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% 9/17/19
% ECE 202 - Fall 2019 - MATLAB Exercise M1
% Equation source: http://www.convertalot.com/elastic_collision_calculator.html
% MATLAB script to determine the final velocities of 2 carts after an
% elastic collision.


clear % clears all variables in the workplace; avoids common errors
clc  % clears all previous outputs in the command window

% -------- given information --------

m1 = 250;  % mass of the cart#1 in g
m2 = 150;  % mass of the cart#2 in g
v1i = 40;  % initial velocity of cart#1 in cm/s
v2i = -30; % initial velocity of cart#2 in cm/s


% --------- calculations ----------
% (a)
M = m1 + m2;                          % total mass of cart#1 and cart#2 in g

v1f = (m1*v1i - m2*v1i + 2*m2*v2i)/ M  % final velocity of cart#1 in cm/s
                                           % using momentum conservation
                                           % and kinetic energy
                                           % conservation

v2f = (2*m1*v1i - m1*v2i + m2*v2i)/ M  % final velocity of cart#2 in cm/s
                                           % using momentum conservation
                                           % and kinetic energy
                                           % conservation

% ---------- check answers --------
% (b)
p1i = m1*v1i;  % Initial Momentum Cart#1
p2i = m2*v2i;  % Initial Momentum Cart#2
p1f = m1*v1f;  % Final Momentum Cart#1
p2f = m2*v2f;  % Final Momentum Cart#2

checkMomentum = p1f + p2f - (p1i + p2i)          % The change in the total
                                                 % momentum of the system
                                                 % before & after the
                                                 % collision should be
                                                 % zero.

e1i = 0.5*m1*v1i^2;   % Initial Energy Cart#1
e2i = 0.5*m2*v2i^2;   % Initial Energy Cart#2
e1f = 0.5*m1*v1f^2;   % Final Energy Car1#1
```

```
50 e2f = 0.5*m2*v2f^2;    % Final Energy Car1#2
51
52 checkEnergy = e1f + e2f - (e1i + e2i)
53                                                  % The change in the total
54                                                  % energy of the system
55                                                  % before & after the
56                                                  % collision should be
57                                                  % zero.
58
```

```
 1
 2 v1f =
 3
 4   -12.5000
 5
 6
 7 v2f =
 8
 9    57.5000
10
11
12 check_p =
13
14      0
15
16
17 check_Energy =
18
19      0
20
21 >>
```