1-D Motion

Name: _____

Video 1d03 (6:42)

-- motion in a straight line → i.e.,

Introductory Concepts

scalar	vector
magnitude	magnitude AND direction
e.g.,	e.g.,
distance (d)	displacement (Δd)
-- it depends on the path taken	-- it is independent of the path taken
e.g.,	e.g.,

A displacement Δd is easily found if we are given two x (or y) coordinates. We simply subtract the two, in the order…

…and instead of Δd, we might write…

To show that Δd could mean L/R, up/down, N/S, E/W, etc., motion, I like to represent it as:

The starting and ending coordinates, by themselves, are NOT enough information to find distance, unless the object goes…

AND…

Sometimes, we're given coords.; sometimes, Δds.

Δds are reported with a direction. A term like "how far," though, refers to a ***distance***, not a Δd, so we don't need a direction in our answer.

Video 1d06 (4:58)

Velocity and Speed

average speed

e.g.,

average velocity

e.g.,

instantaneous speed/velocity:

constant speed: speed isn't changing

--

constant velocity: vel. isn't changing

--

Unless we state otherwise, "velocity" means "instantaneous velocity" and "speed" means "instantaneous speed." If we want "average speed/velocity," we'll say "average speed/velocity."

Velocities are reported with a direction. A term like "how fast," though, refers to a ***speed***, not a velocity, so we don't need a direction in our answer.

Video 1d09 (4:40)

0.00 m, 0.0 s

0.25 m, 9.2 s

0.75 m, 3.8 s

EX. Calc. the following:

a. total distance traveled

b. displacement for time intervals t_1–t_2, t_2–t_3, t_1–t_3


0.00 m, 0.0 s


0.25 m, 9.2 s


0.75 m, 3.8 s

c. average speed for time intervals t_1–t_2, t_2–t_3, t_1–t_3

d. average velocity for time intervals t_1–t_2, t_2–t_3, t_1–t_3

Video 1d12 (5:28)

<u>acceleration</u>:

--

--

--

Equation:

unit →

Video 1d15 (2:55)

Negative Velocities and/or Accelerations

Rule One-and-Only:

A (–) velocity simply means that an object is moving in a direction <u>opposite</u> to what **we chose** as (+). Had we chosen the other way to be (+), the object would now have a (+) velocity.

v	a	"What's happening?"	v	a
+	+			
+	–			
–	+			
–	–			

Video 1d18 (6:32)

EX. An arrow is accelerated by a bowstring to 36 m/s in 0.31 s. Find arrow's acceleration.

G:

U: S:

E: S:

EX. Car traveling 65 m/s approaches stop sign. Driver applies brakes for 8.2 s. Find car's acceleration.

G:

U: S:

E: S:

Video 1d21 (3:02)

EX.  Pygmy goat runs toward a feeding trough with initial speed 2.5 m/s. If goat slows down at 0.42 m/s^2, how long will it take goat to reach trough?

G:

U: S:

E: S:

EX. Boy runs from inside garage and slides down icy driveway. At top, he moves at 2.3 m/s. He slides down in 4.5 s, accelerating at 0.75 m/s^2.

Video 1d24 (5:48)

a. How fast is he moving at the bottom?

G:

U: S:

E: S:

b. How long is the driveway?

c. Assuming the same acceleration, find the time for him to reach the bottom if he starts at the top from rest.

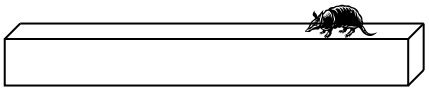
Video 1d27 (3:29)

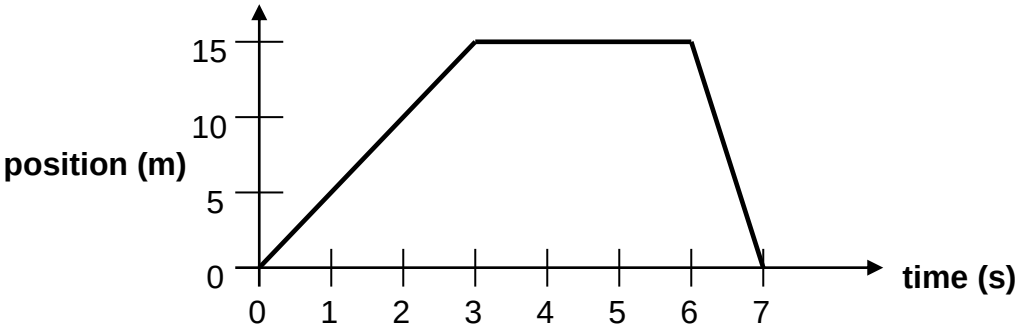
EX. Penguin moves with initial speed 0.65 m/s. At a later time, he has speed 1.9 m/s. During this interval, penguin travels 7.3 m. Find his acceleration.

Video 1d30 (5:57)

Graphical Analysis of 1-D Motion

Consider the following position-time curve.



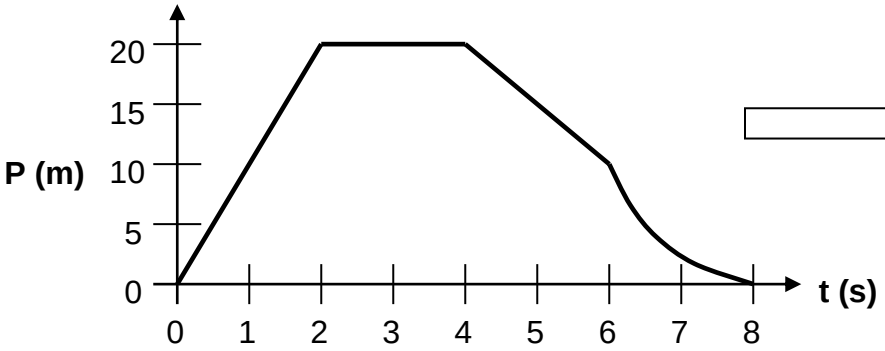


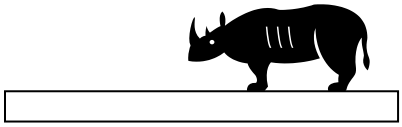
slope of curve is:

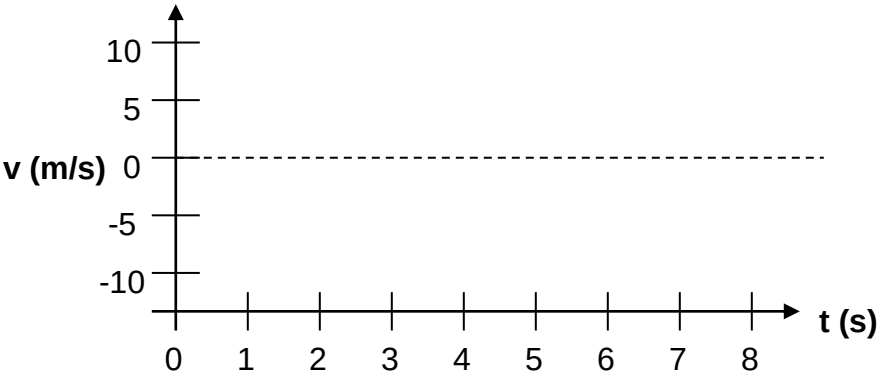
EX. Find armadillo's velocity at t = 2.0 s and at t = 6.5 s.

Video 1d33 (4:26)

Another P-t curve:

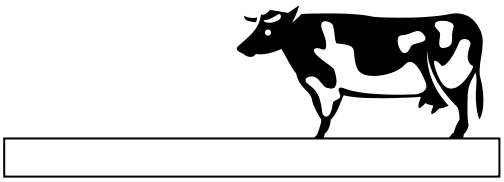


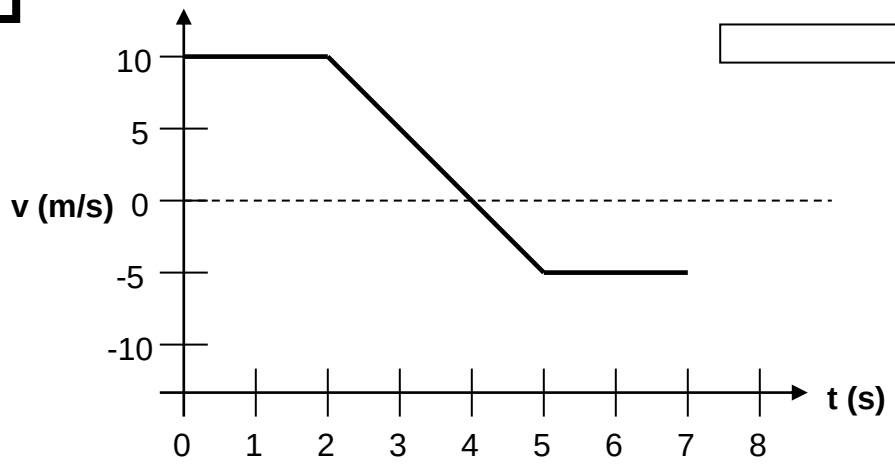




Video 1d36 (6:56)

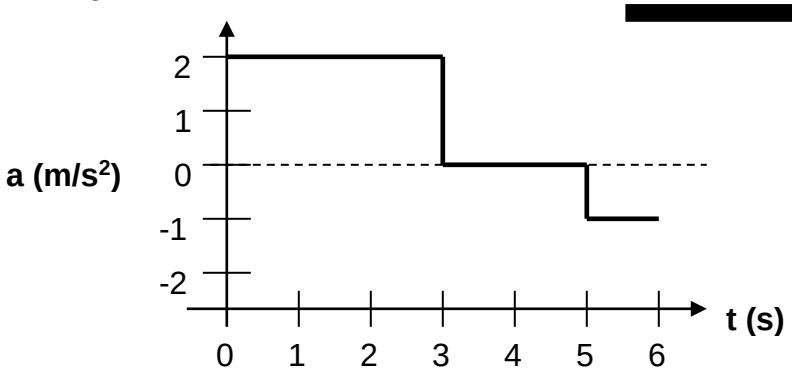
Consider the following v-t curve.



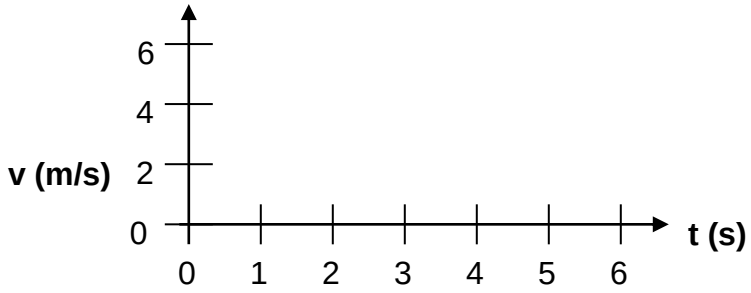


slope of curve is:

Consider the following a-t curve.

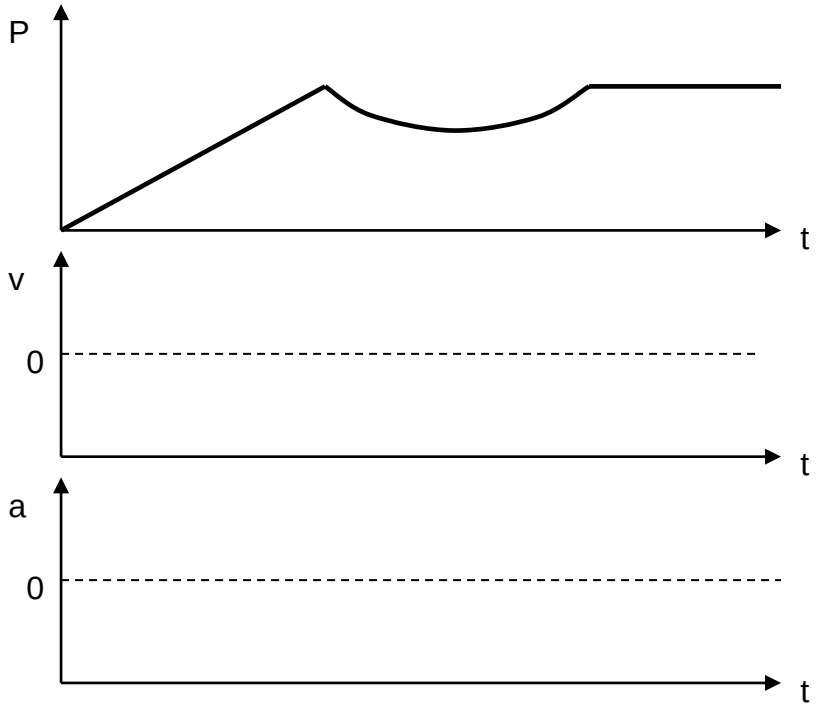


EX. If the object starts at rest, the associated v-t curve looks like…

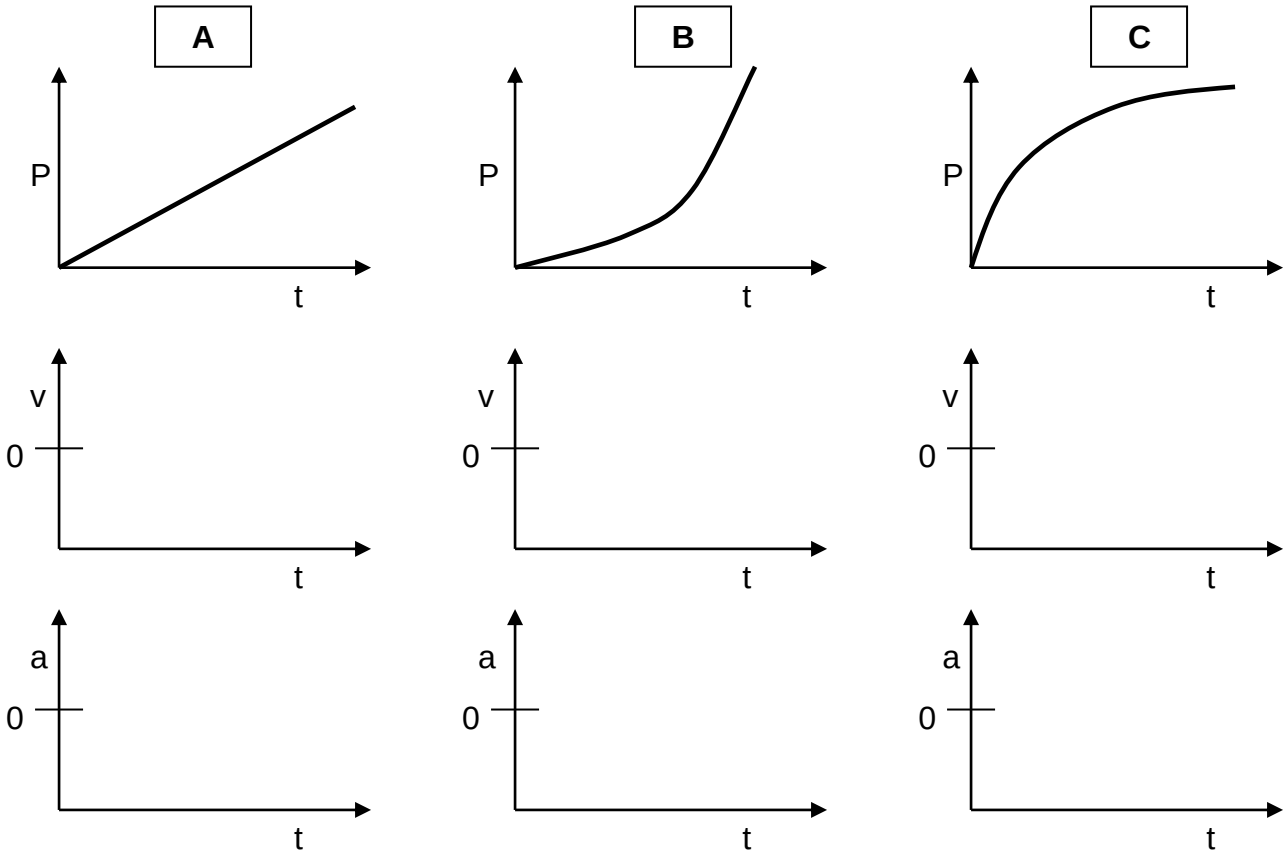


EX. Find object's average velocity.

Video 1d39 (3:32)

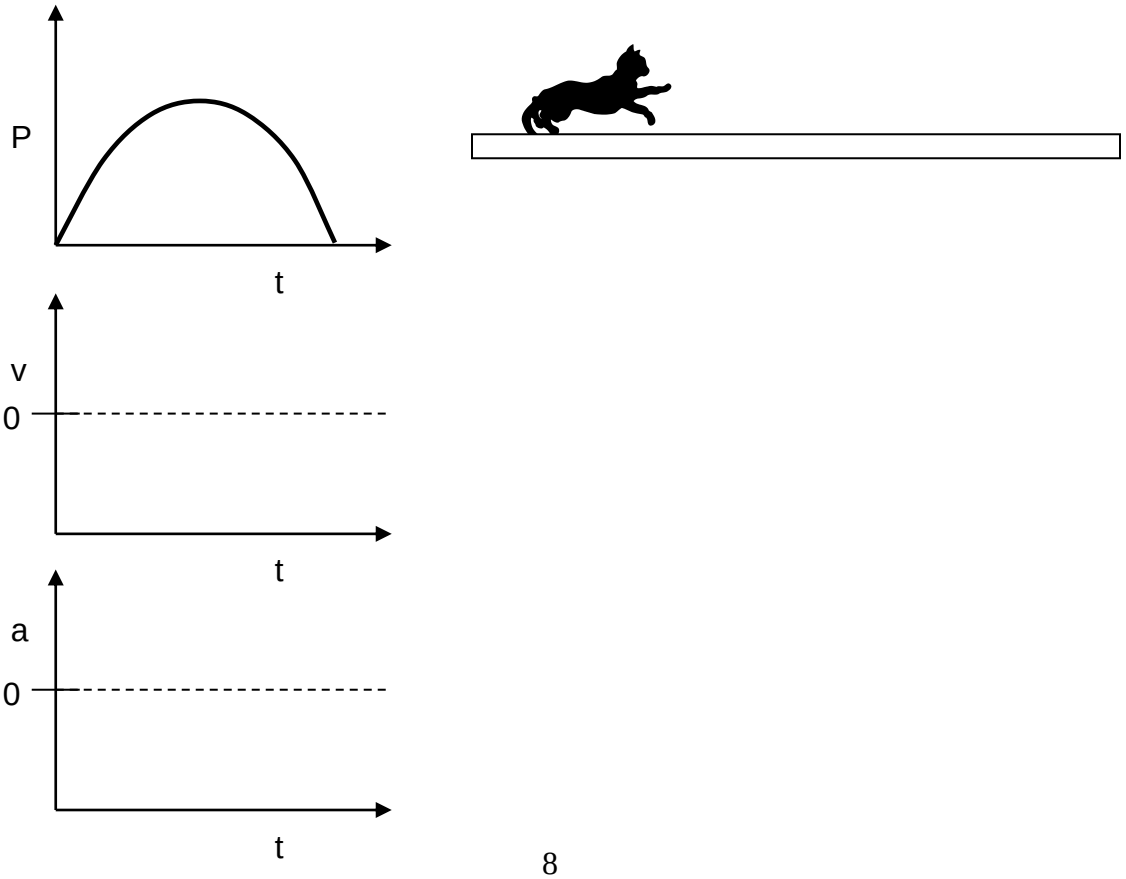


Video 1d42 (3:17)



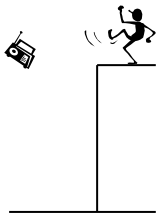
Video 1d45 (4:08)

Now consider a cat on a balance beam…



Video 1d48 (6:56)

Free Fall a = g =



EX. An alarm clock is “fire-escaped” from rest from height 38.0 m.

a. How long is clock in the air?

b. Find velocity of clock at impact.

c. Find velocity of clock halfway down.

Video 1d51 (6:12)

A full beverage can is launched upward with initial velocity 22.8 m/s. Find…

a. …total time in air

b. …maximum height attained

c. ...location of can when its speed is half its original speed