A ball is being thrown in the air by someone inside of a train. Because the ball has two factors, forward and up, a diagonal is created.

<u>1st Law of Motion;</u> <u>Inertia</u>; things at rest tend to stay at rest unless acted upon by an outside force. Also vice versa. Things in motion tend to stay in motion unless acted upon by an outside force. **If** $\Sigma \square = 0$**then** $\alpha = 0$

<u>2nd Law of Motion;</u> <u>Law of Acceleration</u>; if there is a force that is not zero, then there will be an increase in acceleration.

- The acceleration will be directly proportional to the force.
- it will also be inversely proportional to the mass.

<u>Fractions</u>

$\frac{x}{\text{denominator}}$. ⇐ directly proportional $\frac{\text{numerator}}{x}$. ⇐inversely proportional

If one flicks a ping pong ball, a baseball and a bowling ball with the same amount of force, they will all be differently affected.

- the mass of an object affects the effect of the force
- the greater the mass, the lower the acceleration.

<u>Weight</u>; the pull on the mass

- for example, if you have a 2kg mass of something and you bring it into the middle of space, it would be weightless because there is no force (like on earth) pulling it. But technically it is still the same mass as it was on earth.

A 2kg mass is pushed by a 10 newton force and it accelerates at 4 meters per second. How much is the force of friction?

<u>Friction</u>; a negative pull. If a force is pulling one way, the friction is going to be pulling in the opposite.

~energy cannot be created

~so if two things are rubbing together together and are creating heat, it's coming from another source of energy.

~ one type of energy is becoming another

- using the formula **a=F/m**, one would think that you can cross multiply and get the equation **F=am**, But logically, it's not that the force is dependant on the mass and acceleration, but rather acceleration is dependant on the force and the mass.
- for example, using the formula $\pi = \square / \square^2$one would assume that if the area of the circle is increased, then π would increase. But we know that the number of π is fixed it doesn't change. Basically, the radius increases *as* the area increases.

- going back to the problem before;
- the equation should be set up as 10N= (2)(4), but instead it's going to be set up as;

$\Sigma\square = \square\square$ instead of $\square = \square\square$

~*now* it should be set up as $10 - \square = (2)(4)$
~this is because some energy need to be used for the action to be done/ friction

A ball is thrown upwards with a velocity of 29 meters per second. How high will it rise and how long will it be in the air?

Initial Velocity; 29
Final Velocity; 0
Acceleration; -9.8td
Distance; ?
Time; ?

- first, you can solve for time by using the formula of $\square = \square\square / \square$
- using this formula, you get that the time that it took to be thrown up in the air was **3 seconds.** But since the question is asking for how long it was in the air in total, just double it, and the answer is **6 seconds.**
- next, plug that answer into any of the distance formulas (way too lazy to type it out, just do it yourself.)
- $\square\square\square\square\square\square\square\square\square = 42.9\ \square\square\square\square\square\square$

❑ the rule for throwing something up is to solve for one way and then double it.

A ball is thrown with an initial velocity of 40 meters per second horizontally off of a cliff 20 meters high. How far forward will it land?

- the horizontal and vertical motions are simultaneous, but independent
- time is the only thing that stays the same
- vertical and horizontal are 2 seperate problems

    - Step 1) solve for vertical time
    - Step 2) use the time to get the horizontal

<u>To Solve for Vertical</u>

Velocity; 0 meters per second
Distance; 20 meters
Acceleration; 9.8 meters per second
Time; ?

- use the formula □ = □□□ + *1/2*□□^{2}
- $20 = 1/2(9.8)(□^2)$
- $20 = 4.9□^2$
- □□□□ = **2** □□□□□□□

<u>To Solve for Horizontal</u>

Average Velocity; 40 meters per second
Acceleration; 0 meters per second
Time; 2 seconds
Distance; ?

- use the formula v= □/□
- $40 = □/2$
- $□ = 40(2)$
- □□□□□□□□ = *80* □□□□□□

<u>normal</u>; perpendicular
<u>□ =</u>friction force

<u>rubber on concrete</u>; if something with a rubber bottom is rubbing on concrete, if the concrete is wet there is less friction and it slides. If the concrete is not wet there is less friction and it doesn't slide as well.

<u>3rd Law of Motion</u>; for every action there is an equal and opposite reaction.

A person is driving a car at 60 miles per hour. A mosquito flies into the windshield. The force of the window compared to the force of the mosquito are the same because the force of the action is the same as the force of the reaction.
The only differences between them are the results of the action. There will be more of an impact on the mosquito than on the window because the window is sturdier.

<u>Constant Circular Motion</u>

Something is going around at a constant speed in a circle.
Two things are happening; 1) constant speed
2) acceleration increases

- acceleration is not only a change in speed, but also a change in direction
- therefore, the speed isn't increasing, but as the circle is going around, it's facing different directions, so velocity is changing, thus acceleration is increasing.

❑ there is a problem here; if the formula for acceleration involves the change in velocity which we would need a number for. Δ is a number but direction doesn't give us a number.
❑ therefore we need to use the change in the degree of the angle.

- the velocity of something is the result of acceleration, not the opposite
- acceleration is a result of a force

If something gets pushed 90 degrees from the direction that it is going, it doesn't go faster or slower than it was going than while it was facing in its' original direction, it just goes straight out and continues in the straight line it was going before.

- it goes on a **tangent**
- a tangent is perpendicular to the radius

<u>radius force</u>; any force coming at the radius will change direction not speed

=centripetal force directed to the center of the circle.

- an object moving at a constant speed in a circle has its' velocity directed along the tangent and its' force and its' acceleration at the centripedal

$$\square\square = \square^2/\square$$

To make a biggest impact on something, change the velocity because the velocity is exponential so it would increase or decrease by the most.

Q; Why is the graph for a decreasing parabola not touch the x-axis?
Because the denominator physically cannot be zero otherwise it there would be an error, so it never hits zero on the x or y axis.

An object with a miss of 2kg is whirled in a circle with a radius of 3 meters and a constant velocity of 5 meters per second. Solve for the centripetal force and draw a diagram showing the directions of each.

Car going 20 mps and is brought to rest in 4 seconds

A 2000kg car 30mps skids to a stop. How many seconds does it take on dry vs wet ground.