

# SPH3U UNIVERSITY PHYSICS

KINEMATICS  
Introduction  
(P.2-5)

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## 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.*



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## 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.

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**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.

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**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.

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**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

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**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

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**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

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**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

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**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

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**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

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**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)

Time (s)	Object 1 Distance (m)	Object 2 Distance (m)	Object 3 Distance (m)
0	0	0	0
1	4	3	2
2	8	6	4
3	12	9	6
4	16	12	8
5	20	15	10

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**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

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**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

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**Getting Started: Useful Concepts & Skills**

**SKILLS REVIEW**

7. Determine each unknown length.

(a)  $x = 18$  m  
(b)  $z = 17$  m  
(c)  $e = 57$  m  
 $f = 70$  m

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