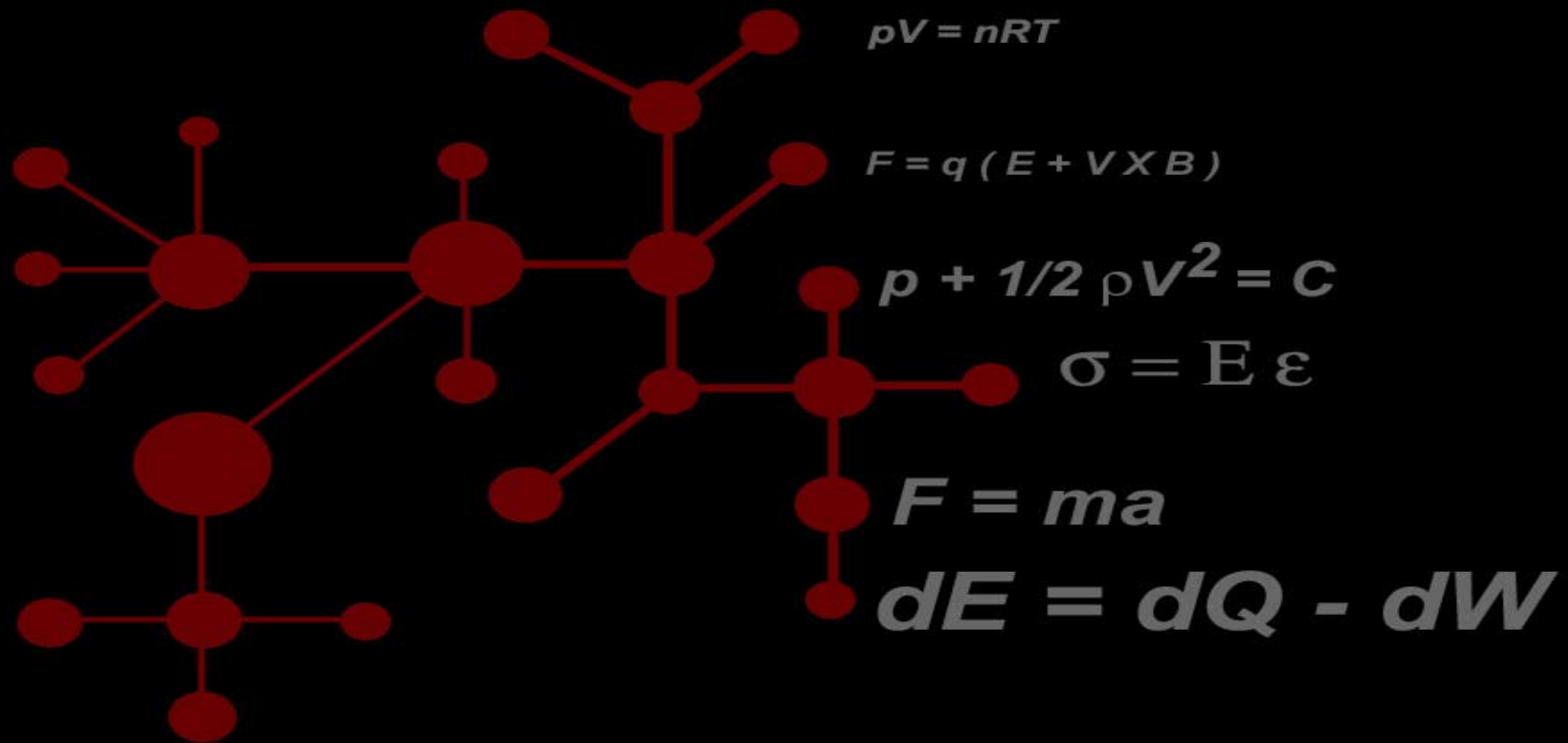


Concept Map

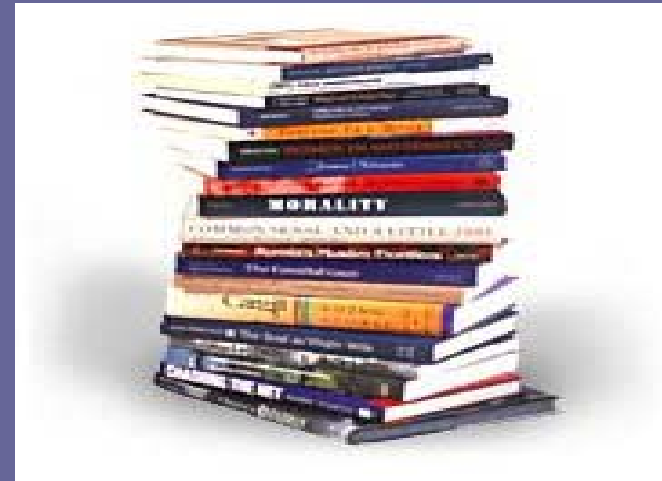
Organize, Apply, Explore, and Innovate



Actus Potentia, Inc.
www.actuspotentia.com

Teaching & Learning Science

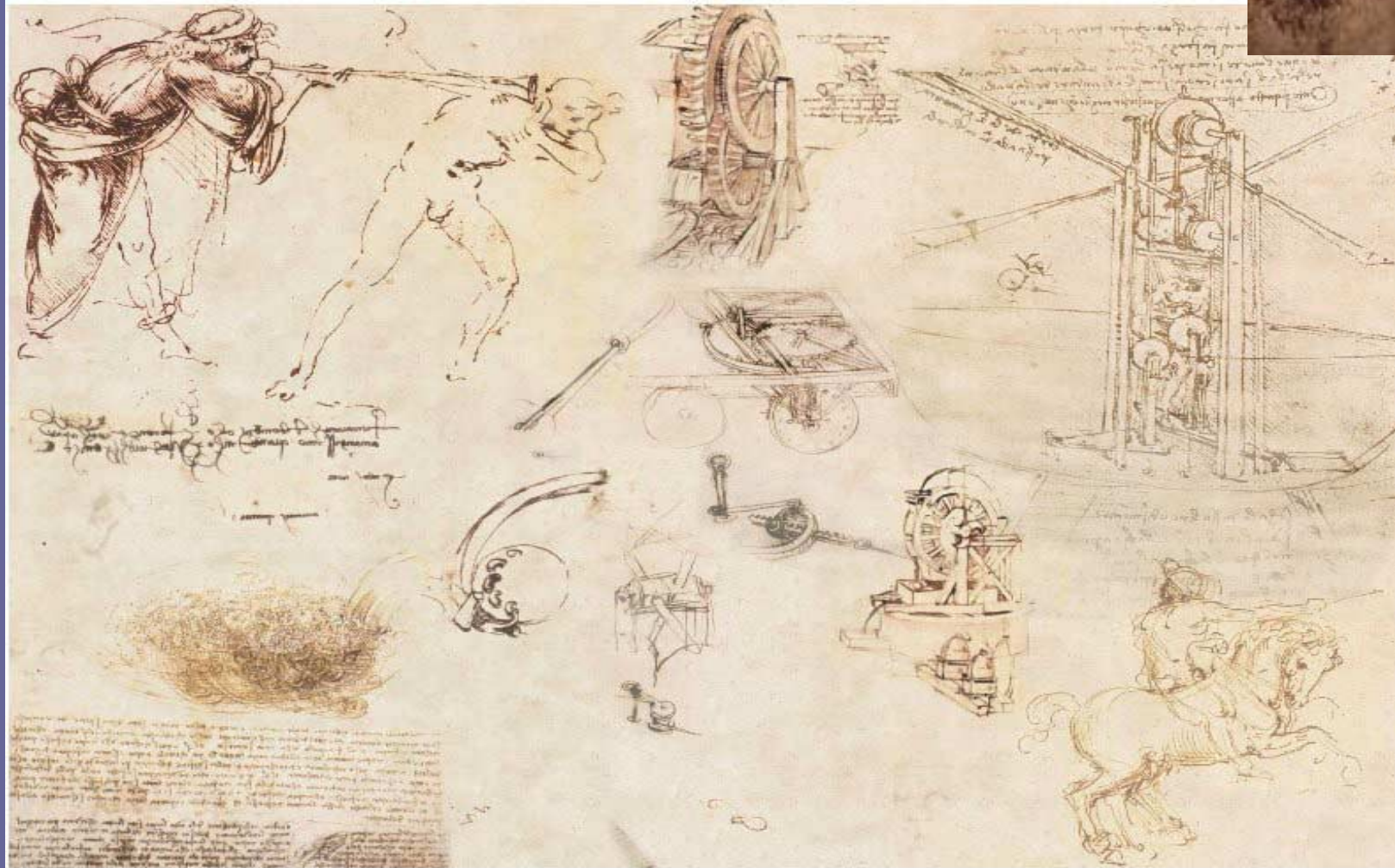
- What we teach.
- What we expect our students to learn.



Concept Map & Components of Learning

- Association
 - connection among related ideas
- Understanding
- Comprehension
 - long term retention
- Application and Analysis
- Innovation/Design/Synthesis

Connect Related Ideas



One Concept – Multiple use

Speed = Distance / Time

$$V = \frac{d}{t}$$

- Problem - 1: d and t are given; find V
- Problem - 2: V and t are given; find d
- Problem - 3: V and d are given; find t

2 Concepts – 45 Uses

- Concept-1 has 1 equation with 5 variables
- Concept-2 has 1 equation with 5 variables
- 8 variables out of 10 are given, solve for the remaining 2
- 45 different kinds of problems (some may be ill-posed)

Learn 2 concepts &
practice innovative usage.

Projectiles

You want to learn about projectiles.

In absence of air resistance and for constant gravity in the range of motion, if you throw an object, then the object follows a parabolic path.



How Concept-Map Streamlines Learning

In a textbook, typically it would take 5 pages of text and 11 equations to explain projectiles.

Our Concept-Map can explain projectiles with 5 **related** equations.

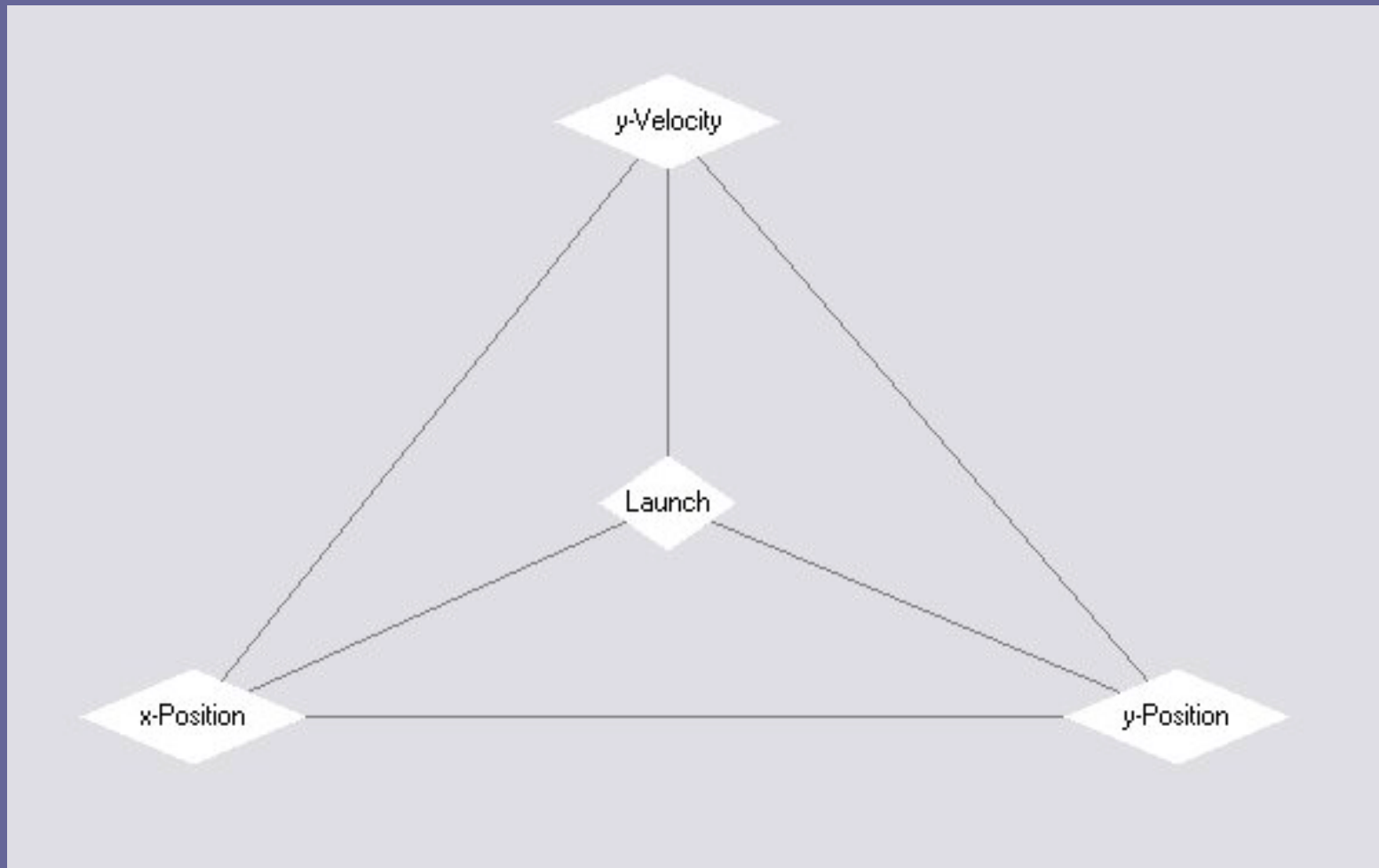
$$V_x = V \cos \theta$$
$$V_{y0} = V \sin \theta$$

$$x = x_0 + V_x t$$

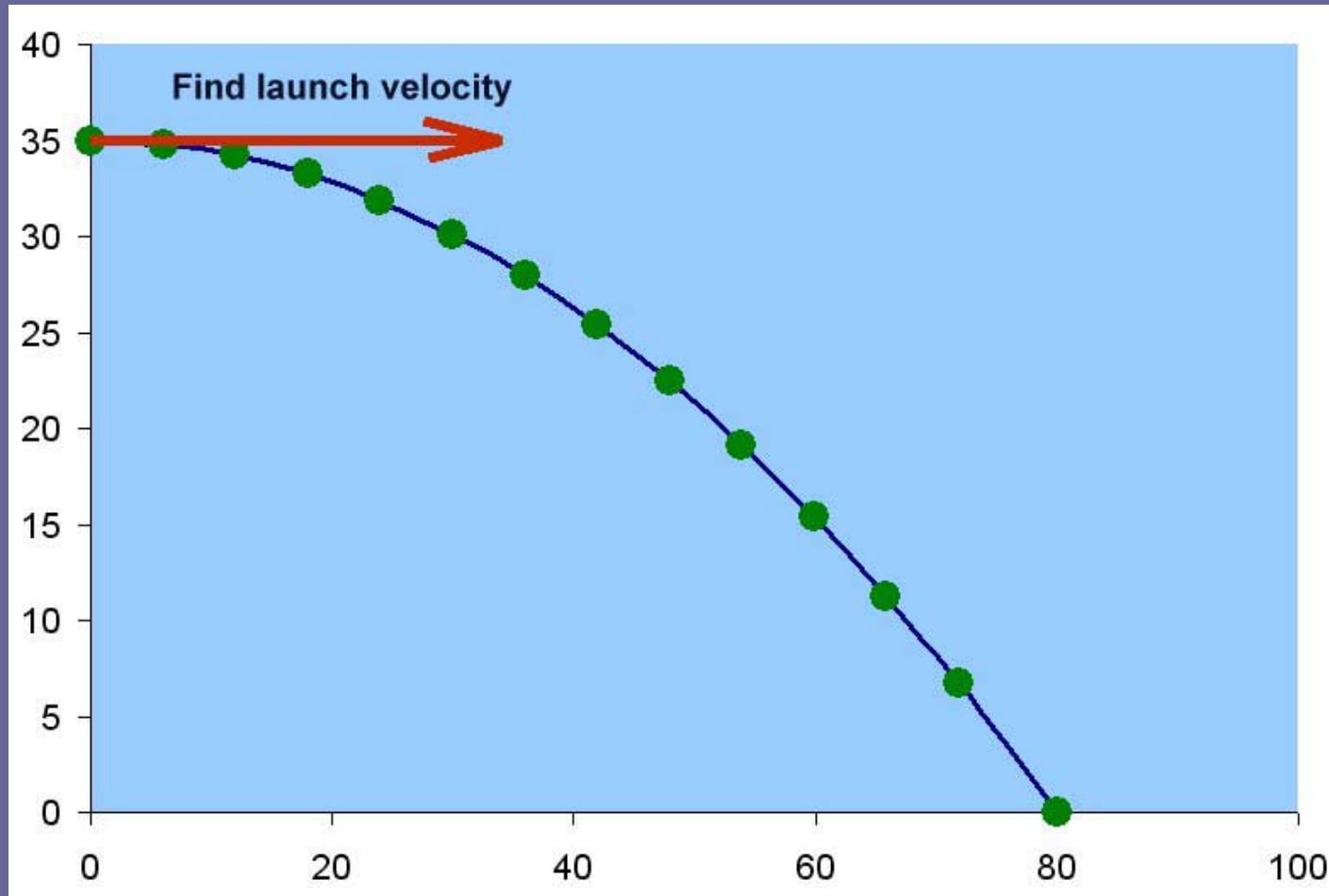
$$y = y_0 + V_{y0} t - \frac{1}{2} g t^2$$

$$V_y = V_{y0} - g t$$

Projectile Concept Map



The Problem



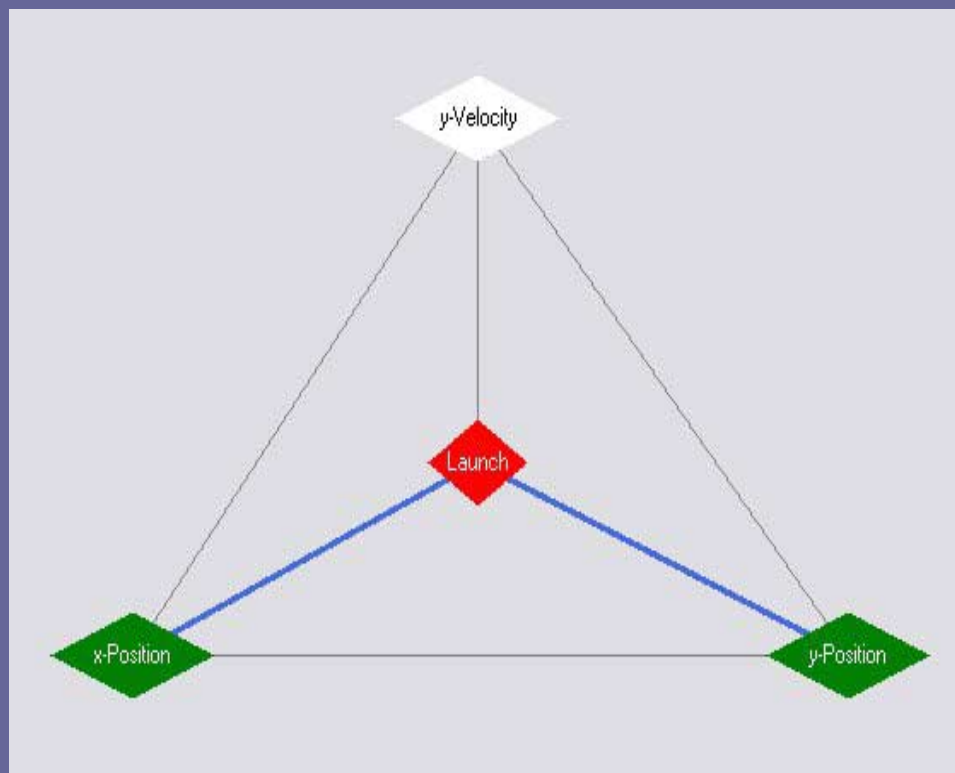
Projectile Variable List

Displaying all variables in map

Accept Changes (Enter) Discard Changes (Esc) Add Derived Variables

KNOWN variables	DESIRED variables
Check all the variables you know.	Check the one variable you need.
<input checked="" type="checkbox"/> Gravity - g	<input type="radio"/> Gravity - g
<input checked="" type="checkbox"/> Launch Angle - theta	<input type="radio"/> Launch Angle - theta
<input type="checkbox"/> Launch Velocity - V	<input checked="" type="radio"/> Launch Velocity - V
<input type="checkbox"/> Time - t	<input type="radio"/> Time - t
<input checked="" type="checkbox"/> x-Final - x _f	<input type="radio"/> x-Final - x _f
<input checked="" type="checkbox"/> x-Initial - x _i	<input type="radio"/> x-Initial - x _i
<input type="checkbox"/> x-Velocity - V _x	<input type="radio"/> x-Velocity - V _x
<input checked="" type="checkbox"/> y-Final - y _f	<input type="radio"/> y-Final - y _f
<input checked="" type="checkbox"/> y-Initial - y _i	<input type="radio"/> y-Initial - y _i
<input type="checkbox"/> y-Velocity Final - V _{yf}	<input type="radio"/> y-Velocity Final - V _{yf}
<input type="checkbox"/> y-Velocity Initial - V _{yi}	<input type="radio"/> y-Velocity Initial - V _{yi}

Concept Map Finds Path



Post Processing

Step 1: Solved variable "x-Velocity" in equation "Launch"

Step 1: Solved variable "Launch Velocity" in equation "Launch"

Step 1: Solved variable "y-Velocity Initial" in equation "Launch"

Step 1: Solved variable "Time" in equation "x-Position"

Solver Screen

Simultaneous Equations

Simultaneous Equations Solution

Node Launch

V - Launch Velocity = 0

theta - Launch Angle = 0

V_x - x-Velocity = 0

Node Launch

V - Launch Velocity = 0

theta - Launch Angle = 0

V_yi - y-Velocity Initial = 0

Node x-Position

x_i - x-initial = 0

V_x - x-Velocity = 0

t - Time = 0

x_f - x-Final = 0

Node y-Position

y_i - y-Initial = 0

V_yi - y-Velocity Initial = 0

t - Time = 0

g - Gravity = 0

y_f - y-Final = 0

Solve Clear Solution Finished

Solution:

Properties of Concept Map

Mapping as a drawing tool is passive.

- Associates ideas based on knowledge
- Contains active nodes of concepts
- Map is interactive and engaging
- Problems can be posed on the map
- Map shows solution paths
- Map yields numerical solutions

Using Concept Map

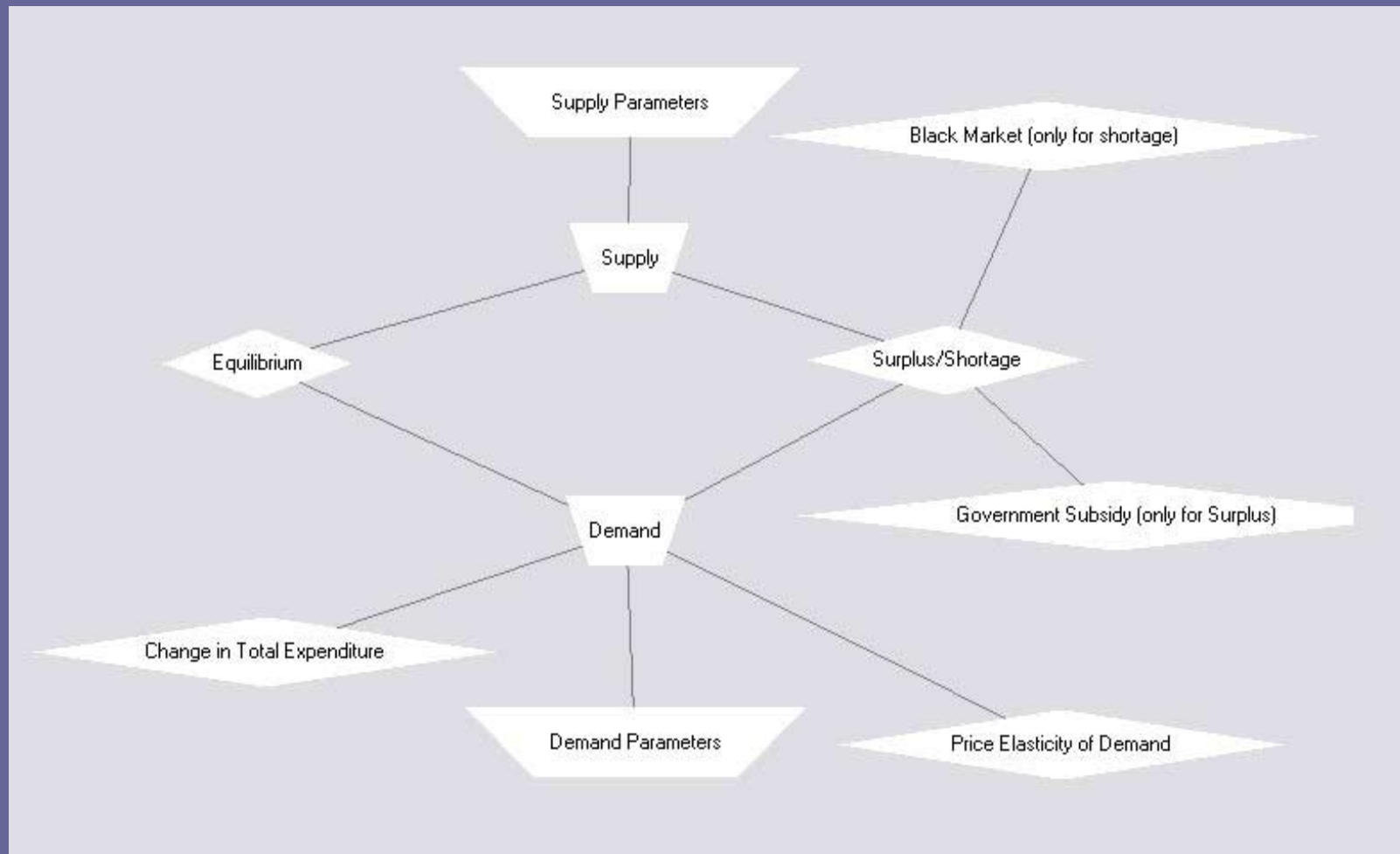
- Build entire lectures around Maps
 - Add equations to nodes
 - Add demonstration movies, ppt/pdf/doc lectures
- Build classroom activities around Maps
 - Guess how the Map will solve a problem
 - How many different ways can you solve this problem
 - Shortest path to solution

Map is a Real Estate

Build anything you wish on the Map.



Economics – Supply/Demand



What was our goal when we developed this software?

- Easy to learn tool that supplements classroom activities.
- Add variety in classroom
- Engage and Motivate
- Give a taste of success
- Empower the students to learn and make it fun.
- 24-7 Personal guide and tutor
- Easily incorporated in existing curriculum, content, and objective.

Efficient Teaching

- Faculty time is valuable
 - easy to learn software; short and steep learning curve
- Eliminates prolonged lecturing
 - students have short attention span
 - combines abstract definitions and derivations with demonstrations and applications.
- Knowledge is not an assembly of floating soap-bubbles
 - compact nugget with a purpose
- Simultaneous teaching and learning
 - engages students in lecture; enhances interaction
- Transfer learning responsibility to student
 - less hand-holding

Efficient Learning

- Traditionally teaching ends and learning begins
 - Blend teaching and learning
- Structured environment
- Interactive lessons
- Success keeps students motivated
- Increased drill and practice
- Reduce perceived volume of knowledge through organization and association.

Innovative Problem Solving

- Today's problem solvers are tomorrow's innovators.