PhyzSpringboard: From Velocity to Position I

ALGEBRAIC EXPRESSIONS FOR UNIFORM MOTION

1. If a body travels at a speed of 4 m/s for 10 s, how far will it go?

$4m/s \cdot 10s = 40m$

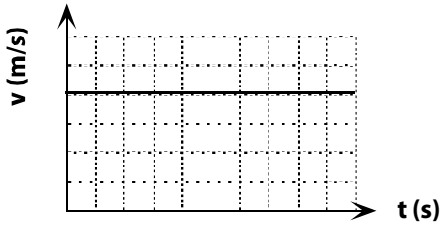
2. If a body travels at a speed of v for an interval t, how far (x) will it go?

$x = v\ t$

GRAPHICAL INTERPRETATION OF UNIFORM MOTION

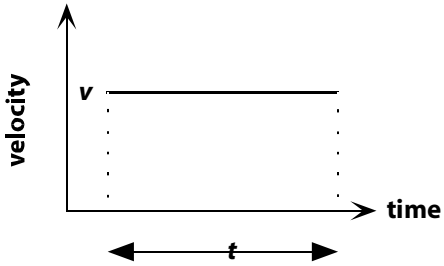
3. Examine the velocity *vs.* clock reading graph of a body that travels at 4 m/s for 10 s. Is there any characteristic of the graph that indicates the **distance** traveled by the body? If so, what is it?

Area bounded by plot indicates change in position.



4. Examine the velocity vs. clock reading graph of a body that travels at a speed v for an interval t. Write an expression for the distance (x) traveled by the body.

$x = v\ t$

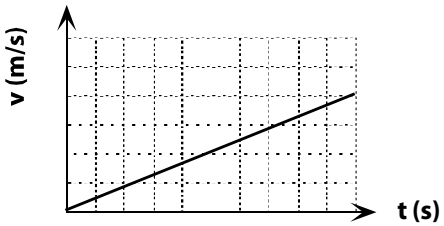


MOTION TYPING

5. a. What kind of motion did the bodies whose velocity vs. clock reading graphs are shown above undergo?

Uniform Motion (constant velocity)

b. What kind of motion did the body whose velocity *vs.* clock reading graph is shown to the right undergo?



Uniform Accelerated Motion (constant acceleration)

GRAPHICAL INTERPRETATION OF UNIFORM ACCELERATED MOTION

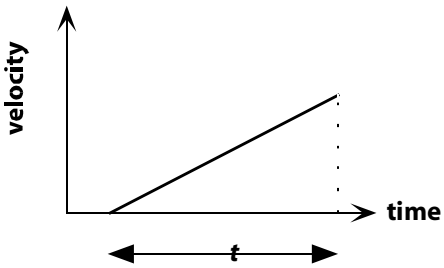
6. The mathematical principle deduced above for determining the distance traveled by a body from a velocity *vs.* clock reading graph is true for all types of motion.

a. How far did the body whose velocity *vs.* clock reading graph is shown in the previous question travel?

$(1/2)(10s)(4m/s) = 20m$

b. Write a general expression for the distance traveled by a body that accelerates from rest to a velocity v in an interval t.

$x = (1/2)v\ t$

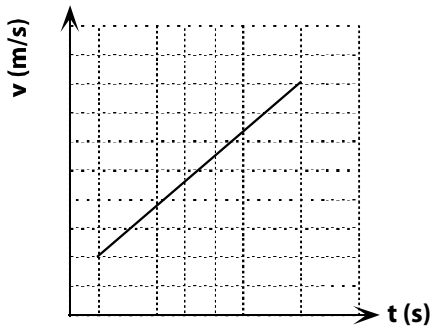


7. a. Consider a body that accelerates from 2 m/s to 8 m/s in 7 s. How far did it travel during that 7 s interval?

... 14m + 21m = 35m

b. Write a general expression for the distance traveled by a body that accelerates from an initial velocity v_0 to a final velocity v in an interval t.

$x = (1/2)(v_0 + v)\ t$

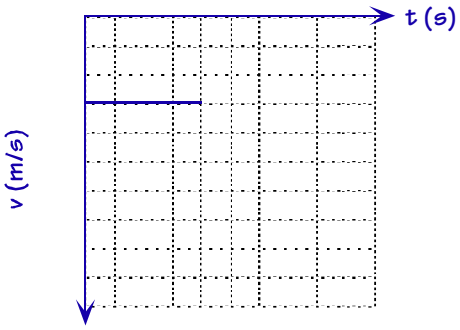


GOING NEGATIVE

8. Consider a body that travels at -3 m/s for 4 s.
a. Plot the body's velocity *vs.* clock reading graph to the right. (The grid is provided for your convenience; you choose the axes.)

b. How far did the body move during the interval?

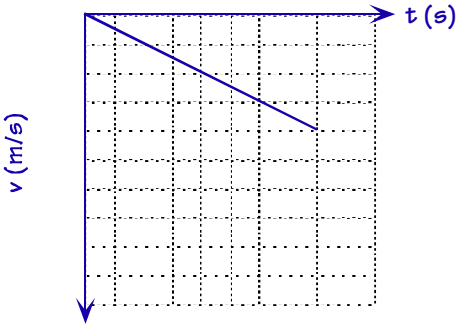
$x = v\ t$
$x = -3m/s \cdot 4s$
$x = -12m$



9. Consider a body that accelerates from rest to -5 m/s in 8 s.
a. Plot the body's velocity *vs.* clock reading graph.

b. How far did the body move during the interval?

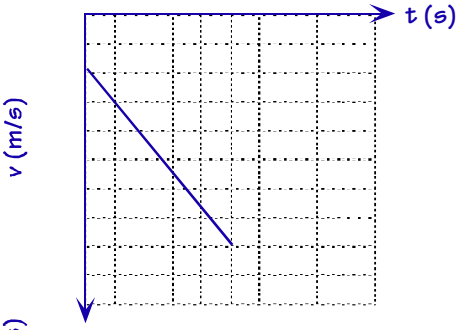
$x = (1/2)v\ t$
$x = (1/2) \cdot -5m/s \cdot 8s$
$x = -20m$



10. Consider a body that accelerates from -2 m/s to -8 m/s in 5 s.
a. Plot the body's velocity *vs.* clock reading graph.

b. How far did the body move during the interval?

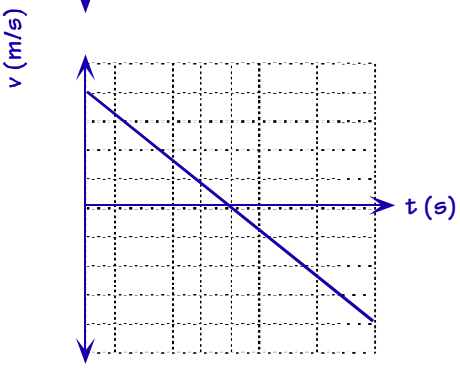
$x = (1/2)(v_0 + v)\ t$
$x = (1/2)(-2m/s + -8m/s) \cdot 5s$
$x = -25m$



11. Consider a body that accelerates from 4 m/s to -4 m/s in 10 s.
a. Plot the body's velocity *vs.* clock reading graph.

b. How far did the body move during the interval?

$x = (1/2)(v_0 + v)\ t$
$x = (1/2)(4m/s + -4m/s) \cdot 10s$
$x = 0m$



c. **Did** the body move during the interval? If so, how? Describe qualitatively.

Yes! It moves +10m in the first 5s and -10m in the second 5s.