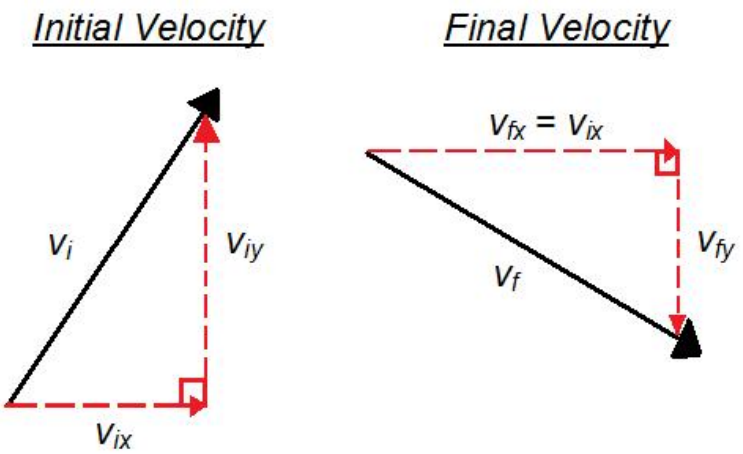
HOW TO SOLVE PROJECTILE PROBLEMS

1. Chose origin and axis. Usually the best choice will be to chose x=0 on the vertical line passing through launch point and y=0 either at launch point or at the end point level, whichever is lower. x axis directed usually to the right and y axis up.
2. Identify resolution of the initial velocity into chosen axis.

   $u_x = u\cos\theta$ $\quad$ $u_y = u\sin\theta$

   In case of horisontal launch $u_x = u$ and $u_y = 0$

   In rare case of launch direction below horisontal line, angle has to be taken as negative.
3. Write down equations of the motion along each axis. Motion in horisontal direction is with the constant speed so equation is $x = x_0 + u_x t$, where x_0 is initial x position, usually 0. Motion in vertical direction is with the uniform acceleration g=10 ms^{-2} down so equation is $y = y_0 + u_y t - 5t^2$
4. Sub all known values in those equations. Instead of x and y sub in final position, often for y it will be 0. Solve obtained simultaneous equations and find unknown values.
5. If you need to find final velocity use formula $v = \sqrt{{v_x}^2 + {v_y}^2}$ to find speed (magnitude of velocity), where v_x and v_y are final components of velocity. $v_x = u_x$ and $v_y = u_y - 10t$



To find angle θ with the horisontal use formula $\theta = \tan^{-1}(\frac{v_y}{v_x})$

6. In case when launch point is at the same level as end point you can use standard formulas for maximum height H and range L:

$H = \frac{u^2 sin^2\theta}{2g}$ and $L = \frac{u^2 \sin 2\theta}{g}$ $t = \frac{2u \sin\theta}{g}$

Final speed in this case equal to initial and final angle equal initial with minus (as angle below horisontal) .