

Solving for Mass Algebraically

For each problem:

- Draw a complete free-body diagram.
 - **Solve algebraically for mass.**
 - Show all work.
1. A box is pushed across a frictionless floor by a force of **8.0 N**, producing an acceleration of **2.0 m/s²**. Determine the mass of the box.
 2. A **24 N** force pushes a crate across a **frictionless** warehouse floor and the crate accelerates at **3.0 m/s²**. Determine the mass of the crate.
 3. A force of **32 N** pushes a cart across a floor with **kinetic friction** $\mu_k = 0.20$. The cart accelerates at **1.6 m/s²**. Determine the mass of the cart.
 4. A rope pulls a sled with **50 N** of force along snow. The coefficient of kinetic friction is **0.25** and the sled accelerates at **2.1 m/s²**. Determine the mass of the sled.
 5. A winch lifts a bucket vertically with a **tension force of 210 N**. The bucket accelerates **upward** at **2.3 m/s²**. Determine the mass of the bucket.
 6. A crane lowers a gravel bucket vertically. The tension in the cable is **530 N**, and the bucket accelerates **downward** at **1.7 m/s²**. Determine the mass of the bucket.
 7. A storage bin is pushed right by forces of **90 N** and **60 N**. Friction opposes the motion with **120 N**, and the bin accelerates **to the right** at **1.9 m/s²**. Determine the mass of the bin.
 8. A hovercart has two thrusters: one pushes **right with 145 N**, the other pushes **left with 35 N**. There is no friction, and the cart accelerates **to the right** at **4.5 m/s²**. Determine the mass of the cart.
 9. A shipping crate is pushed with **250 N** of force and accelerates at **2.0 m/s²**. The coefficient of kinetic friction is **0.40**. Determine the mass of the crate.
 10. A rocket-sled is pushed along a track with **7200 N** of thrust. Air drag opposing the motion is **1850 N**. The sled accelerates at **6.2 m/s²**. Determine the mass of the sled.
 11. Two masses hang from a pulley. The **heavier mass accelerates downward at 1.4 m/s²**. The **lighter mass is 3.2 kg**. Determine the mass of the heavier object.
 12. A **4.5 kg** block on a horizontal table is attached by a rope over a pulley to a hanging mass. The system accelerates at **1.8 m/s²**, and the coefficient of kinetic friction is **0.30**. Determine the mass of the hanging block.

13. Two blocks rest on a **frictionless** table and are connected by a rope. A **75 N** pull on the right-hand block accelerates the whole system at **2.5 m/s²**. The right-hand block has a mass of **6.0 kg**. Determine the mass of the left-hand block.
14. A crate is pulled **right with 130 N** and **left with 75 N**. Kinetic friction is present with $\mu_k = 0.42$. The crate accelerates **to the right** at **1.3 m/s²**. Determine the mass of the crate.
15. Two masses hang from a pulley. The **combined mass of the system is 16.0 kg**, and when released the system accelerates at **2.8 m/s²**. Determine the mass of **each** object.
16. Two masses hang from a pulley. The heavier mass is known to be **4.8 kg**. When released from rest, the heavier mass falls **1.25 m in 1.10 s**.
- Determine the acceleration of the system.
 - Determine the mass of the lighter object.
17. Two masses hang from a pulley and are released from rest. The descending side falls **1.80 m in 0.95 s**. The **combined mass of the system is 14.0 kg**.
- Determine the acceleration of the system.
 - Determine the mass of **each object**.