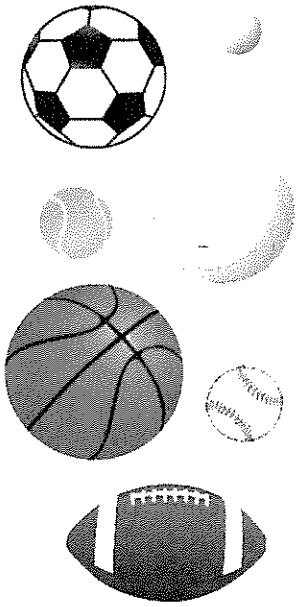
Graphing Newton's Second Law Name_____

Newton's Second Law of Motion: F = MA

Part One: Mass and Force

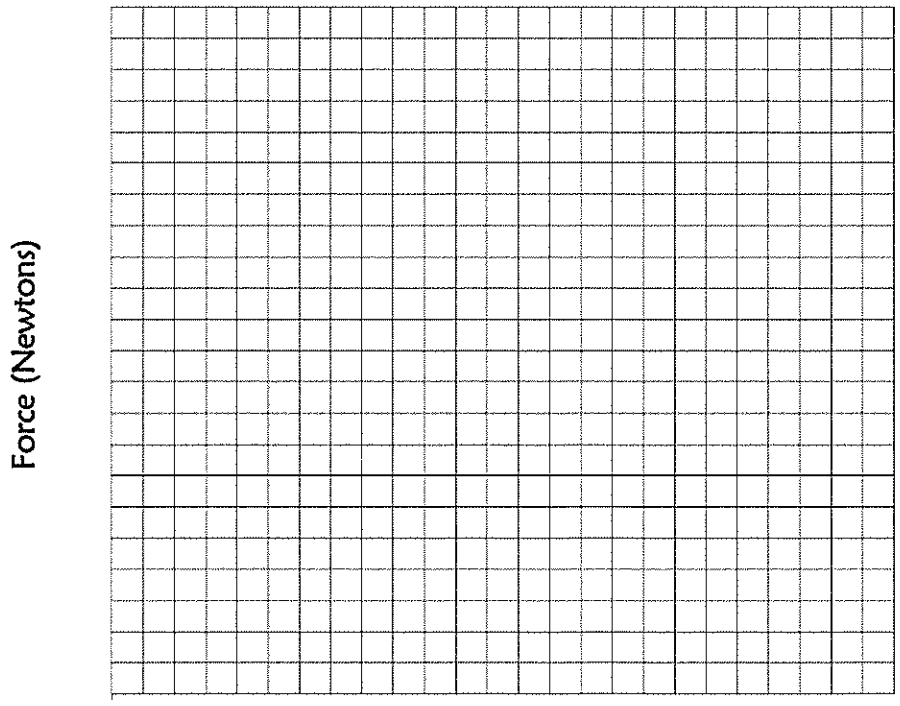
1. Calculate the force required to move each type of sports ball listed at an acceleration of 8 m/s².



Sports Ball Type	Mass (kg)	Acceleration (m/s²)	Force in Newtons (N)	
Golf	0.046	8		Round to the nearest tenth.
Tennis	0.057	8		
Baseball	0.142	8		
Lacrosse	0.150	8		
Field Hockey	0.156	8		
Softball	0.180	8		
Volleyball	0.270	8		
Football	0.397	8		
Soccer	0.430	8		
Basketball	0.624	8		

2. In the data table, the **only *given* variable that changes** is the sports balls _____ .
3. Graph the data above to show how changing mass affects force.
   Hint: Use increments of 0.25 N for force. Use increments of 0.025 kg for mass.

Mass versus Force for Objects Accelerated at 8m/s²



4. Examine the graph from Part One. Describe what happens to the force needed to accelerate a ball as mass increases. Use data from the data table or graph to support your answer.

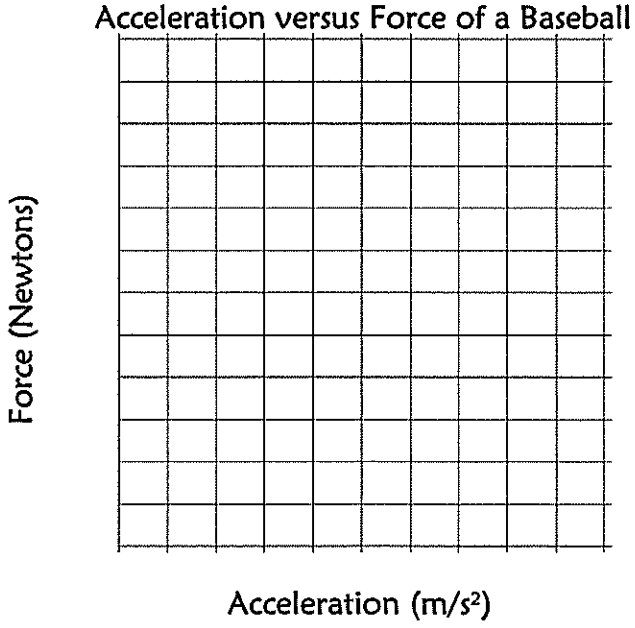
Part Two: Acceleration and Force

5. Calculate the force required to accelerate a baseball (0.142 kg) at each listed acceleration.

Baseball Mass (kg)	Acceleration (m/s^2)	Force in Newtons (N)
0.142	2	
0.142	4	
0.142	6	
0.142	8	
0.142	10	
0.142	12	
0.142	14	
0.142	16	
0.142	18	
0.142	20	

Round to the nearest tenth.

6. In the data table, the **only *given* variable that changes** is the baseball's _____.
7. Graph the data above to show how changing acceleration affects force.
   Hint: Use increments of 0.25 N for force. Use increments of 2 m/s^2 for acceleration.



8. Examine the graph from Part Two. Describe what happens to force as acceleration increases. Use data from the data table or graph to support your answer.

Part Three: Analysis

9. Look back to Part One.

   a. Which ball has the most mass? _____ The least mass? _____

   b. Which ball required the most force to accelerate it at 8 m/s^2? _____

   c. Why did that particular ball require the most force to accelerate it?

10. Use your graph to *estimate* the following:

    a. Force needed to accelerate a 0.25 kg object 8 m/s^2: _____ N

    b. Force needed to accelerate a 0.5 kg object 8 m/s^2: _____ N

    c. Mass of an object with a force of 2.4 N and an acceleration of 8 m/s^2: _____ kg

11. If the acceleration of a ball increased and its mass remained constant, what would be the change in force? (Hint: Will force increase or decrease?)

12. Look back to Part Two.

    a. Which acceleration is associated with the lowest force of the baseball? _____ m/s^2

    b. Which acceleration is associated with the highest force of the baseball? _____ m/s^2

    c. Why was the force different between these two scenarios even though the masses remained the same? (12a. and 12b.)

12. Use your graph to *estimate* the following:

    a. Force needed to accelerate a baseball 7 m/s^2: _____ N

    b. Force needed to accelerate a baseball object 19 m/s^2: _____ N

    c. Acceleration of a baseball with a force of 0.75 N: _____ m/s^2

13. Without changing its mass, how could you increase the acceleration of a baseball?

14. A young child probably doesn't know the terms "force", "mass", or "acceleration". How could you explain Newton's 2nd Law to a young child *without using these words*?