**FPS – Free Body Diagram – Active Reading**

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| I can… |
| *Interpret free-body diagrams.**Solve for net force and determine direction and magnitude.**Construct a Free-body diagram from a scenario description.* |

Complete the active reading by highlighting, underlining, coding, or making notes. Then, answer questions about the reading and apply the reading to the free-body diagram problems.

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| ***Reading Section*** |
| ***What are free-body diagrams?*** These are simplified representations of an object (the body) in a problem, and they include **force vectors** (represented by arrows) acting on the object. This body is free because the diagram will show it without its surroundings; the body is 'free' of its environment. This eliminates unnecessary information which might be given in a problem. ***What are the forces involved in a free-body diagrams?***  *Gravity* – in these diagrams we will call the force due to gravity the **gravitational force**. We know that the acceleration due to gravity (if on Earth) is approximately g = 9.8m/s2 . The force of gravity, by Newton's Second Law is the product of the object’s mass and the acceleration due to gravity (F=ma). *Normal* – The normal force one which prevents objects from 'falling' into whatever it is they are sitting upon. It is always perpendicular to the surface with which an object is in contact. For example, if there is a crate on the floor, then we say that the crate experiences a normal force by the floor; and because of this force, the crate does not fall into the floor. The normal force on the crate points upward, perpendicular to the floor. *Friction* - Related to the normal force is the frictional force. The two are related because they are both due to the surface in contact with the body. Whereas the normal force was perpendicular to the surface, the frictional force is parallel. Furthermore, friction opposes motion, and so its vector always points **away** from the direction of movement. *Applied* – You may see this force called the “push or pull” on the body. This could be caused by a person pushing a crate on the floor, a child pulling on a wagon, or in the case of our example image, the wind pushing on the ship.  *Tension* – Tension in an object results if pulling force act on its ends, such as in a rope used to pull a boulder. If no forces are acting on the rope, say, except at its ends, and the rope itself is in equilibrium, then the tension is the same throughout the rope.***How do we know the overall force?***As we saw in class, the overall force is the **net force** which we find by combining (or adding) the forces in one dimension. See the free-body diagrams below. |
| ***Questions on the reading*** |
| Try these on your own, first. Then, check your answers with a partner.1. Why do we call these diagrams “free body” diagrams?
2. List and explain each of the 5 forces in free body diagrams.
3. Find the net force of the following free-body diagrams. Then, write if they are **balanced or unbalanced.**

1. See the free-body diagrams below. The net force is given, but the magnitudes of the individual forces is not. Analyze and determine the magnitude of each force.

1. Create a free-body diagram for each of the following scenarios. You may not be able to label exact magnitudes of force, but use the size and directions of arrows to represent estimates.
2. A book is at rest on a table-top.
3. A girl is suspended motionless from a bar which hangs from the ceiling by two ropes.
4. An egg is free-falling from a nest in a tree. Neglect air resistance.
5. A flying squirrel is gliding (no wing flaps) from a tree to the ground at constant velocity. Consider air resistance.
6. A rightward force is applied to a book in order to move it across a desk with a rightward acceleration. Consider frictional forces.
7. A college student rests a backpack upon his shoulder. The pack is suspended motionless by one strap from one shoulder.
8. A skydiver is descending with a constant velocity. Consider air resistance.
9. A force is applied to the right to drag a sled across loosely-packed snow with a rightward acceleration.
10. A football is moving upwards towards its peak after having been booted by the punter.
11. A car is coasting to the right and slowing down.
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