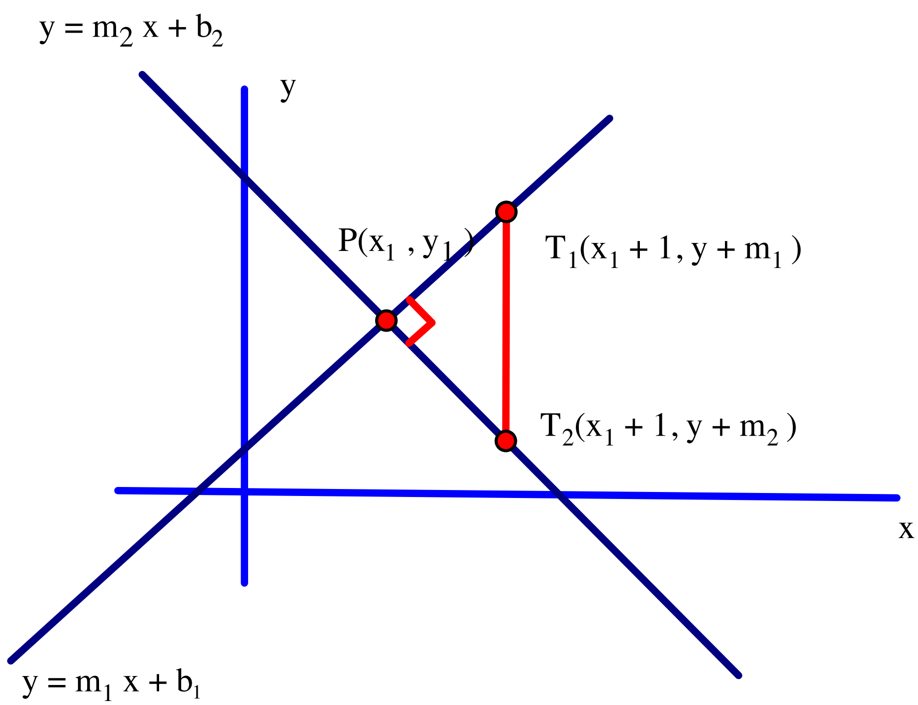
Perpendicular Lines



Since $P(x_1, y_1)$ lies on both lines and using the slope, I can go up m_1 and over 1 on l_1 and using the same reasoning for l_2, go over 1 and up m_2. That results in $T_1(x_1 + 1, y_1 + m_1)$ and $T_2(x_1 + 1, y_1 + m_2)$.

The points P, T_1 and T_2 are the vertices of a triangle. Since the lines are perpendicular, ΔPT_1T_2 is a right triangle. Because I have a right triangle, I can use the Pythagorean Theorem to determine the lengths of each side of the triangle.

$$c^2 = a^2 + b^2$$

$$[d(T_1, T_2)]^2 = [d(P, T_1)]^2 + [d(p, T_2)]^2$$

$$(m_1 - m_2)^2 = (1 + m_1^2) + (1 + m_2^2)$$

$$m_1^2 - 2m_1m_2 + m_2^2 = 2 + m_1^2 + m_2^2$$

$$-2m_1m_2 = 2$$

$$m_1m_2 = -1$$

$$m_2 = -\frac{1}{m_1}$$

$\therefore \rightarrow$ perpendicular lines have negative reciprocal slopes

Example 4. Find an equation of a line passing through (2, –3) that is parallel to $y = 4x + 5$

Using $y - y_1 = m\,(x - x_1)$

I have a point and the number in front of the coefficient is 4, the slope is 4. Substituting, we have

$$y + 3 = m\,(x - 2)$$

The slope of $y = 4x + 5$ is 4, so

$$y + 3 = 4(x - 2)$$

$$y + 3 = 4x - 8$$

$$y = 4x - 11$$