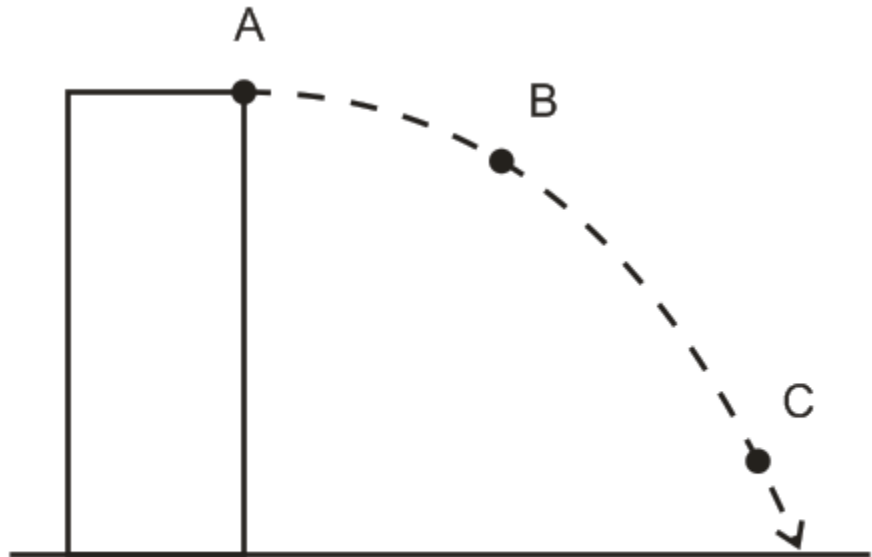


Note about Partial Credit on Problems: *In the case of wrong answers, partial credit may be given for correct formulas – in their original form -- and correct units. Enclose your answers and your starting formulas in boxes.* For problems with multiple parts, if you do not know the answer to one part, you may make up an answer to use in a subsequent part. For river problems, you may receive partial credit for head-to-tail vector diagrams properly identifying the resultant and component vectors. Attach extra paper if necessary.

Part 1: Short Answer and Multiple Choice: (11 points total)

The diagram on the right shows a projectile that is launched from left to right in the absence of air resistance.

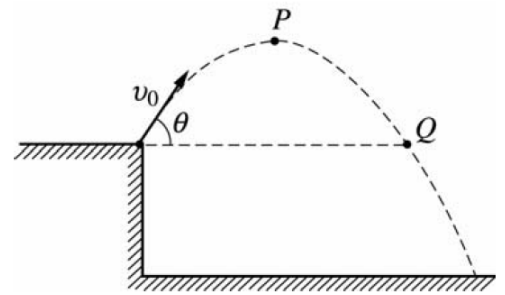


1. $1\text{m/s} = \underline{\hspace{2cm}}$ mph
- 2-4. (4 points, total)
 - For each lettered location on the right, draw labeled arrows representing the object's speed (v), x velocity (v_x), and y velocity (v_y).
 - If v , v_x , or v_y is equal to zero at any point, do not draw an arrow.
 - If, at any point, two or more vectors are identical, you may draw one arrow with multiple labels.
 - The lengths of your arrows must be in correct proportion to one another.
 - The directions of your arrows must be correct.

Multiple Choice: Circle the correct answer.

5. Two of the vectors on the right are components that may be added together to produce the third (resultant) vector. Circle the resultant.
6. A projectile is shot vertically upward with a given initial velocity. It reaches a maximum height of 50.0 m. If, on a second shot, the initial velocity is doubled (i.e. 2X), then the projectile will reach a maximum height of:
 A) 75 m B) 100 m C) 150 m D) 200 m E) 450 m
7. If θ is the angle of vector A with respect to the $+x$ -axis, the y -component of the vector with magnitude A is given by
 A) $A \cos \theta$ B) $\mu A \cos \theta$ C) $A \sin \theta$ D) $mg - A \sin \theta$ E) $\tan^{-1}\theta$
8. A vector in the xy plane has an x -component of $+5.7$ and a y -component of $+9.4$. The angle it makes with the positive x axis is approximately:
 A) 26° B) 34° C) 45° D) 59° E) 66°

9-10. A rock is thrown from the edge of a cliff with an initial velocity v_0 at an angle θ with the horizontal as shown above. Point P is the highest point in the rock's trajectory and point Q is level with the starting point. Assume air resistance is negligible.



9. Which of the following correctly describes the horizontal and vertical speeds and the acceleration of the rock at **Point P**?

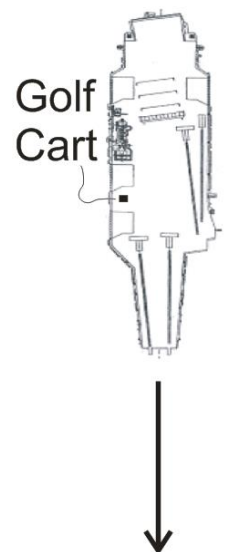
	<u>Horizontal Speed</u>	<u>Vertical Speed</u>	<u>Acceleration</u>
A)	0	$v_0 \cos \theta$	-g
B)	$v_0 \cos \theta$	0	0
C)	$v_0 \cos \theta$	$v_0 \sin \theta$	-g
D)	0	0	-g
E)	$v_0 \cos \theta$	0	-g

10. Which of the following correctly describes the horizontal and vertical speeds and the acceleration of the rock at **Point Q**?

	<u>Horizontal Speed</u>	<u>Vertical Speed</u>	<u>Acceleration</u>
A)	0	$v_0 \cos \theta$	-g
B)	$v_0 \cos \theta$	0	0
C)	$v_0 \cos \theta$	$v_0 \sin \theta$	-g
D)	0	0	-g
E)	$v_0 \cos \theta$	0	-g

Part II: "River Problems" (14 points)

1. (8 Points) An aircraft carrier is traveling at a rate of 10m/s southward. An airman drives a golf cart uses a compass to head eastward across the moving carrier, perpendicular to the carrier's length. The golf cart's speedometer reads 6m/s.

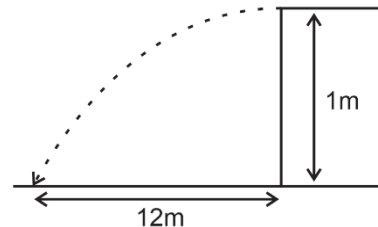


- a. What is the actual speed of the golf cart, relative to the Earth?

- b. What is the golf cart's direction of travel? Describe the direction in degrees relative to North, South, East, or West.

Part III: Projectile Problems (24 points)

3. (8pts) You shoot a projectile horizontally from a 1m high table top. The projectile flies 12m horizontally before it hits the floor.



- a. How long was the projectile in the air?
- b. What was the projectile's initial speed as it left the table top?
4. (8 points) An athlete executing a long jump leaves the ground at a 28.0° angle above horizontal and with an initial speed of 8m/s . His landing point is at the same elevation as his take-off point. Determine the following.
- a. What was his total time aloft?
- c. What horizontal distance did he travel?