1. $v_0 = 15 m/s [E]$
$v_f = 25 m/s [W] (-25)$
$t = 26 s$

a) $\vec{a} = \frac{\vec{v_f} - \vec{v_0}}{t}$
$\vec{a} = \frac{-25 - 15}{26}$
$\vec{a} = \frac{-40}{26}$
$\vec{a} = -1.54 m/s^2 [E]$

b) $\vec{d_f} = \vec{d_0} + \vec{v_0} t + \frac{1}{2} a t^2$
$\vec{d_f} = 0 + (15)(26) + \frac{1}{2}(-1.54)(26)^2$
$\vec{d_f} = 0 + 390 + -520.52$
$\vec{d_f} = -130 m [E]$

c) $v_f = ?$
$\vec{a} = -1.54 m/s^2$
$t = 15 s$
$v_i = 25 m/s (W) (-25)$

$\vec{a} = \frac{\vec{v_f} - \vec{v_0}}{t}$
$-1.54 = \frac{\vec{v_f} - (-25)}{15} .15$
-25
$-23.1 = \vec{v_f} + 25 - 25$
$-48.1 m/s [E] = \vec{v_f}$

3. $d = 250 m$
$\vec{a} = -9.81 m/s^2$
$\vec{v_0} = 0 m/s$

a) $\vec{d_f} = \vec{d_0} + \vec{v_0} t + \frac{1}{2} a t^2$
$0 = 250 + (0)(t) + \frac{1}{2}(-9.81)(t^2)$
$0 = 250 + 0 + -4905 t^2$
$\frac{-250}{-4.905} = \frac{-4.905 t^2}{-4.905}$
$50.97 = t^2$
$\sqrt{50.97} = t$
$7 s = t$

b) $\vec{v_f}^2 = \vec{v_0}^2 + 2a(\vec{d_f} - \vec{d_0})$
$\vec{v_f}^2 = 0^2 + 2(-9.81)(-250)$
$\vec{v_f}^2 = 0 + 4905$
$\vec{v_f} = \sqrt{4905}$
$\vec{v_f} = 70 m/s$ down $(-70 m/s$ up$)$

c) $v_f = ?$
$\vec{v_0} = 0 m/s$
$\vec{a} = -9.8 m/s^2$
$d_0 = 250$
$d_f = 75$

$\vec{v_f}^2 = \vec{v_0}^2 + 2a(\vec{d_f} - \vec{d_0})$
$\vec{v_f}^2 = 0 + 2(-9.81)(75 - 250)$
$\vec{v_f}^2 = 0 + (-19.62)(-175)$
$\vec{v_f}^2 = +3433.50$
$\vec{v_f} = \sqrt{3433.50}$
$\vec{v_f} = +58.6 m/s$ [down]
$\vec{v_f} = -58.6 m/s$ [up]

4. $v_0 = 21 m/s$ (up)
$\vec{a} = -9.81 m/s^2$
$t = ?$
$\vec{d_0} = 0 m$
$\vec{d_f} = ?$
$v_f = 0 m/s$

a) $\vec{a} = \frac{\vec{v_f} - \vec{v_0}}{t}$

$-9.81 = \frac{0 - 21}{t}$

$-9.81 \cdot t = \frac{-21}{t} \cdot t$

$\frac{-9.81t}{-9.81} = \frac{-21}{-9.81}$

$t = 2.1 s$

b) $\vec{d_f} = \vec{d_0} + \vec{v_0}t + \frac{1}{2}at^2$

$\vec{d_f} = 0 + (21)(2.1) + \frac{1}{2}(-9.81)(2.1)^2$

$\vec{d_f} = 0 + 44.1 + (-21.63)$

$\vec{d_f} = 22.5 m$

c) $\vec{v_f} = ?$
$\vec{d_0} = 0$
$\vec{d_f} = 15 m$
$\vec{v_0} = 21 m/s$

$\vec{v_f}^2 = \vec{v_0}^2 + 2\vec{a}(\vec{d_f} - \vec{d_0})$
$\vec{v_f}^2 = (21)^2 + 2(-9.81)(15)$
$\vec{v_f}^2 = 441 + (-294.3)$
$\vec{v_f}^2 = 146.7$
$v_f = \sqrt{146.7}$
$v_f = \pm 12.1 m/s$

5. a) $\vec{v_0} = 215 m/s$ (S)
$\vec{v_f} = 300 m/s$ [N]
$\vec{a} = 5.72 m/s^2$ (N)
$t = ?$

$\vec{a} = \frac{\vec{v_f} - \vec{v_0}}{t}$

$5.72 = \frac{300 - (-215)}{t}$

$5.72 \cdot t = \frac{515}{t} \cdot t$

$5.72t = 515$

$t = \frac{515}{5.72}$

$t = 90.05$

b) $v_0 = 215 m/s$ (S) (-215)
$v_f = 300 m/s$ (N)
$a = 5.72 m/s^2$
$t = 90.05$
$d_0 = 0$
$d_f = ?$

$\vec{d_f} = \vec{d_0} + \vec{v_0}t + \frac{1}{2}at^2$

$\vec{d_f} = 0 + (-215)(90) + \frac{1}{2}(5.72)(90)^2$

$\vec{d_f} = -19350 + 23166$
$\vec{d_f} = 3816 m$

c) distance travelled total

distance south

215 m/s (S)

$a = 5.72 m/s^2$
$d_0 = 0$
$v_0 = 0$
$v_f = -215$

$\vec{v_f}^2 = \vec{v_0}^2 + 2\vec{a}(\vec{d_f} - \vec{d_0})$
$(-215)^2 = 0 + 2(5.72)(\vec{d_f} - 0)$
$\frac{46225}{11.44} = \frac{(11.44)(\vec{d_f})}{11.44}$
$4041 m = \vec{d_f}$

distance North

$a = 5.72$
$d_0 = 0$
$v_0 = 0$
$v_f = 300$

$\vec{v_f}^2 = \vec{v_0}^2 + 2\vec{a}(\vec{d_f} - \vec{d_0})$
$(300)^2 = 0^2 + 2(5.72)(\vec{d_f} - 0)$
$\frac{90000}{11.44} = \frac{(11.44)(\vec{d_f})}{11.44}$
$7867 m = \vec{d_f}$

total $= 4041 + 7867$
total $= 11900 m$

distance does not have direction

6) $v_0 = 250\ m/s\ [E]$
$v_f = 400\ m/s\ [W]$
$t = 12s$
$a = ?$

$\vec{a} = \frac{\vec{v_f} - \vec{v_0}}{t}$
$\vec{a} = \frac{-400 - 250}{12}$
$\vec{a} = \frac{-650}{12}$
$\vec{a} = -54.2\ m/s^2\ [E]$

b) $a = -54.2\ m/s^2$
$v_f = -400\ m/s$
$v_0 = 250\ m/s$
$t = 12s$
$d_0 = 0$
$d_f = ?$

$\vec{d_f} = \vec{d_0} + \vec{v_0}t + \frac{1}{2}at^2$
$\vec{d_f} = 0 + (250)(12) + \frac{1}{2}(-54.2)(12)^2$
$\vec{d_f} = 3000 + -3902.4$
$\vec{d_f} = -902\ m$

c) distance travelled

distance south
$a = -54.2$
$d_0 = 0$
$d_f = ?$
$v_0 = 0$
$v_f = -400$

$\vec{v_f}^2 = \vec{v_0}^2 + 2\vec{a}(\vec{d_f} - \vec{d_0})$
$(-400)^2 = 0^2 + 2(-54.2)(\vec{d_f} - 0)$
$160\,000 = 0 + (-108.4\vec{d_f})$
$\frac{160\,000}{-108.4} = \frac{-108.4\vec{d_f}}{-108.4}$
$+1476\ m = \vec{d_f}$

distance north
$a = -54.2$
$d_0 = 0$
$d_f = ?$
$v_0 = 0$
$v_f = 250$

$\vec{v_f}^2 = \vec{v_0}^2 + 2\vec{a}(\vec{d_f} - \vec{d_0})$
$(250)^2 = 0 + 2(-54.2)(\vec{d_f} - 0)$
$\frac{62500}{-108.4} = \frac{(-108.4)(\vec{d_f})}{-108.4}$
$+576.57 = \vec{d_f}$

total $= -1476 + -576.57$
$= 2052\ m$

remember distance is not a vector and doesn't have direction

7a) $v_0 = 75\ m/s\ (up)$
$a = -9.81\ m/s^2$
$d_0 = 250\ m$
$d_f = ?$
(↑250m)

$v_f^2 = v_0^2 + 2a(d_f - d_0)$
$0^2 = (75)^2 + 2(-9.81)(d_f - 250)$
$0 = 5625 + (-19.62)(d_f - 250)$
$0 = 5625 + (-19.62d_f) + 4905$
$0 = 10530 + -19.62d_f$
$\frac{-10530}{-19.62} = \frac{-19.62d_f}{-19.62}$
$537\ m = d_f$

b) $d_f = 0$
$d_0 = 250$

$\vec{v_f}^2 = \vec{v_0}^2 + 2\vec{a}(\vec{d_f} - \vec{d_0})$
$\vec{v_f}^2 = (-75)^2 + 2(-9.81)(0 - 250)$
$\vec{v_f}^2 = 5625 + (-19.62)(-250)$
$\vec{v_f}^2 = 5625 + 4905$
$\vec{v_f}^2 = 10530$
$\vec{v_f} = \sqrt{10530}$
$\vec{v_f} = -103\ m/s$

c) $d_f = 250$
$d_0 = 0$
$v_0 = 75$
$v_f = -103$
$a = -9.81$

$\vec{a} = \frac{\vec{v_f} - \vec{v_0}}{t}$ $\cdot t$ t
$-9.81 = \frac{-103 - 75}{t}$ $\cdot t$
$\frac{-9.81t}{-9.81} = \frac{-178}{-9.81}$
$t = 18.1s$