Part 1.   *(1.0 point each)*
Please circle ◯ the correct answer, to the nearest number for quantitative questions, for each of the following:

1. Three vectors have equal magnitudes and make **120°** with each other. We can say that

A) the magnitude of the resultant is one-third the magnitude of the component vectors.
B) the magnitude of the resultant is three times the magnitude of the component vectors.
C) the magnitude of the resultant is more than three times the magnitude of each component vector.
D) the resultant is zero.
E) the magnitude of the resultant is equal to the magnitude of the component vectors.

2. What is the angle between the vectors $\vec{A}$ and $-\vec{A}$ when these vectors are drawn from a common origin?

   A) 90°   B) 0°   C) 360°   D) 180°   E) 270°

3. Vector $\vec{A}$ = **6.0 m** and points **30° east of south**. Vector $\vec{B}$ = **4.0 m** and points **30° west of north**. The resultant vector $\vec{A}$ + $\vec{B}$ is given by

A) 2.0 m at an angle 30° north of west.   B) 2.0 m at an angle 30° east of south.
C) 10.0 m at an angle 60° north of west.   D) 10.0 m at an angle 60° east of south.
E) 1.0 m at an angle 60° north of west.

4. A swimmer heading directly across a river **200 m** wide reaches the opposite bank in **6 min 40 s**. She is swept downstream **480 m**. What is the speed of the water?

   A) 1.5 m/s.   B) 0.8 m/s.   C) 1.2 m/s.   D) 0.5 m/s.   E) 1.8 m/s.

5. Use the information in **Question 4,** How fast can she swim in still (unmoving) water?

   A) 1.5 m/s.   B) 0.8 m/s.   C) 1.2 m/s.   D) 0.5 m/s.   E) 1.8 m/s.

6. A bullet is fired from ground level with a speed of **150 m/s** at an angle **30.0°** above the horizontal at a location where **g = 10.0 m/s^2**. What is the vertical component of its velocity when it is at the highest point of its trajectory?

   A) 0 m/s.   B) 10 m/s.   C) 75 m/s.   D) 130 m/s.   E) 150 m/s.

7. In a free fall, the horizontal and vertical components of the initial velocity of a football are **16 m/s** and **20 m/s** respectively. How long does it take for the football to rise to the highest point of its trajectory?

   A) 1.0 s.   B) 2.0 s.   C) 3.0 s.   D) 4.0 s.   E) 5.0 s.

8. A person throws a ball horizontally from the top of a building that is **24.0 m** above the ground level. The ball lands **100 m** down range from the base of the building. What was the initial velocity of the ball?

     A) 202 m/s.   B) 9.80 m/s.   C) 19.6 m/s.   D) 45.2 m/s.   E) 94.4 m/s.

9. A **1200 kg** car is pulling a **500 kg** trailer along level ground. Friction is negligible. The car accelerates with an acceleration of **1.3 m/s^2**. What is the force exerted by the car on the trailer?

     A) 550 N.   B) 600 N.   C) 650 N.   D) 700 N.   E) 750 N.

10. The two forces indicated in **Figure below** act on a **3.00 kg** object. What is the acceleration of the object?

A) $(1.67 \text{ m/s}^2)\,\hat{x}$ - $(0.333 \text{ m/s}^2)\,\hat{y}$

B) $(5.00 \text{ m/s}^2)\,\hat{x}$ + $(1.00 \text{ m/s}^2)\,\hat{y}$

C) $(1.67 \text{ m/s}^2)\,\hat{x}$ + $(2.333 \text{ m/s}^2)\,\hat{y}$

D) $(15.0 \text{ m/s}^2)\,\hat{x}$ + $(3.00 \text{ m/s}^2)\,\hat{y}$

E) $(1.67 \text{ m/s}^2)\,\hat{x}$ + $(0.333 \text{ m/s}^2)\,\hat{y}$
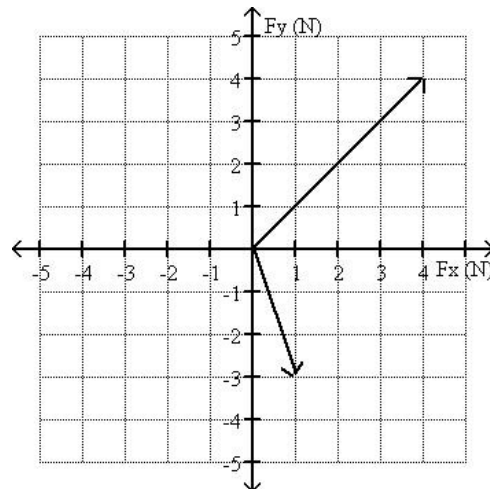
11. An object is being acted upon by three forces and moves with a constant velocity. One force is **60.0 N** along the *x*-axis, the second is **75.0 N** along the *y*-axis. What is the magnitude of the third force?

     A) 135 N   B) 15.0 N   C) 48.0 N
     D) 67.5 N   E) 96.0 N

End of Part 1

Some useful constants and formula for Parts 1 & 2:

g=9.81 m/s^2   *For quadratic equations* $$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Part 2:

Please read each of the following questions carefully and show your work in the space provided. Include the appropriate units with your answer. *(3 points each)*

P1. To determine the mass of a car, a student (with a friend at the wheel) pushes the car and carefully maintains a constant reading force of **400 N** while the car accelerates on level ground. His friend reports that the car accelerated from rest to **14.0 km/hr** in **12.0 s**. What was the mass of the car?

Answer (with units) _____

P2. An airplane is flying at a constant velocity of **200 m/s** in level flight at an altitude of **800 m**. A package is to be dropped from the airplane to land on a target on the ground.

  A) At what horizontal distance away from the target should the package be released so that it lands on the target?

Answer (with units) _____

  B) In what direction will the package be traveling when it hits the ground?

Answer (with units) _____