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Lines

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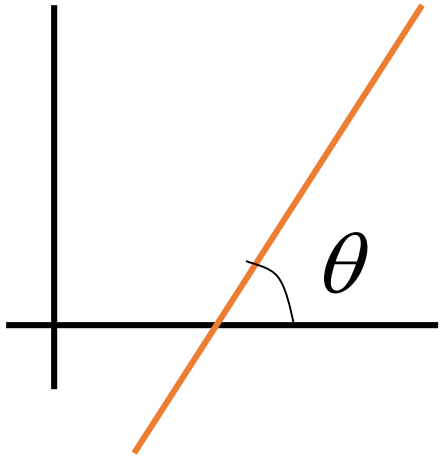
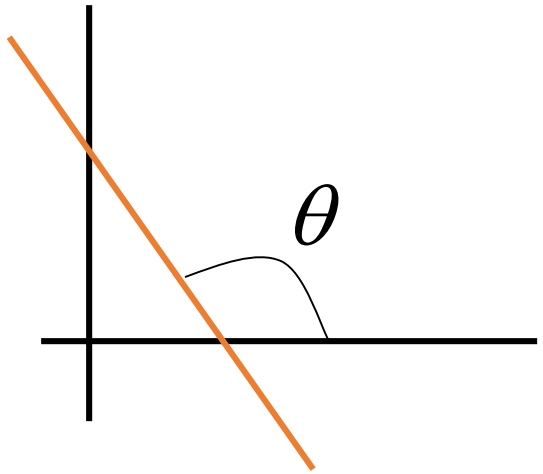
The **Inclination** of a nonhorizontal line is the positive angle theta measured counterclockwise from the x-axis to the line.



Acute angle



Obtuse angle

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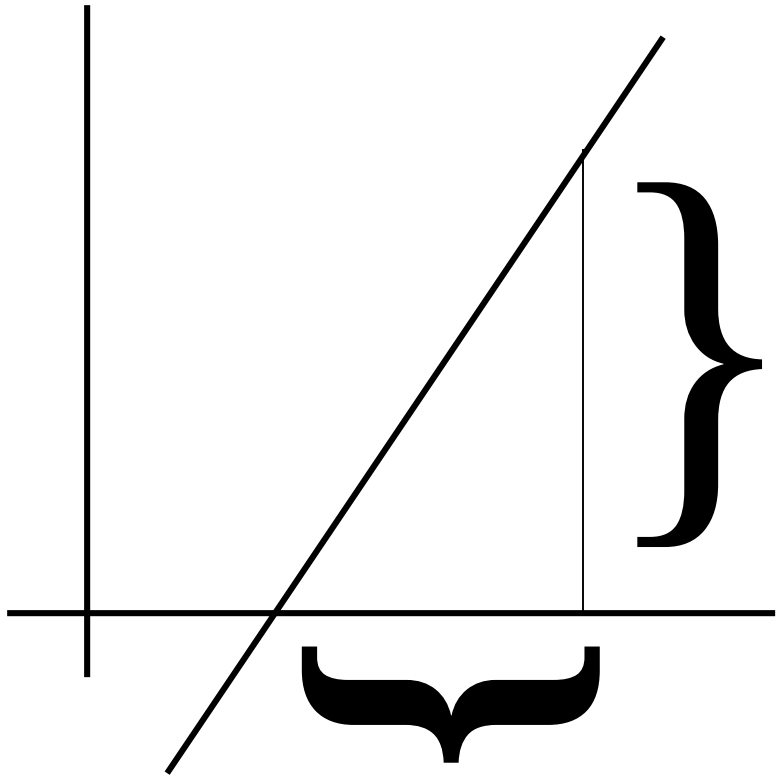
If a nonvertical line has inclination theta and slope m, then

$$m = \tan\theta$$



rise or opposite

Run or adjacent

$$m = \frac{rise}{run}$$

$$\tan\theta = \frac{opp}{adj}$$

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Find the inclination of the line given by 2x + 3y = 6

First, find the slope by solving for y.

$$m = -\frac{2}{3}$$

Set m = tan

$$\tan\theta = -\frac{2}{3} \qquad \tan^{-1}\left(-\frac{2}{3}\right) = -33.69^{o}$$

$33.69^{o} + 180^{o} = 146.31^{o}$, the angle of inclination.-

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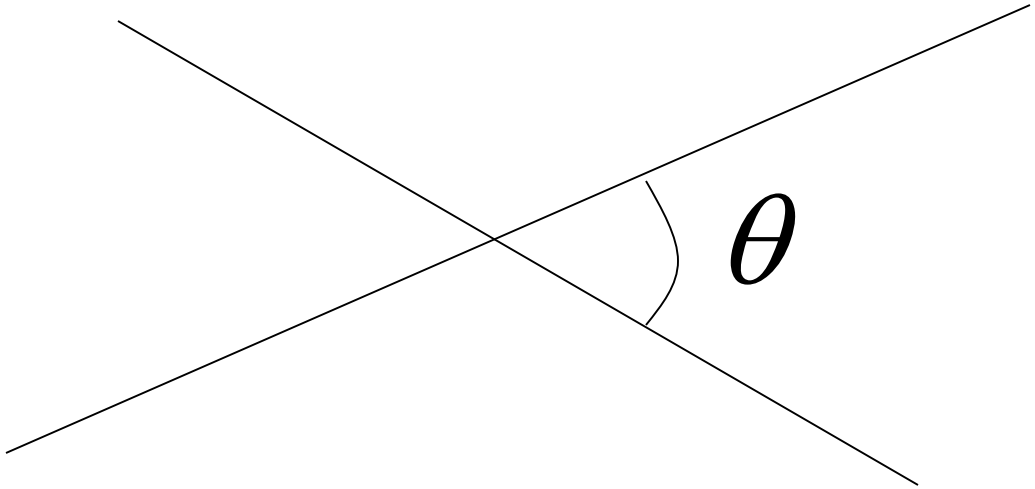
The angle between two lines.

If two non-perpendicular lines have slopes m_1 and m_2, then the angle between the two lines is given by

$$\tan\theta = \left|\frac{m_2 - m_1}{1 + m_1 m_2}\right|$$



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Find the angle between the two lines.

Line 1: $2x - y - 4 = 0$

Line 2: $3x + 4y - 12 = 0$

First, find the slope of the two lines.

$m_1 = 2$ and $m_2 = -3/4$

Now plug these into the equation.

$$\tan\theta = \left|\frac{-\frac{3}{4} - 2}{1 + \left(-\frac{3}{4}\right)(2)}\right| = \left|\frac{-\frac{11}{4}}{-\frac{2}{4}}\right| = \frac{11}{2}$$

Now take the arctan of 11/2

$$\theta = \arctan\frac{11}{2} \approx 79.70^{o}$$

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The Distance Between a Point and a Line.

The distance between the point (x_1, y_1) and the line given by Ax + By + C is

$$d = \frac{|Ax_1 + By_1 + C|}{\sqrt{A^2 + B^2}}$$

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Find the distance between the point (4,1) and the line y = 2x + 1

Note: first put the equation in general form.

-2x + y - 1 = 0

$$d = \frac{|-2(4)+1(1)-1|}{\sqrt{(-2)^2+1^2}}$$

$$= \frac{8}{\sqrt{5}} \approx 3.58$$

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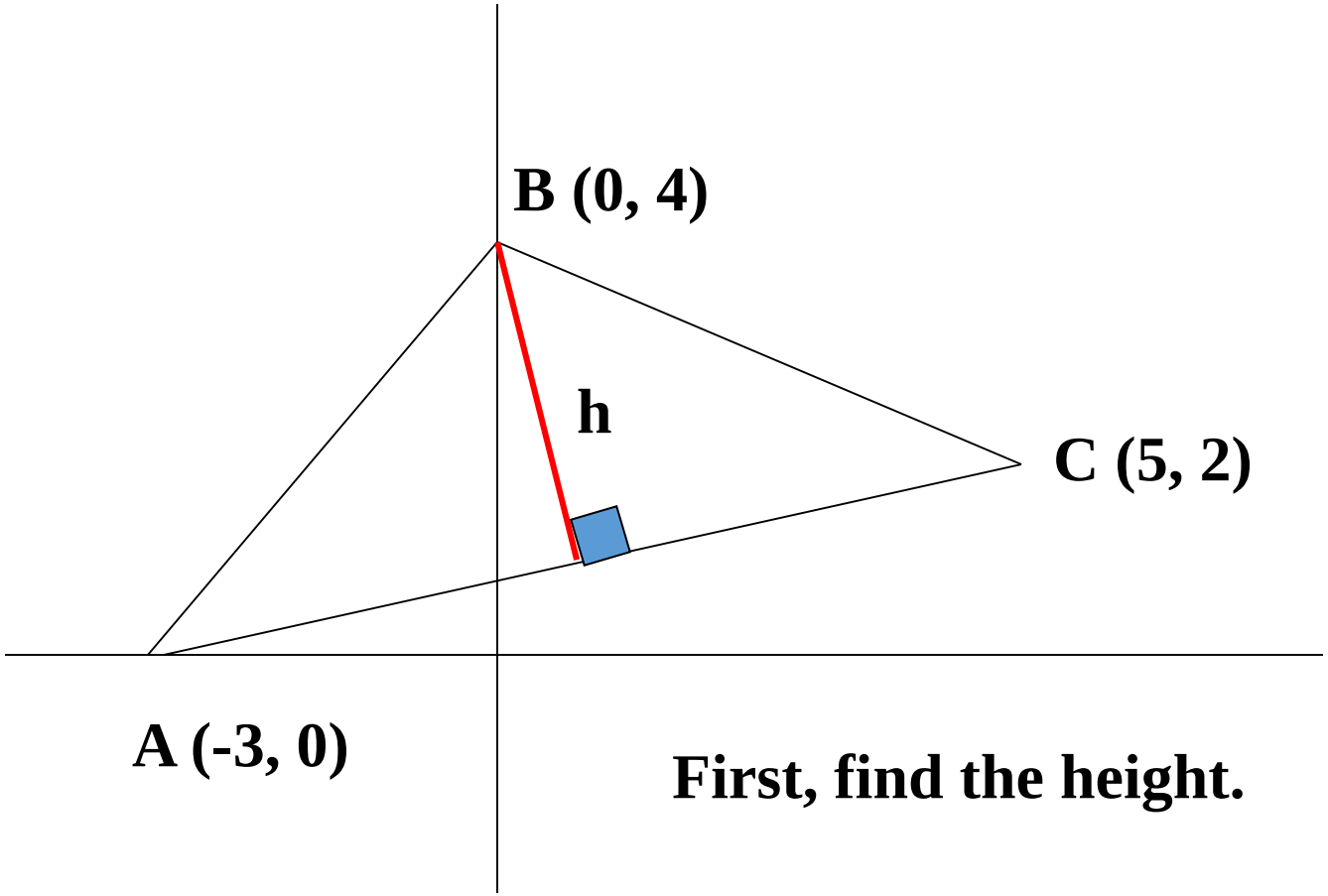
Find the area of a triangle with the points A(-3,0), B(0,4), C(5,2).



First, find the height.

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To find the height, we need to find the equation of line AC.

So, find the slope of AC.

$$m = \frac{2-0}{5-(-3)} = \frac{1}{4}$$

Point-slope form gives us: $$y - 0 = \frac{1}{4}(x+3)$$

Put this eq. in general form. **x - 4y + 3 = 0**

Now find h using this equation and the point (0,4).

$$h = \left|\frac{1(0)-4(4)+3}{\sqrt{1^2+(-4)^2}}\right| = \frac{13}{\sqrt{17}}$$

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Now, using the distance formula between two points, find the length of base AC.

$$b = \sqrt{(5+3)^2 + (2-0)^2} = \sqrt{68} = 2\sqrt{17}$$

Now, the area of a triangle is A = 1/2 (bh)

So go ahead and find the area.

$$A = \frac{1}{2}\left(2\sqrt{17}\right)\left(\frac{13}{\sqrt{17}}\right) = 13$$