



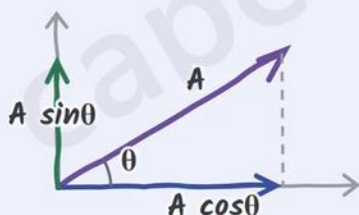
Straight Lines



one slope, four forms, and the general equation that ties them together

Angle of inclination and slope *

- the angle of inclination θ of a line is measured from the positive x-axis, counter-clockwise, with $0^\circ \leq \theta < 180^\circ$
- slope $m = \tan \theta$, defined for every θ except 90°
- $\theta = 0^\circ$ gives a horizontal line, $m = 0$; $\theta = 90^\circ$ gives a vertical line, where slope is **undefined**
- a line rising left to right has $0^\circ < \theta < 90^\circ$, so $m > 0$; a line falling left to right has $90^\circ < \theta < 180^\circ$, so $m < 0$



the inclination angle θ of a line: the horizontal run and vertical rise work out to $A \cos \theta$ and $A \sin \theta$, so
slope = $\tan \theta$ = rise over run

Slope from two points, and the two big conditions

slope through (x_1, y_1) and (x_2, y_2) , $x_1 \neq x_2$ $m = \frac{y_2 - y_1}{x_2 - x_1}$

two lines are parallel exactly when $m_1 = m_2$

two lines are perpendicular exactly when $m_1 m_2 = -1$

both slope conditions assume neither line is vertical. A vertical line pairs with a horizontal line at a right angle even though the vertical line has no defined slope

Four special lines

Horizontal line

$\theta = 0^\circ$, $m = 0$, equation $y = k$ for some constant k

Vertical line

$\theta = 90^\circ$, slope undefined, equation $x = k$ for some constant k

Through the origin

y-intercept is 0, equation reduces to $y = mx$

At 45° to the x-axis

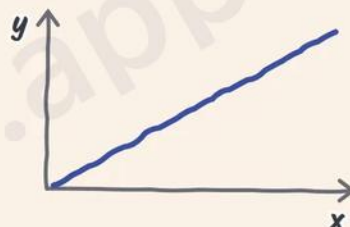
$\theta = 45^\circ$, so $m = \tan 45^\circ = 1$

slope is never a distance and never an area, it is a pure ratio, rise over run, and it stays the same at every point along a straight line

Point-slope and two-point forms

line through (x_1, y_1) with slope m $y - y_1 = m(x - x_1)$

line through (x_1, y_1) and (x_2, y_2) , $x_1 \neq x_2$ $y - y_1 = \frac{y_2 - y_1}{x_2 - x_1} (x - x_1)$



a line with positive slope: as x grows, y grows steadily along the same straight path

