Projectile Motion.

In[489]:=

```
(* Define constants and initial conditions *)
g = 9.8;                              (* Acceleration due to gravity (m/s^2) *)
tStart = 0;                           (* Start time (seconds) *)
tmax = 100;                           (* Maximum time (seconds) *)
v0 = 700;                             (* Initial velocity (m/s) *)

(* Initial position *)
x0 = 0.0;                             (* Initial x position (meters) *)
y0 = 0.0;                             (* Initial y position (meters) *)

(* Launch angle in radians *)
θ = (30 * Pi) / 180.0;      (* Launch angle (30 degrees converted to radians) *)

(* Time step for simulation *)
dt = 1;                               (* Time step (seconds) *)

(* Initial velocity components *)
vx0 = v0 * Cos[θ];          (* Initial x velocity component (m/s) *)
vy0 = v0 * Sin[θ];          (* Initial y velocity component (m/s) *)

(* Create a list of time values *)
tList = Range[tStart, tmax, dt];  (* List of time values from tStart to tmax with step dt *)
lt = Length[tList];                (* Length of the time list *)

(* Initialize lists for positions and velocities *)
xList = 0 * tList;                (* Initialize x positions list *)
yList = 0 * tList;                (* Initialize y positions list *)
vxList = 0 * tList;               (* Initialize x velocities list *)
vyList = 0 * tList;               (* Initialize y velocities list *)

(* Set initial velocities *)
vxList[[1]] = vx0;                (* Set initial x velocity *)
vyList[[1]] = vy0;                (* Set initial y velocity *)

(* Update positions and velocities over time *)
Do[
    (* Update x position *)
    xList[[i + 1]] = xList[[i]] + dt * vxList[[i]];
    (* Update y position *)
    yList[[i + 1]] = yList[[i]] + dt * vyList[[i]];
    (* Keep x velocity constant *)
    vxList[[i + 1]] = vxList[[i]];
    (* Update y velocity considering gravity *)
    vyList[[i + 1]] = vyList[[i]] - g * dt,
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    {i, 1, lt - 1}                (* Loop over time steps *)
];

(* Create a table of (x, y) positions for plotting *)
xy = Table[{xList[[i]], yList[[i]]}, {i, lt}];

(* Plot the trajectory of the projectile *)
ListPlot[xy, Joined → True,
    PlotLabel → "Projectile Motion Trajectory",  (* Title for the plot *)
    AxesLabel → {"x (m)", "y (m)"},              (* Labels for axes *)
    AspectRatio → 1,                             (* Maintain aspect ratio *)
    PlotStyle → {Thick, Blue}                    (* Style for the plot line *)
]
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Out[509]=