CH02-5 Net Force

The Momentum Principle

$$\vec{F}_{net} = \frac{\Delta \vec{p}}{\Delta t}$$

Analyzing the motion of the object tells us the net force on the object.

Principle of Superposition

The net force on a system is equal to the sum of the forces acting on the system.

$$\vec{F}_{net} = \vec{F}_1 + \vec{F}_2 + \vec{F}_3 + \cdots$$

Using the Momentum Principle to Solve for Unknown Forces.

Steps to applying the Momentum Principle to solve for unknown forces.

1. Apply the Momentum Principle to find the net force.
2. Sketch all forces acting on the system.
3. Apply the Principle of Superposition, by summing the forces acting on the system.
4. Solve for the unknown force.

Example

A 200-kg motorcycle at the starting line speeds up from zero to 60 mi/h (27 m/s) on a straight track in 4.5 s. To simplify the model, neglect the force of air (it's a "real drag" anyway) on the motorcycle. What is the force by the road on the motorcycle?

Example

Suppose that 0.10 s after a 0.050-kg model rocket is launched, the rocket is moving directly upward with a speed of 12 m/s. Assume that the thrust on the rocket due to the engine is approximately constant during this time interval and is 8.0 N, upward. What is the (average) force of air on the rocket during this time interval?

More Examples

See Sections 2.3 and 2.6 at:

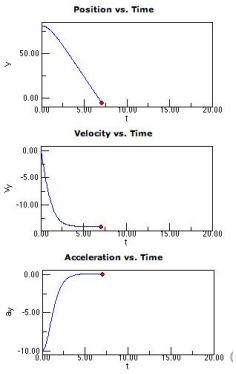
http://linus.highpoint.edu/~atitus/mandi/

Air Resistance

Its direction is opposite the velocity of the object. Its magnitude depends on the speed of the object squared.

$$\vec{F}_{drag} = C|\vec{v}|^2(-\hat{v})$$

y-velocity vs. time for object falling from rest



Drag constant

VPython

Model the motion of a BASE jumper who falls from rest, if his total mass (with chute) is 100 kg and his drag constant is 0.31.

Graph y vs. t and v_y vs. t.

What is the BASE jumper's terminal speed and approximately how long does he fall until he reaches this speed?