2D Momentum

Newton described momentum as the “**quantity**” of motion. He considered it dependent on both mass and velocity.

Remember: Momentum is a

So which would have more momentum?

A 90kg football playing running at 3.5m/s?

Or a 55kg jockey running at 3.5m/s?

How could the jockey gain more momentum than the football player?

**Impulse** is the…

Since the momentum relies upon mass and velocity, and (in most situations) the velocity is the most likely part to change:

Or, a net force provides acceleration (RATE of changing velocity), then:

**The Law of Conservation of Momentum**

Momentum in a \_\_\_\_\_\_\_\_\_\_\_\_\_\_ system is always conserved. This means that in any collision, the total momentum before the collision will be the same as the total momentum after the collision.

Collisions are grouped into two categories:

**Elastic** (bouncy)

Momentum and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ energy are conserved.

**Inelastic** (sticky)

Momentum is conserved, \_\_\_\_\_\_\_\_\_\_\_\_\_ energy is not.

Most collisions are a mix of both.

Ex. A 1250kg car coasting at 3.0 m/s is rear ended by a 3000kg bus going at 12.5m/s. After the collision, the car is travelling at 15m/s. How fast is the bus going after the collision?

TOO EASY! We did that in Physics 11!

**2D – Collisions**: Since momentum is a vector, we have to use \_\_\_\_\_\_\_\_\_\_\_\_\_\_ ­­­­­­­­­­­­­­­­­­­­\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to find the total momentum of a system.

Remember: Vector addition can be done by **components** or **trig**.

Ex. Two 1150kg cars are had a collision at a four way stop. Car A was travelling East and Car B was travelling North. The cars collided and stuck together, skidding 23m distance at 35.6° North of East. If 28500 N of friction force stopped the cars, who should get a ticket?

**Explosions!**

Ex. Mr. W is sitting in a chair when his head explodes into three pieces (because… reasons). His head is normally 2kg. One 0.75kg piece launces straight up at 3.1m/s, a second 0.50kg piece flies to the right at 1.4m/s. What is the velocity of the third piece?