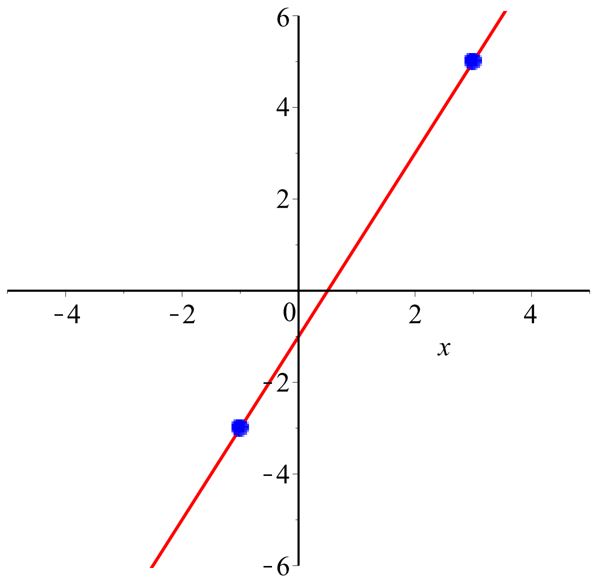
Linear function:

$$f(x) = a \cdot x + b$$

$a, b \in \mathbb{R}$, $\quad Dm(f) = \mathbb{R} \quad Vm(f) = \mathbb{R}$

When a < 0 $\quad f(x)$ is decreasing,
When a $= 0$ $\quad f(x)$ is constant,
When a > 0 $\quad f(x)$ is increasing.

$$f(x) = 2 \cdot x - 1$$



If x is increasing by Δx, then $y = f(x)$ increase by $a \cdot \Delta x$

The number a is called the slope coefficient of the line
(or slope, or incline).

In the example above : $f(x) = 2 \cdot x - 1$, $\quad y = f(x)$ is increasing by $2 \cdot \Delta x = 2 \cdot 4 = 8$

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$$\Delta f = \Delta y = f(x + \Delta x) - f(x) = a \cdot (x + \Delta x) + b - (a \cdot x + b)$$
$$= ax + a \cdot \Delta x + b - ax - b = a \cdot \Delta x \qquad \square$$

.

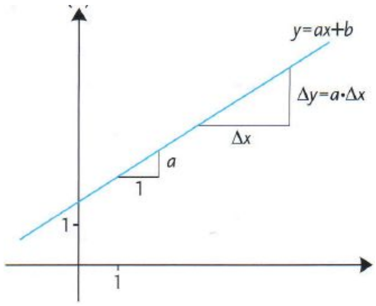
$$\Delta y = a \cdot \Delta x \qquad (1)$$

From page 1, we have: $\Delta y = a \cdot \Delta x$ (**1**)

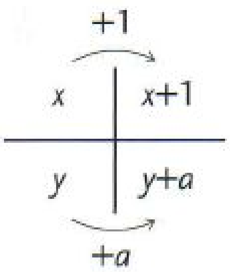
When $\Delta x = 1$, (**1**) *gives*, $\Delta y = a$.

graphic illustration
shows linear growth

When
$\Delta x = 1$, $\Delta y = a$.



Linear growth



***Example*:** The price $f(x)$ for a taxi ride depends on the distance traveled x in this manner :

$f(x) = 15 \cdot x + 30$. $f(x)$ are the price in kr. x is the distance traveled in *km.*

In this example a = 15, equal to the price 15 *kr. pr. km.*
Furthermore b = 30, equal to the initial charge 30 *kr.*

If we give the independent variable x an increment by 4, Δx = 4, the dependent variabel $f(x)$ will have an increment

$$\Delta f = \Delta y = a \cdot \Delta x = 15 \cdot 4 = 60 \; .$$

This of course means, that an extension of the taxi ride by 4 km provides an increase of the price by 60 kr.

The calculation of a and b :

we know two points on a line : $f(-1) = -3$ and $f(3) = 5$.

$(x_1 , y_1) = (-1 , -3)$ and $(x_2 , y_2) = (3 , 5)$

From (**1**) $\Delta y = a \cdot \Delta x$, we get : $a = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$

ie. $a = \frac{y_2 - y_1}{x_2 - x_1} = \frac{5 - (-3)}{3 - (-1)} = \frac{8}{4} = 2$.

The equation of the line, then are $f(x) = 2x + b$.

When the point (3, 5) lies on the line, we may insert the point in the equation.

$5 = 2 \cdot 3 + b \quad \Leftrightarrow \quad b = 5 - 6 = -1$.

ie. $a = 2$ and $b = -1$.

The equation of the line has been calculated to $f(x) = 2x - 1$