# Webreview cp physics ch 3 practice test (holt)

Multiple Choice
Identify the choice that best completes the statement or answers the question.

____ 1. Identify the following quantities as scalar or vector: the mass of an object, the number of leaves on a tree, wind velocity.
- a. vector, scalar, scalar
- b. scalar, scalar, vector
- c. scalar, vector, scalar
- d. vector, scalar, vector

____ 2. Multiplying or dividing vectors by scalars results in
- a. vectors.
- b. scalars.
- c. vectors if multiplied or scalars if divided.
- d. scalars if multiplied or vectors if divided.

____ 3. A student walks from the door of the house to the end of the driveway and realizes that he missed the bus. The student runs back to the house, traveling three times as fast. Which of the following is the correct expression for the return velocity if the initial velocity is $v_{student}$?
- a. $3v_{student}$
- b. $\frac{1}{3}v_{student}$
- c. $\frac{1}{3}v_{student}$
- d. $-3v_{student}$

____ 4. Which of the following is the best coordinate system to analyze a painter climbing a ladder at an angle of 60° to the ground?
- a. *x*-axis: horizontal along the ground; *y*-axis: along the ladder
- b. *x*-axis: along the ladder; *y*-axis: horizontal along the ground
- c. *x*-axis: horizontal along the ground; *y*-axis: up and down
- d. *x*-axis: along the ladder; *y*-axis: up and down

____ 5. Find the resultant of these two vectors: 2.00×10^2 units due east and 4.00×10^2 units 30.0° north of west.
- a. 300 units, 29.8° north of west
- b. 581 units, 20.1° north of east
- c. 546 units, 59.3° north of west
- d. 248 units, 53.9° north of west

____ 6. Which of the following is the motion of objects moving in two dimensions under the influence of gravity?
- a. horizontal velocity
- b. directrix
- c. vertical velocity
- d. projectile motion

____ 7. A track star in the long jump goes into the jump at 12 m/s and launches herself at 20.0° above the horizontal. What is the magnitude of her horizontal displacement? (Assume no air resistance and that $a_y = -g = -9.81 \text{ m/s}^2$.)
- a. 4.6 m
- b. 9.2 m
- c. 13 m
- d. 15 m

Short Answer
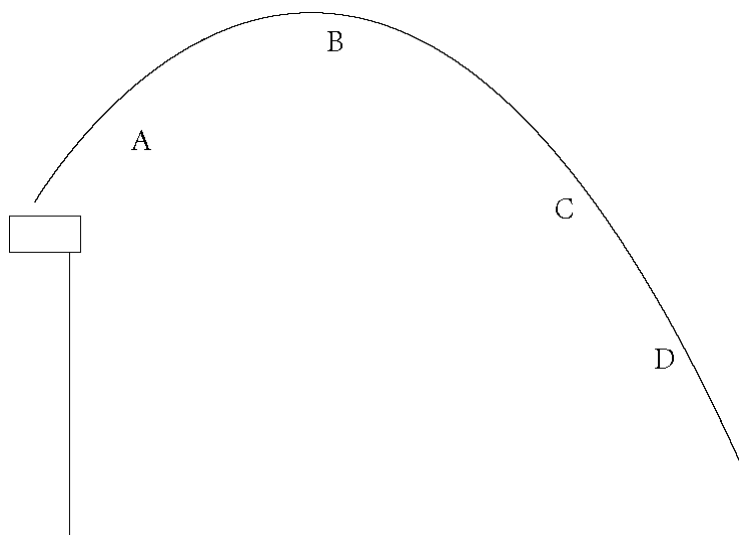
The figure above shows the path of a ball tossed from a building. Air resistance is ignored.

8. In the figure above, what would happen to the width of the ball's path if it were launched with a greater velocity?

9. In the figure above, what would happen to the height of the ball's path if it were launched with a greater velocity?

10. In the figure above, what would happen to the height of the ball's path if it were launched with a lesser velocity?

11. In the figure above, what would happen to the width of the ball's path if it were launched with a lesser velocity?

12. Describe the graph of the horizontal component of velocity versus time for the motion of the ball shown in the figure above.

13. Describe the graph of the vertical component of velocity versus time for the motion of the ball shown in the figure above. Identify any constants that would appear in the graph.

14. Briefly explain why the true path of a projectile traveling through Earth's atmosphere is not a parabola.

Problem

15. A lightning bug flies at a velocity of 0.25 m/s due east toward another lightning bug seen off in the distance. A light easterly breeze blows on the bug at a velocity of 0.25 m/s. What is the resultant velocity of the lightning bug?

16. A jogger runs 10.0 blocks due east, 5.0 blocks due south, and another 2.0 blocks due east. Assume all blocks are of equal size. Use the graphical method to find the magnitude of the jogger's net displacement.

17. A cave explorer travels 3.0 m eastward, then 2.5 m northward, and finally 15.0 m westward. Use the graphical method to find the magnitude of the net displacement.

18. A quarterback takes the ball from the line of scrimmage and runs backward for 1.0×10^1 m. He then runs sideways, parallel to the line of scrimmage, for 15 m. Next, he throws the ball forward 5.0×10^1 m, perpendicular to the line of scrimmage. The receiver is tackled immediately. How far is the football displaced from its original position?

19. A duck waddles 2.5 m east and 6.0 m north. What are the magnitude and direction of the duck's displacement with respect to its original position?

20. While following directions on a treasure map, a person walks 45.0 m south, then turns and walks 7.50 m east. Which single straight-line displacement could the person have walked to reach the same spot?

21. Vector **A** is 3.2 m in length and points along the positive y-axis. Vector **B** is 4.6 m in length and points along a direction 195° counterclockwise from the positive x-axis. What is the magnitude of the resultant when vectors **A** and **B** are added?

22. A cow ambles through a break in the barnyard fence and wanders 24 m at 40.0° north of east, and then 13 m east. If the cow's wanderings last 3.0 minutes, what is the cow's average velocity?

23. An hockey puck travels 2.00 m at 10.0° east of south before ricocheting 2.50 m at 75.0° north of east. What is the puck's resultant displacement?

24. A stone is thrown at an angle of 30.0° above the horizontal from the top edge of a cliff with an initial speed of 12 m/s. A stopwatch measures the stone's trajectory time from the top of the cliff to the bottom at 5.60 s. What is the height of the cliff? (Assume no air resistance and that $a_y = -g = -9.81$ m/s^2.)

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Answer Section

MULTIPLE CHOICE

1. B
2. A
3. D
4. C
5. D
6. D
7. B

SHORT ANSWER

8. The width of the ball's path would increase.
9. The height of the ball's path would increase.
10. The height of the ball's path would decrease.
11. The width of the ball's path would decrease.
12. The graph of the horizontal component of the velocity versus time is a straight line parallel to the time axis.
13. The graph of the vertical component of the velocity versus time is a straight line with a negative slope. The slope of the line is -9.81 m/s^2, which is $-g$.
14. With air resistance, a projectile slows down as it collides with air particles. Therefore, the true path of a projectile would not be a parabola.

PROBLEM

15. 0.00 m/s

    Given
    $\mathbf{v}_1 = 0.25$ m/s east
    $\mathbf{v}_2 = 0.25$ m/s west

    Solution
    $v_R = v_1 - v_2 = 0.25 \text{ m/s} - 0.25 \text{ m/s} = 0.00 \text{ m/s}$

16. 13.0 blocks

    Solution
    Students should use graphical techniques. Their answers can be checked using the techniques presented in Section 2.

    $$d = \sqrt{(12.0 \text{ blocks})^2 + (5.0 \text{ blocks})^2} = 13.0 \text{ blocks}$$

17. 12.2 m

Solution
Students should use graphical techniques. Their answers can be checked using the techniques presented in Section 2.

$$d = \sqrt{(12.0 \text{ m})^2 + (2.5 \text{ m})^2} = 12.2 \text{ m}$$

18. 43 m

Given
$$\Delta x_1 = -1.0 \times 10^1 \text{ m}$$
$$\Delta y_1 = 15 \text{ m}$$
$$\Delta x_2 = +5.0 \times 10^1 \text{ m}$$

Solution
$$\Delta x_{tot} = \Delta x_1 + \Delta x_2 = (-1.0 \times 10^1 \text{ m}) + (5.0 \times 10^1 \text{ m}) = 4.0 \times 10^1 \text{ m}$$
$$\Delta y_{tot} = \Delta y_1 = 15 \text{ m}$$
$$d^2 = (\Delta x_{tot})^2 + (\Delta y_{tot})^2$$
$$d = \sqrt{(\Delta x_{tot})^2 + (\Delta y_{tot})^2} = \sqrt{(4.0 \times 10^1 \text{ m})^2 + (1.5 \times 10^1 \text{ m})^2} = 4.3 \times 10^1 \text{ m}$$

19. 6.5 m at 67° north of east

Given
$$\mathbf{d}_1 = 2.5 \text{ m east}$$
$$\mathbf{d}_2 = 6.0 \text{ m north}$$

Solution
$$\Delta x = d_1 = 2.5 \text{ m}$$
$$\Delta y = d_2 = 6.0 \text{ m}$$
$$d^2 = \Delta x^2 + \Delta y^2$$
$$d = \sqrt{\Delta x^2 + \Delta y^2} = \sqrt{(2.5 \text{ m})^2 + (6.0 \text{ m})^2} = 6.5 \text{ m}$$
$$\theta = \tan^{-1}\left(\frac{\Delta y}{\Delta x}\right) = \tan^{-1}\left(\frac{6.0 \text{ m}}{2.5 \text{ m}}\right) = 67°$$
$$\mathbf{d} = 6.5 \text{ m at } 67° \text{ north of east}$$

20. 45.6 m at 80.5° south of east

Given

$\mathbf{d}_1 = 45.0$ m south

$\mathbf{d}_2 = 7.50$ m east

Solution

$\Delta x = d_2 = 7.50$ m

$\Delta y = d_1 = 45.0$ m

$d^2 = \Delta x^2 + \Delta y^2$

$d = \sqrt{\Delta x^2 + \Delta y^2} = \sqrt{(7.50 \text{ m})^2 + (45.0 \text{ m})^2} = 45.6$ m

$\theta = \tan^{-1}\left(\dfrac{\Delta y}{\Delta x}\right) = \tan^{-1}\left(\dfrac{45.0 \text{ m}}{7.50 \text{ m}}\right) = 80.5°$

$\mathbf{d} = 45.6$ m at 80.5° south of east

21. 4.9 m

Given

$\mathbf{d}_1 = 3.2$ m along $+y$-axis

$\mathbf{d}_2 = 4.6$ m at 195° counterclockwise from $+x$-axis

$d_1 = 3.2$ m $\theta_1 = 0.0°$

$d_2 = 4.6$ m $\theta_2 = 195°$

Solution

$\Delta x_1 = 0.0$ m

$\Delta y_1 = 3.2$ m

$\Delta x_2 = d_2 \cos\theta_2 = (4.6 \text{ m})(\cos 195°) = -4.4$ m

$\Delta y_2 = d_2 \sin\theta_2 = (4.6 \text{ m})(\sin 195°) = -1.2$ m

$\Delta x_{tot} = \Delta x_1 + \Delta x_2 = (0 \text{ m}) + (-4.4 \text{ m}) = -4.4$ m

$\Delta y_{tot} = \Delta y_1 + \Delta y_2 = (3.2 \text{ m}) + (-1.2 \text{ m}) = 2.0$ m

$d^2 = (\Delta x_{tot})^2 + (\Delta y_{tot})^2$

$d = \sqrt{(\Delta x_{tot})^2 + (\Delta y_{tot})^2} = \sqrt{(-4.4 \text{ m})^2 + (2.0 \text{ m})^2} = 4.9$ m

22. 0.19 m/s, 26° north of east

Given
$d_1 = 24$ m $\qquad \theta_1 = 40.0°$ north of east
$d_2 = 13$ m $\qquad \theta_2 = 0°$ east
$\Delta t = (3.0 \text{ min})(60 \text{ s/min}) = 180$ s

Solution
$\Delta x_1 = d_1 \cos \theta_1 = (24 \text{ m})(\cos 40.0°) = 18$ m

$\Delta y_1 = d_1 \sin \theta_1 = (24 \text{ m})(\sin 40.0°) = 15$ m

$\Delta x_2 = 13$ m

$\Delta y_2 = 0$ m

$\Delta x_{tot} = \Delta x_1 + \Delta x_2 = 18 \text{ m} + 13 \text{ m} = 31$ m

$\Delta y_{tot} = \Delta y_1 + \Delta y_2 = 15 \text{ m} + 0 \text{ m} = 15$ m

$d = \sqrt{(\Delta x_{tot})^2 + (\Delta y_{tot})^2} = \sqrt{(31 \text{ m})^2 + (15 \text{ m})^2} = 34$ m

$\theta = \tan^{-1} \dfrac{\Delta y_{tot}}{\Delta x_{tot}} = \tan^{-1} \left(\dfrac{15 \text{ m}}{31 \text{ m}} \right) = 26°$

d = 34 m, 26° north of east

$v_{avg} = \dfrac{d}{\Delta t} = \dfrac{34 \text{ m}}{180 \text{ s}} = 0.19$ m/s

v$_{\textbf{avg}}$ = 0.19 m/s, 26° north of east

23. 1.09 m at 24° north of east

Given
$d_1 = 2.00$ m $\theta_1 = 10.0°$ east of south
$d_2 = 2.50$ m $\theta_2 = 75.0°$ north of east

Solution
$\Delta x_1 = d_1 \sin \theta_1 = (2.00)(\sin 10.0°) = 0.347$ m

$\Delta y_1 = d_1 \cos \theta_1 = (2.00 \text{ m})(\cos 10.0°) = 1.97$ m

$\Delta x_2 = d_2 \cos \theta_2 = (2.50 \text{ m})(\cos 75.0°) = 0.647$ m

$\Delta y_2 = d_2 \sin \theta_2 = (2.50 \text{ m})(\sin 75.0°) = 2.41$ m

$\Delta x_{tot} = \Delta x_1 + \Delta x_2 = 0.347 \text{ m} + 0.647 \text{ m} = 0.994$ m

$\Delta y_{tot} = \Delta y_1 + \Delta y_2 = -1.97 \text{ m} + 2.41 \text{ m} = 0.44$ m

$d = \sqrt{(\Delta x_{tot})^2 + (\Delta y_{tot})^2} = \sqrt{(0.994 \text{ m})^2 + (0.44 \text{ m})^2} = 1.09$ m

$\theta = \tan^{-1}\left(\dfrac{0.44 \text{ m}}{0.994 \text{ m}}\right) = 24°$

d = 1.09 m at 24° north of east

24. 120 m

Given
$\mathbf{v}_i = 12$ m/s at 30.0° above the horizontal
$\Delta t = 5.60$ s
$g = 9.81$ m/s^2

Solution
$v_{i,y} = v_i \sin \theta = (12 \text{ m/s})(\sin 30.0°) = 6.0$ m/s

$\Delta y = v_{i,y} \Delta t + \frac{1}{2} a_y (\Delta t)^2 = (6.0 \text{ m/s})(5.60 \text{ s}) + \frac{1}{2}(-9.81 \text{ m/s}^2)(5.60 \text{ s})^2$

$\Delta y = 34 \text{ m} - 154 \text{ m} = -120$ m

$h = 120$ m