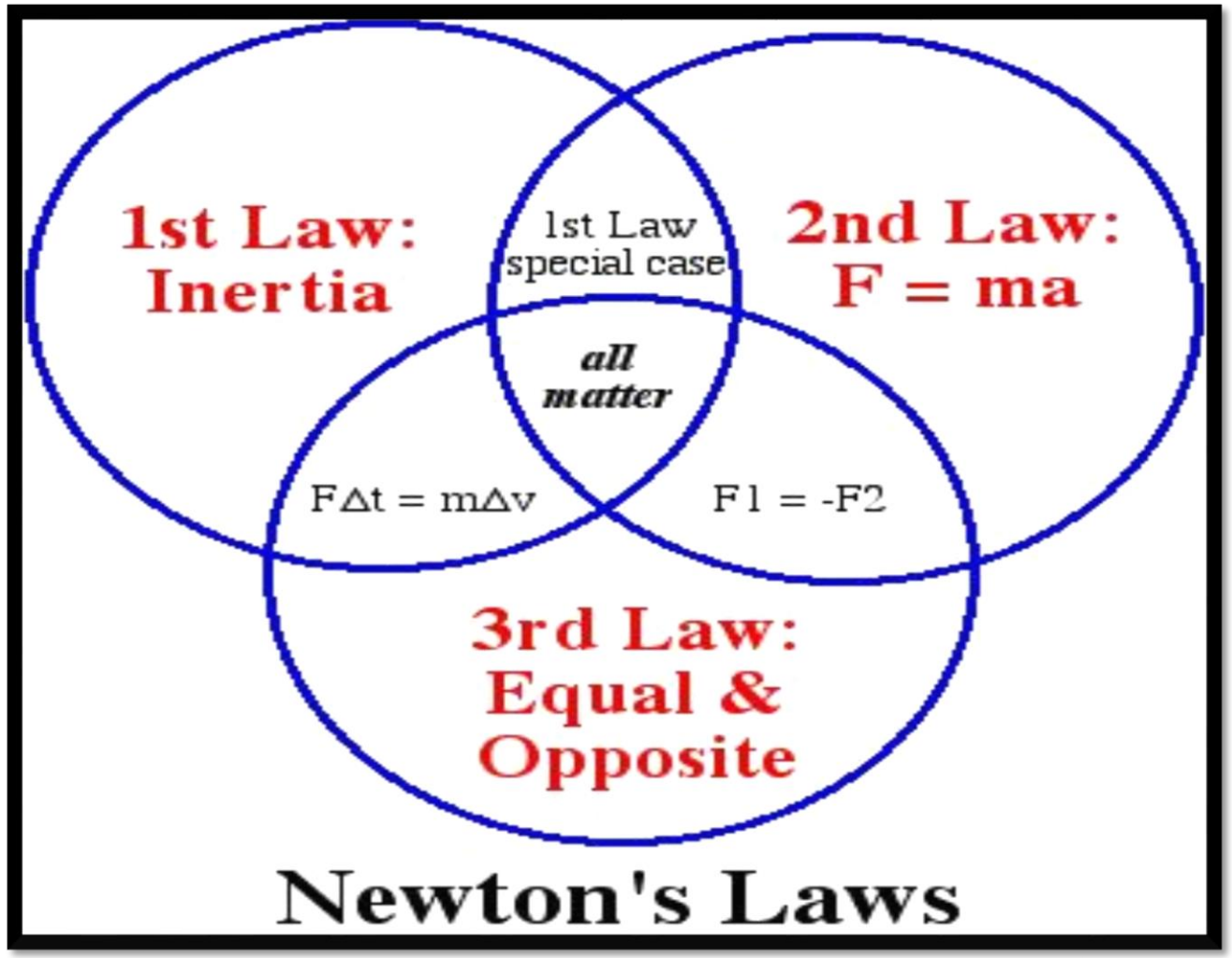
How does Newton's Three Laws of Motions apply to sports?

What are Newton's Three Law of Motion?



Newton's 1st Law of Motion

- **An object at rest will stay at rest, unless an outside force is placed on it.**
- **Commonly known as Inertia**

How does Newton's 1st Law apply to sports?

Sport examples:

- **Statics – athlete/object is motionless**
  - **Olympic lifter**
  - **Diver before a dive**
  - **Gymnast after the landing**
- **Dynamics – athlete/object is in motion.**
  - **Cyclist coasting at a constant velocity**
  - **Skier coasting at a constant velocity**

Newton's 2nd Law of Motion

- **Is the most complicated of the laws**
- **The acceleration of an object as produced by a net force is directly proportional to the magnitude of the net force, in the same direction as the net force, and inversely proportional to the mass of the object.**
- **The change of motion of an object is proportional to the force impressed; and is made in the direction of the straight line in which the force is impressed.**

Newton's 2nd Law of Motion

- **Formula**
  - **F=ma**
- **F = Force (1N)**
  - **1lb = 4.5N**
- **m = mass (kg)**
  - **1kg = 2.2 lbs**
  - **Weight = mass x acceleration of gravity**
  - **W = mg**
  - **W = 1 kg x (9.8 m/s2) = 9.8 N**
- **a = acceleration of gravity**
  - **9.8m/s2 or 32.2 ft/s2**

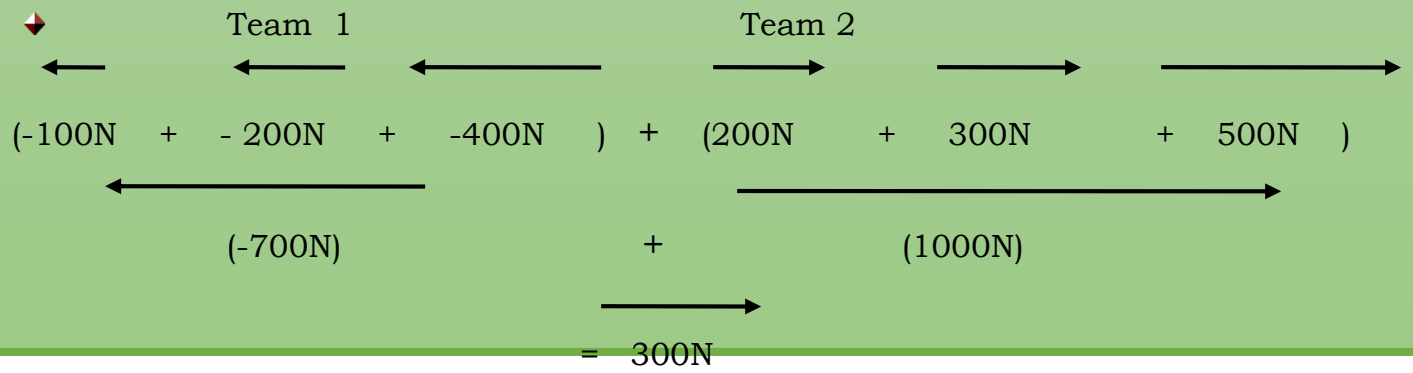
Newton's 2nd Law of Motion

- **What is a Force?**
  - **A vector defined by the size and direction**
  - **A → to the right (+) or a ← left (-). The length = the force. The longer the line the greater the force, and vice versa on shorter**
  - **The same for the Up ↑ (+) and the down ↓ (-) arrow.**

- **There are different types of force:**
  - **Tensile Force (Pulling a rope)**
  - **Compressive Force (Pushing together)**
  - **Non contact forces – Gravity, magnetic forces, electricity**

Newton's 2nd Law of Motion

- **Net Force = the sum of all external forces acting on an object.**
  - **$\sum F = F1+F2+F3+.....$**
  - **Statics – Bodies at rest equal zero**
    - **$\sum F = 0$**
- **Collinear forces – in the same line, maybe in the same or opposite direction and may be added to determine resultant force.**
- **Example:**
  - Tug –of – War Team 1 has 3 members exerting the following forces: 100N, 200N, 400N and team 2 has 3 members exerting the following forces: 200N, 300N, 500N; who will win?



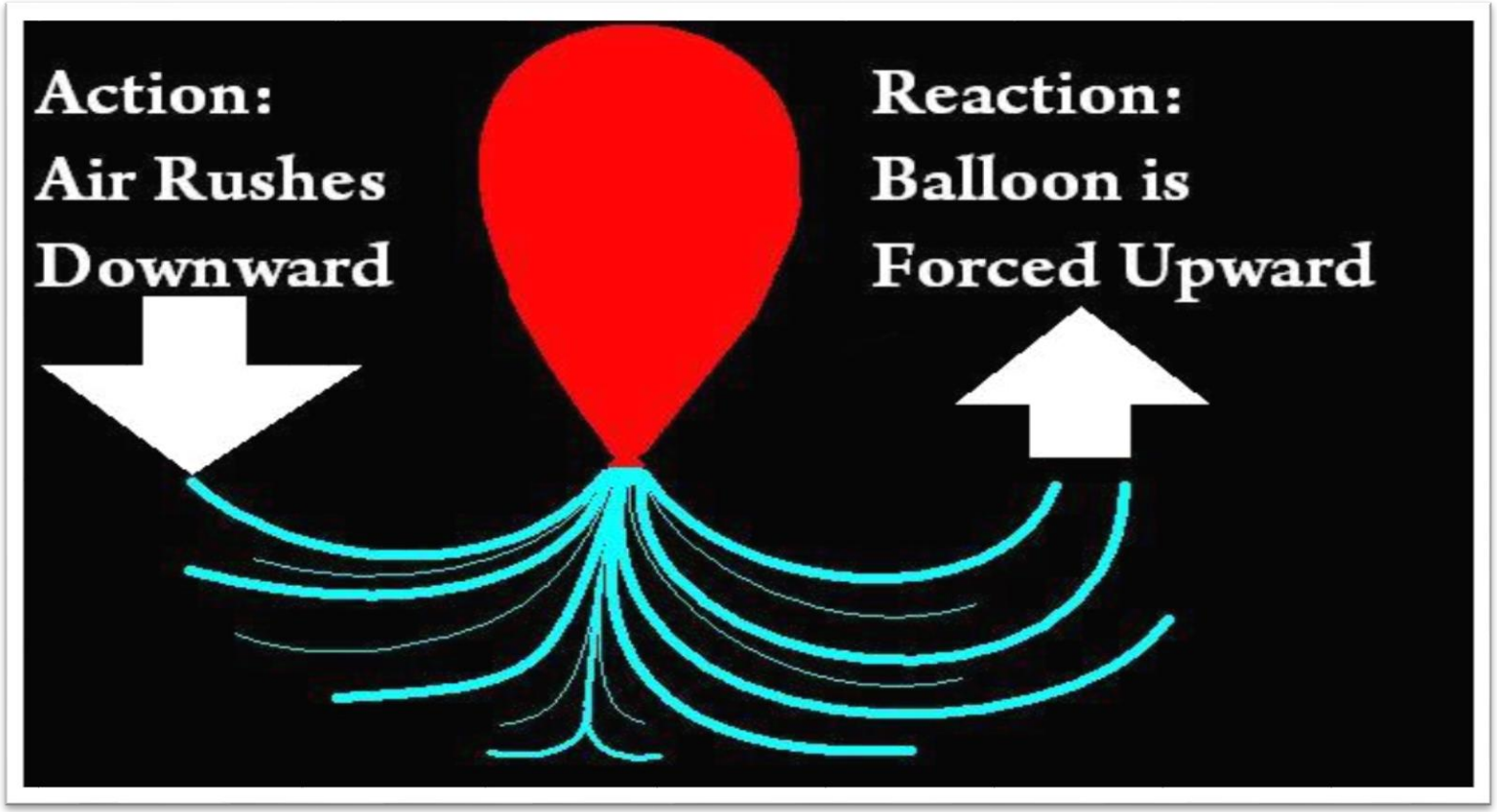
- Team 2 is the winner due to 300N more force.

How does Newton's 2nd Law apply to sports?

- **Pitching a baseball**
  - **How fast is the ball moving?**
- **Weightlifting**
  - **How much force do I need to lift this weight?**
- **Track and Field**
  - **How fast is that person running?**
  - **How much force is needed to throw the shot-put 50 feet?**

Newton's 3rd Law of Motion

- **For every action, there is an equal and opposite reaction.**
- **Action equals Reaction**



How does Newton's 3rd Law apply to sports?

Hitting a baseball

Kicking a Football

All sports use one of Newton's laws

- **Baseball**
- **Football**
- **Basketball**
- **Track**
- **Gymnastics**
- **All Sports use Newton's Laws**