Physics 512   Name _____KEY_____

Final Review: Non-Linear Motion

1. An object in projectile motion is said to be in ____free fall____ meaning

that the only force that is acting on the object is the force of gravity. The shape of the object's

path will be a(n) ____parabolic____.

2. An object is projected horizontally off of a cliff. As the object is falling, its horizontal

velocity ____remains the same____ and its vertical velocity ____increases____

3. For an object in circular motion, the velocity always points ____tangential____ to

the circle, the net force points ____inward (toward center)____ and the acceleration

vector points ____inward____.

4. How can we say that an object moves at a constant speed around a circle even though we also
say it is accelerating?

____The object is changing direction____
____which is acceleration.____

5. Why do the astronauts in the space shuttle experience apparent weightlessness (i.e Normal
force of zero)?

____They are in constant free fall, but____
____"miss" hitting the Earth____

6. The diagram below shows the path of a ball that has been hit at a 45° angle. Place vectors on
the diagram representing the v_x and v_y at each location.
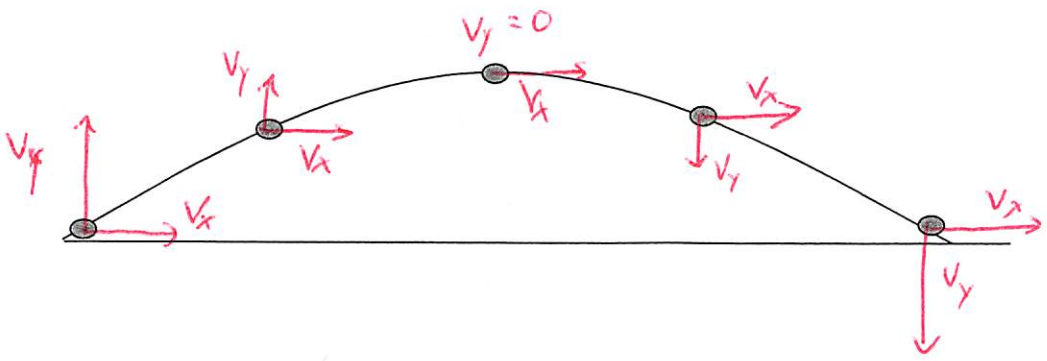
7. An object is thrown horizontally from the top of cliff. Answer the following questions based on this situation by circling the right answer.

a) As the projectile travels, its
horizontal velocity is   INCREASING   DECREASING   (CONSTANT)

b) As the projectile travels, its
vertical speed is   (INCREASING)   DECREASING   CONSTANT

c) As the projectile travels, its
vertical acceleration is   INCREASING   DECREASING   (CONSTANT)

d) If the initial horizontal velocity
increased, the time of flight would   INCREASE   DECREASE (STAY THE SAME)

e) If the height of the cliff
increased, the time of flight would   (INCREASE)   DECREASE   STAY THE SAME

9) The diagram below shows an overhead view of a child swinging a toy plane in a circle above her head by a rope at a constant speed in a counterclockwise direction. The picture shows the toy plane (represented by a grey blob) at two different locations A and B.
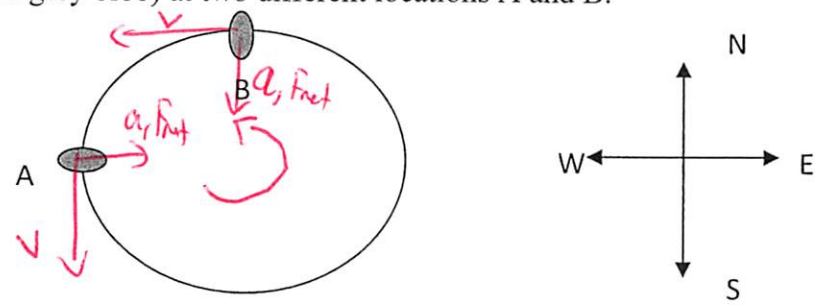

a) At position A, what is the direction of the velocity? __S__; the acceleration? __E__

b) At position B, what is the direction of the velocity? __W__; the net force? __S__

c) If the rope were cut when the plane were at point A, describe the motion that results.
____Straight line motion, South____

d) If the speed were tripled, the force needed would ____X 9 b/c $(v)^2$____ $F_c = \frac{mv^2}{r}$

e) If the speed were halved, the force needed would ____X $\frac{1}{4}$____

f) If the mass were halved, the force needed would ____X $\frac{1}{2}$____

g) If the radius were quadrupled, the force needed would $\frac{1}{4}$

10. A ball rolls off the end of a table that is 1.0 m high. The horizontal speed of the ball is 2 m/s.
a) How long does it take to reach the ground? b) Where does it land?
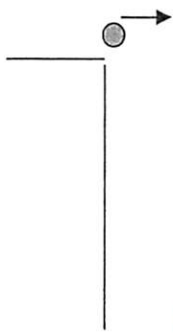
$v_x = $ _2m/s_ $d_y = $ _1m_

$t = $ _.45s_ $d_x = $ _.9m_

X-direction

$d_x = V_x t$

$d_x = (2m/s)(.45s)$

$= .9m$

y-direction

$d_y = \frac{1}{2}gt^2$

$1m = (.5)(10-r^2)t^2$

$t = .45s$

11. An airplane is flying at an altitude of 810 m. It drops a bomb that lands 4500 m forward of the planes position when it dropped it.
a) How long is the bomb in the air? b) How fast was the plane going?

$v_x = $ _353.5m/s_ $d_y = $ _810m_

$t = $ _12.73s_ $d_x = $ _4500_

X-direction

$V_x = \frac{d_x}{t}$

$V_x = \frac{4500m}{12.73s}$

$V_x = 353.5m/s$

y-direction

$d_y = \frac{1}{2}gt^2$

$810m = \frac{1}{2}(10m/s)(t^2)$

$t = 12.73s$

12. A rock is thrown from a cliff with a horizontal velocity of 3 m/s. It lands 15 m from the base of the cliff. a) How long was it in the air? b) How high was the cliff?

y-direction

$d_y = \frac{1}{2}gt^2$

$d_y = \frac{1}{2}(10m/s)(5s)^2$

$d_y = 125m$

X-direction

$d_x = V_x t$

$15m = (3m/s)t$

$t = 5s$