3-2005

Centripetal Forces: Circular Motion

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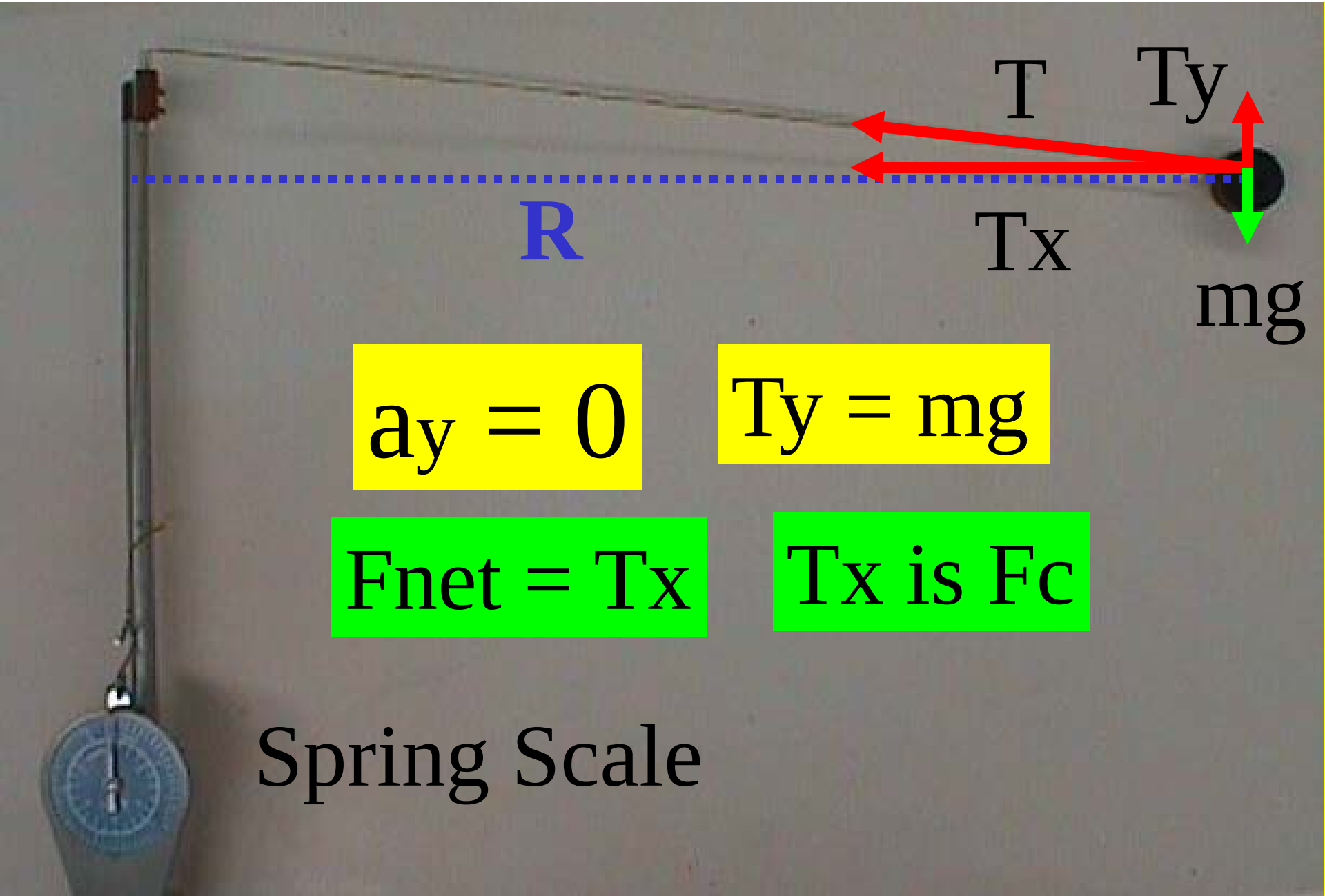
LAB #8

- Centripetal Forces: Circular Motion

GOALS

- 1 TO TEST THE FACTORS WHICH DETERMINE CENTRIPETAL FORCES REQUIRED FOR CIRCULAR MOTION
  - **Fc** vs SPEED **(V)**
  - **Fc** vs MASS **(m)**
  - **Fc** vs RADIUS **(r)**

CIRCULAR MOTION: Part 1



PROCEDURE: Part 1: Fc vs V

- MEASURE CONSTANTS:
  - MASS (m) OF STOPPER
  - RADIUS (r) OF MOTION
- SPIN STOPPER WITH UNIFORM CIRCULAR MOTION.
  - TIME ATLEAST 10 REVOLUTIONS
  - MEASURE Fc WITH SPRING SCALE
- REPEAT WITH ANOTHER UNIFORM SPEED, BUT FASTER.
  - MINIMUM OF 5 TRIALS

CIRCULAR MOTION
Determine Speed of Mass

$$\text{Speed} = \frac{\text{distance}}{\text{time}} = \frac{\text{Circumference}}{\text{Period}}$$

Period (T) = time / revolution

$$V = \frac{C}{T} = \frac{2\pi r}{T}$$

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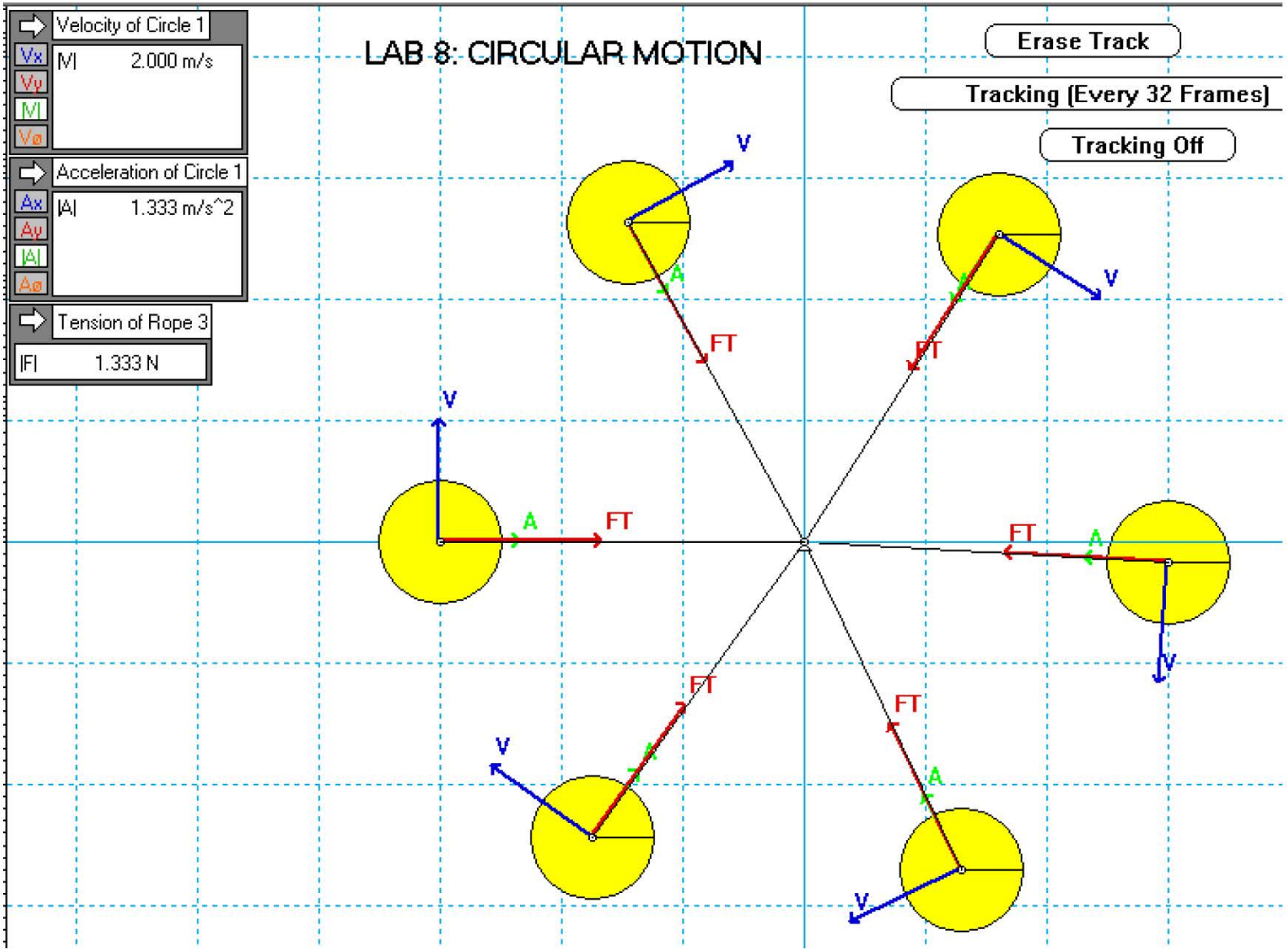
I.P. CIRCULAR MOTION



PROCEDURE: Part 2: Fc vs m

- CREATE AN IP SIMULATION OF AN OVERHEAD VIEW OF A MASS ON A FRICTIONLESS SURFACE
  - TURN OFF GRAVITY
  - CREATE MASS
  - ATTACH A ROPE TO MASS OF A GIVEN LENGTH WHICH WILL DETERMINE RADIUS
  - GIVE MASS A TANGENTIAL VELOCITY
  - RECORD CONSTANTS:
    - RADIUS
    - SPEED
  - RUN SIMULATION, RECORD TENSION
  - MEASURE TENSION IN ROPE
  - CHANGE MASS AND REPEAT FOR 8 TRIALS

PROCEDURE: Part 3: Fc vs r

- USE THE SAME IP SIMULATION OF AN OVERHEAD VIEW OF A MASS ON A FRICTIONLESS SURFACE
  - SELECT AND RECORD CONSTANTS:
    - MASS
    - SPEED
  - RUN SIMULATION, RECORD TENSION
  - SHORTEN THE ROPE TO A NEW RADIUS
  - RUN SIMULATION AND RECORD TENSION
  - REPEAT FOR 8 TRIALS

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DATA TABLE PART 1: Fc vs V

SAMPLE DATA TABLE: PART 1: Fc vs V

CONSTANTS:		MASS (kg)		R (m)		
	TIME FOR	PERIOD		SPEED (m/s)		SCALE
TRIAL	10 REV (S)	T (s/rev)	C (m)	V = C/T	V^2 (m^2/s^2)	Fc (N)
1						
2						
3						
4						
5						
6						
7						
8						

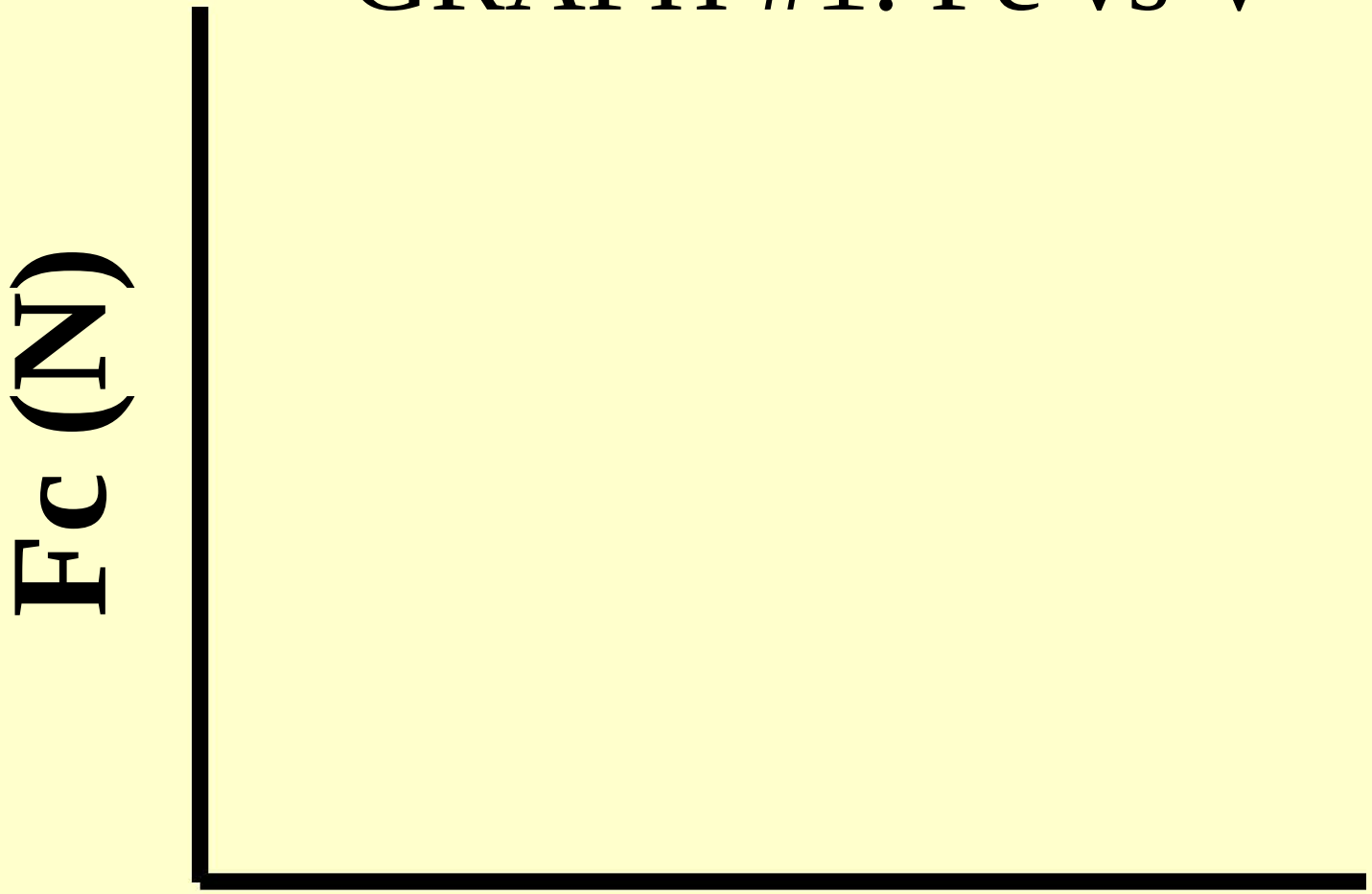
DATA TABLE PART 2: F_C vs M

- **MAKE YOUR OWN TABLE**
  - **8-10 TRIALS**
  - **INCLUDE CONSTANTS**
  - **INDEPENDENT VARIABLE (WITH UNITS)**
  - **DEPENDENT VARIABLE (WITH UNITS)**

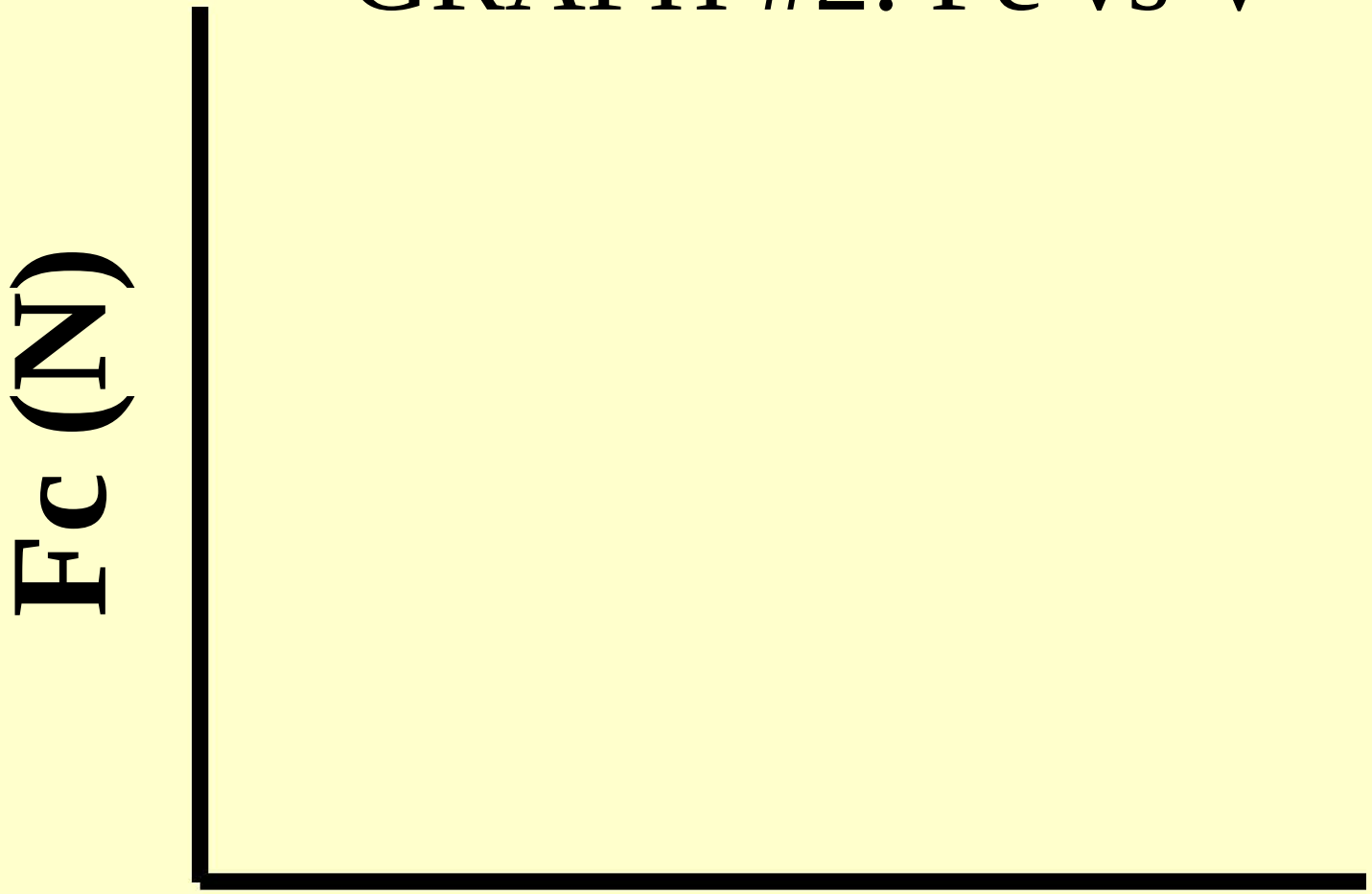
DATA TABLE PART 2: F_C vs r

- **MAKE YOUR OWN TABLE**
  - **8-10 TRIALS**
  - **INCLUDE CONSTANTS**
  - **INDEPENDENT VARIABLE (WITH UNITS)**
  - **DEPENDENT VARIABLE (WITH UNITS)**

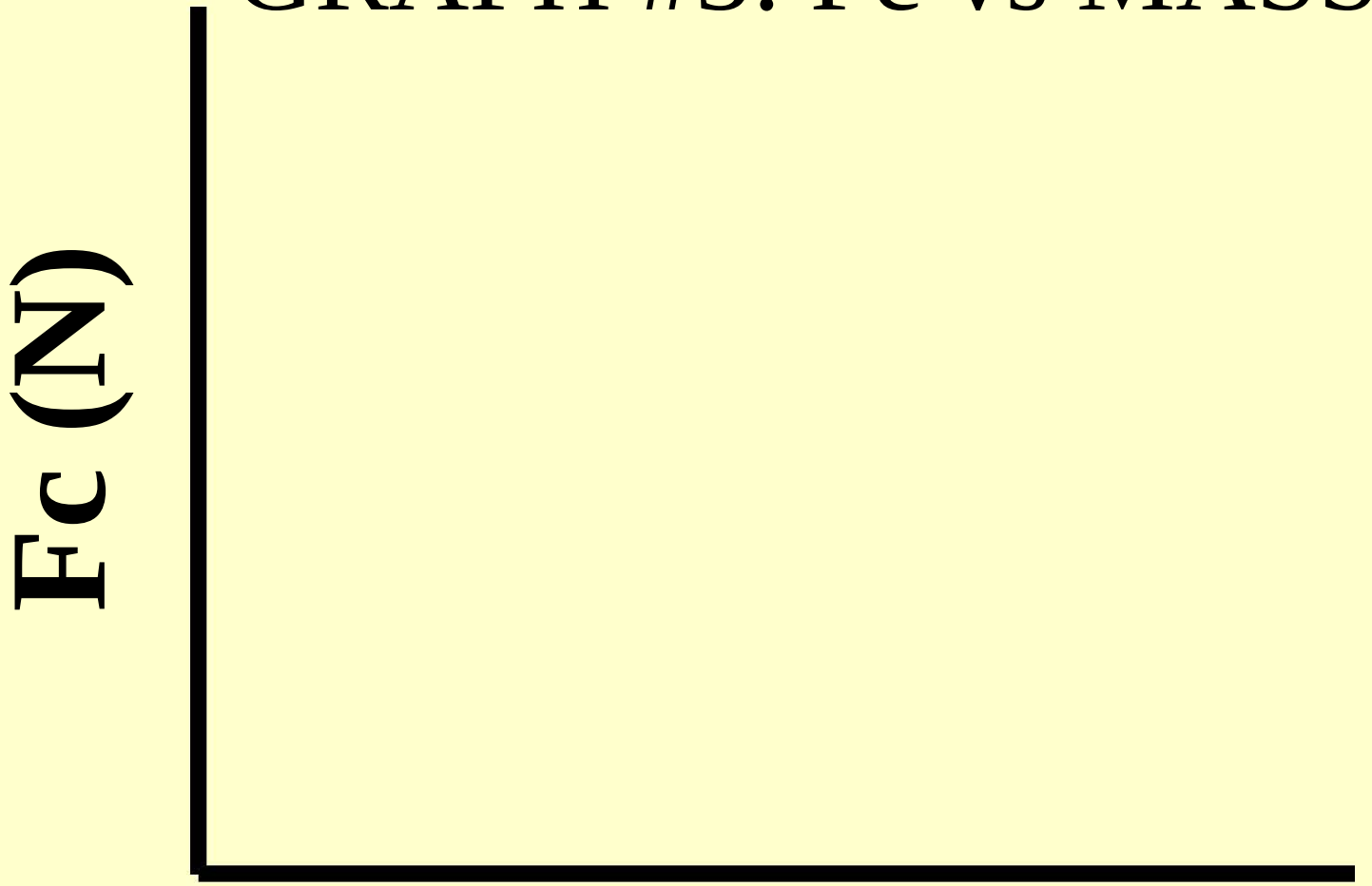
GRAPH #1: Fc vs V



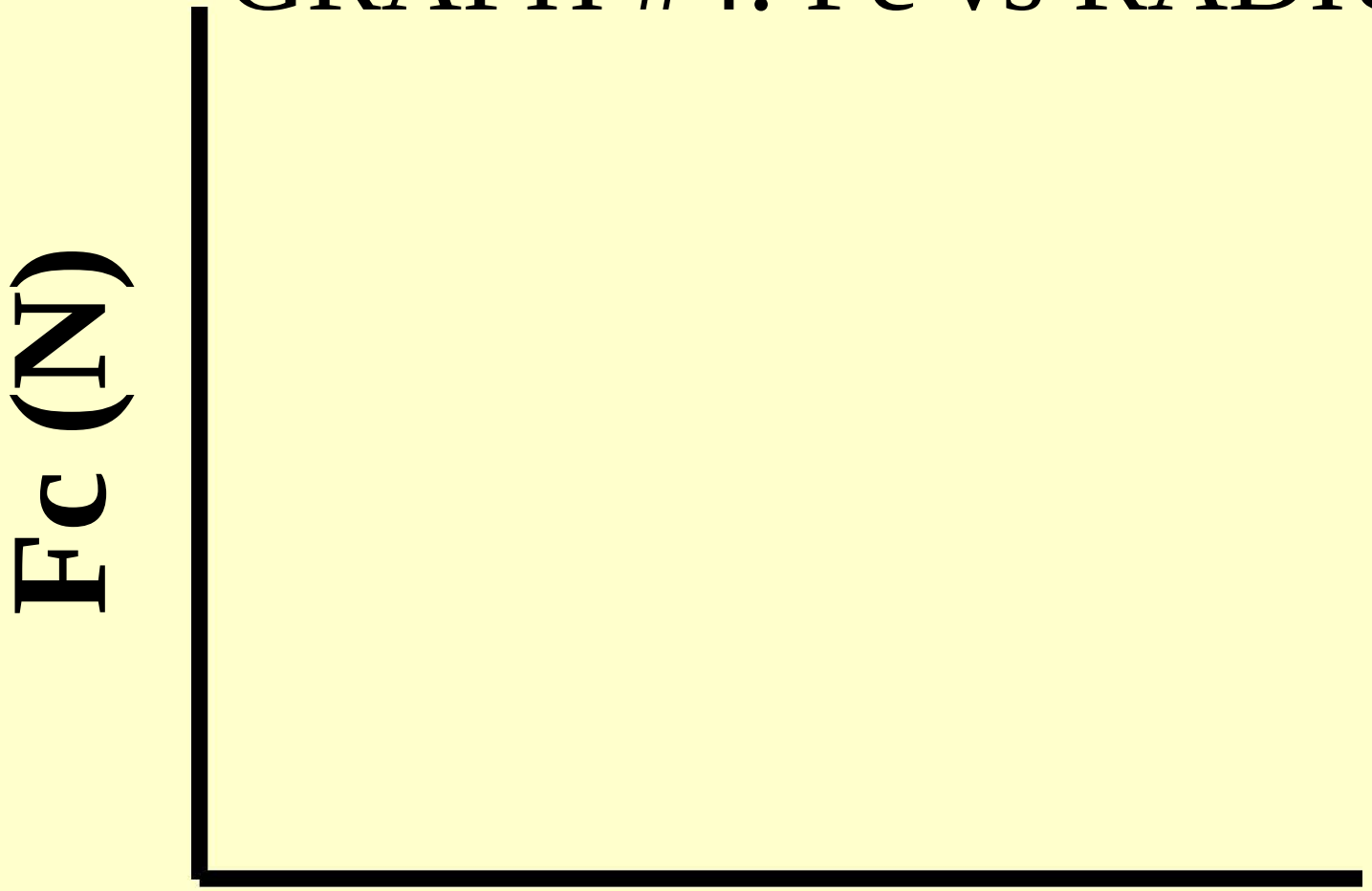
GRAPH #2: Fc vs V



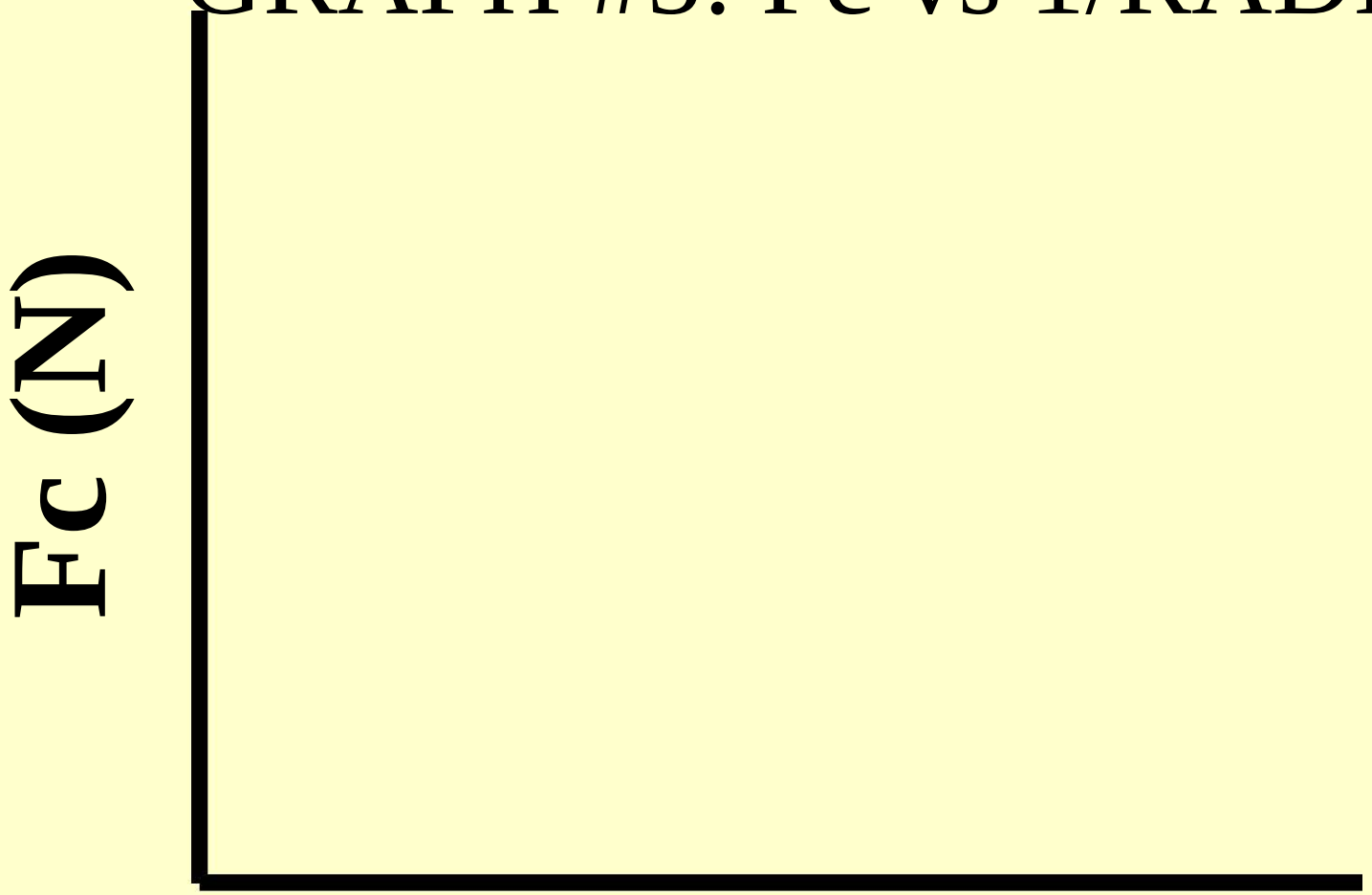
GRAPH #3: Fc vs MASS



GRAPH #4: Fc vs RADIUS



GRAPH #5: Fc vs 1/RADIUS



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WRITE-UP

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

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DATA ANALYSIS


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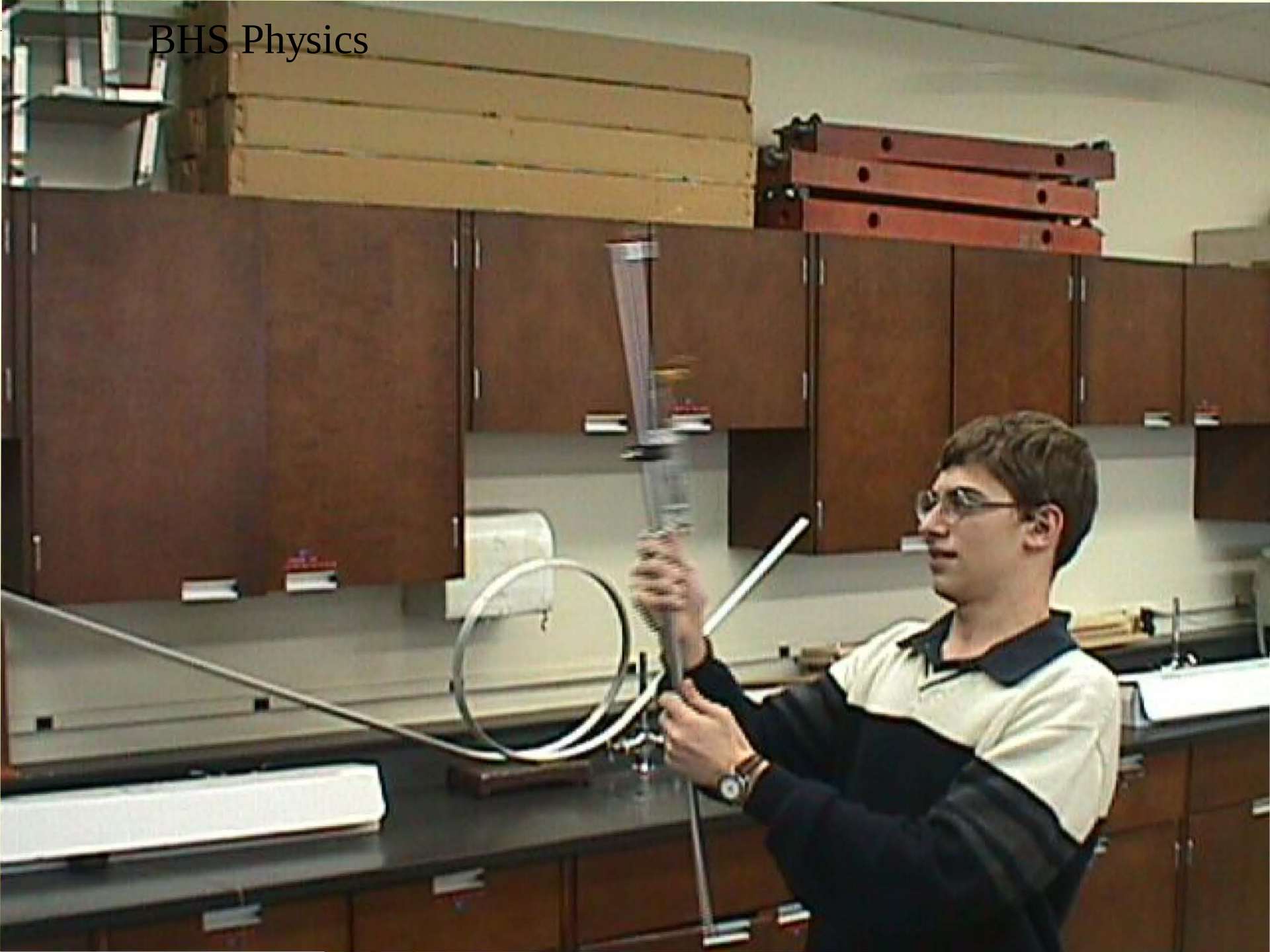
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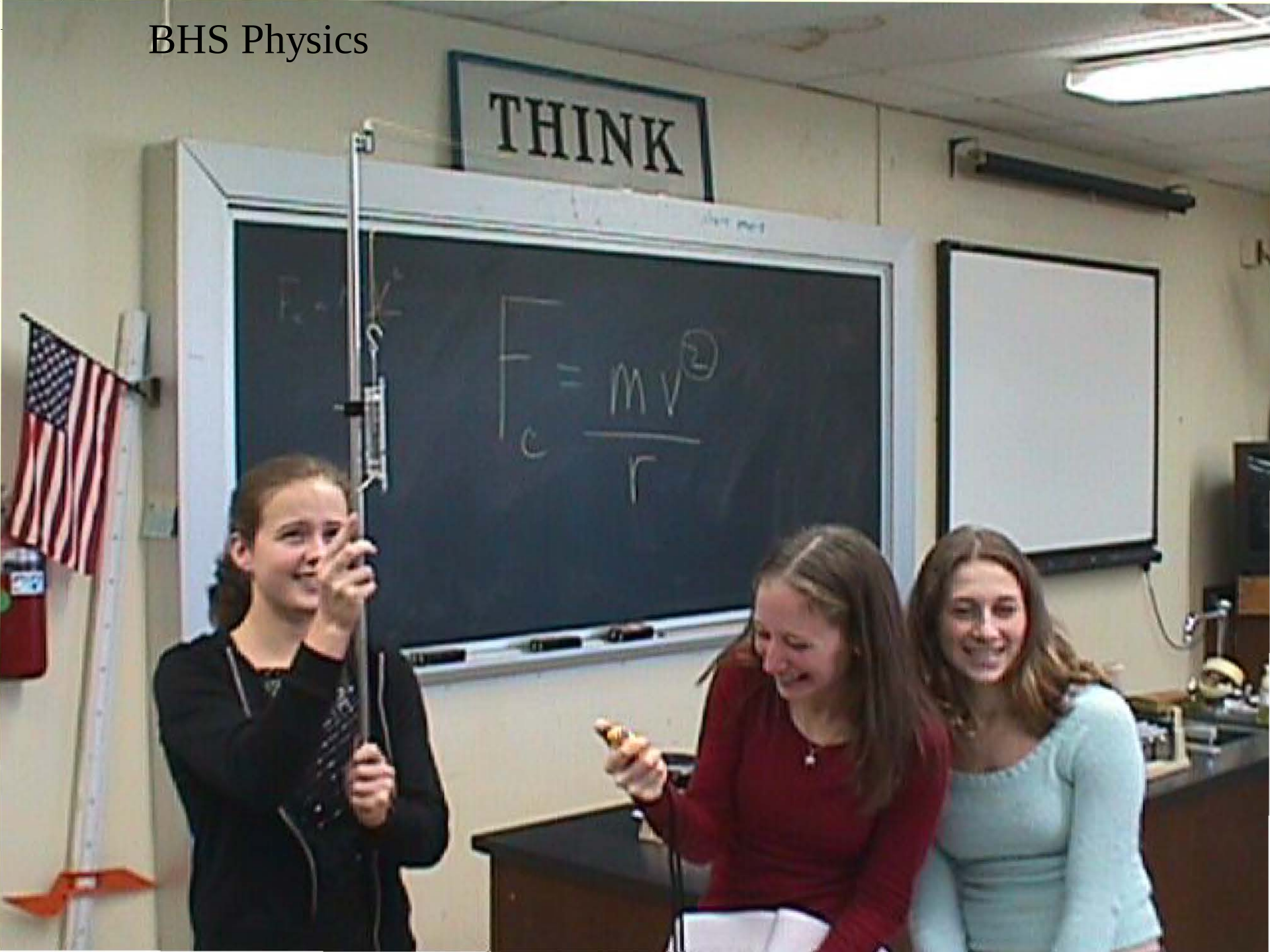

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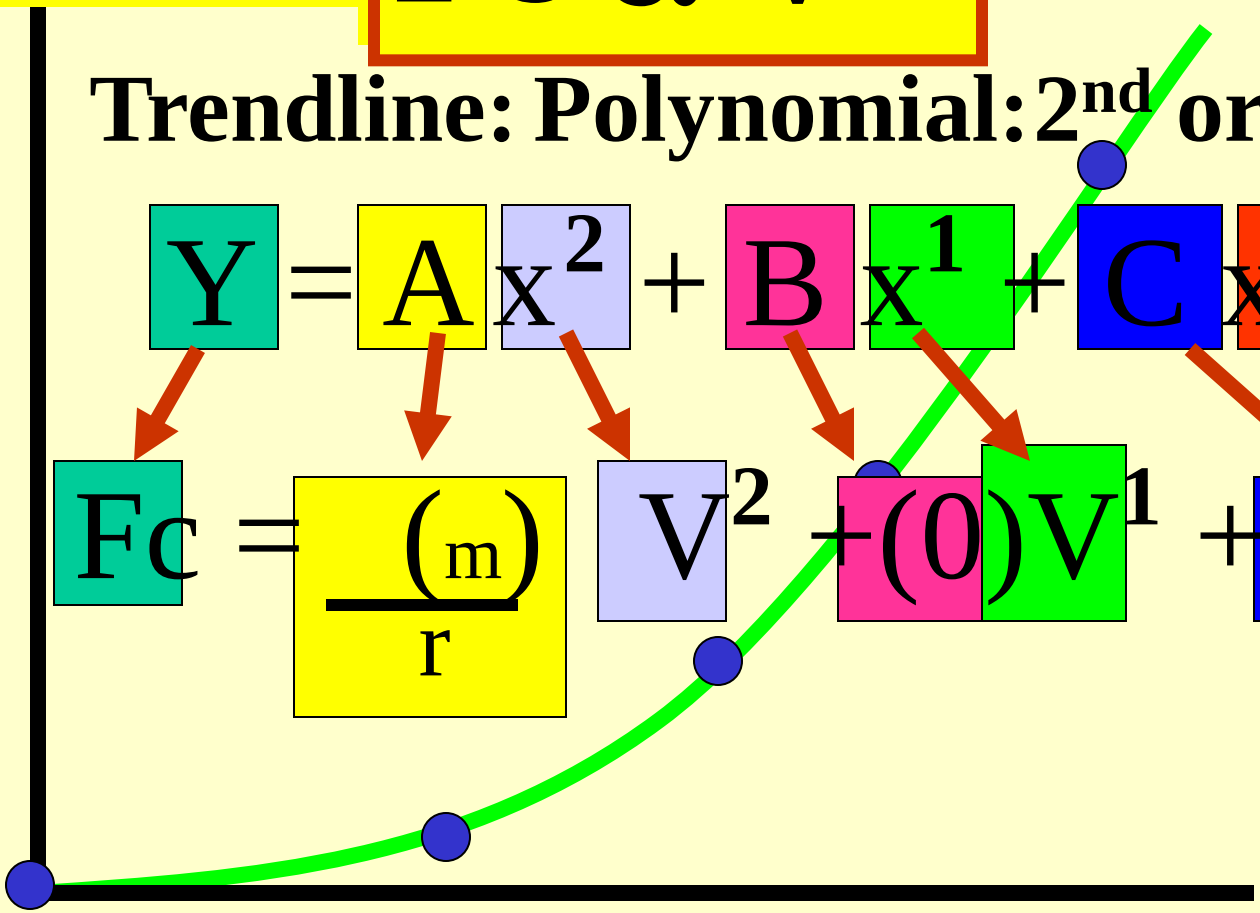
GRAPH #1: Fc vs Vo

Relationship: $Fc \propto V^2$

Trendline: Polynomial: 2nd order

$$Y = Ax^2 + Bx^1 + Cx^0$$

$$Fc = \frac{(m)}{r} V^2 + (0)V^1 + (0)V^0$$



Fc (N)

Speed (m/s)

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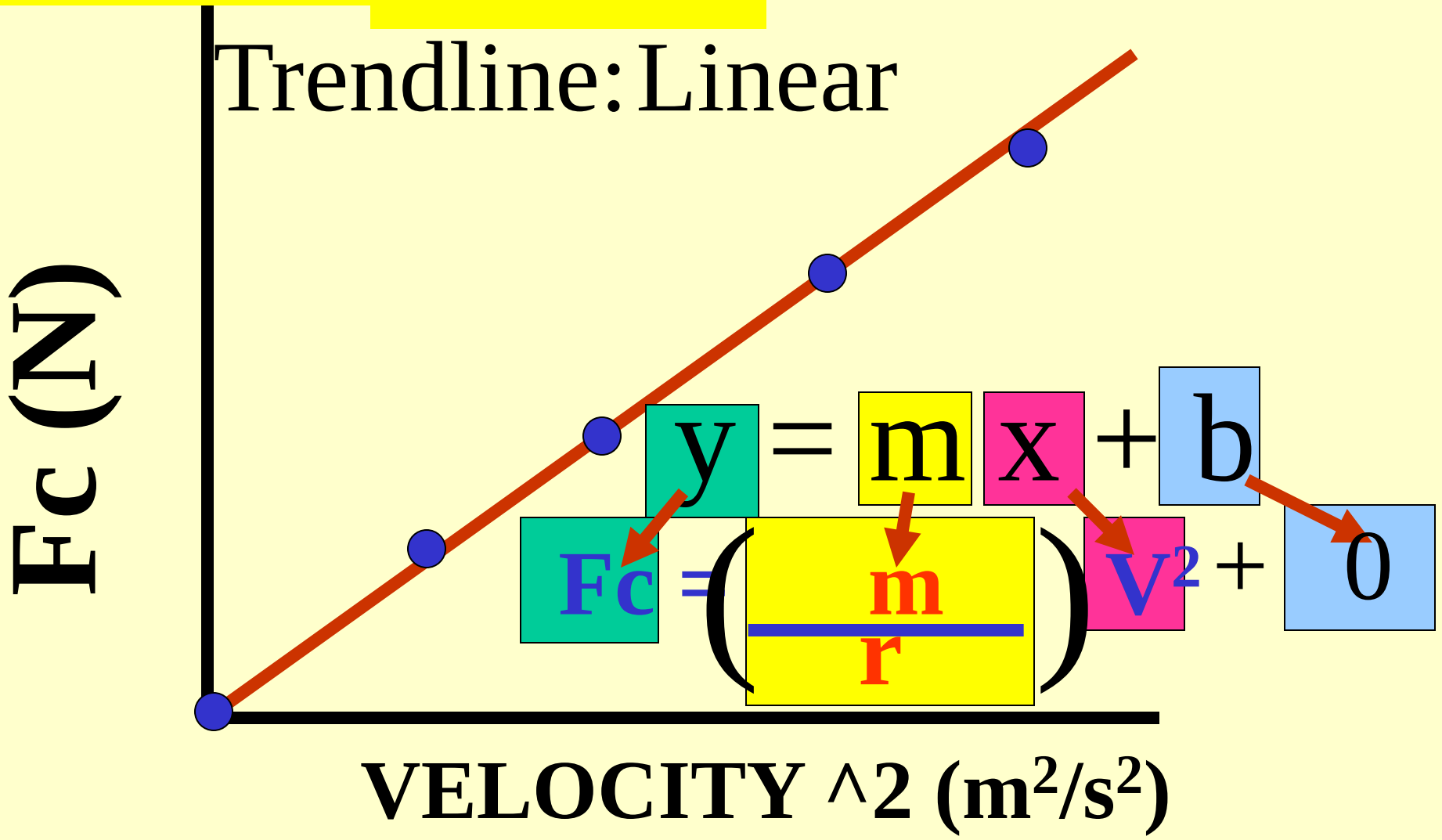
GRAPH #2: Fc vs. V^2

Relationship: $Fc \propto V^2$



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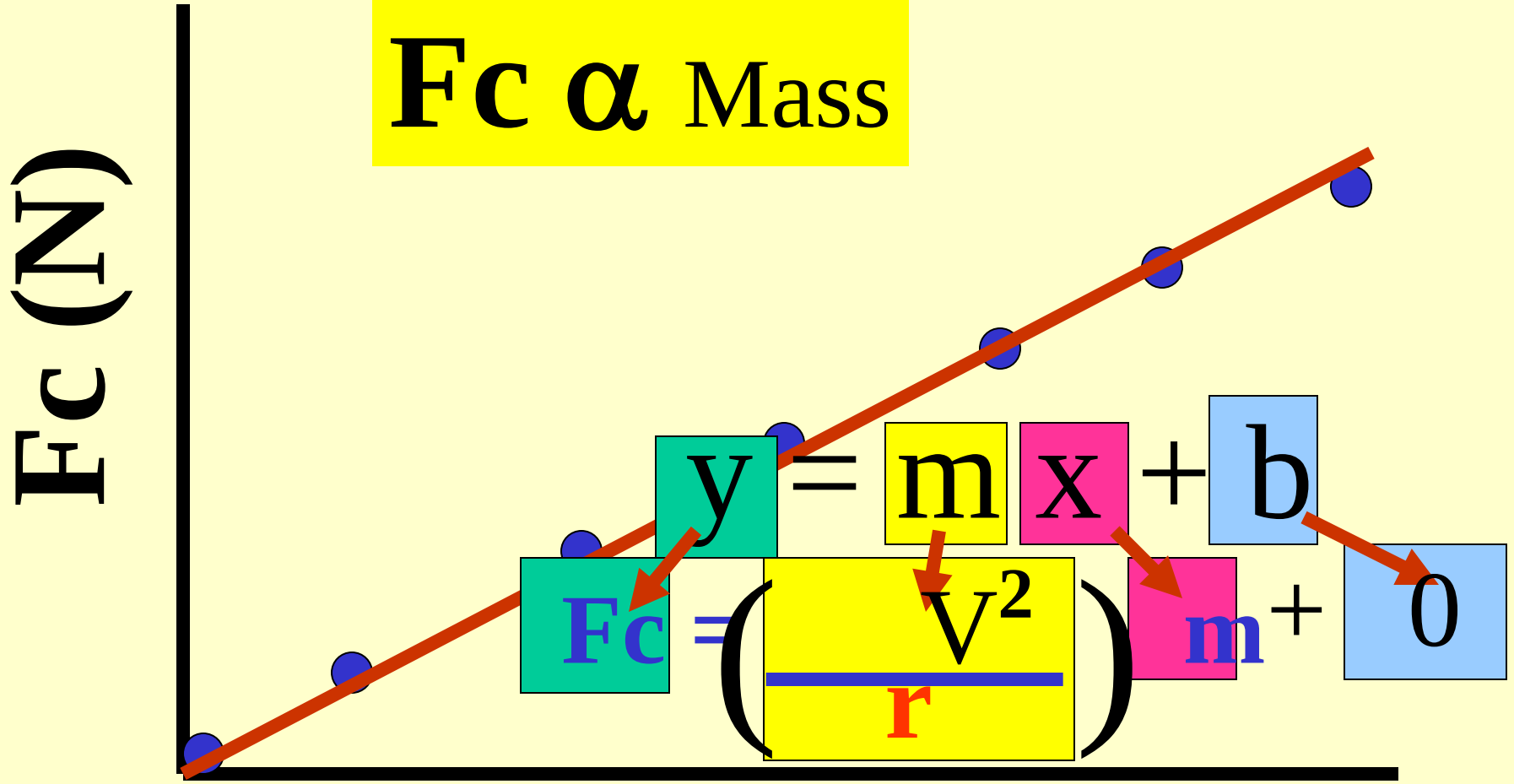
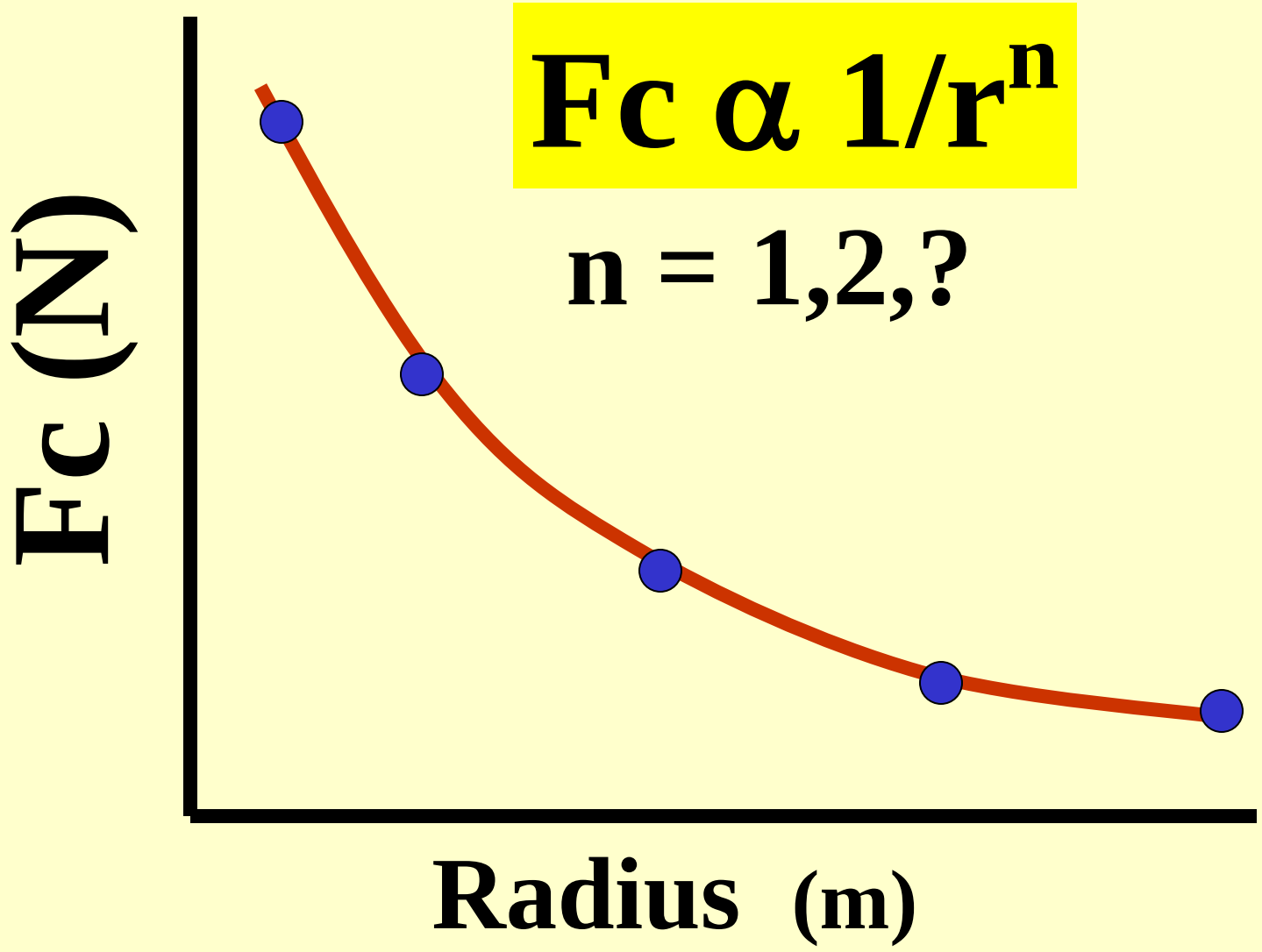
GRAPH #3: Fc vs Mass

Fc α Mass



GRAPH #4: Fc vs Radius



GRAPH #4: Fc vs 1/r

Fc α 1/r