Intersection between Lines L1 and L2:

When working with hitbox, it's convenient to describe a line by its two end points:
Line L1$\{x_1, y_1, x_2, y_2\}$

The y = mx + c form of the line can be found:
$$m = \frac{x2 - x1}{y2 - y1}$$
$$c = y_1 - mx_1$$

The intersection point (x_{in}, y_{in}) must fulfill the equation of both lines:
$$y_{in} = m_1 x_{in} + c_1 = m_2 x_{in} + c_2$$

which leads to:
$$x_{in} = \frac{c_1 - c_2}{m_2 - m_1}$$

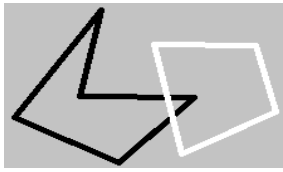This intersection point may, however, lie only at the extension of the two lines.

Therefore, it is necessary to check that the intersection point is inside the line:
The lines intersects if and only if these two conditions are met:
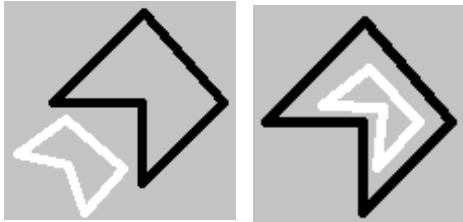1). $L_1.x_1 \leq x_{in} \leq L_1.x_2$
2). $L_2.x_1 \leq x_{in} \leq L_2.x_2$

Intersection between Polygons P1 and P2

Polygons P1 and P2 are given as $\{\underline{x}, \underline{y}\}$, where $\underline{x} = \{x_1, x_2, ..., x_n\}$ and $\underline{y} = \{y_1, y_2, ..., y_n\}$.

If at least one of the sides of P1 (which is a line) intersects with at least one of the sides of P2, then **collision**. To check this, we can use the line intersection check to all sides of the polygons.

If none of them intersects, then:

If (P1 is inside P2 or P2 is inside P1) then **collision**, otherwise **no collision**.

The most difficult problem left is how to determine whether a polygon is inside another polygon. **Since none of the sides of the polygons intersect**:

P1 is inside P2 iff one of the edges (for example the point $(P_1.x_1, P_1.y_1)$) of P1 is inside P2.

Therefore, the problem is further reduced to checking if a point is inside a polygon. A very clever method called 'ray casting' (http://en.wikipedia.org/wiki/Point_in_polygon) can easily give the answer. Make a very long line from the point to outside (say, to the left). This line must exceed the outermost side of the polygon:
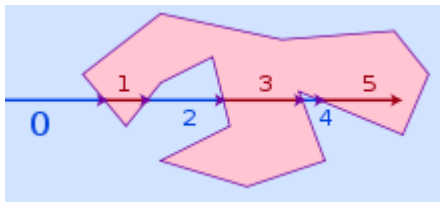
Then, check for each side of the polygon if they intersects with this new long line. Intuitively, if the number of intersections is odd, the point is inside the polygon, while if it is even, the point is outside.

image source: wikipedia