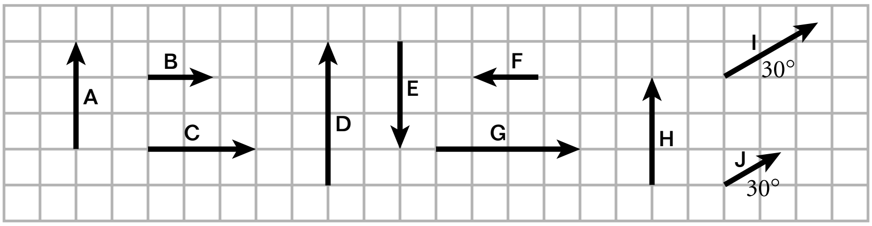
Section **3-1**

HOLT PHYSICS

Diagram Skills

Introduction to Vectors

Use the following vectors to answer the questions.



A = 3 m	C = 3 m	E = 3 m	G = 4 m	I = 3 m
B = 2 m	D = 4 m	F = 2 m	H = 3 m	J = 2 m

1. Which vectors have the same magnitude?

____

2. Which vectors have the same direction?

____

3. Which arrows, if any, represent the same vector?

____

4. In the space provided, construct and label a diagram that shows the vector sum 2**A** + **B.** Construct and label a second diagram that shows **B** + 2**A.**

5. In the space provided, construct and label a diagram that shows the vector difference **A** – (**B**/2). Construct and label a second diagram that shows (**B**/2) – **A.**

Section **3-2**

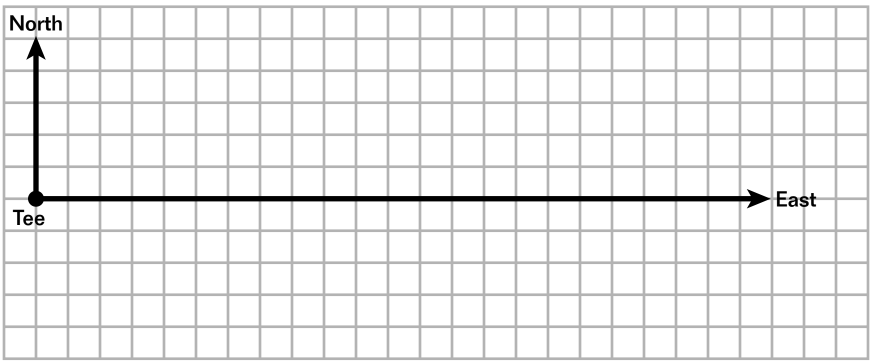
HOLT PHYSICS

Diagram Skills

Vector Operations

One of the holes on a golf course lies due east of the tee. A novice golfer flubs his tee shot so that the ball lands only 64 m directly northeast of the tee. He then slices the ball 30° south of east so that the ball lands in a sand trap 127 m away. Frustrated, the golfer then blasts the ball out of the sand trap, and the ball lands at a point 73 m away at an angle 27° north of east. At this point, the ball is on the putting green and 14.89 m due north of the hole. To his amazement, the golfer then sinks the ball with a single shot.

1. In the space provided, choose a scale, then draw a sketch of the displacement for each shot the golfer made. Label the magnitude of each vector and the angle of each vector relative to the horizontal axis.



2. Use algebraic formulas to find the *x* and *y* components of each displacement vector.

Shot 1 *x* component ______ *y* component ______

Shot 2 *x* component ______ *y* component ______

Shot 3 *x* component ______ *y* component ______

Shot 4 *x* component ______ *y* component ______

3. Find the total displacement (to the nearest meter) the golf ball traveled from the tee to the hole. Assume the golf course is flat. (Hint: Which component of each displacement vector contributes to the total displacement of the ball between the tee and the hole?)

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Section 3-3

HOLT PHYSICS

Math Skills

Projectile Motion

After a snowstorm, a boy and a girl decide to have a snowball fight. The girl uses a large slingshot to shoot snowballs at the boy. Assume that the girl fires each snowball at an angle θ from the ground and that the snowballs travel with an initial velocity of v_0.

1. In terms of the initial velocity, v_0, and the launch angle, θ, for what amount of time, Δt, will a snowball travel before it reaches its maximum height above the ground? (Hint: Recall that $v_f = 0$ when an object reaches its maximum height.)

______

2. What is the maximum height, h, above the ground that a snowball reaches after it has been launched?

______

3. What is the horizontal distance, x, the snowball has traveled when it reaches its maximum height?

______

4. The range, R, is the horizontal distance traveled in *twice* the time it takes for an object to reach its maximum height. Using your answers from items 1 and 3, write an expression for the range in terms of v_0, θ, and g.

______

5. If the initial velocity, v_0, equals 50.00 m/s, find the maximum height and range for each of the launch angles listed in the table below.

Launch angle	Maximum height (m)	Range (m)
15°		
30°		
45°		
60°		
75°		

DATE ______________ CLASS ________________

Section 3-4

HOLT PHYSICS

Diagram Skills

Relative Motion

The water current in a river moves relative to the land with a velocity $\mathbf{v}_{WL}$, and a boat is traveling on the river relative to the current with a velocity $\mathbf{v}_{BW}$.

1. How is the velocity of the boat relative to the land ($\mathbf{v}_{BL}$) related to $\mathbf{v}_{WL}$ and $\mathbf{v}_{BW}$?

____

2. Suppose that both the boat and the water current move in the same direction and that the boat is moving twice as fast as the current. Draw a vector diagram to determine the velocity of the boat relative to the land, $\mathbf{v}_{BL}$.

2.

3. Suppose that the boat travels in the opposite direction of the current and that the boat is moving twice as fast as the current. Draw a vector diagram to determine the velocity of the boat relative to the land, $\mathbf{v}_{BL}$.

3.

4. Suppose that the boat travels in a direction perpendicular to the current and that the boat is moving twice as fast as the current. Draw a vector diagram to determine the velocity of the boat relative to the land, $\mathbf{v}_{BL}$.

4.

5. Assume that the boat travels with a speed of 4.0 km/h relative to the current and that the current moves due east at a speed of 2.0 km/h relative to the land. Determine the velocity of the boat relative to the land for each of the situations described in items 2–4.

a. $\mathbf{v}_{BL}$ for item 2 ______________________

b. $\mathbf{v}_{BL}$ for item 3 ______________________

c. $\mathbf{v}_{BL}$ for item 4 ______________________

DATE ______________ CLASS ____________________

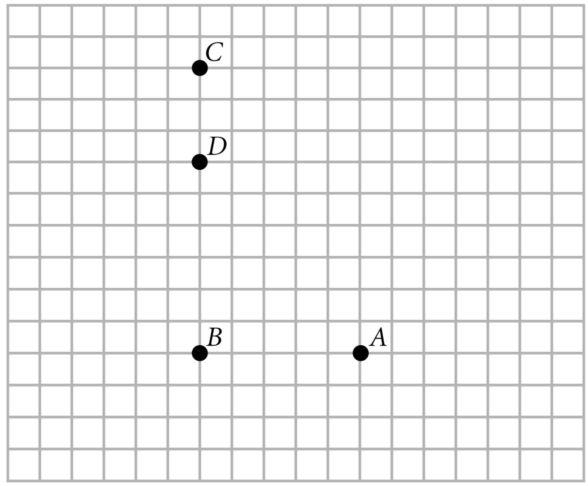
Chapter 3

HOLT PHYSICS

Mixed Review

Two-Dimensional Motion and Vectors

1. The diagram below indicates three positions to which a woman travels. She starts at position *A*, travels 3.0 km to the west to point *B*, then 6.0 km to the north to point *C*. She then backtracks, and travels 2.0 km to the south to point *D*.



a. In the space provided, diagram the displacement vectors for each segment of the woman's trip.

b. What is the total displacement of the woman from her initial position, *A*, to her final position, *D*?

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c. What is the total distance traveled by the woman from her initial position, *A*, to her final position, *D*?

____

2. Two projectiles are launched from the ground, and both reach the same vertical height. However, projectile B travels twice the horizontal distance as projectile A before hitting the ground.

a. How large is the vertical component of the initial velocity of projectile B compared with the vertical component of the initial velocity of projectile A?

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b. How large is the horizontal component of the initial velocity of projectile B compared with the horizontal component of the initial velocity of projectile A?

____

c. Suppose projectile A is launched at an angle of 45° to the horizontal. What is the ratio, v_B/v_A, of the speed of projectile B, v_B, compared with the speed of projectile A, v_A?

____

Chapter 3

HOLT PHYSICS

Mixed Review *continued*

3. A passenger at an airport steps onto a moving sidewalk that is 100.0 m long and is moving at a speed of 1.5 m/s. The passenger then starts walking at a speed of 1.0 m/s in the same direction as the sidewalk is moving. What is the passenger's velocity relative to the following observers?

a. A person standing stationary alongside to the moving sidewalk.

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b. A person standing stationary *on* the moving sidewalk.

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c. A person walking alongside the sidewalk with a speed of 2.0 m/s and in a direction opposite the motion of the sidewalk.

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d. A person riding in a cart alongside the sidewalk with a speed of 5.0 m/s and in the same direction in which the sidewalk is moving.

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e. A person riding in a cart with a speed of 4.0 m/s and in a direction perpendicular to the direction in which the sidewalk is moving.

____

4. Use the information given in item 3 to answer the following questions:

a. How long does it take for the passenger walking on the sidewalk to get from one end of the sidewalk to the other end?

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b. How much time does the passenger save by taking the moving sidewalk instead of walking alongside it?

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