Step-by-step Process of Solving

One-Dimensional Kinematics Problems

[Chapter](https://openstax.org/books/college-physics/pages/2-problems-exercises) 2

**This handout contains selected problems with**

* **step-by-step solutions**

**and**

* **the demonstration of the thinking process involved in problem-solving.**

**For extra support watch: Khan Academy:** [**One-dimensional motion**](https://www.khanacademy.org/science/physics/one-dimensional-motion)

**# 16**

*A cheetah can accelerate from rest to a speed of 30.0 m/s in 7.00 s. What is its acceleration?*

# Step 1

Read the problem again and highlight main information: what is known and what is unknown.

Check that all quantities have SI units of measurements.

If not, convert to SI units before calculations.

*A cheetah can accelerate from rest to a speed of 30.0 m/s in 7.00 s. What is its acceleration?*

We know:

A cheetah accelerates from rest means that the initial speed is zero, $v\_{0}=0$.

The final speed is 30.0 m/s, $v\_{f}=30.0 m/s$.

Time is 7.00 s, $t=7.00 $s.

We need to find:

Acceleration, $a$.

# Step 2

Think about what formula to use.

This problem is about velocity, time, and acceleration. The definition of acceleration is the right formula to use.

$$a= \frac{v\_{f}-v\_{0}}{t}$$

Note:

Acceleration and velocity are vector quantities.

Time is a scalar quantity.

# Step 3

Substitute numbers into formula and calculate.



**# 18**

*A commuter backs her car out of her garage with an acceleration of . (a) How long does it take her to reach a speed of 2.00 m/s? (b) If she then brakes to a stop in 0.800 s, what is her deceleration?*

# Step 1

Read the problem again and highlight main information: what is known and what is unknown.

Check that all quantities have SI units of measurements.

If not, convert to SI units before calculations.

*A commuter backs her car out of her garage with an acceleration of .*

*(a) How long does it take her to reach a speed of 2.00 m/s?*

*(b) If she then brakes to a stop in 0.800 s, what is her deceleration?*

All the quantities are in SI units.

1. The initial speed is 0 m/s. The car starts from rest and goes backwards.

 The final speed is 2.00 m/s.

Acceleration is 1.40 m/s2.

1. The initial speed is 2.00 m/s.

The final speed is zero. The car stops.

Deceleration means negative acceleration.

Time is 0.800 s.

# Step 2

Think about what formula to use.

This problem is about velocity, time, and acceleration. The definition of acceleration is the right formula to use.

$$a= \frac{v\_{f}-v\_{0}}{t}$$

$$t= \frac{v\_{f}-v\_{0}}{a}$$

Note:

Acceleration and velocity are vector quantities.

Time is a scalar quantity.

(a)

We will use this formula $$t= \frac{v\_{f}-v\_{0}}{a}$$

(b)

We will use this formula

$$a= \frac{v\_{f}-v\_{0}}{t}$$

# Step 3

Substitute numbers into formula and calculate.

(a)



(b)

