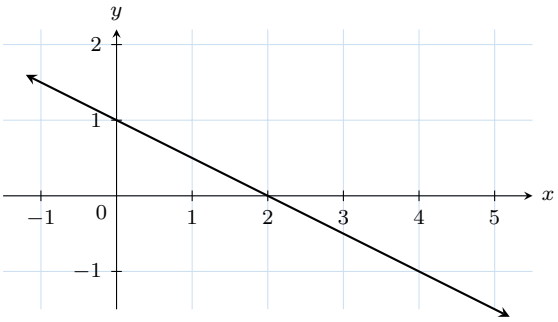
- $$\begin{aligned}\text{slope of } \overleftrightarrow{AB} &= \frac{y_B - y_A}{x_B - x_A} \\ &= \frac{4-2}{5-1} \\ &= \frac{2}{4} \\ &= \frac{1}{2}\end{aligned}$$

C y-INTERCEPT

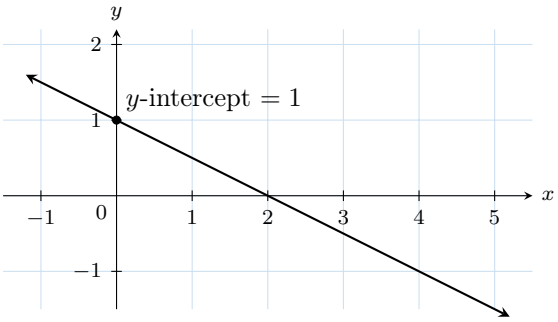
Definition y-Intercept

The **y-intercept** is the value of y where the graph crosses the y-axis (when $x = 0$).

Ex: Find the y-intercept.



Answer:



- The y-intercept is 1 because the graph crosses the y-axis at the point $(0, 1)$.

D LINE EQUATIONS

Discover: Consider the equation $y = 2x - 1$, which describes the relationship between two variables x and y. For any given value of x, we can use the equation to find the corresponding value of y. These values give coordinates (x, y) of points on the graph.

- For $x = 1$:

$$\begin{aligned}y &= 2 \times 1 - 1 \\ &= 1\end{aligned}$$

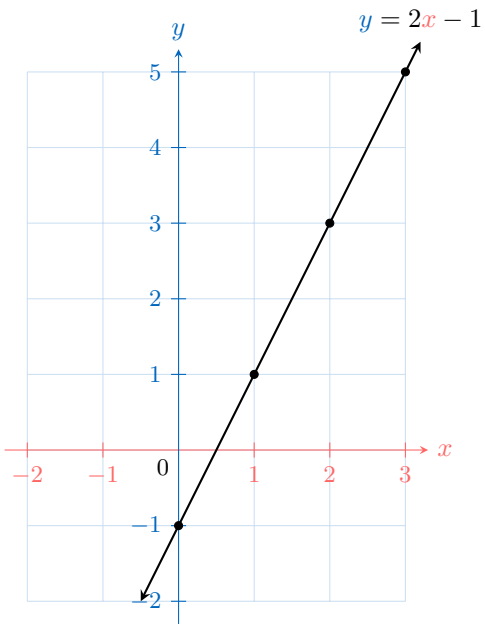
- For $x = 2$:

$$\begin{aligned}y &= 2 \times 2 - 1 \\ &= 3\end{aligned}$$

From calculations like these, we can construct a table of values:

x	0	1	2	3
y	-1	1	3	5

So, the points $(0, -1)$, $(1, 1)$, $(2, 3)$, and $(3, 5)$ all lie on the graph.
In fact, there are infinitely many points that satisfy $y = 2x - 1$, forming a continuous line extending indefinitely in both directions (indicated with arrowheads).



$y = 2x - 1$ is an equation that relates x and y for all points on the line.

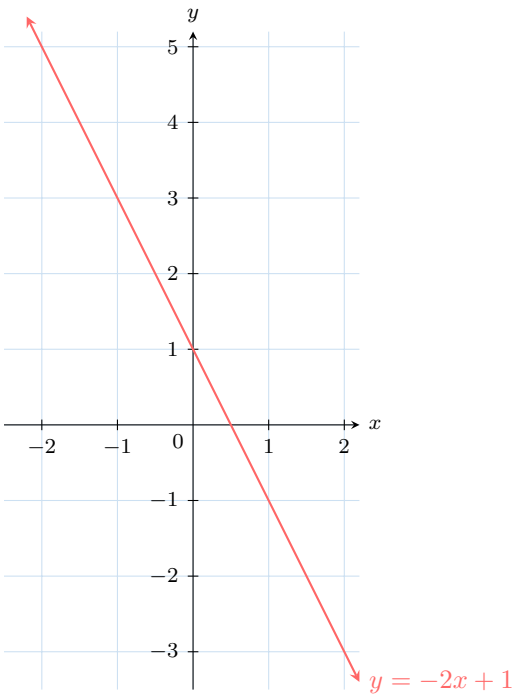
Definition **Equation of a line**

The **equation of a line** can be written as:

$$y = mx + c$$

where m is the **slope** and c is the **y-intercept**.

Ex:



E GRAPHING LINE EQUATIONS

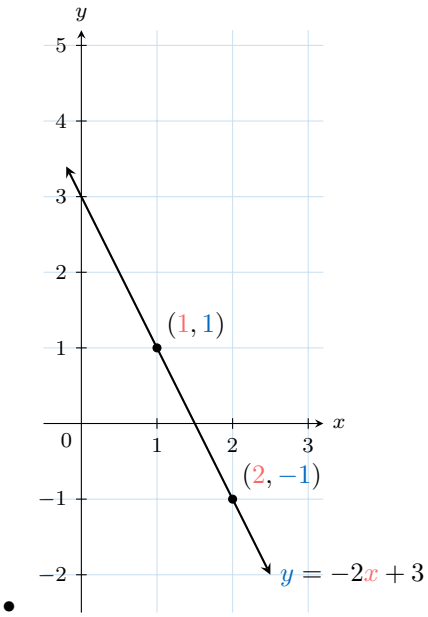
Method Graphing a Line Using Two Points

To **graph a line** given by $y = mx + c$:

1. **Find the first point (x_1, y_1):**
   - Choose any value for x_1.
   - Substitute x_1 into the equation to calculate y_1.
2. **Find a second point (x_2, y_2):**
   - Choose a different value for x_2.
   - Substitute x_2 into the equation to calculate y_2.
3. **Draw the line:**
   - Plot both points on a graph.
   - Use a ruler to draw a straight line passing through both points.

Ex: Graph the line $y = -2x + 3$.

Answer:

- For $x = 1$,
$$\begin{aligned} y &= -2 \times 1 + 3 \\ &= 1 \end{aligned}$$
- For $x = 2$,
$$\begin{aligned} y &= -2 \times 2 + 3 \\ &= -1 \end{aligned}$$
- So, the points $(1, 1)$ and $(2, -1)$ are on the graph.
- 

Method Graphing a Line Using the y-Intercept and Slope

To **graph a line** $y = mx + c$:

1. **Plot the y-intercept:**
   - Mark the point $(0, c)$ on the graph.
2. **Use the slope m to find a second point:**
   - From $(0, c)$, move horizontally by Δx.
   - Then move vertically by $\Delta y = m \cdot \Delta x$.

- Mark the second point.

3. **Draw the line:**
   - Draw a straight line passing through both points.

Ex: Graph the line $y = 2x - 1$.

Answer:

- The y-intercept is -1, so plot the point $(0, -1)$.
- The slope is 2: from $(0, -1)$, move 1 unit right ($\Delta x = 1$), then 2 units up ($\Delta y = 2$), to reach $(1, 1)$.
- Draw the line through these two points.