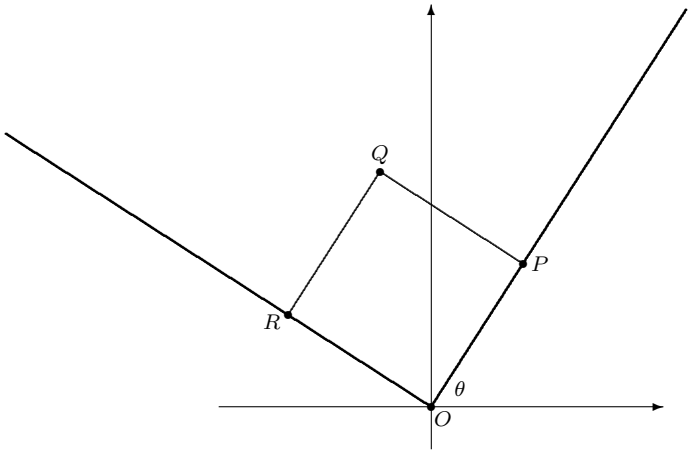
Drawing Right-Angles

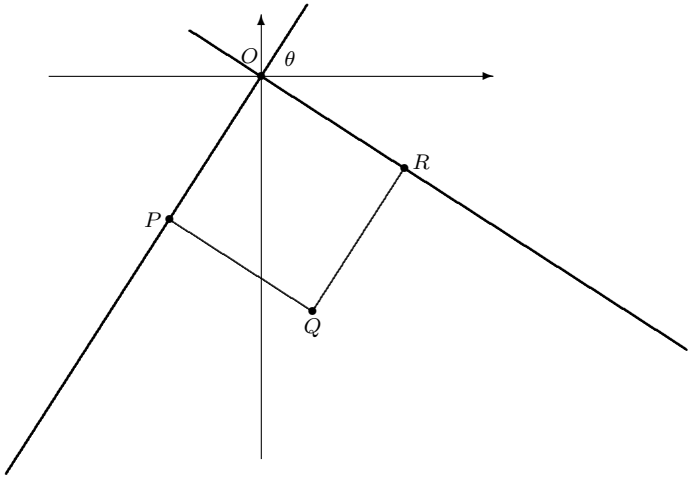
Let $y = (\tan\theta)x$ be the equation of a line through the origin. The line, through the origin, perpendicular to this line has equation $y = (-\cot\theta)x$. (The special case of θ being the measure of a right-angle can be done separately.)



Let the dimensions of the square be $c \times c$. Then it should be clear that P has coordinates $P(c\cos\theta, c\sin\theta)$ and R has coordinates $R(-c\sin\theta, c\cos\theta)$. Then the coordinates of Q are found by adding the two vectors $\overrightarrow{OP}$ and $\overrightarrow{OR}$. Hence Q has coordinates $Q(c\cos\theta - c\sin\theta, c\sin\theta + c\cos\theta)$. Let $P(p_1, p_2)$, $Q(q_1, q_2)$ and $R(r_1, r_2)$ be the coordinates of P, Q, and R. Then to put a right-angle at a point (a, b) with reference to a line with slope $\tan\theta$, you simply have to use the LaTeX command

$$\backslash\text{put}(a,b)\{\backslash\text{join}(p_1,p_2)(q_1,q_2)(r_1,r_2)\}.$$

Sometimes it may be difficult to figure out the θ, so you may want to modify the above for other situations. For example:



Note that for the same θ as above, the coordinates of the points P, Q, and R are just the negatives of the ones above since each is just reflected in the origin. The diagram above is the one that fits the example below, where we have drawn the altitude from the vertex C in the

$\triangle ABC$ where $A(7,8)$, $B(0,0)$, $C(10,0)$ and C', the foot of the perpendicular, has coordinates $C'(4.33628, 4.95575)$. It is not trivial to find C'. You should write a program to find the coordinates of the perpendicular projection from a point to a line. (See your Math 2050 notes.) You can either use your ten-dollar scientific calculator or write a short program to compute the numbers needed in the command \put$(4.33628, 4.95575)${\join$(p_1, p_2)(q_1, q_2)(r_1, r_2)$}. We used $c = 0.5$, and $\theta = \arctan(8/7)$ to compute the symbol for the right-angle below.