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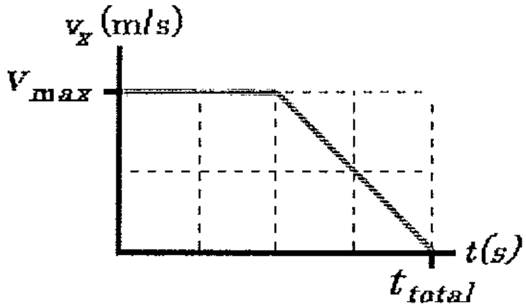
a.)The velocity-versus-time graph is shown for a particle moving along the x-axis. Its initial position is x_0=2.20m at t_0=0.00s. What is the particle's position at t=2.00s if the total time the particle moves is 8.00s and the maximum velocity is 1.00m/s? **4.20 m**



You are correct. Previous Tries

b.)At t=2.00s, what is the particle's velocity? **1.00 m/s**

You are correct. Previous Tries

c.)At t=2.00s, what is the particle's acceleration? **0.00 m/s^2**

You are correct. Previous Tries

d.)At t=6.00s, what is the particle's position? **7.70 m**

You are correct. Previous Tries

e.)At t=6.00s, what is the particle's velocity? **5.00×10^{-1} m/s**

You are correct. Previous Tries

f.)At t=6.00s, what is the particle's acceleration? **-2.50×10^{-1} m/s^2**

You are correct. Previous Tries

An object is thrown vertically upward with a speed of 34.3m/s. How high does it rise?

Submit Answer Tries 0/10

How long does it take to reach this highest altitude?

Submit Answer Tries 0/10

How long does it take the object to hit the ground after it reaches the highest altitude?

Submit Answer Tries 0/10

What is the speed when it returns to the level from which it was initially released?

Submit Answer Tries 0/10

You are driving to the grocery store at 12.1m/s. You are 189.0m from an intersection when the traffic light turns red. Assume that your reaction time is 0.140s and that your car brakes with constant acceleration. How far are you from the intersection when you begin to apply the brakes?

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What acceleration will bring you to rest as you just reach the intersection?

Submit Answer Tries 0/10

How long does it take you to stop?

Submit Answer Tries 0/10

A ball is tossed from an upper-story window of a building. The ball is given an initial velocity of 8.35m/s at an angle of 19.9deg below the horizontal. It strikes the ground 3.25s later. How far horizontally from the base of the building does the ball strike the ground?

Submit Answer Tries 0/10

Calculate the height from which the ball was thrown.

Submit Answer Tries 0/10

How long does it take the ball to reach a point 11.5m below the level of launching?

Submit Answer Tries 0/10

Larry leaves home at 4:03 and runs at a constant speed to the lamppost. He reaches the lamppost at 4:16, immediately turns, and runs to the tree. Larry arrives at the tree at 4:21. What is Larry's average velocity during his trip from home to the lamppost, if the lamppost is 360.0m west of home, and the tree is 633.0m east of home?

Submit Answer Tries 0/10

What is Larry's average velocity during his trip from the lamppost to the tree?

Submit Answer Tries 0/10

What is the average velocity for Larry's entire run?

Submit Answer Tries 0/10

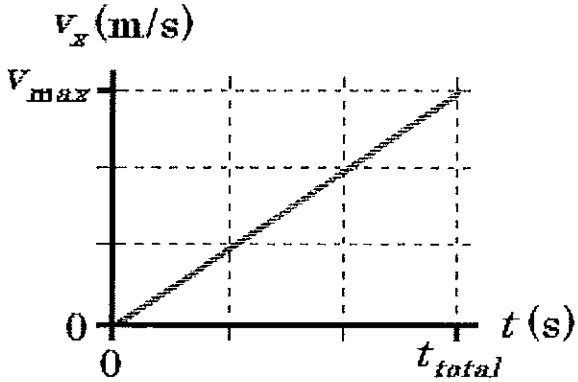
A motorist drives north for 35.9min at 73.3km/hr and then stops for 15.4min. He then continues north, traveling 114.5km in 1.93hr. What is his total displacement in kilometers? **1.58×10^2 km**

You are correct. Previous Tries

What is his average velocity in kilometers per hour? **5.69×10^1 km/hr**

You are correct. Previous Tries

The velocity graph of a particle moving along the x-axis is shown. The particle has zero velocity at t=0.00s and reaches a maximum velocity, v_{max}, after a total elapsed time, t_{total}. If the initial position of the particle is x_0 =8.58m, the maximum velocity of the particle is v_{max}=40.5m/s, and the total elapsed time is t_{total}=17.8s, what is the particle's position at t=11.9s?



Submit Answer Tries 0/10

At t=11.9s, what is the particle's velocity?

Submit Answer Tries 0/10

At t=11.9s, what is the particle's acceleration?

Submit Answer Tries 0/10

In 1865, Jules Verne suggested sending people to the Moon by launching a space capsule with a 215.9m long cannon. The final speed of the capsule must reach 10.96 km/s. What acceleration would the passengers experience?

Submit Answer Tries 0/10

A rock is tossed straight up with a velocity of 38.0m/s. When it returns, it falls into a hole 23.4m deep. What is the rock's velocity as it hits the bottom of the hole? **-4.36×10^{1} m/s**

You are correct. Previous Tries

How long is the rock in the air, from the instant it is released until it hits the bottom of the hole? **8.32 s**

You are correct. Previous Tries

A motorist drives along a straight road at a constant speed of 13.8m/s. Just as she passes a parked motorcycle police officer, the officer starts to accelerate at 1.8m/s^2 to overtake her. Assuming the officer maintains this acceleration, determine the time it takes the police officer to reach the motorist (in seconds).

Submit Answer Tries 0/10

Determine the speed at which the officer overtakes the motorist.

Submit Answer Tries 0/10

Find the total displacement of the officer as he overtakes the motorist.

Submit Answer Tries 0/10

A ball thrown horizontally at 26.9m/s travels a horizontal distance of 45.9m before hitting the ground. From what height was the ball thrown? **1.43×10^{1} m**

You are correct. Previous Tries

A bird watcher meanders through the woods, walking 0.86 km due east, 0.58 km due south, and 2.04 km in a direction 35.0 degrees north of west, The time required for this trip is 2.81 h. Determine the magnitude and the direction (relative to due west) of the bird watcher's displacement (in km). **1.00 km**

You are correct. Previous Tries

3.61×10^{1} deg

You are correct. Previous Tries

What is the magnitude and direction (relative to due west) of his average velocity (in km/h)? **3.57×10^{-1} km/h**

You are correct. Previous Tries

3.61×10^{1} deg

You are correct. Previous Tries

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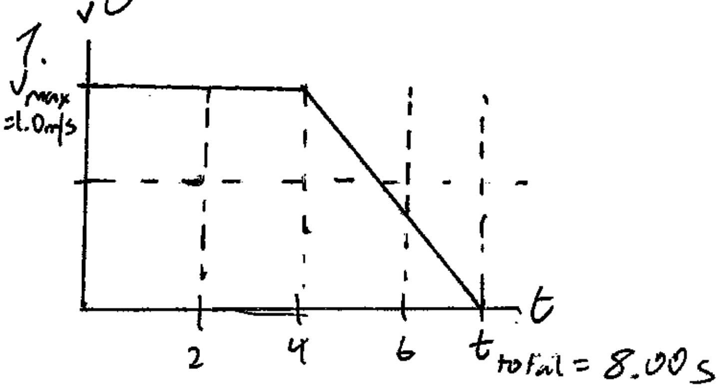
Physics 1A03

Assignment 2 solutions

1.



a) at $t=2s$, particle has been moving at a constant speed, $v_{max} = 1.0 m/s$, for 2s.

$x = x_0 + v\Delta t$

$= 2.20m + 1.0m/s * 2s$

$= 2.20 + 2$

$= 4.20 m$

$x_0 = 2.20m$

$v = 1.0m/s$

$\Delta t = 2s$

b) at $t=2s$, v is still constant at v_{max}.

$v = 1.0 m/s$

c) at $t=2s$, since v is constant, acceleration is zero.

$a = 0 \ m/s^2$

d) particle's position @ $t=6s$ is initial x + x travelled at constant velocity (0-4s) + x travelled while accelerating (4-6s).

$\Delta x_{tot} = x_0 + \Delta x_{constant} + \Delta x_{acceleration}$

$\Delta x_{constant} = v\Delta t$

$= 1m/s \times 4s$

$= 4m$

$\Delta x_{acceleration} = \frac{(v_i + v_f)}{2} \Delta t$

$= \frac{(1.0m/s + 0.5m/s)}{\cancel{2}} \times \cancel{2}s$

$= 1.5m$

$\Delta x_{tot} = x_0 + \Delta x_{constant} + \Delta x_{acceleration}$

$= 2.20m + 4m + 1.5m$

$= 7.7m$

e) at $t = 6s$, v is ½ of v_{max}

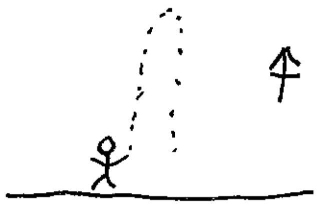
$v = ½ \ m/s$

f) the car accelerates over a 4s period.

$v_i = 1 m/s \quad v_f = 0 m/s \quad \Delta t = 4s$

$$a = \frac{\Delta v}{\Delta t}$$
$$= \frac{v_f - v_i}{4s}$$
$$= \frac{0 m/s - 1 m/s}{4s}$$
$$= -\frac{1}{4} m/s^2$$
$$= 0.25 m/s^2$$

2.



$v_i = 34.3 m/s$
$a = -9.8 m/s^2$

a) at its highest point, the object's velocity is zero.

$v_i = 34.3 m/s \quad v_f = 0 m/s \quad a = -9.8 m/s^2 \quad \Delta y = ?$

$$v_f^2 = v_i^2 + 2a\Delta y$$
$$(0 m/s)^2 = (34.3 m/s)^2 + 2(-9.8 m/s^2)\Delta y$$
$$(-2)(-9.8)\Delta y = (34.3)^2$$
$$\Delta y = \frac{(34.3)^2}{(-2)(-9.8)}$$
$$= 60.025 m$$

b) $v_i = 34.3 m/s \quad v_f = 0 m/s \quad a = -9.8 m/s^2 \quad \Delta y = 60.025 m \quad \Delta t = ?$

$$v_f = v_i + a\Delta t$$
$$0 m/s = 34.3 m/s + (-9.8 m/s^2)\Delta t$$
$$9.8\Delta t = 34.3 m/s$$
$$\Delta t = \frac{34.3 m/s}{9.8 m/s^2}$$
$$= 3.5 s$$

d) since a, Δy and Δt are the same on the way up and down, the object's speed will be identical. let's do the math to be thorough, though:

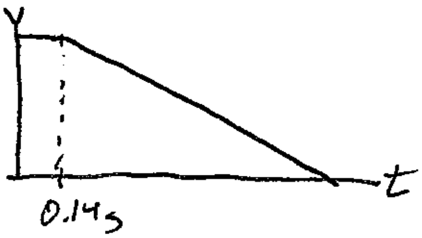
$\Delta y = 60.025m$ $v_i = 0m/s$ $t = 3.5s$ $a = -9.8m/s^2$ $v_f = ?$

$$\Delta y = \frac{v_i + v_f}{2} \times \Delta t$$

$$\frac{2\Delta y}{\Delta t} = v_i + v_f$$

$$\frac{2(60.025m)}{3.5s} = 0m/s + v_f$$

$$v_f = 34.3m/s$$

3. 

a) $X_0 = 189.0m$ $t = 0.140s$ $v = 12.1m/s$

distance from intersection $= x_0 - x_{travelled}$

$= 189.0m - v\Delta t$

$= 189.0 - (12.1m/s)(0.140s)$

$= 187.306$

$= 187.3\ m$

b) $\Delta x = 187.306m$ $v_i = 12.1m/s$ $v_0 = 0m/s$ $a = ?$

$$v_f^2 = v_i^2 + 2a\Delta x$$

$$(0m/s)^2 = (12.1m/s)^2 + 2a(187.306m)$$

rearrange:

$$a = \frac{-(12.1)^2}{2(187.306)}$$

$$= -0.391m/s^2$$

c) $v_i = 12.1\,m/s$ $v_f = 0\,m/s$ $\Delta d = 187.306\,m$ $a = -0.391\,m/s^2$ $\Delta t = ?$

$$v_f = v_i + a\Delta t$$

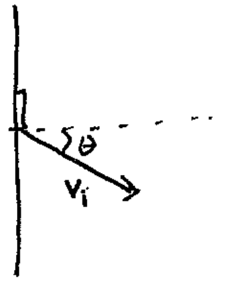
$$0\,m/s = 12.1\,m/s + (-0.391\,m/s^2)\cdot\Delta t$$

$$\Delta t = \frac{-12.1\,m/s}{-0.391\,m/s^2}$$

$$= 30.946$$

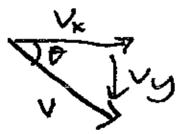
$$= 30.9\,s$$

4.



$\theta = 19.9^\circ$
$v_i = 8.35\,m/s$

a) we need to find the horizontal component of the velocity vector.



SOH
CAH
TOA

since we want v_x, which is adjacent to θ, and we know v, the hypotenuse, let's use cos.

$$\cos\theta = \frac{\text{adjacent}}{\text{hypotenuse}}$$

$$\cos(19.9) = \frac{v_x}{v}$$

$$= \frac{v_x}{8.35\,m/s}$$

$$v_x = 7.85\,m/s$$

now we can find how far it goes horizontally.

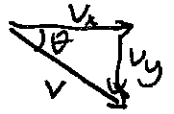
$$\Delta x = v_x \Delta t$$

$$= 7.85\,m/s \times 3.25\,s$$

$$= 25.5\,m$$

b) $t = 3.25\,s \quad v_i = v_y \quad a = -9.8\,m/s^2 \quad \Delta y = ?$

first let's find v_y:



this time we need v_y, which is opposite from θ, so we'll use sin.

$$\sin\theta = \frac{v_y}{v}$$

$$\sin(19.9) = \frac{v_y}{8.35\,m/s}$$

$$v_y = 2.84\,m/s$$

→ since we've defined ↑ as the positive direction, this is actually $-2.84\,m/s$

now we can find Δy:

$$y_f = y_i + v_i\Delta t + \tfrac{1}{2}a\Delta t^2$$

$$y_f - y_i = v_i\Delta t + \tfrac{1}{2}a\Delta t^2$$

$$\Delta y = v_i\Delta t + \tfrac{1}{2}a\Delta t^2$$

$$= (-2.84\,m/s)(3.25\,s) + \tfrac{1}{2}(-9.8\,m/s^2)(3.25\,s)^2$$

$$= -60.98$$

$$= -61.0\,m$$

c) $\Delta y = -11.5\,m \quad v_i = -2.84\,m/s \quad a = -9.8\,m/s^2 \quad \Delta t = ?$

$$y_f = y_i + v_i\Delta t + \tfrac{1}{2}a\Delta t^2$$

$$0 = y_i - y_f + v_i\Delta t + \tfrac{1}{2}a\Delta t^2$$

$$= -\Delta y + v_i\Delta t + \tfrac{1}{2}a\Delta t^2$$

← we can use the quadratic formula to solve for Δt

$$= -(-11.5\,m) + (-2.84)\Delta t + \tfrac{1}{2}(-9.8\,m/s^2)\Delta t^2$$

$$= -4.9\Delta t^2 - 2.84\Delta t + 11.5$$

$$\Delta t = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$= \frac{-(-2.84) \pm \sqrt{(-2.84)^2 - 4(-4.9)(11.5)}}{2(-4.9)}$$

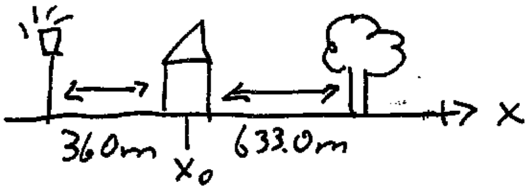
solving for Δt gives two possible solutions:

$\Delta t = -1.85$ OR $\Delta t = 1.27$

since time cannot be negative,

$$\Delta t = 1.27\,s$$

5.



a) $\Delta t = 13\text{min}$ $\Delta x = 360.0\text{m}$ west $v = ?$

first let's convert Δt to seconds:

$$13\cancel{\text{min}} \cdot \frac{60\text{sec}}{1\cancel{\text{min}}} = 780\text{s}$$

$$v = \frac{\Delta x}{\Delta t} = \frac{360.0\text{m}}{780\text{s}} = 0.4615\text{m/s} \text{ west}$$

b) $\Delta t = 5\text{min}$ $\Delta x = x_{\text{tree to home}} + x_{\text{home to tree}}$ $v = ?$

$= 300\text{s}$

$$v = \frac{\Delta x}{\Delta t}$$

$$= \frac{x_{\text{tree to home}} + x_{\text{home to tree}}}{300\text{s}}$$

$$= \frac{360.0 + 633.0\text{m}}{300\text{s}}$$

$$= \frac{993}{300}$$

$$= 3.3\text{m/s} \text{ east}$$

c) $\Delta t = 18\text{min}$ $\Delta x_{\text{total}} =$ distance from origin (home) to final (tree)

$= 633.0\text{m}$

$v_{avg} = ?$

$$\Delta t = 18\text{min}$$

$$18\cancel{\text{min}} \cdot \frac{60\text{s}}{1\cancel{\text{min}}} = 1080\text{s}$$

$$v_{avg} = \frac{\Delta x}{\Delta t}$$

$$= \frac{633.0\text{m}}{1080\text{s}}$$

$$= 0.586\text{m/s} \text{ east}$$

6. there are three legs to his journey:

1. north @ 73.3 km/hr for 35.9 min
2. at rest for 15.4 min
3. north @ 114.5 km in 1.93 hr

a) let's figure out how far he went

1. let's convert 35.9 min to hours

$$35.9\,\cancel{min}\cdot\frac{1\,hr}{60\,\cancel{min}} = 0.5983\,hr$$

$$\begin{aligned}\Delta x_1 &= v\Delta t\\ &= 73.3\,km/hr\cdot 0.5983\,hr\\ &= 43.85783\\ &= 43.9\,km\end{aligned}$$

2. at rest; no distance travelled

3. 114.5 km travelled

$$\begin{aligned}\Delta x_{tot} &= \Delta x_1 + \Delta x_2 + \Delta x_3\\ &= 43.9\,km + 0\,km + 114.5\,km\\ &= 158.4\,km\end{aligned}$$

b) $\Delta x_{tot} = 158.4\,km$ $\quad \Delta t = ?$ $\quad V_{avg} = \frac{\Delta x}{\Delta t} = ?$

$$\Delta t_1 = 0.5983\,hr$$

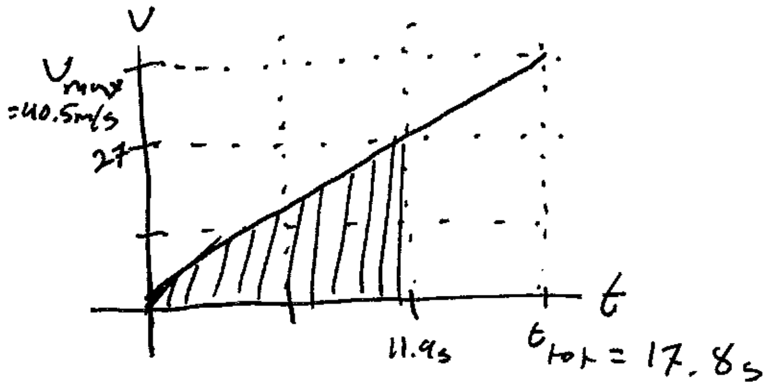
$$\Delta t_2 = 15.4\,\cancel{min}\times\frac{1\,hr}{60\,\cancel{min}} = 0.2567\,hr$$

$$\Delta t_3 = 1.93\,hr$$

$$\begin{aligned}\Delta t_{tot} &= 0.5983 + 0.2567 + 1.93\\ &= 2.78496\,hr\end{aligned}$$

$$\begin{aligned}V_{avg} &= \frac{\Delta x}{\Delta t}\\ &= \frac{158.4\,km}{2.78496\,hr}\\ &= 56.8768\\ &= 56.9\,km/hr\end{aligned}$$

7. $v_i = 0\,m/s$ $v_{max} = 40.5\,m/s$ $\Delta t = 17.8\,s$



a) the distance covered by the particle is represented by the shaded area under the graph.

$$x = \frac{b \times h}{2}$$
$$= \frac{11.9\,s \times 27\,m/s}{2}$$
$$= 160.65\,m$$

$$x_{tot} = x_0 + x$$
$$= 8.58 + 160.65$$
$$= 169.23$$
$$= 169.2\,m$$

b) at $t = 11.9\,s$, v is $\frac{2}{3}$rds of v_{max}

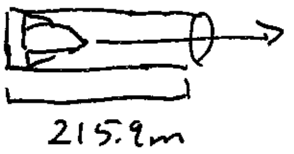
$$40.5\,m/s \times \frac{2}{3} = 27.0\,m/s$$

$$v = 27.0\,m/s$$

c) since the slope on the v-t graph is constant, acceleration is also constant.

$$a = \frac{\Delta v}{\Delta t}$$
$$= \frac{v_f - v_i}{\Delta t}$$
$$= \frac{40.5\,m/s - 0\,m/s}{17.8\,s}$$
$$= 2.275$$
$$= 2.3\,m/s^2$$

8.



$v_i = 0\,m/s$ $\quad v_f = 10.96\,km/s = 10960\,m/s$ $\quad \Delta d = 215.9\,m$

$a = ?$

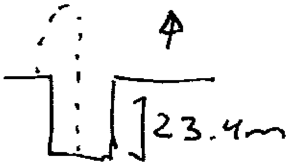
$$v_f^2 = v_i^2 + 2a\Delta d$$
$$(10960\,m/s)^2 = (0\,m/s)^2 + 2a(215.9\,m)$$
$$\frac{10960^2}{2(215.9)} = a$$

$$a = 278\,188.05\,m/s^2$$

OR

$$278.19\ km/s^2$$

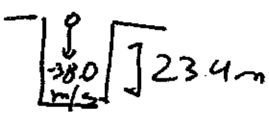
9.



$v_i = 38.0\,m/s$

$a = -9.8\,m/s^2$

a) if the rock is tossed up w/ a velocity of 38.0 m/s from ground level, its velocity on the way down will also be −38.0 m/s at ground level.
let's take ground level as our starting point.



$v_i = -38.0\,m/s$

$\Delta y = -23.4\,m$

$a = -9.8\,m/s^2$

$$v_f^2 = v_i^2 + 2a\Delta y$$
$$= (-38.0\,m/s)^2 + 2(-9.8\,m/s^2)(-23.4\,m)$$
$$= 1902.64$$
$$v_f = 43.619$$
$$= 43.6\,m/s \text{ downwards}$$

so:

$$v_f = -43.6\,m/s$$

b) $\Delta y_{tot} = -23.4m$ $v_i = 38.0m/s$ $a = -9.8m/s^2$ $\Delta t = ?$

$$\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2$$
$$-23.4m = (38.0m/s)\Delta t + \frac{1}{2}(-9.8m/s^2)\Delta t^2$$
$$0 = 38.0\Delta t - 4.9\Delta t^2 + 23.4$$
$$= -4.9\Delta t^2 + 38.0\Delta t + 23.4$$

$\longrightarrow$ we can use quadratic formula to solve for Δt

$$\Delta t = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$
$$= \frac{-38.0 \pm \sqrt{(38.0)^2 - 4(-4.9)(23.4)}}{2(-4.9)}$$

solving for Δt gives two possible solutions:

$\Delta t = -0.57$ OR $\Delta t = 8.33$

since time cannot be negative,

$\Delta t = 8.33s$

10. a) v_i of motorist $= 13.8m/s$ $a_m = 0m/s^2$
v_i of officer $= 0m/s$ $a_o = 1.8m/s^2$
$t = ?$

when the officer overtakes the motorist, they have both travelled the same distance from the starting point.

motorist: $\Delta d_m = v\Delta t$
$= 13.8m/s\,\Delta t$

officer: $\Delta d_o = v_i \Delta t + \frac{1}{2} a \Delta t^2$
$= 0m/s\,\Delta t + \frac{1}{2}(1.8m/s^2)\Delta t^2$
$= 0.9m/s^2\,\Delta t^2$

since $\Delta d_m = \Delta d_o$:

$$13.8\Delta t = 0.9\Delta t^2$$
$$\frac{13.8}{0.9} = \frac{\Delta t^2}{\Delta t}$$
$$\Delta t = 15.3s$$

b) $v_f = v_i + a\Delta t$ $\quad$ $v_i = 0 m/s$ $\quad a = 1.8 m/s^2$ $\quad \Delta t = 15.3 s$
$v_f = ?$

$= 0 m/s + 1.8 m/s^2 \cdot 15.3 s$
$= 27.54$
$= 27.6 m/s$

c) $v_i = 0 m/s$ $\quad v_f = 27.6 m/s$ $\quad a = 1.8 m/s^2$ $\quad \Delta t = 15.3 s$ $\quad \Delta d = ?$

$\Delta d = v_i \Delta t + \frac{1}{2} a \Delta t^2$
$= 0\Delta t + \frac{1}{2}(1.8)(15.3)^2$
$= 210.681$
$= 210.7 m$

11. if we know how long the ball was in the air for, we can find the height it was thrown from.

$v_x = 26.9 m/s$ $\quad \Delta x = 45.9 m$ $\quad \Delta t = ?$

$\Delta x = v\Delta t$
$45.9 m = 26.9 m/s \, \Delta t$
$\Delta t = 1.71 s$

$v_{y_i} = 0 m/s$ $\quad \Delta y = ?$ $\quad \Delta t = 1.71 s$ $\quad a_y = -9.8 m/s^2$

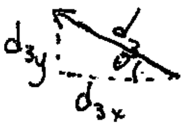
$\Delta y = v_{y_i} \Delta t + \frac{1}{2} a_y \Delta t^2$
$= 0\cancel{\Delta t} + \frac{1}{2}(-9.8)(1.71 s)^2$
$= -14.3 m$

12. let's define north and west as positive

$d_1 = -0.86\,km$
$d_2 = -0.58\,km$
$d_3 = 2.04\,km$
$\theta = 35.0°$

a) $\Delta d = \sqrt{\Delta x^2 + \Delta y^2}$

let's split the three distances into x and y components



$d_{1x} = -0.86\,km$
$d_{2x} = 0$
$d_{3x} = d_3 \cdot \cos\theta$
$= 1.671\,km$

$d_{1y} = 0$
$d_{2y} = -0.58\,km$
$d_{3y} = d_3 \cdot \sin\theta$
$= 1.170\,km$

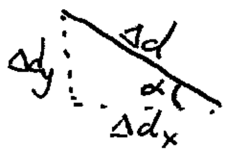
$\Delta x_{tot} = (-0.86) + 0 + 1.671$
$= 0.811\,km$

$\Delta y_{tot} = 0 + (-0.58) + 1.170$
$= 0.59\,km$

$\Delta d = \sqrt{\Delta x^2 + \Delta y^2}$
$= \sqrt{(0.811)^2 + (0.59)^2}$
$= 1.0029$
$= 1.00\,km$

now let's find the direction:

* not to scale



$\Delta d = 1.00\,km$
$\Delta d_y = 0.59\,km$
$\Delta d_x = 0.811\,km$
$\alpha = ?$

we can use any of SOH CAH TOA, but let's use tan:

$\tan\alpha = \dfrac{\Delta d_y}{\Delta d_x}$
$= \dfrac{0.59\,km}{0.811\,km}$
$= 0.715$
$\alpha = 35.57$
$= 35.6°$

The magnitude of the displacement is 1.00 km and the direction is 35.6° north of west.

b) $$v_{avg} = \frac{\Delta d_{tot}}{\Delta t_{tot}}$$

$$= \frac{1.00\,km}{2.81\,hr}$$

$$= 0.3569$$

$$= 0.36\,km/hr$$

since the average velocity is in the same direction as the total displacement, so:

$$v_{avg} = 0.36\,km/hr \text{ at } 35.6^\circ \text{ north from due west.}$$