# Intersection of Two Lines

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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 $(x_{int}, y_{int})$, then

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

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

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

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

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

Equating Eqs. (3) and (4),

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

Solving for $x_{int}$,

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

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

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