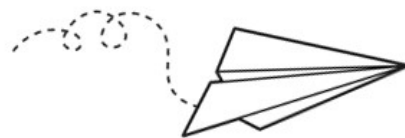


Name \_\_\_\_\_

## How Do Things Fly?



Have you ever thrown a toy glider or paper airplane and watched it soar through the air? What makes it move through the air and stay afloat? If you guessed force, you are correct. There are four forces that help an airplane fly through the air. Those forces are **lift**, **thrust**, **drag**, and **weight**.

Orville and Wilbur Wright were the first to successfully fly an airplane. In order to learn how to fly, the Wright brothers studied birds. This helped them to better understand how birds take flight and stay in the air. Wings of an airplane, like wings of a bird, help keep an airplane up in the air, but that is not the only reason a bird or airplane can fly. The four forces are the reason the airplane even got up in the air in first place. These forces act on the airplane to push it up, push it down, move it forward, or slow it down.

### The Four Forces:

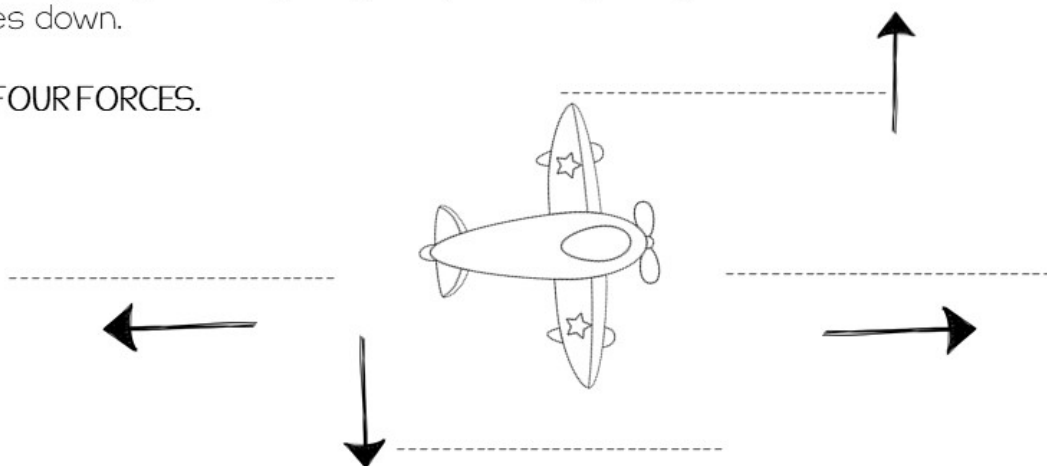
- **Weight** is the force of gravity that acts in a downward direction.
- The force that holds an airplane in the air is called **lift**. Most of the lift used by an airplane is created by the wings.
- Airplanes move in the direction of motion because of **thrust**. Engines produce thrust.
- **Drag** is the force that acts opposite of the direction of motion. It is caused by friction and differences in air pressure.

Each of the four forces has an opposite force that works against it.

- Which force is opposite of lift? \_\_\_\_\_
- Which force is opposite of thrust? \_\_\_\_\_

If the forces work against each other, then how does an airplane stay in the air? Balance is the key. All four forces must be in balance for an airplane to stay in the air. When the forces are balanced, an airplane flies in a level direction. The plane goes up if the forces of lift and thrust are more than gravity and drag. If gravity and drag are greater than lift and thrust, the airplane goes down.

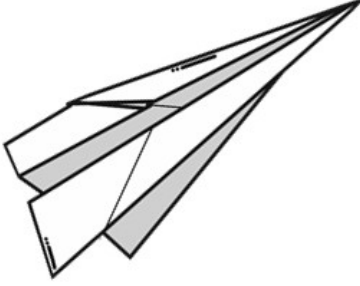
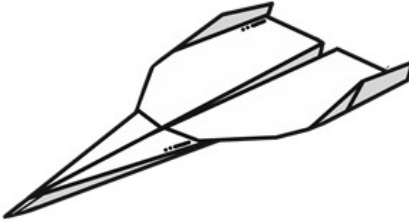
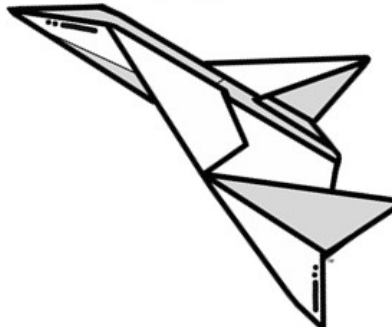
**LABEL THE FOUR FORCES.**



Name \_\_\_\_\_

## Evaluating Paper Airplane Design

There are many ways to fold paper to create a variety of paper airplane designs. Some designs may allow a paper airplane to have more lift or to have less resistance to friction (drag). Take a look at the following paper airplane designs. As you study each design, think about how the design is affected by the four forces: thrust, drag, lift, and weight.

<p>Basic Dart</p> 	<p>What features make this a good design?</p> <p>What features could cause this plane to be slow or not travel far?</p>
<p>Jet Fighter</p> 	<p>What features make this a good design?</p> <p>What features could cause this plane to be slow or not travel far?</p>
<p>Sonic Jet</p> 	<p>What features make this a good design?</p> <p>What features could cause this plane to be slow or not travel far?</p>

Which features from these paper airplanes do you want to include on your paper airplane? Why?

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