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# Intersection of Two Lines

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## Contents

### 1 Intersection of Two Lines

2

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# 1 INTERSECTION OF TWO LINES

Consider the following two lines given in point-slope form:

$$y - y_1 = m_1 (x - x_1)$$

$$y - y_2 = m_2 (x - x_2)$$

If these two lines intersect at  $(x_{\text{int}}, y_{\text{int}})$ , then

$$y_{\text{int}} - y_1 = m_1 (x_{\text{int}} - x_1) \quad (1)$$

$$y_{\text{int}} - y_2 = m_2 (x_{\text{int}} - x_2) \quad (2)$$

Solving Eqs. (1) and (2) for  $y_{\text{int}}$ ,

$$y_{\text{int}} = y_1 + m_1 (x_{\text{int}} - x_1) \quad (3)$$

$$y_{\text{int}} = y_2 + m_2 (x_{\text{int}} - x_2) \quad (4)$$

Equating Eqs. (3) and (4),

$$y_1 + m_1 (x_{\text{int}} - x_1) = y_2 + m_2 (x_{\text{int}} - x_2)$$

Solving for  $x_{\text{int}}$ ,

$$x_{\text{int}} = \frac{(m_1 x_1 - m_2 x_2) - (y_1 - y_2)}{m_1 - m_2} \quad (5)$$

To obtain  $y_{\text{int}}$ , we can use either line. We choose to use line 1.

$$y_{\text{int}} = y_1 + m_1 (x_{\text{int}} - x_1) \quad (6)$$