Animating Attributes
(in Maya 2008)
but first, understand Maya internals

Maya's internal representation nodes with attributes connected to each other
Dependency Graph

Types of nodes
shape
transform
group
expression
shading
etc.

Windows->Hypergraph:Connections
Attributes: types
- integers
- floating point
- enumerated
- vectors
- matrices
- arrays

connections: links between attributes
Attribute Editor

1st of upper right icons

displays keyable attributes

Windows->General Editors ->Attribute Editor
Connections

upstream v. downstream
Scene hierarchy
subset of DG
directed acyclic graph DAG
transform hierarchy

Windows->Hypergraph:Hierarchy
Outliner

Windows->Outliner
Animating Attributes

Driven Keys

Expression Nodes
Direct Connections between attributes

Window->General Editors->Connection Editor
**Driven Keys** - set one attribute to 'drive' another

with the 'Animation' menu set: Animate-> Set Driven Keys -> Set ...

[Image of Set Driven Key interface]
Window->Animation Editors->Graph Editor
Expression Nodes

Create expressions to set attribute values from other attributes

Creates an expression node in the DG

1. define variables
2. compute value
3. assign value to attribute
Expression Editor

Window->Animation Editors->Expression Editors
Make a sphere

hypergraph
in Dynamics menu set, Particles->Particle Set attribute box

creation expression
per Object expression
per Particle expression
MEL/Python

command line

script editor
MEL

similar syntax to Expressions, but not same
MEL: setAttr(pSphere.translateX) = 10;
Expr: pSphere.translateX = 10;

write MEL script to define expression nodes
Script Editor
string $sph[] = `sphere`;

currentTime 1;
setKeyframe ($sph[0] + ".translate");

currentTime 30;
move -r -moveY 2;
setKeyframe ($sph[0] + ".translate");

playbackOptions -min 1 -max 30;
play;
// simpleAnimation.mel
// shows use of setting an *Expression* in MEL
// an Expression gets executed each frame and is a way to set up
// procedural animation
// this script also sets the up and initiates playback
// from http://www.fundza.com/mel/quickref2/#expression1

string $exp = "";

for($i = 0; $i < 3; $i++) {
    $obj = `sphere`;
    move (rand(-3,3)) (rand(-3,3)) (rand(-3,3));
    $exp += "select -r " + $obj[0] + ";\n" +
    "move -moveY (rand(0,2));\n";
}
$exp += "select -clear;\n";

expression -s $exp -ae 1;
playbackOptions -min 1 -max 30;
// play;
**Bouncing ball**

*script editor*

create a sphere, name it b1
add attributes of velocity in x & y

*expression editor*

if first frame
  b1.velocityY = initVelocity
  b1.position = (0,0)
else
  add velocity to position
  add acceleration (gravity) to velocity
  if (positionY <= 0)
    K = 0.9*K
    b1.velocityY = initVelocity*K

v += a; p += v
where a = (0,-g)
Springy ball \[ f_1 = (K_s |p_1-p_2| - K_d (v_1-v_2).\frac{(p_2-p_1)}{|p_2-p_1|}) \frac{(p_2-p_1)}{|p_2-p_1|} \]

script editor
create two spheres, named b1 & b2
add attributes of velocity and acceleration in x & y

expression editor
for b1: if first frame, reinitialize position & velocity
else
compute f1, f2
compute \( a_1 = \frac{f_1}{m_1}; a_2 = \frac{f_2}{m_2} \)
update velocity += acceleration
[scale velocity down]
update position += velocity