

Center of mass

The weight of an object (or any other force acting on it) can be thought of as acting at a single point: the center of mass. Whether or not an object is stable depends on the position of its center of mass.

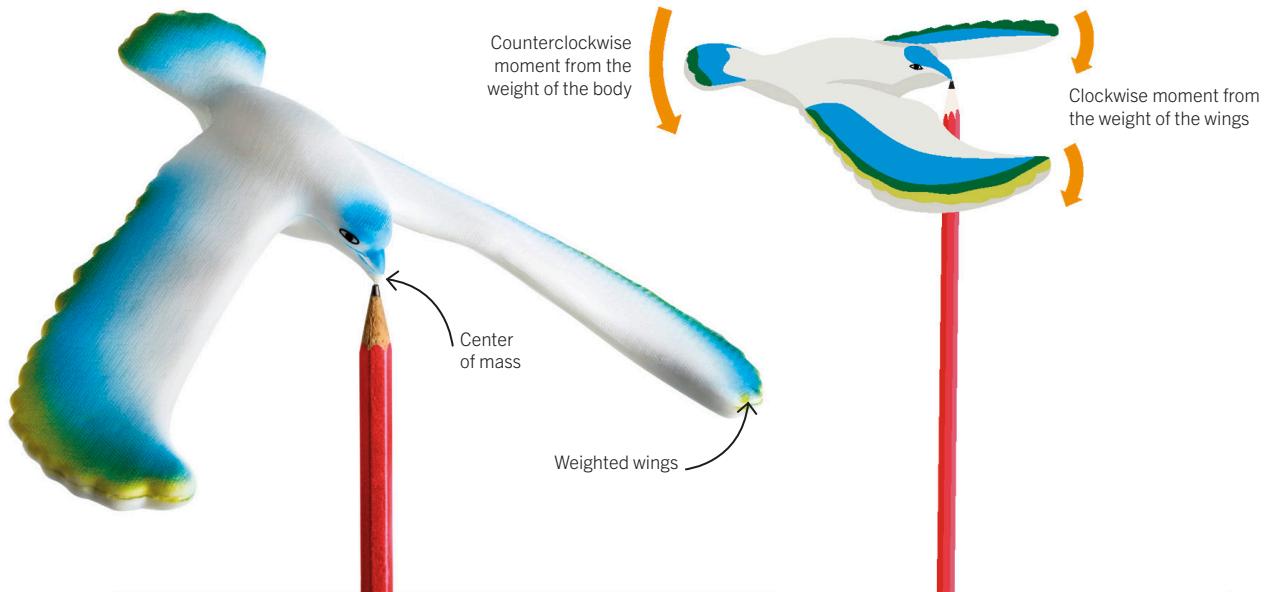
The balancing bird

This toy bird looks like it shouldn't be able to balance on its beak. However, because its wingtips extend forward and are weighted, the bird's center of mass is located at the beak. The heavy wings and the rear of the body both produce moments (turning forces), but these balance each other, much like people at opposite ends of a seesaw.



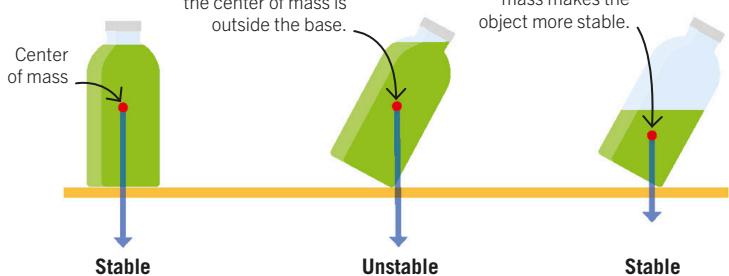
Key facts

- ✓ The weight of an object can be thought of as acting at a single point: the center of mass.
- ✓ The center of mass can be inside or outside an object, depending on its shape.
- ✓ An object is stable when its center of mass is above its base.
- ✓ An object will fall over if its center of mass is outside the base.



Stability

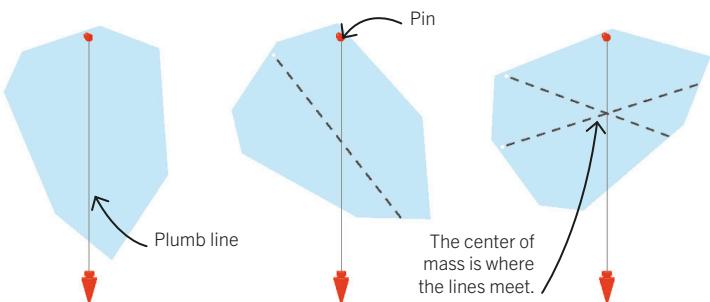
An object is stable when its center of mass is above its base. Tall objects with narrow bases fall over easily because even a small movement can push the center of mass outside the base. Stable objects tend to have a low center of mass and a wide base.





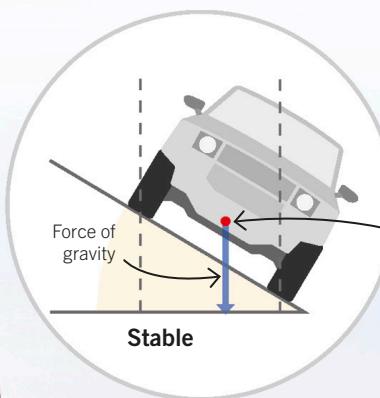
Finding the center of mass

To find the center of mass of an irregular 2D shape (a plane lamina), hang the shape from a vertical surface with a pin so it can swing freely. After it comes to rest, hang a plumb line (a weight on a string) from the pin and use it to draw a vertical line on the object. Repeat, hanging the shape from two more pivot points. The center of mass is the point where the lines intersect.



Off-road stability

Off-road vehicles are designed to have a very low center of mass and a wide wheelbase so they can negotiate steep or bumpy ground without becoming unstable.



The car remains stable provided the center of mass stays between the wheels.