



IIT Madras

ONLINE DEGREE

Mathematics for Data Science 1
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Lecture-22
Equation of a Perpendicular Line Passing Through a Point

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Examples

Find the equation of a line perpendicular to the line $x - 2y + 3 = 0$ and passing through the point $(-1, 2)$.

The slope of the given line is $m_1 = \frac{1}{2}$.

The slope of a line perpendicular to the given line is $m_2 = -1/m_1 = -2$.

To find the equation of the line passing through the point $(-1, 2)$ and slope -2 .

$(y - 2) = -2(x + 1)$ or $y = -2x$.

So, now you have been presented with an equation of line and a point and the question is you find the equation of a line perpendicular to the line $x - 2y + 3 = 0$ and passing through the point $(-1, 2)$. So, in this case let us identify the general form of the equation that is $Ax + By + C = 0$ and you can easily see that $A = 1, B = -2, C = 3$.

Therefore, the slope of the given line the line that is given to you will be $-\frac{A}{B}$ which is $-\frac{1}{-2}$ that

will be $\frac{1}{2}$. So, the slope of the given line $m_1 = \frac{1}{2}$, now if at all a line is perpendicular to it then you already know that the product of the slopes is -1 . So if the product of the slopes is -1 then

$m_1 m_2 = -1$ that is $m_2 = \frac{-1}{m_1}$. So m_1 is $\frac{1}{2}$ which will give me $m_2 = -2$.

So now the problem reduces to the slope of a given line is -2 and it passes through point $(-1, 2)$ and I want to find the equation of a line that is passing through point $(-1, 2)$ and has slope -2. So, use the slope point form $y - y_0 = m(x - x_0)$, y_0 is 2 so you can easily see $y - 2 = -2(x + 1)$, so $(x + 1)$, rearrange the terms so this 2 will get cancelled constant therefore I will get the equation of a line to be $y = -2x$ or in a general form you can write this as $-2x + y = 0$.

So, let us try to figure out whether the line which we have actually found is perpendicular or not. So, the orange line is the line for which the equation is given $x - 2y + 3 = 0$ the point $(-1, 2)$ is displayed in the graph and the line passing through it is also displayed and you can clearly see the angle that is made is 90 degrees therefore the lines are perpendicular and our answer is correct. So, our verification test has passed.

