1.5 The Kinematics Equations

Pg. 46-53

Ex 1.12)

$\vec{v}_i = +10.0\ m/s$

$\vec{a} = +3.0\ m/s^2$

$\vec{v}_f = +25.0\ m/s$

$t = ?$

$\vec{a} = \frac{\vec{v}_f - \vec{v}_i}{\Delta t}$

$t \cdot 3.0 = \frac{25.0 - 10.0}{t} \cdot t$

$\frac{3.0t}{3.0} = \frac{15.0}{3.0}$

$t = 5.0\ s$

Practice Problems

1. $\vec{v}_i = +6.0\ m/s$
   $\vec{a} = +4.0\ m/s^2$
   $\vec{v}_f = +36.0\ m/s$
   $t = ?$

$\vec{a} = \frac{\vec{v}_f - \vec{v}_i}{\Delta t}$

$4.0 = \frac{36.0 - 6.0}{t}$

$t = \frac{30.0}{4.0}$

$t = 7.5\ s$

20 km/h ÷ 3.6 = 5.6 m/s

2. $\vec{v}_i = +5.6\ m/s$
   $\vec{a} = +1.5\ m/s^2$
   $t = 9.3\ s$
   $\vec{v}_f = ?$

$\vec{a} = \frac{\vec{v}_f - \vec{v}_i}{t}$

$9.3 \cdot 1.5 = \frac{\vec{v}_f - 5.6}{9.3} \cdot 9.3$

$13.95 = \vec{v}_f - 5.6$

$+5.6 \quad +5.6$

$\vec{v}_f = +20\ m/s \quad \times 3.6$

$\vec{v}_f = +70\ km/h$

$\vec{v}_f = 70\ km/h\ [N]$

Ex 1.13)

$\vec{v}_i = -16.0\ m/s$

$\vec{v}_f = 0\ m/s$

$t = 8.0\ s$

$\vec{d} = ?$

$\Delta\vec{d} = \left(\frac{\vec{v}_i + \vec{v}_f}{2}\right) t$

$= \left(\frac{-16.0 + 0}{2}\right)(8.0)$

$\Delta\vec{d} = -64\ m$

$\Delta\vec{d} = 64\ m\ [W]$

Practice Problem

$\vec{v}_i = -16.0\ m/s$

$\vec{v}_f = -4.0\ m/s$

$t = 4.0\ s$

$\vec{d} = ?$

$\Delta\vec{d} = \left(\frac{\vec{v}_i + \vec{v}_f}{2}\right) t$

$\Delta\vec{d} = \left(\frac{-16.0 + -4.0}{2}\right)(4.0)$

$\Delta\vec{d} = -40\ m$

$\Delta\vec{d} = 40\ m\ [S]$

2.

$\vec{v}_i = +3.0\ m/s$

$\vec{v}_f = -9.0\ m/s$

$t = 4\ s$

$\vec{d} = ?$

$\Delta\vec{d} = \left(\frac{\vec{v}_i + \vec{v}_f}{2}\right) t$

$= \left(\frac{+3.0 + -9.0}{2}\right)(4)$

$= -12\ m$

$\Delta\vec{d} = 12\ m$ [down the hill]

Ex 1.14)

$\vec{v}_i = 25 m/s$
$\vec{a} = -20 m/s^2$
$t = 2.0 s$
$\vec{d} = ?$

$\Delta\vec{d} = \vec{v}_i t + \frac{1}{2}\vec{a}t^2$ *

$= (25)(2.0) + (\frac{1}{2})(-20)(2.0)^2$

$= 50 + -40$

$\Delta\vec{d} = 10 m$ [forward]

Practice Problems

1. $\vec{v}_i = -3.0 m/s$
$\vec{a} = -4.0 m/s^2$
$t = 5.0 s$
$\vec{d} = ?$

$\Delta\vec{d} = \vec{v}_i t + \frac{1}{2}\vec{a}t^2$

$= (-3.0)(5.0) + (\frac{1}{2})(-4.0)(5.0)^2$

$= -15 + -50$

$= -65 m$

$\Delta\vec{d} = 65 m$ [down]

2.

$\vec{v}_i = 27.8 m/s$ *
$\vec{a} = -0.80 m/s^2$ *
$t = 60 s$ *
$\vec{d} = ?$

$\Delta\vec{d} = \vec{v}_i t + \frac{1}{2}\vec{a}t^2$

$= (27.8)(60) + (\frac{1}{2})(-0.80)(60)^2$

$= 1666.6 + -1440$

$\Delta\vec{d} = 227 m$

$\Delta\vec{d} = 2.3 \times 10^2 m$ [forward]

Textbook Learning Assignment: Finish 1.15, 1.16 examples and practice problems in a neat organized manner.