LAB #7

- ATWOOD MACHINE

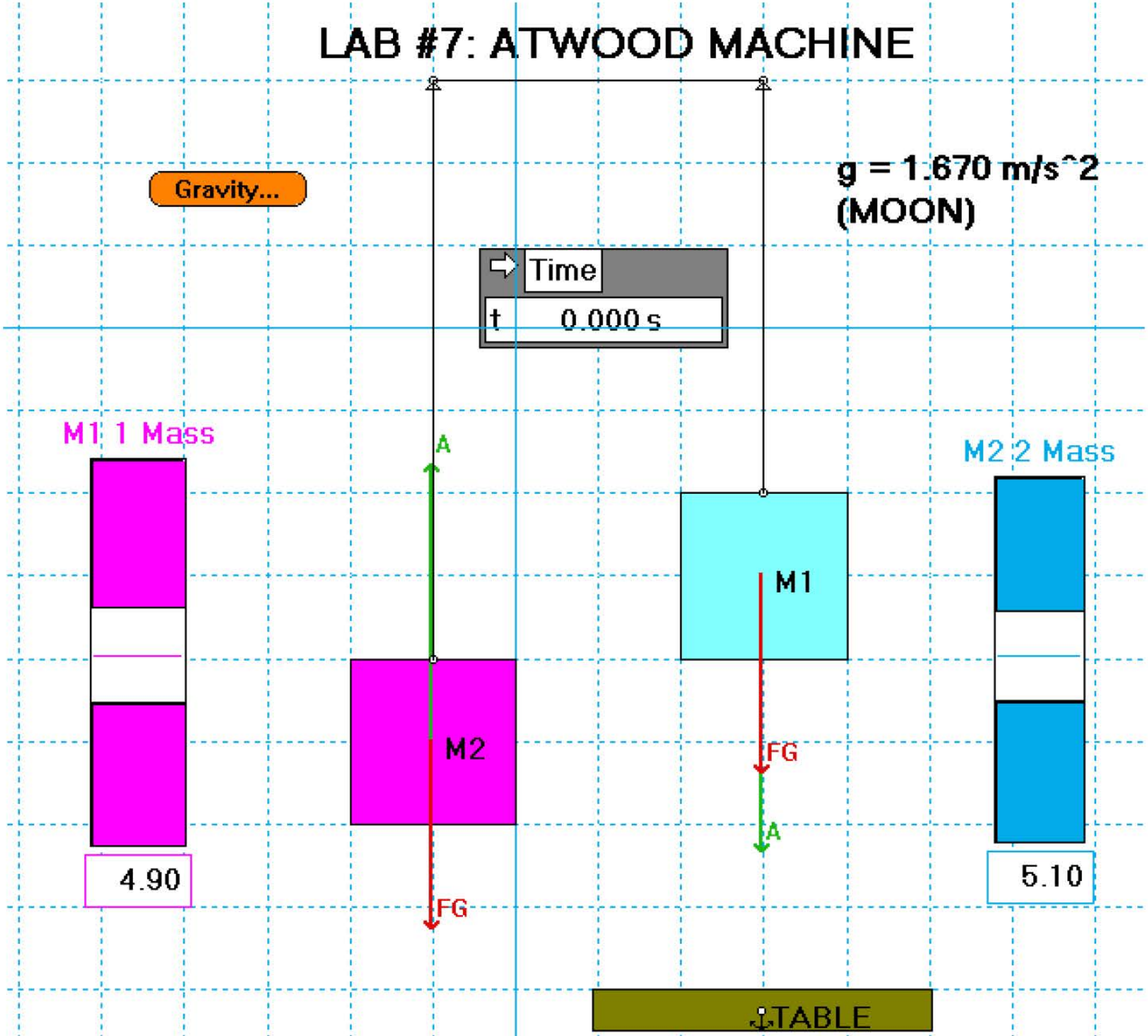
GOALS

- TO USE AN ATWOOD MACHINE TO DETERMINE THE ACCELERATION DUE TO GRAVITY:
  - OF EARTH **(REAL ATWOOD)**
  - OF THE MOON **(IP ATWOOD)**

PROCEDURE

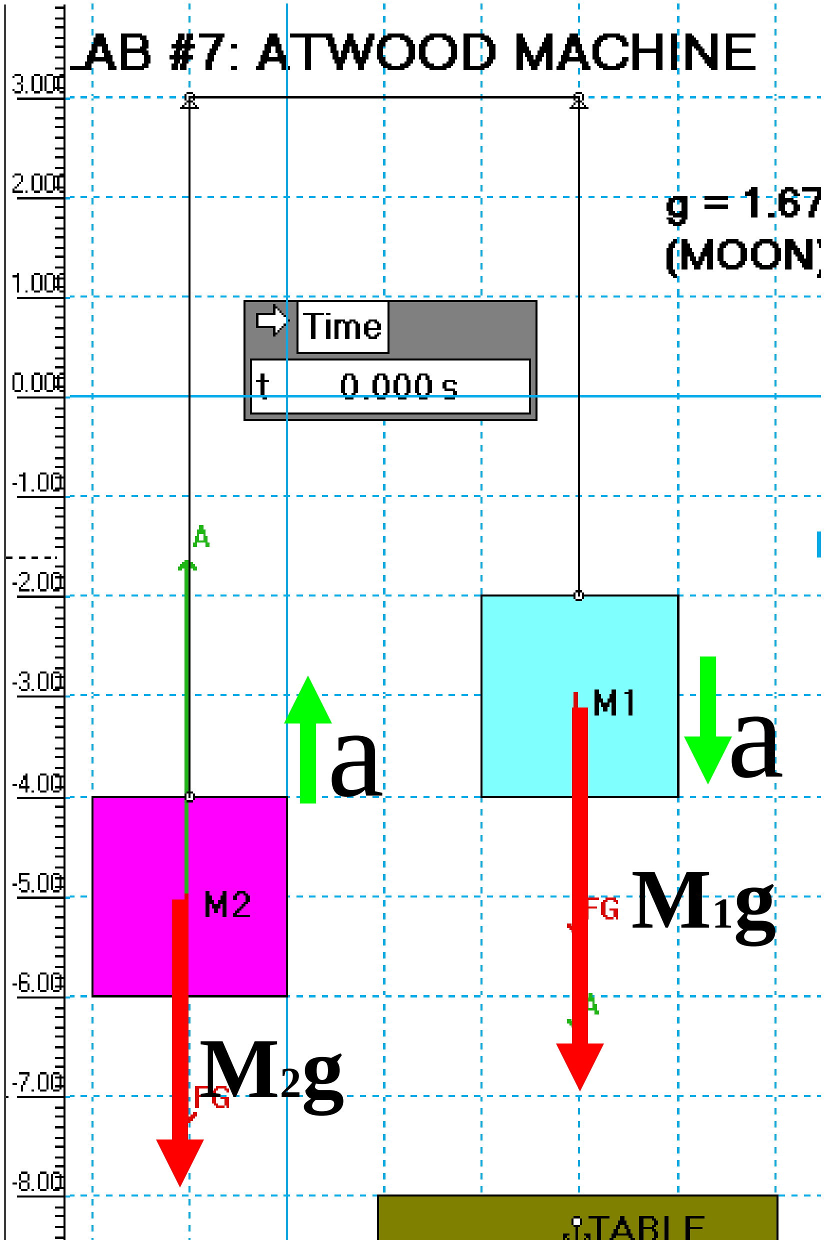
- Set up Atwood machine with 2 equal masses (500g)
- Add a 10 g mass to one side
- Clamp 5 paper clips to each side
  - Each clamp is ~4g
- Release system and clock the time required for heavier mass to reach the table top
- Measure Y, record time
- Transfer one clamp from one side to the other and repeat
- Continue trials until all clamps are on one side of system

ATWOOD MACHINE



BHS Physics

ATWOOD MACHINE PROOF



$$M_1g > M_2g$$

$$F_{net} = ma$$

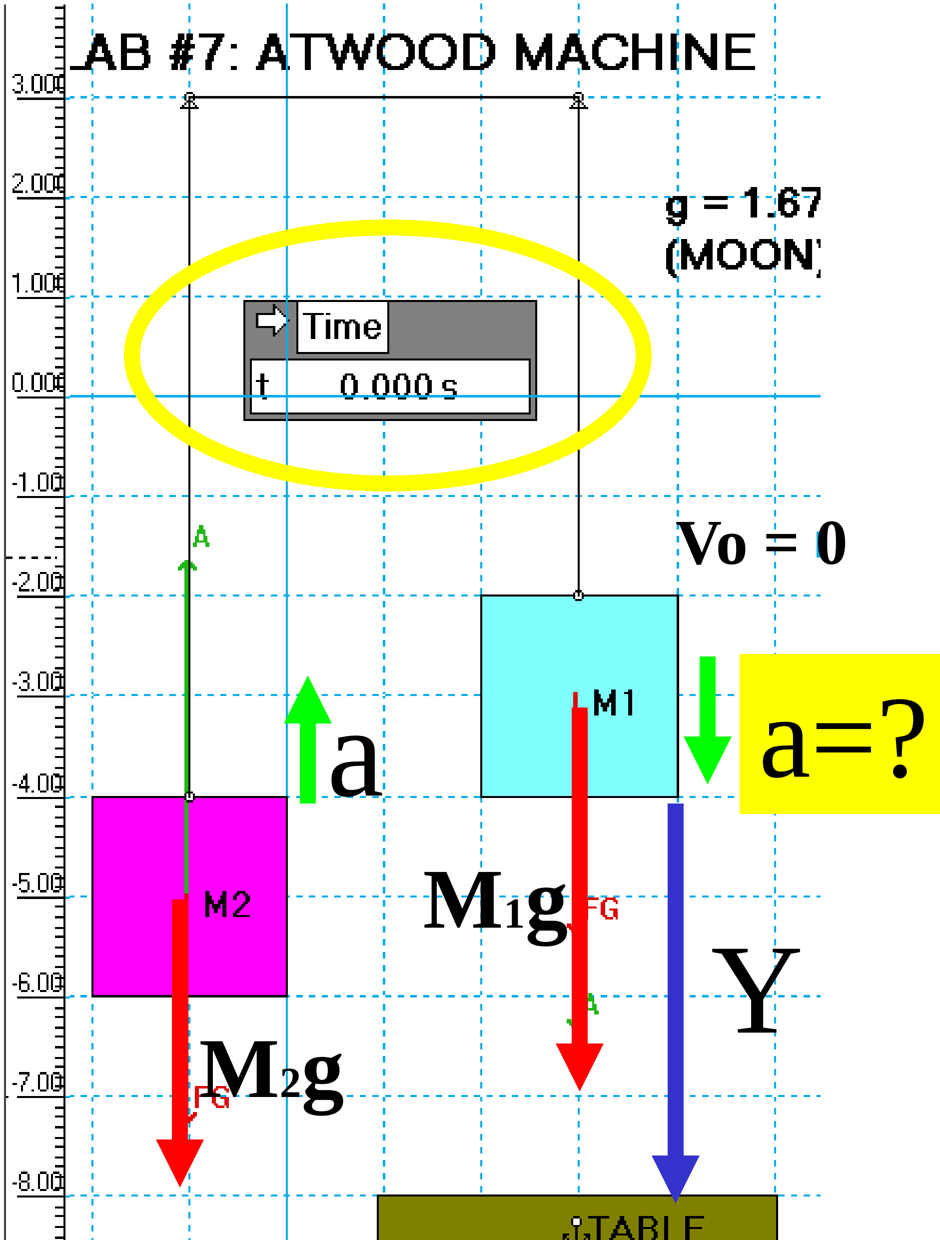
$$F_{net} = M_1g - M_2g$$

$$M_1g - M_2g = (M_1 + M_2)\,a$$

$$(M_1 - M_2)\,g = (M_1 + M_2)\,a$$

$$a = g\left(\frac{M_1 - M_2}{M_1 + M_2}\right)$$

ATWOOD MACHINE: OBSERVED ACCEL



Theoretical a:

$$a = g\left(\frac{M_1 - M_2}{M_1 + M_2}\right)$$

Observed a: (from data)

Vo	
Vf	
a	
t	
d	

$V_f = V_o + at$

$d = V_o t + \frac{1}{2}(at^2)$

$V_f^{\,2} = V_o^{\,2} + 2ad$

DATA TABLE PART 1: Earth's g

SAMPLE DATA TABLE: PART 1: SOLVE FOR EARTH'S g

(M1+ M2) = CONSTANT = ________kg g = 9.8

M1 (kg)	M2 (kg)	M TOTAL (kg) (M1+ M2)	(M1- M2)	(M1- M2) / (M1+ M2)	Y (m)	t (s)	a (m/s^2)
0.530	0.520						
0.534	0.516						
0.538	0.512						
0.542	0.508						
0.546	0.504						
0.550	0.500						

DATA TABLE PART 2: Moon's g

SAMPLE DATA TABLE: PART 2: SOLVE FOR MOON'S g (INTERACTIVE PHYSICS)

(M1+ M2) = CONSTANT = ___________kg g = 1.67

M1 (kg)	M2 (kg)	M TOTAL (kg) (M1+ M2)	(M1- M2)	$\frac{(M1-M2)}{(M1+M2)}$	Y (m)	t (s)	a (m/s^2)
0.530	0.520						
0.534	0.516						
0.538	0.512						
0.542	0.508						
0.546	0.504						
0.550	0.500						

GRAPH #1: Earth

Acceleration (m/s^2)

Mass ratio $\left(\frac{M_1 - M_2}{M_1 + M_2}\right)$

GRAPH #2: Moon

Acceleration (m/s^2)

Mass ratio $\left(\dfrac{M_1 - M_2}{M_1 + M_2}\right)$

WRITE-UP

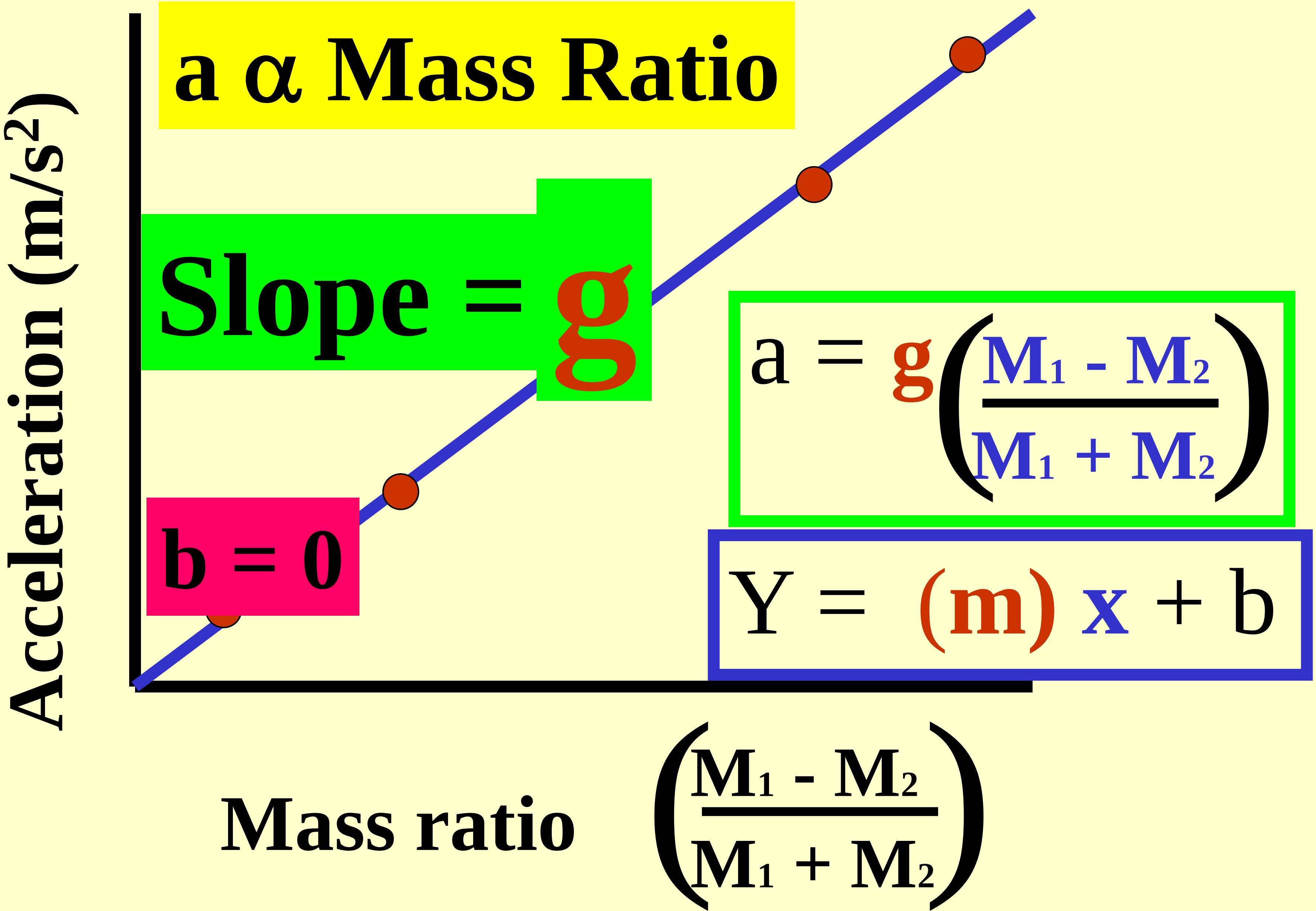
- ABSTRACT:
  - BACKGROUND
  - METHOD
- **SKETCH:** **ENHANCED** I.P. SCREEN DUMP
  - INCLUDE PROOF OF ATWOOD EQUATION
- DATA TABLES
- GRAPHS
  - TRENDLINES
  - GRAPH ANALYSIS
    - TEXT BOX TO TELL STORY OF ***EACH*** GRAPH
    - INCLUDE THE SIGNIFICANCE OF SLOPE OF LINEAR TRENDLINES
- CONCLUSION

$$a = \mathbf{g}\left(\frac{\mathbf{M_1 - M_2}}{\mathbf{M_1 + M_2}}\right)$$

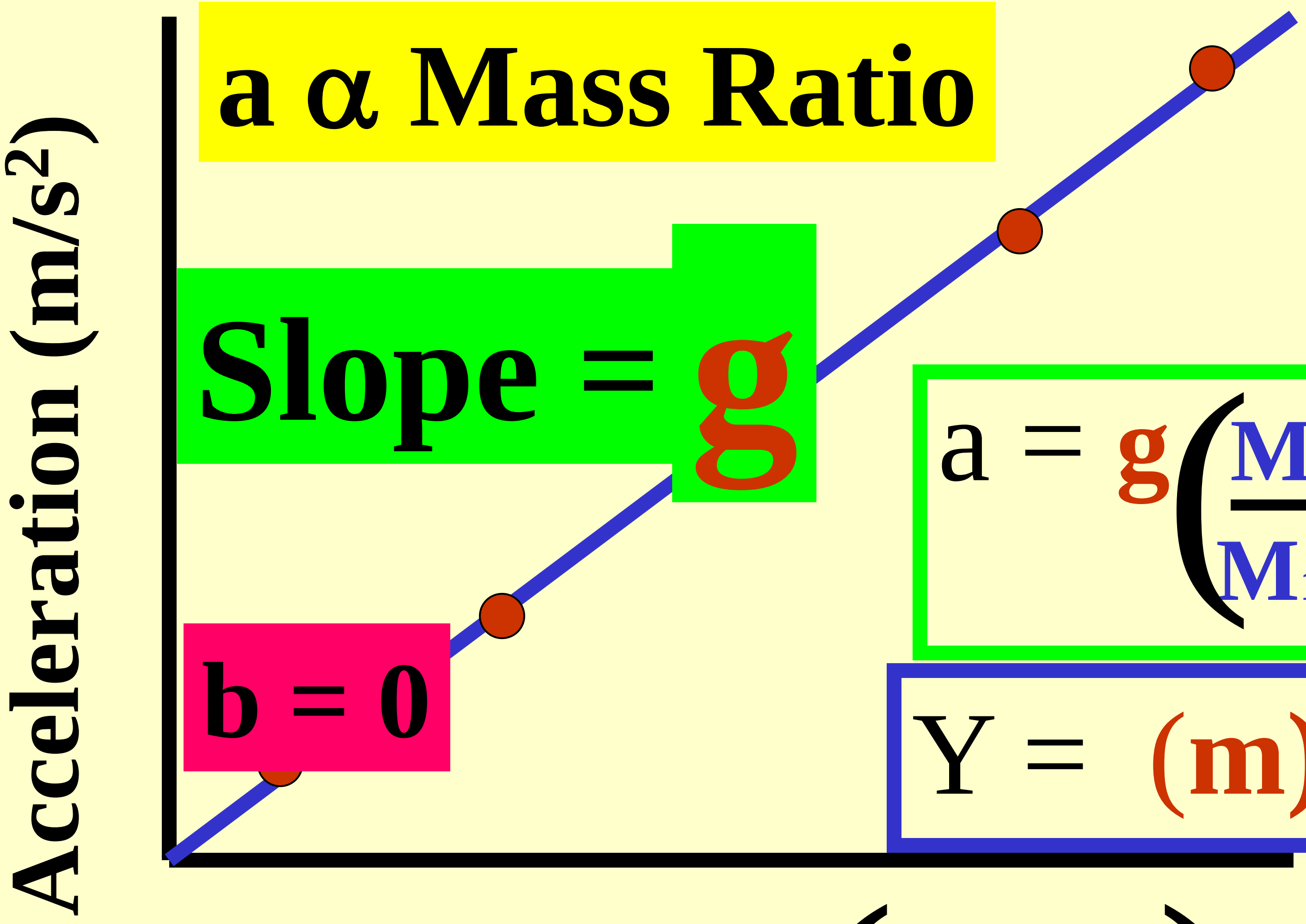
LAB #7

DATA ANALYSIS

GRAPH #1: Earth



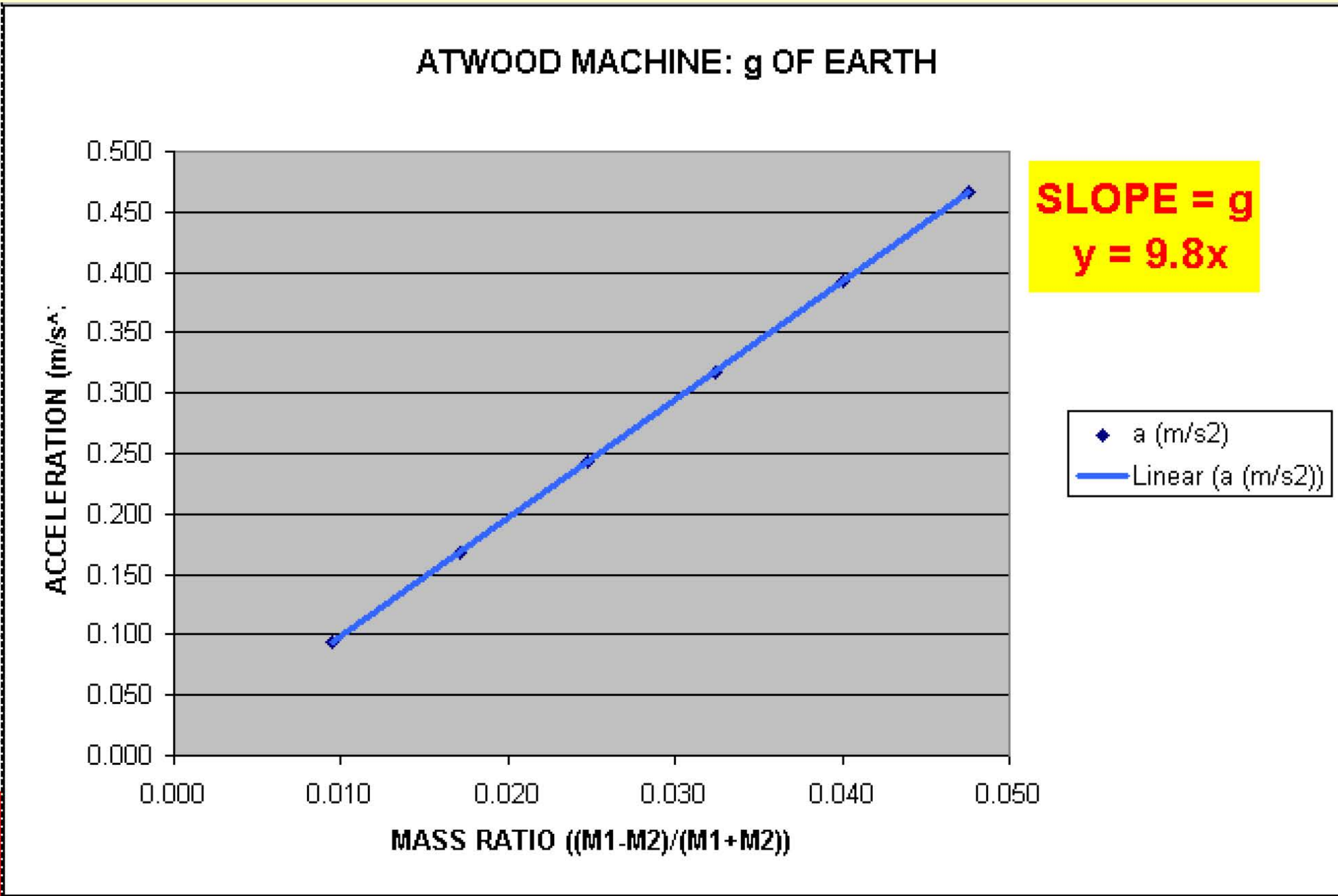
GRAPH #2: Moon

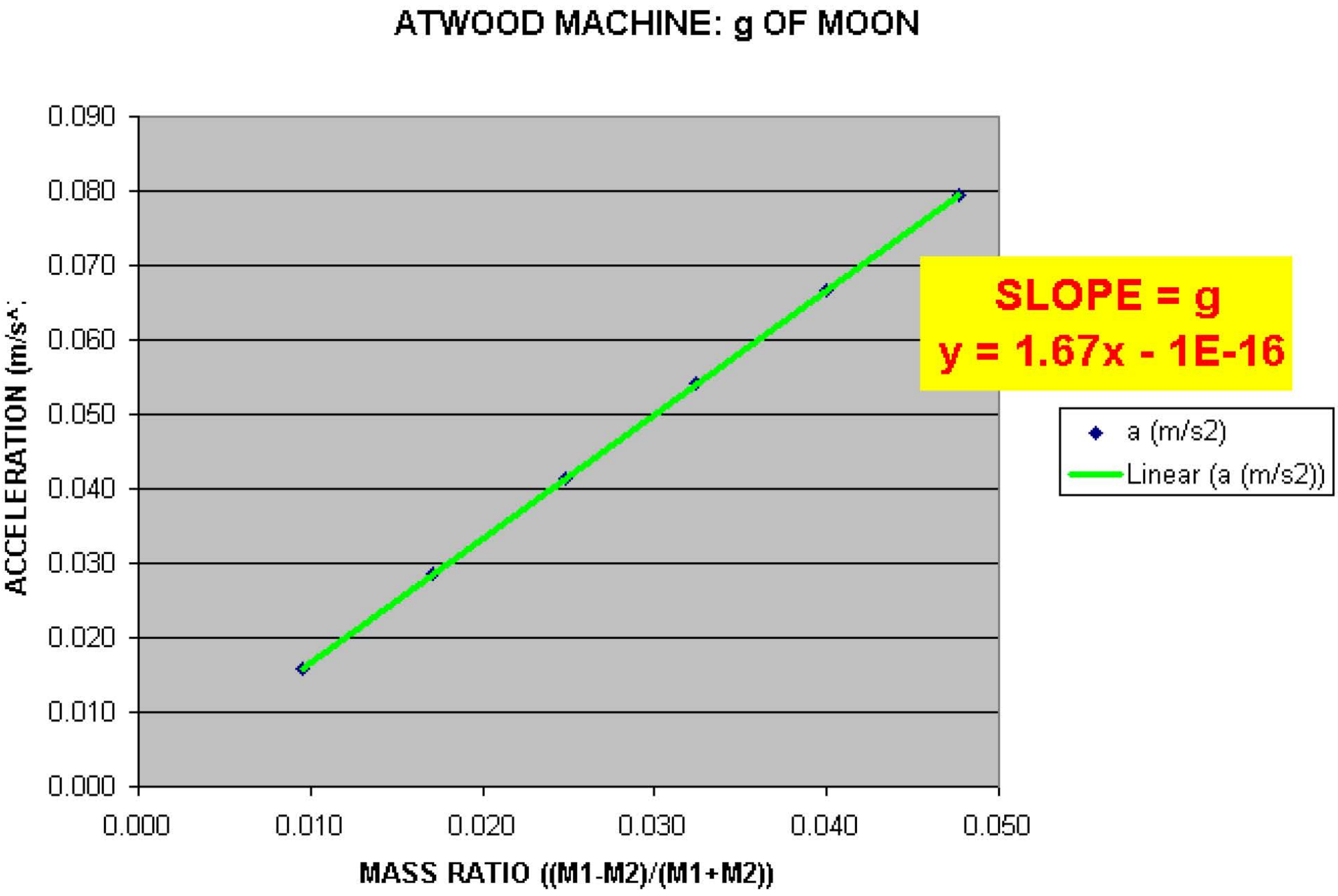


$$a = g\left(\frac{M_1 - M_2}{M_1 + M_2}\right)$$

$$Y = (m)\,x + b$$

$$\text{Mass ratio} \quad \left(\frac{M_1 - M_2}{M_1 + M_2}\right)$$


ATWOOD MACHINE: g OF EARTH
SLOPE = g
y = 9.8x
ACCELERATION (m/s^
MASS RATIO ((M1-M2)/(M1+M2))
0.500
0.450
0.400
0.350
0.300
0.250
0.200
0.150
0.100
0.050
0.000
0.000
0.010
0.020
0.030
0.040
0.050
a (m/s2)
Linear (a (m/s2))


ATWOOD MACHINE: g OF MOON
SLOPE = g
y = 1.67x - 1E-16
a (m/s2)
Linear (a (m/s2))
ACCELERATION (m/s^
MASS RATIO ((M1-M2)/(M1+M2))
0.000
0.010
0.020
0.030
0.040
0.050
0.060
0.070
0.080
0.090
0.000
0.010
0.020
0.030
0.040
0.050