vertical must use gravity $a_g = 9.8\frac{m}{s^2}$ fall, drop, height #7, 11, 12, 17, 20 ⟷ horizontal not include gravity 8, 9, 10, 15, 16

$v = \frac{\Delta d}{\Delta t}$ $d = vt$ $\Delta d = v_i \Delta t + \frac{1}{2} a \Delta t^2$ $a = \frac{\Delta v}{\Delta t}$ $a = \frac{v_f^2 - v_i^2}{2\Delta d}$ $a = \frac{v_f - v_i}{\Delta t}$

$a = 9.8\frac{m}{s^2}$ when falling

$v_f = v_i + at$ $h = \frac{1}{2} g t^2$ $c = \sqrt{a^2 + b^2}$ $t = \sqrt{\frac{2h}{a}}$ (h / $a_g = 9.8\frac{m}{s^2}$) horizontal=hyp(cosθ) vertical=hyp(sinθ)

Unit 3 Comprehensive Quiz: 2D motion

Name: Teacher:

1. What is the difference between a vector and a scalar quantity?
   a. Vectors have magnitude while scalars do not
   b. Vectors have direction while scalars do not
   c. Scalars have direction while vectors do not
   d. Scalars have magnitude while vectors do not

2. Choose the correct statement
   a. I and III
   b. II and IV
   c. I and IV
   d. II and III

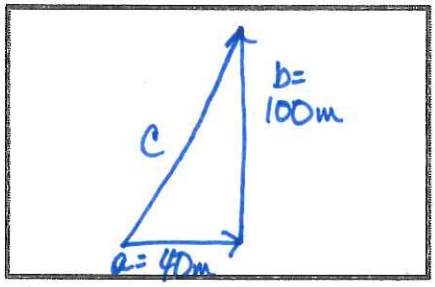
I.	Distance is a scalar, Displacement is a vector
II.	Distance is a vector, Displacement is a scalar
III.	Velocity is a scalar, Acceleration is a vector
IV.	Velocity is a vector, Acceleration is a vector

A rabbit runs 40 m east and then 100 m north. Sketch the path and the resultant displacement.

3. What is the magnitude of the resultant displacement?
   a. 140m east
   b. 60m north
   c. 60 m north east
   d. 107 m north east

$a^2 + b^2 = c^2$

$c = \sqrt{a^2 + b^2}$
$= \sqrt{40^2 + 100^2}$
$= \sqrt{1600 + 10000}$
$= \sqrt{11600}$

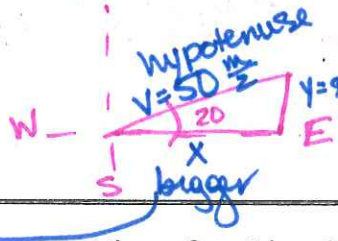


Calculators must be in degrees not rad!

Determine the horizontal and vertical components of a baseball moving at 50 m/s at 20° above the horizontal.

4. The horizontal component is
   a. 17m/s
   b. 20m/s
   c. 47m/s
   d. 50m/s

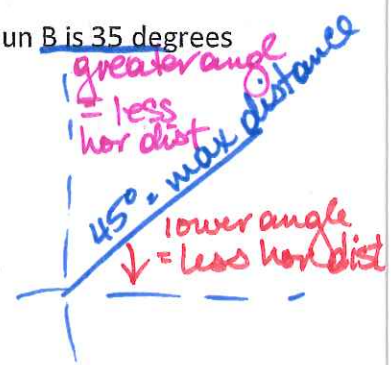
hor = hyp(cosθ)
$x = 50(\cos 20)$
$x = 50(.9397)$
$x = 46.98\ E$



5. The vertical component is
   a. 17m/s
   b. 20m/s
   c. 47m/s
   d. 50m/s

vert = hyp(sinθ)
$y = 50(\sin 20)$
$y = 50(.3420)$
$y = 17.1\frac{m}{s}$ N

6. A dart is fired from two nerf dart guns at the same time. Gun A is pointed horizontal. Gun B is 35 degrees above the horizontal. What occurs?
   a. Darts from gun A travel further than gun B
   b. Darts from gun B travel further than gun A
   c. Darts from both guns land at the same time in the same place
   d. The darts have different heights but travel the same horizontal distance.



A pumpkin chunked horizontally off a building on earth with an initial velocity of 8 m/s and falls for 4 seconds.

7. What is the distance the pumpkin falls?

a. 2m
b. 32m
c. 19m
d. 78m

not $d = vt$ no gravity

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

$d_y = \frac{1}{2}at^2$ square only t

$d_{y\,vert}^{h} = \frac{1}{2}(9.8\frac{m}{s^2})(4s^2)$

$= \frac{1}{2}(9.8)(16)$

8. What is the pumpkin's original horizontal velocity?

a. 8 m/s
b. 12 m/s
c. 32 m/s
d. 47.2 m/s

$V_{x\,hor}$ never changes

$V_{x\,hor} = V_0 = V_f$

9. What is the horizontal velocity at the instant before that the pumpkin hits the ground?

a. 8 m/s
b. 12 m/s
c. 32 m/s
d. 47.2 m/s

$V_{x\,hor}$ never changes

10. Where should you avoid parking your car so the pumpkin will not dent it when it falls. In other words, what is the horizontal distance from the building that the pumpkin will land?

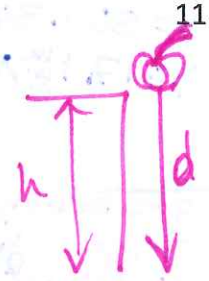
a. 2m
b. 32m
c. 19m
d. 78m

$t \cdot v = \frac{d}{t} \cdot t$ $V_{x\,hor}$ never changes

$d_{x\,hor} = v_{x\,hor}\,t$ must be consistant both are x horizontal

$d = (8\frac{m}{s})(4s)$ time doesn't have x+y component

11. Can the height of the building be determined?



height = dist falls

a. There is no relationship between the height of the building and the distance fallen
b. The height of the building is the same as the distance the pumpkin falls
c. The buildings height is calculated by a formula separate from the height formula
d. There is not enough data to determine the height of the building

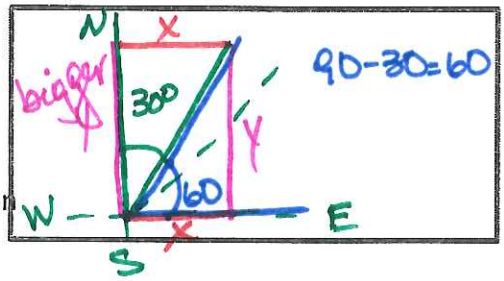
falling

12. A water balloon is thrown directly down at an innocent bystander below? The soon to be punished fraternity student hurled the balloon at 21m/s and it accelerated due to gravity for 1.4 seconds. How fast was the balloon traveling?
    a. 15.0 m/s
    b. 21.0 m/s
    c. 29.4 m/s
    d. 34.7 m/s

$V_f = V_0 + at$ ($a = 9.8 \frac{m}{s^2}$)

$V_f = 21\frac{m}{s} + 9.8\frac{m}{s^2}(1.4s)$

13. A bird flies with a velocity of 20m/sec at an angle of 30 degrees east of north. Select the correct evaluation. Draw the angle and velocity.
    a. X component is larger
    b. Y component is larger
    c. Both X and Y components are the same size
    d. There is not enough data to make a prediction



must calc in respect to x axis

14. A kite is blown with a velocity of 35m/sec at an angle of 20 degrees East of North. Find the components. Draw the angle and velocity.
    a. 30E and 18N (m/s)
    b. 18E and 30N (m/s)
    c. 12N and 33E (m/s)
    d. 33E and 12N (m/s)

$hor = hyp(\cos\theta)$

$x = 35(\cos 70)$

$x = 35(.3420)$

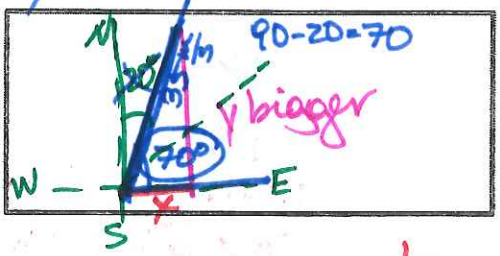
$x = 11.97E$

$vert = hyp(\sin\theta)$

$y = 35(\sin 70)$

$y = 35(.9375)$

$y = 33.89N$



similar to #10 in LAB

15. A marble is launched by dropping it through a marble launcher. The marble took .37s to land .64m from where it was launched. Find the horizontal velocity of the marble as it rolls off the table.
    a. .27m/s
    b. .58m/s
    c. .67m/s
    d. 1.7m/s

$V_{xhor} = \frac{d_{xhor}}{t} = \frac{.64m}{.37s} = 1.73\frac{m}{s}$

be consistant

16. As a projectile travels through the air its horizontal velocity will be-
    a. Accelerating horizontally
    b. Constant until it stops
    c. Perpendicular to the ground
    d. Slowed by gravity

V_{xhor} never changes

17. What can be correctly state about a cow's vertical acceleration when launched over a barn?
    a. Decreases
    b. Increases
    c. Doesn't change
    d. There is no vertical acceleration

READ CAREFULLY

a due to gravity $9.8\frac{m}{s^2}$

V_y vert ↓ as goes up

V_y vert top = 0

Vy vert = 0 at top

Vx hor never changes = constant

Vy vert ↑ as goes down, same dir as g

a due to g never changes = 9.8 m/s

18. A bullet is fired above horizontal toward. If the bullet is travelling at 200 m/s and it takes .3s to reach the target, neglecting air resistance. Write the roman numeral of the correct statements on the blank?

II, III, VII

I.	Vertical velocity is constant	VI.	Vy increase going up decreases going down
II.	Horizontal velocity is constant	VII.	Vy decrease going up increases going down
III.	Acceleration is constants	VIII.	Vx increase going up decreases going down
IV.	Position is constant moving	IX.	Vx decrease going up increases going down
V.	Displacement is constant	X.	Displacement increases

f-orig changes

19. A car is moving horizontally in the + x direction. For each time, describe each of the four conditions of the motion as:

Time (s)	Speed m\s
0	0
0.5	5
1	15
1.5	20
2	20
2.5	15

	+a or –a or no a; or not applicable	+v or –v or no v; or not applicable	constant a or constant v; or not applicable	coast, speed up, or stop or not applicable
0-0.5 s:	+a	+v	(not const v)	speed up
0.5-1 s:	+a	+v	(not const v)	speed up faster
1-1.5 s:	+a, no Δv	+v (not no v)	(not const v)	speed up
1.5-2 s:	= no a	v = 20 m/s (+v)	const v	coasting (not stop, not coast)
2-2.5 s:	–a	–v	(not const v)	slowing

20. Draw the path and label the motion of a Buick fired from a cannon to a height of 25m and falls back to where it is fired from. The total motion takes 3 seconds. Draw the motion and label each with a value and units.

a. Acceleration as goes up
b. Acceleration at the top
c. Acceleration as down
d. ~~Initial speed~~
e. Speed at the top
f. Time to rise
g. Time to fall