SPH3U
UNIVERSITY PHYSICS

KINEMATICS

- ☞ Introduction
  (P.2-5)

Motion

What is the physics of motion all about? Motion is part of the everyday physical world. We learn to walk, run, and drive without a formal understanding of the physics of motion. We do, however, have an intuitive idea of motion and its effects and causes.

Overall Expectations

By the end of this unit, students will:

1. analyse technologies that apply concepts related to kinematics, and assess the technologies' social and environment impact;

2. investigate, in qualitative and quantitative terms, uniform and non-uniform linear motion, and solve related problems;

3. demonstrate an understanding of uniform and non-uniform linear motion, in one and two dimensions.

Big Ideas

Concepts that students should retain long after this course are:

- Motion involves a change in the position of an object over time.
- Motion can be described using mathematical relationships.
- Many technologies that apply concepts related to kinematics have societal and environmental implications.

Getting Started: Useful Concepts & Skills

CONCEPTS REVIEW

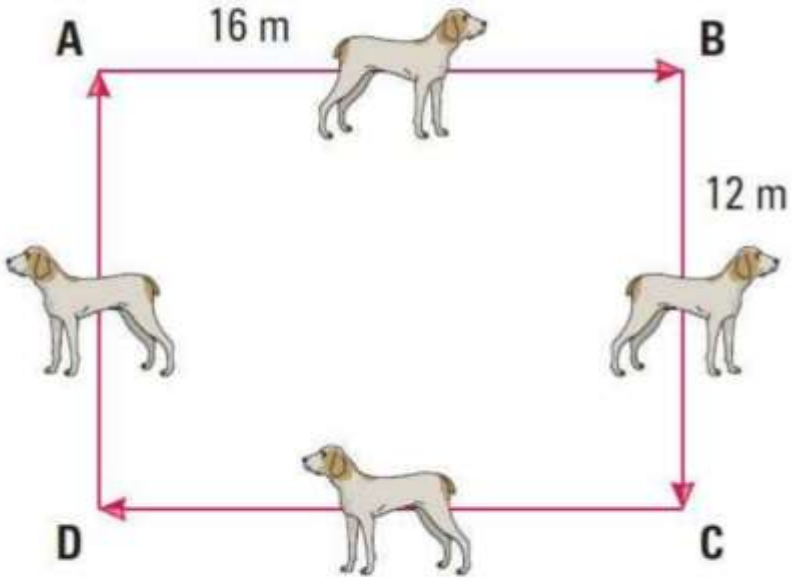
1. The diagram below shows the motion of a car along a straight road. The images are taken at time intervals of 1.0 s. Describe the motion of the car.

Getting Started: Useful Concepts & Skills

CONCEPTS REVIEW

2. A playful dog runs along the path shown, starting at A. The total time the dog takes to go from A along the path back to A again is 16 s.

   (a) State the compass directions the dog is moving in each part.



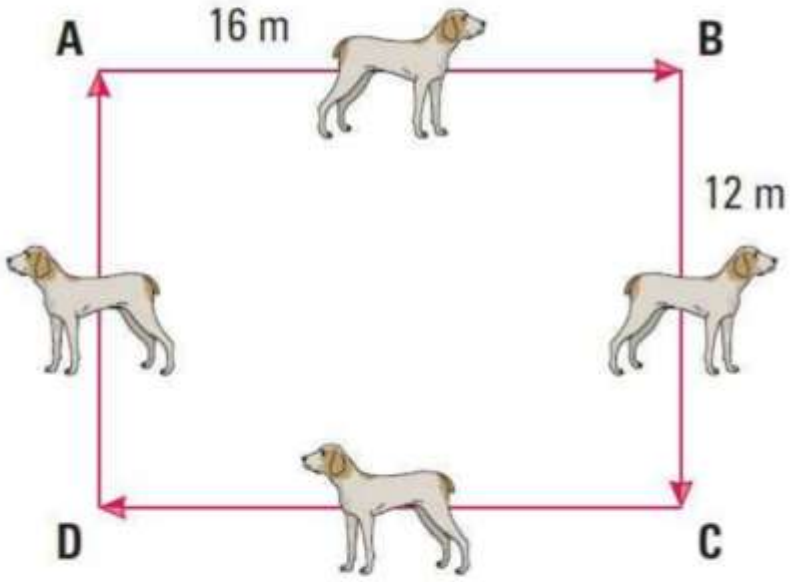
(a) E – S – W – N

Getting Started: Useful Concepts & Skills

CONCEPTS REVIEW

2. A playful dog runs along the path shown, starting at A. The total time the dog takes to go from A along the path back to A again is 16 s.

   (b) Determine the total distance travelled by the dog.



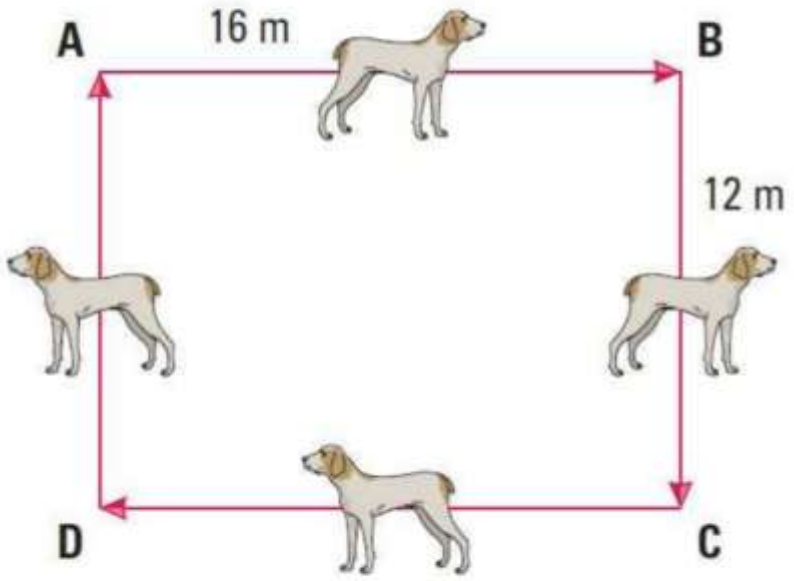
(b) 56 m

Getting Started: Useful Concepts & Skills

CONCEPTS REVIEW

2. A playful dog runs along the path shown, starting at A. The total time the dog takes to go from A along the path back to A again is 16 s.

   (c) What is the net displacement of the dog over the entire run?



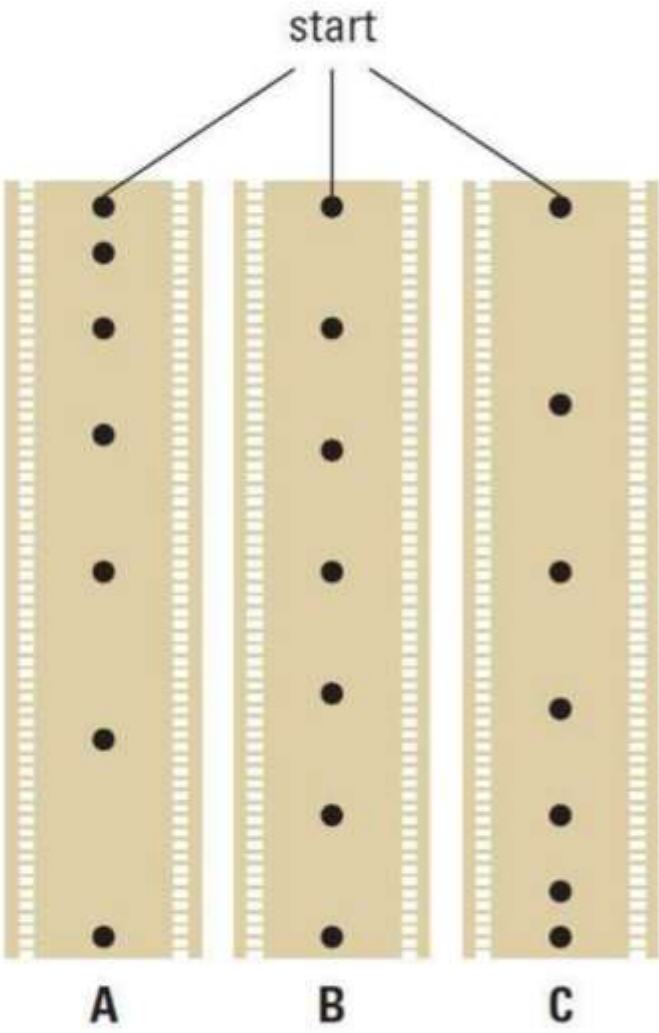
(c) 0 m

Getting Started: Useful Concepts & Skills

CONCEPTS REVIEW

3. A golf ball, attached with a light that flashes regularly with time, is dropped in a dark room from shoulder height to the floor. Which set of dots representing the flashing of light would you observe in a photograph of the golf ball's downward motion? Explain your choice.

A – object speeds up as it falls



Getting Started: Useful Concepts & Skills

SKILLS REVIEW

4. (a) A robin flies a distance of 46 000 cm. How far has it flown in kilometres?

   (b) What is the speed in metres per second (m/s) of a car that is travelling at 72 km/h?

   (c) What is the speed in kilometres per hour (km/h) of a baseball thrown at 25 m/s?

(a) 0.46 km

(b) 20 m/s

(c) 90 km/h

Getting Started: Useful Concepts & Skills

SKILLS REVIEW

5. You are asked to calculate the speed of a jogger that runs besides you along a straight track. Describe how you would perform an experiment to calculate the required quantity.

$v = d/t$

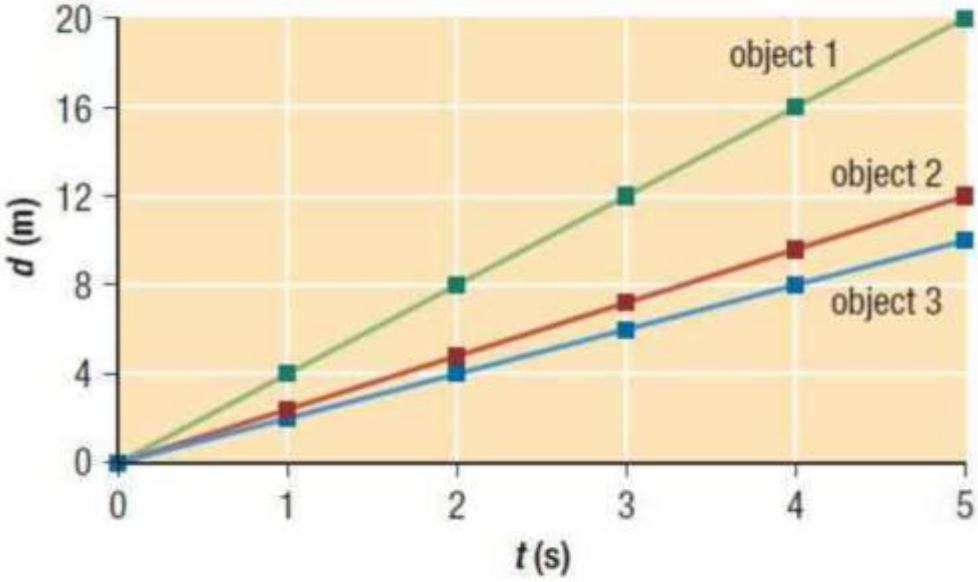
need to measure the distance the jogger travels in a set time

Getting Started: Useful Concepts & Skills

SKILLS REVIEW

6. The three lines on the distance-time graph represent the motion of three objects.

   (a) Which object has travelled the farthest at time t = 5 s?



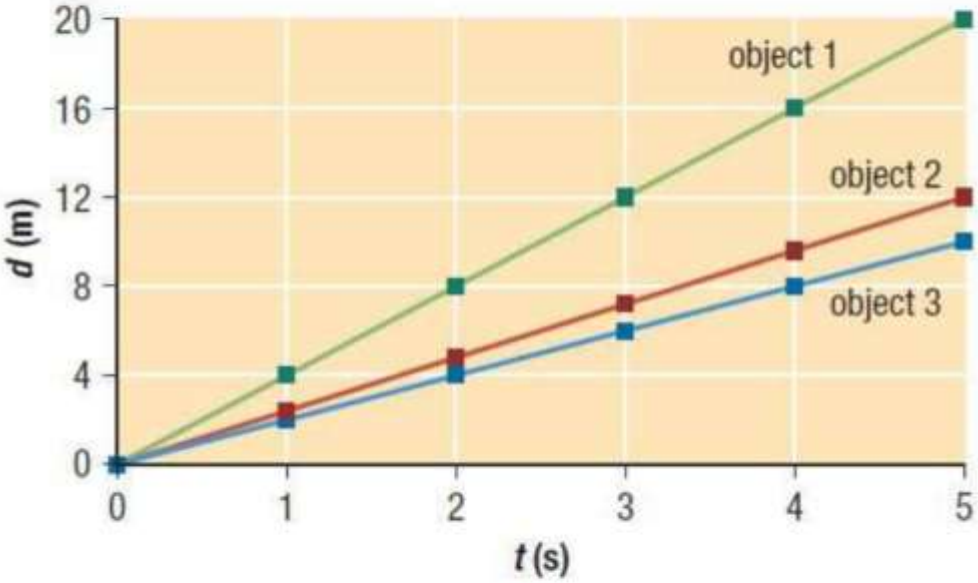
(a) object 1 (20 m)

Getting Started: Useful Concepts & Skills

SKILLS REVIEW

6. The three lines on the distance-time graph represent the motion of three objects.

   (b) How far has each object travelled at time t = 3 s?



(b) $d_1 = 12$ m

$d_2 = 7$ m

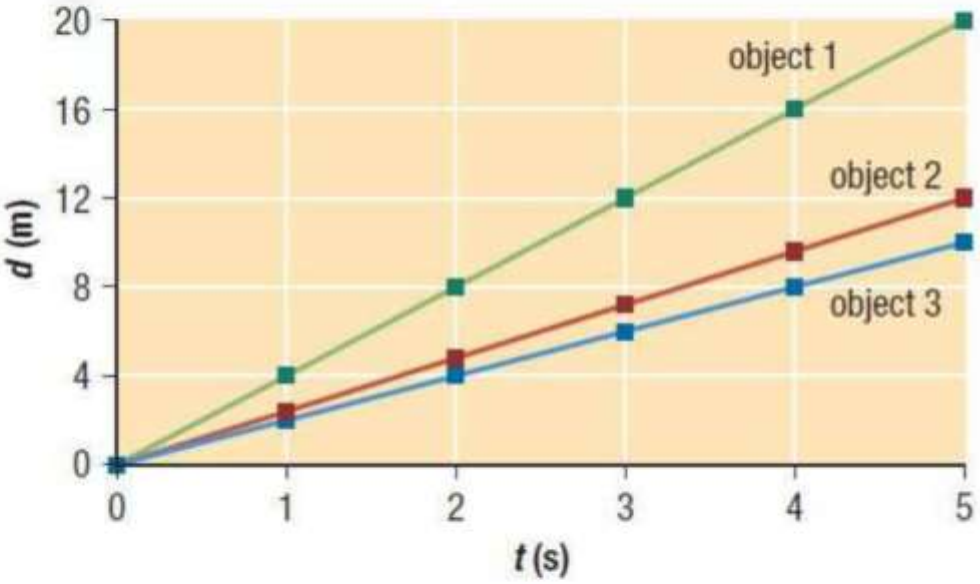
$d_3 = 6$ m

Getting Started: Useful Concepts & Skills

SKILLS REVIEW

6. The three lines on the distance-time graph represent the motion of three objects.

   (c) What is the slope of each line?



(c) $m_1 = 4.0$ m/s

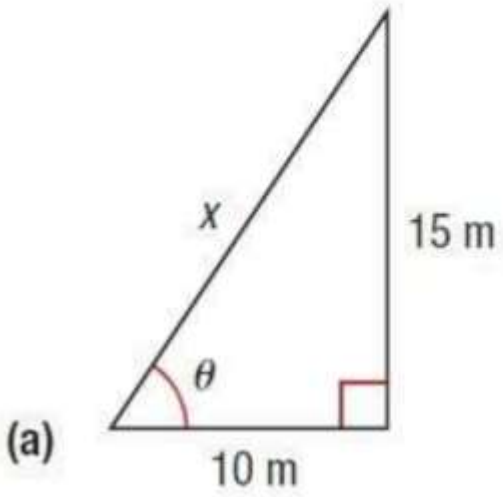
$m_2 = 2.4$ m/s

$m_3 = 2.0$ m/s

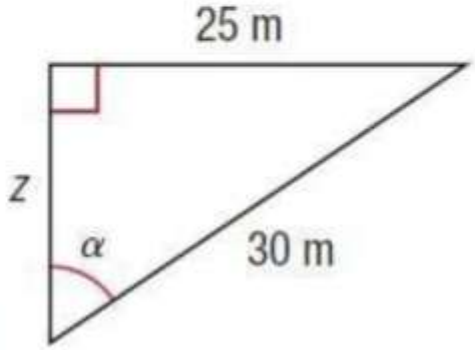
Getting Started: Useful Concepts & Skills

SKILLS REVIEW

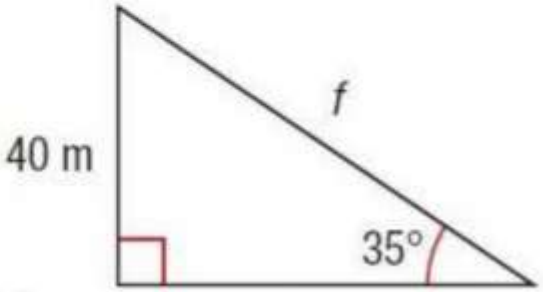
7. Determine each unknown length.



(a)



(b)



(c)

(a) x = 18 m

(b) z = 17 m

(c) e = 57 m

f = 70 m