Section 4.3: Newton's Third Law and Free Body Diagrams

Newton's Third Law: For every action (force) there is an equal and opposite reaction (force).

magnitude direction

In a sense, every force has an evil twin.

Examples:

Situation	Action Force	Reaction (Buddy) Force
runner accelerates	runner pushes ground backwards	Ground pushes runner forwards
Rocket flies upwards	Rocket pushes exhaust down	Exhaust pushes rocket up
Bug hits windsheild	car pushes bug forward ↓ SPLAT	Bug pushes car backward

Free Body Diagram: A diagram of the forces acting on an object.

Two Rules of FBD **(Free Body Diagrams):**

1. **The** body **must be** free **(draw only the object of interest, no others)**
2. **Draw** all the forces acting on the body

Typical forces we use in FBDs:

Force	Symbol	Description
Gravity	F_g	Pull from the Earth (or anything else w/ mass)
Friction	F_f	- Always opposes motion when an object slides or tries to slide - Acts parallel to the interface between the two objects
Normal	F_N	- whenever one object slides or rests against another - Acts perpendicular too the interface between the two objects
Tension	F_T or T	- Force at both ends of a rope and within it (assume the rope is massless)
Elastic	F_E	Force from something being stretched or compressed

Example: Draw a FBD for a sled being pulled at constant velocity. (to the right)