5.1 Vector Addition/Subtraction (Graphically)

Vector **A** has a magnitude of 5 units and points to the east. Vector **B** has a magnitude of 3 units and points to the north. Using a ruler and protractor, find the magnitude and direction of the resultant vector **C.**

Mr. Szwast walks 4 blocks, 30° north of east, and then turns around and walks 6 blocks, 60° south of east. Using a ruler and protractor, find Mr. Szwast's total displacement.

Vector **A** has a magnitude of 9 units, north. Vector **B** has a magnitude of 4 units, east. Find the magnitude of **A – B.** Use a ruler and protractor.

A chicken (yes, a chicken) walks 2 miles, 45° north of east. The chicken then arrives at the farm and has lunch. After lunch, the chicken walks another 5 miles (very tenacious chicken), 60° north of west. Find the chicken's displacement, using a ruler and protractor.

5.2 Vector Addition & Subtraction (Analytically)

A ladybug flies 27.8 m, 37.2° north of east. It then pauses on the windowsill, before flying another 24.6 m, 60.1° south of east. What is the direction and magnitude of the resultant vector?

A wooden box experiences a force at two different angles:
F_1 = 10.0 N, 45.0° north of east
F_2 = 6.0 N, 30.0° south of east
Find the magnitude and direction of the resultant force.

A woman is sailing in a boat. She first sails 43.2 m, 63.5° north of east. The instructions then said to travel 62.9 m, 31.0 north of east, but instead, the woman travels 62.9 m, 31.0 south of east! Where does she end up relative to where she started?

Three forces act on a plastic container.
F_1 = 15.1 N, 0° (directly east)
F_2 = 10.2 N, 90° (directly north)
F_3 = 12.7 N, 210° (30° south of west)
Find the magnitude and direction of the resultant force.

5.3 Projectile Motion

A man shoots an arrow with velocity of 25 m/s at an angle of 20 degrees. What is the speed just before it hits the ground?

Ryan Mansour is playing Overwatch when he rages and throws his computer into a 1.00 meter tall trash can downstairs. He throws it horizontally, with a velocity of 2.50 m/s, at a height of 20.6 meters. How far must the trash be placed?

Rithvik kicks a soccer ball with a velocity v and an angle of 35.0 degrees. The ball lands 20.0 meters away, in front of Veer. What is the velocity Rithvik kicked it at?

Veer is facing North and also attempts to kick the soccer ball back, at an angle of 40.0 degrees North at a velocity of 18 m/s. While kicking it, he accidentally also makes it go 2.50 m/s west. What is the displacement of the ball relative to Veer?

5.4 Inclined Planes

Draw a free body diagram of a stationary block on an inclined plane with an applied force upwards.

A 10.0 kg block is stationary on an inclined plane with an angle of 22.4 degrees. What is the force of friction on the block?

A 30.0 kg block is moving downwards on an inclined plane with an angle of 35.0 degrees. If the coefficient of friction is 0.250, what is the magnitude of the acceleration of the box?

A 30.0 kg block is stationary on an inclined plane with an angle of 40 degrees. If the applied force on the box is 100. N, what is the coefficient of friction on the box?

5.5 Simple Harmonic Motion

A block is hung from a vertical spring with a spring constant 250. N/m. When it is hung on the spring, the spring stretches 0.042 m. If the spring is forced to oscillate with the block attached to it, what is the period of oscillation?

Given that the frequency of oscillation is 3.87 Hz and the gravitational field strength in this region is 9.78 N/kg, what is the length of the pendulum (in centimeters)?

If a block of mass 8.95 kg is attached to a horizontal spring (k = 175 N/m) that is stretched 87.0 cm, calculate the magnitude of the restoring force.

A mass m is oscillating freely on a spring. When the mass is 0.76 kg, the period is 0.85 seconds. An unknown mass on the spring has a period of 1.25 seconds.

a) Find the spring constant of the spring, k.

b) Find the unknown mass.