1) Two displacement vectors have magnitudes of 5.0 m and 7.0 m, respectively. If these two vectors are added together, the magnitude of the sum
   A) could be as small as 2.0 m or as large as 12 m.
   B) is equal to 8.6 m.
   C) is equal to 12 m.
   D) is equal to 2.0 m.

2) If $\vec{\mathbf{A}} + \vec{\mathbf{B}} = \vec{\mathbf{C}}$ and their magnitudes are given by $A + B = C$, then the vectors $\vec{\mathbf{A}}$ and $\vec{\mathbf{B}}$ are oriented
   A) antiparallel to each other (in opposite directions).
   B) perpendicular relative to one other.
   C) parallel to each other (in the same direction).
   D) It is impossible to know from the given information.

3) The sum of two vectors of fixed magnitudes has its minimum magnitude when the angle between these vectors is
   A) 180° B) 360° C) 90° D) 270° E) 0°

4) If a vector $\vec{\mathbf{A}}$ has components $A_x < 0$, and $A_y < 0$, then the angle that this vector makes with the positive x–axis must be in the range
   A) 90° to 180°
   B) 270° to 360°
   C) 180° to 270°
   D) 0° to 90°
   E) cannot be determined without additional information

5) Which of the following statements are true about an object in two–dimensional projectile motion with no air resistance? (There could be more than one correct choice.)
   A) The speed of the object is constant but its velocity is not constant.
   B) The acceleration of the object is zero at its highest point.
   C) The speed of the object is zero at its highest point.
   D) The acceleration of the object is $+g$ when the object is rising and $-g$ when it is falling.
   E) The horizontal acceleration is always zero and the vertical acceleration is always a non–zero constant downward.

6) In an air–free chamber, a pebble is thrown horizontally, and at the same instant a second pebble is dropped from the same height. Compare the times of fall of the two pebbles.
   A) They hit at the same time.
   B) The thrown pebble hits first.
   C) The dropped pebble hits first.
   D) We cannot tell without knowing which pebble is heavier.

7) A pilot drops a package from a plane flying horizontally at a constant speed. Neglecting air resistance, when the package hits the ground the horizontal location of the plane will
   A) be in front of the package.
   B) be behind the package.
   C) depend on the speed of the plane when the package was released.
   D) be directly over the package.

8) James and John dive from an overhang into the lake below. James simply drops straight down from the edge. John takes a running start and jumps with an initial horizontal velocity of 25 m/s. Compare the time it takes each to reach the lake below if there is no air resistance.
A) John reaches the surface of the lake first.
B) Cannot be determined without knowing the mass of both James and John.
C) James reaches the surface of the lake first.
D) James and John will reach the surface of the lake at the same time.
E) Cannot be determined without knowing the weight of both James and John.

9) A small car and a large SUV are at a stoplight. The car has a mass equal to half that of the SUV, and the SUV can produce a maximum accelerating force equal to twice that of the car. When the light turns green, both drivers push their accelerators to the floor at the same time. Which vehicle pulls ahead of the other vehicle after a few seconds?
A) The SUV pulls ahead. B) It is a tie. C) The car pulls ahead.

10) An object is moving with constant non–zero velocity. Which of the following statements about it *must* be true?
A) A constant force is being applied to it perpendicular to the direction of motion.
B) Its acceleration is in the same direction as it velocity.
C) The net force on the object is zero.
D) A constant force is being applied to it in the direction of motion.
E) A constant force is being applied to it in the direction opposite of motion.

11) The x component of vector $\vec{\mathbf{A}}$ is 8.7 units, and its y component is –6.5 units. The magnitude of $\vec{\mathbf{A}}$ is

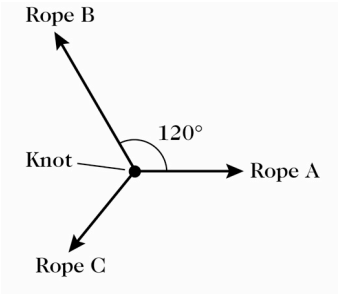
12) When Jeff ran up a hill at 7.0 m/s, the horizontal component of his velocity vector was 5.1 m/s. What was the vertical component of Jeff's velocity?

13) A vector $\vec{\mathbf{A}}$ has components $A_x = 12.0$ m and $A_y = 5.00$ m.
(a) What is the angle that vector $\vec{\mathbf{A}}$ makes with the +x–axis?
(b) What is the magnitude of vector $\vec{\mathbf{A}}$?

14) You walk 33 m to the north, then turn 60° to your right and walk another 45 m. How far are you from where you originally started?

15) Two perpendicular vectors, $\vec{\mathbf{A}}$ and $\vec{\mathbf{B}}$, are added together giving vector $\vec{\mathbf{C}}$. If the magnitudes of both vectors $\vec{\mathbf{A}}$ and $\vec{\mathbf{B}}$ are doubled without changing their directions, the magnitude of vector $\vec{\mathbf{C}}$ will
A) increase by a factor of 8.
B) increase by a factor of 4.
C) increase by a factor of $\sqrt{2}$.
D) increase by a factor of 2.
E) not change.

16) Three ropes are tied in a knot as shown in the figure. One student pulls on rope A with 1.0 pound of force, and another student pulls on rope B with 7.0 pounds of force. How *hard* and in what *direction* must you pull on rope C to *balance* the first two pulls? Give the direction by specifying the angle (clockwise or counterclockwise) of the pull with the direction of rope A.



17) Vector $\vec{\mathbf{A}}$ has a magnitude of 6.0 m and points 30° north of east. Vector $\vec{\mathbf{B}}$ has a magnitude of 4.0 m and points 30° east of north. The resultant vector $\vec{\mathbf{A}} + \vec{\mathbf{B}}$ is ...

18) An airplane undergoes the following displacements, all at the same altitude: First, it flies 59.0 km in a direction 30.0° east of north. Next, it flies 58.0 km due south. Finally, it flies 100 km 30.0° north of west. Use components to determine how far the airplane ends up from its starting point.

19) A ball is thrown with an initial velocity of 20 m/s at an angle of 60° above the horizontal. If we can neglect air resistance, what is the horizontal component of its instantaneous velocity at the exact top of its trajectory?

20) A ball thrown horizontally from a point 24 m above the ground, strikes the ground after traveling horizontally a distance of 18 m. With what speed was it thrown, assuming negligible air resistance?

21) A cat leaps to try to catch a bird. If the cat's jump was at 60° off the ground and its initial velocity was 2.74 m/s, what is the highest point of its trajectory, neglecting air resistance?

22) A projectile leaves the ground at 150 m/s and reaches a maximum height of 0.57 km. If there was no air resistance, at what angle above the horizontal did it leave the ground?

23) You are traveling at 55 mi/h along the +x–axis relative to a straight, level road and pass a car that is traveling at 45 mi/h. The relative velocity of your car to the other car is ...

24) An airplane with an airspeed of 140 km/h has a heading of 50° west of north in a wind that is blowing toward the east at 25 km/h. What is the groundspeed of the plane?

25) Alicia intends to swim to a point straight across a 100 m wide river with a current that flows at 1.2 m/s. She can swim 2.5 m/s in still water. At what angle, measured from the upstream direction, must she swim upstream to achieve her goal?

Answer Key
Testname: HW_CH3_VECTORS_TWO-D_KINEMATICS

1) A
2) C
3) A
4) C
5) E
6) A
7) D
8) D
9) B
10) C
11) 11 units
12) 4.8 m/s
13) (a) 22.6° (b) 13.0 m
14) 68 m
15) D
16) 6.6 lb at 68° clockwise from rope A
17) 9.7 m at an angle of 42° north of east.
18) 71.5 km
19) 10 m/s
20) 8.1 m/s
21) 0.29 m
22) 45°
23) 10 mi/h.
24) 120 km/h
25) 61°