SECTION 1, PART I and II
A graphing calculator is allowed for these problems.

Part I: An airplane is flying directly north at 300 miles/hour. There is a very strong crosswind of 45 miles per hour blowing directly from the west.
   a. Draw a vector diagram that models this situation.
   b. If no correction is made for the wind, what is the final bearing of the plane?
   c. If no correction is made for the wind, what is the final ground speed of the plane?
   d. What will the plane's coordinates be after 60 minutes? 30 minutes?

Part II: Another small plane traveling at 200 miles/hour leaves the origin at the same time as the plane in Part I. It points directly south, and is also subject to the 45 mile/hour crosswind that is blowing directly from the west.
   a. Draw a vector diagram representing the movements of **both planes.**
   b. What is the distance between the planes after 30 minutes have passed?
   c. After 30 minutes have passed, the control tower at $(0, 0)$ measures the angle between the two planes in degrees. What is the angle they measure?

Part I: An airplane is flying directly north at 300 miles/hour. There is a very strong crosswind of 45 miles per hour blowing directly from the west.
   a. Draw a vector diagram that models this situation.
   b. If no correction is made for the wind, what is the final bearing of the plane?
   c. If no correction is made for the wind, what is the final ground speed of the plane?
   d. What will the plane's coordinates be after 60 minutes? 30 minutes?

Part II: Another small plane traveling at 200 miles/hour leaves the origin at the same time as the plane in Part I. It points directly south, and is also subject to the 45 mile/hour crosswind that is blowing directly from the west.
   a. Draw a vector diagram representing the movements of **both planes.**
   b. What is the distance between the planes after 30 minutes have passed?
   c. After 30 minutes have passed, the control tower at $(0,\ 0)$ measures the angle between the two planes in degrees. What is the angle they measure?

Part I Solutions

a.

Part I Points

1 point for wind vector
1 point for airspeed vector
1 point for accurate vector lengths

b. Setup → $tan\theta = \frac{300}{45}$, bearing = $8.53°$

1 point for setup
1 point for bearing = $8.53°$
1 point for units

c. Setup → $\|v\| = \sqrt{45^2 + 300^2}$, magnitude = 303.36 mph

1 point for setup
1 point for magnitude = 303.36 mph
1 point for units

d. 60 minutes $(45,\ 300)$; 30 minutes $(22.5,\ 150)$

1 point for coordinate after 60 minutes
1 point for coordinate after 30 minutes
1 point for correct parenthesis

Part II Solutions

Part II Points

a.

1 point for wind vector
1 point for plane vector #1
1 point for plane vector #2
1 point for accurate vector lengths

b. 250 miles apart

1 point for answer
1 point for units

c. Setup→ $cos\theta = \frac{<22.5,\ 150> \cdot <22.5,\ -100>}{(\sqrt{22.5^2+150^2})(\sqrt{22.5^2+-100^2})} = 158.78°$

1 point for setup
1 point for answer
1 point for units