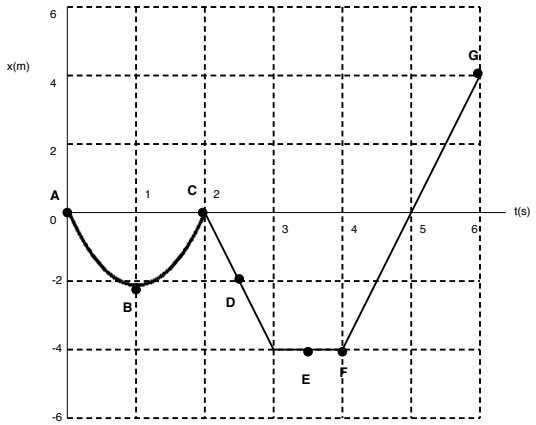
Your Name: _____

PHY203
Exam #1
Chapters 1-3
Fri., 9/27/13

Solutions



1. The plot above depicts the position vs. time for the one dimensional motion of a toy car:

a. Find the average velocity (magnitude and sign) from point A to point C.

$v_{iavg} = \Delta x/\Delta t = (0 - 0)/(2s) = 0$ **5**

b. Find the average speed (magnitude and sign) from point A to point B.

$speed_{iavg} = \Delta s/\Delta t = (2m))/(1s) = +2.00$ m/s **5**

c. Find the instantaneous velocity (magnitude and sign) at point D.

v_{int} = slope = (-4m)/1s = -4.00 m/s **5**

d. Find the instantaneous velocity (magnitude and sign) at point E.

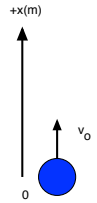
v_{int} = slope = 0 **5**

e. Find the average velocity (magnitude and sign) from point D to point G.

$v_{iavg} = \Delta x/\Delta t = (4m - (-2m))/(3.5s) = +1.71$ m/s **5**

f. Find the average speed (magnitude and sign) from point D to point G.

$speed_{iavg} = \Delta s/\Delta t = (2m + 8m))/(3.5s) = 2.86$ m/s **5**



2. A ball is thrown straight up in the air at an initial speed of v_o=15.0 m/s. (Ignore air resistance.)

a. At the highest point the ball reaches, find the acceleration of the ball (magnitude and sign) using the coordinate system given above.

-9.81 m/s^2 **5**

b. At the highest point the ball reaches, find the velocity of the ball (magnitude and sign) using the coordinate system given above.

0 **5**

c. Find the time it takes the ball to reach its highest point.

Use kinematic eq. B:

0 = 15.0 m/s + (-9.81 m/s^2)(t) **10**
t = 1.53 s

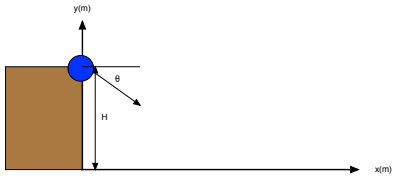
d. Find the total distance the ball travels between its 2nd and 3rd second in flight.

Use kinematic eq. A: **15**

x(2) = 0 + (15.0 m/s)(2)+ 1/2(-9.81 m/s^2)(2)^2
= 10.4 m

x(3) = 0 + (15.0 m/s)(3)+ 1/2(-9.81 m/s^2)(3)^2
= 0.855 m

10.4-0.855 = 9.54 m



3. A cannon ball is launched from a cliff with an initial speed of 28.0 m/s at angle of $\theta=40.0^o$ with respect to the horizontal direction, as shown above. It hits the ground after 2.50 s. (Ignore air resistance.)
a. Write the initial velocity of the ball in vector notation using the coordinate system above.

v_{xo} = (28.0 m/s)(cos40^o) = 21.4 m/s
v_{yo} = -(28.0 m/s)(sin40^o) = -18.0 m/s

v = (21.4 **i** - 18.0 **j**) m/s **5**

c. Find the horizontal (x) distance the ball lands from the base of the cliff.

Use kinematic eq. A: **10**

x = 0 + (21.4 m/s)(2.50 s) + 0

x = 53.5 m

c. Find the height of the cliff.

Use kinematic eq. A: **10**

0 = H + (-18.0 m/s)(2.50 s) + 1/2(-9.81 m/s^2)(2.50 s)^2

H = 75.7 m

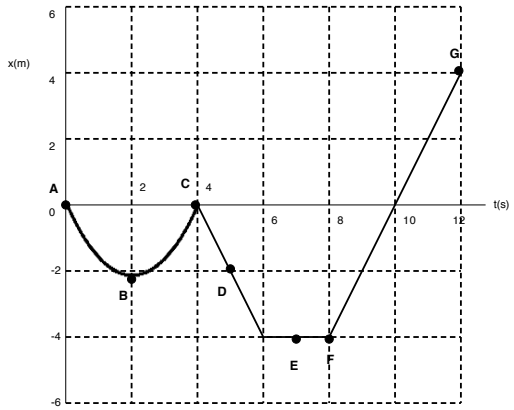
d. Write the final velocity of the ball just before it hits the ground in vector notation using the coordinate system above.

Use kinematic eq. B:

v_y = -18.0 m/s + (-9.81 m/s^2)(2.50 s) **5**
v_y = -42.5 m/s

v = (21.4 **i** - 42.5 **j**) m/s **5**

Alternate



1. The plot above depicts the position vs. time for the one dimensional motion of a toy car:

a. Find the average velocity (magnitude and sign) from point A to point C.

$v_{iavg} = \Delta x/\Delta t = (0 - 0)/(2s) = 0$ **5**

b. Find the average speed (magnitude and sign) from point A to point B.

$speed_{iavg} = \Delta s/\Delta t = (2m))/(2s) = +1.00$ m/s **5**

c. Find the instantaneous velocity (magnitude and sign) at point D.

v_{int} = slope = (-4m)/2s = -2.00 m/s **5**

d. Find the instantaneous velocity (magnitude and sign) at point E.

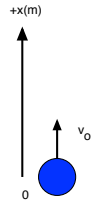
v_{int} = slope = 0 **5**

e. Find the average velocity (magnitude and sign) from point D to point G.

$v_{iavg} = \Delta x/\Delta t = (4m - (-2m))/(7.0s) = +0.857$ m/s **5**

f. Find the average speed (magnitude and sign) from point D to point G.

$speed_{iavg} = \Delta s/\Delta t = (2m + 8m))/(7.0s) = 1.43$ m/s **5**



2. A ball is thrown straight up in the air at an initial speed of v_o=18.0 m/s. (Ignore air resistance.)

a. At the highest point the ball reaches, find the acceleration of the ball (magnitude and sign) using the coordinate system given above.

-9.81 m/s^2 **5**

b. At the highest point the ball reaches, find the velocity of the ball (magnitude and sign) using the coordinate system given above.

0 **5**

c. Find the time it takes the ball to reach its highest point.

Use kinematic eq. B:

0 = 18.0 m/s + (-9.81 m/s^2)(t) **10**
t = 1.83 s

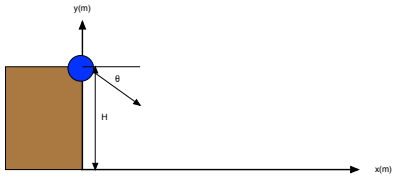
d. Find the total distance the ball travels between its 2nd and 3rd second in flight.

Use kinematic eq. A: **15**

x(2) = 0 + (18.0 m/s)(2)+ 1/2(-9.81 m/s^2)(2)^2
= 16.4 m

x(3) = 0 + (18.0 m/s)(3)+ 1/2(-9.81 m/s^2)(3)^2
= 9.86 m

16.4-9.86 = 6.54 m



3. A cannon ball is launched from a cliff with an initial speed of 25.0 m/s at angle of $\theta=35.0^o$ with respect to the horizontal direction, as shown above. It hits the ground after 3.50 s. (Ignore air resistance.)
a. Write the initial velocity of the ball in vector notation using the coordinate system above.

v_{xo} = (25.0 m/s)(cos35^o) = 20.5 m/s
v_{yo} = -(25.0 m/s)(sin35^o) = -14.3 m/s

v = (20.5 **i** - 14.3 **j**) m/s **5**

c. Find the horizontal (x) distance the ball lands from the base of the cliff.

Use kinematic eq. A: **10**

x = 0 + (20.5 m/s)(3.50 s) + 0

x = 71.8 m

c. Find the height of the cliff.

Use kinematic eq. A: **10**

0 = H + (-14.3 m/s)(3.50 s) + 1/2(-9.81 m/s^2)(3.50 s)^2

H = 110 m

d. Write the final velocity of the ball just before it hits the ground in vector notation using the coordinate system above.

Use kinematic eq. B:

v_y = -14.3 m/s + (-9.81 m/s^2)(3.50 s) **5**
v_y = -48.6 m/s

v = (20.5 **i** - 48.6 **j**) m/s **5**