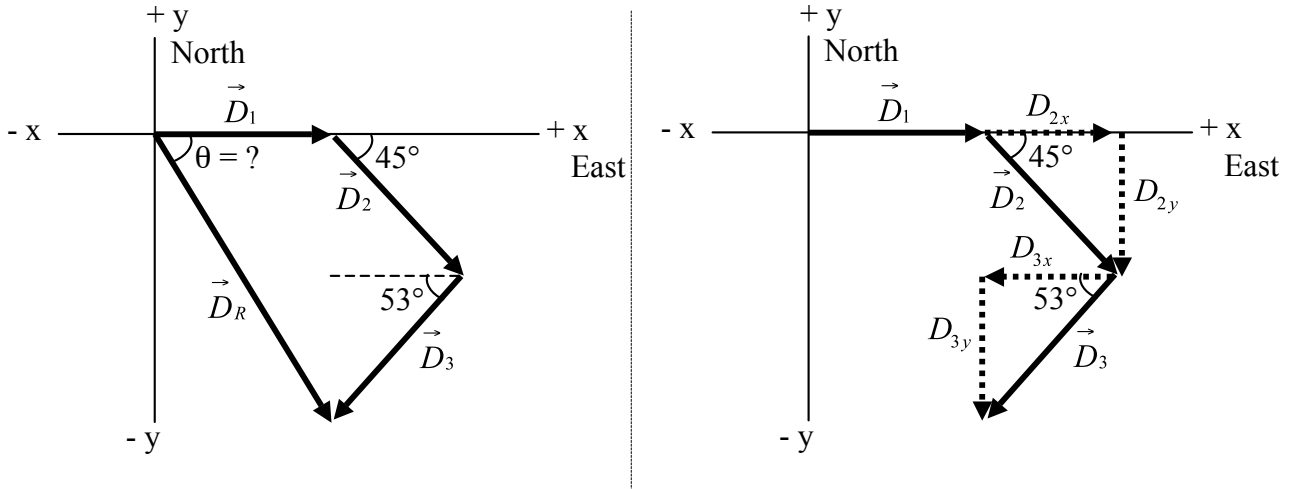


# Summer AP Physics Assignment

1. During the first week of summer school, check out: Hewitt, Conceptual Physics
2. Read as much of Hewitt text as possible. It will give you a conceptual understanding of the ideas we will be covering next year.  
Minimum: Chapters 1-9  
Ideal: Chapters 1-9, 14-20  
  
\* At the end of each chapter, read and think about the exercises. Discuss these with other students, ex students, or parents.
3. Work on the vector worksheet.
4. Optional: Buy Schaum's Solved Problems Series ISBN 0-07-025734-5 and work some vector problems.
5. Optional: Buy Cracking the AP Physics book. I highly recommend this book as an excellent resource to use throughout the year.

# Vector Worksheet

1. An airplane trip involves three legs, with two stopovers, as shown in the figure below. The first leg is due east for 620 km; the second leg is southeast ( $45^\circ$ ) for 440 km; and the third leg is at  $53^\circ$  south of west, for 550 km, as shown, as shown. What is the plane's total displacement?



Answer:

1. **Draw a diagram** such as the figure above, where  $\vec{D}_1$ ,  $\vec{D}_2$ , and  $\vec{D}_3$  represent the three legs of the trip, and  $\vec{D}_R$  is the plane's total displacement.
2. **Choose axes:** Axes are also shown in the figure above.
3. **Resolve components:** It is imperative to draw a good figure. The components are drawn in the figure above. Instead of drawing all the vectors starting from a common origin, here we draw them "head-to-tail" style, which is just as valid and may make it easier to see.
4. **Calculate the components:**

$$\vec{D}_1 : D_{1x} = +D_1 \cos 0^\circ = D_1 = 620km$$

$$D_{1y} = +D_1 \sin 0^\circ = 0km$$

$$\vec{D}_2 : D_{2x} = +D_2 \cos 45^\circ = +(440km)(0.707) = +311km$$

$$D_{2y} = -D_2 \sin 45^\circ = -(440km)(0.707) = -311km$$

$$\vec{D}_3 : D_{3x} = -D_3 \cos 53^\circ = -(550km)(0.602) = -331km$$

$$D_{3y} = -D_3 \sin 53^\circ = -(550km)(0.799) = -439km.$$

	x	y
$\vec{D}_1$	620	0
$\vec{D}_2$	311	-
$\vec{D}_3$	-	311
$\vec{D}_R$		

We have given a minus sign to each component that in the figure points in the -x or -y direction. The components are shown in the Table in the margin.

5. **Add the components:** We add the x components together, and we add the y components together to obtain the x and y components of the resultant:

$$D_x = D_{1x} + D_{2x} + D_{3x} = 620\text{km} + 311\text{km} - 331\text{km} = 600\text{km}$$

$$D_y = D_{1y} + D_{2y} + D_{3y} = 0\text{km} - 311\text{km} - 439\text{km} = -750\text{km}$$

6. **Magnitude and direction:** We can also give the answer as

$$D_R = \sqrt{D_x^2 + D_y^2} = \sqrt{(600)^2 + (-750)^2}\text{km} = 960\text{km}$$

$$\tan \theta = \frac{D_y}{D_x} = \frac{-750\text{km}}{600\text{km}} = -1.25, \text{ so } \theta = -51^\circ.$$

Thus, the total displacement has magnitude 960 km and points  $51^\circ$  below the x axis (south of east), as shown in our original figure.

- Find the scalar x- and y- components of the following displacements in the xy-plane:  
 (a) 300.0 cm at  $126^\circ$  and (b) 500.0 cm at  $220^\circ$   
*Answer:* (a) -176 cm, 242 cm; (b) -383 cm, -321 cm
- A bug starts at point A, crawls 8.0 cm east, then 5.0 cm south, 3.0 cm west, and 4.0 cm north to point B. (a) How far south and east is B from A? (b) Find the displacement from A to B.  
*Answer:* (a) 5.0 cm - east, 1.0 cm - south; (b) 5.10 cm -  $348.7^\circ$
- Compute the resultant of the following coplanar forces: 100 N at  $30^\circ$ , 141.4 N at  $45^\circ$ , and 100 N at  $240^\circ$ .  
*Answer:* (a) 0.15 kN at  $25^\circ$
- Compute the resultant of the following coplanar displacements: 20.0 m at  $30.0^\circ$ , 40.0 m at  $120.0^\circ$ , 25.0 m at  $180.0^\circ$ , 42.0 m at  $270.0^\circ$ , and 12.0 m at  $315^\circ$ .  
*Answer:* 20.1 m at  $197^\circ$
- Two forces, 80 N and 100 N acting at an angle of  $60^\circ$  with each other, pull on an object. (a) What single force would replace the two forces? (b) What single force (called the equilibrant) would balance the two forces?  
*Answer:* (a) **R**: 0.16 kN at  $34^\circ$  with 80 N force; (b) **-R**: 0.16 kN at  $214^\circ$  with the 80 N force
- What displacement at  $70^\circ$  has an x-component of 450 m? What is its y-component?  
*Answer:* 1.3 km, 1.2 km
- What displacement must be added to a 50 cm displacement in the +x-direction to give a resultant displacement of 85 cm at  $25^\circ$ ?  
*Answer:* 45 cm at  $53^\circ$
- A woman walks 4 km east and then 8 km north. Find her displacement.  
*Answer:* 8.94 km,  $63.4^\circ$  N of E

10. Find the x and y components of: (a) a displacement of 200 km at  $34^\circ$ , (b) a velocity of 40 km/h at  $120^\circ$ , and (c) a force of 50 N at  $330^\circ$ .

*Answer:* (a) 166 km, 112 km; (b) -20 km, 34.6 km/h; (c) 43.3 N, -25 N

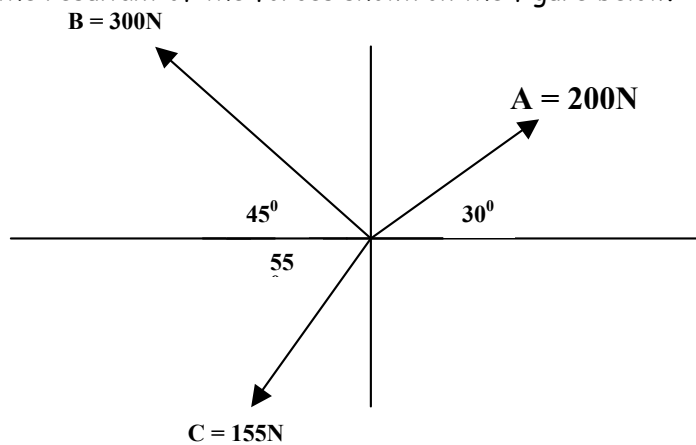
11. Find the resultant of the following perpendicular forces: (a) 400 N,  $0^\circ$ ; (b) 820 N,  $270^\circ$ ; (c) 650 N,  $180^\circ$ ; and (d) 500 N,  $90^\circ$ .

*Answer:* 406 N,  $232^\circ$

12. Determine the resultant of the following forces by the component method of vector addition: A = (200 lb.,  $30^\circ$ ); B = (300 lb.,  $330^\circ$ ); and C = (400 lb.,  $250^\circ$ )

*Answer:* 518.76 N,  $-55.18^\circ$

13. Determine the resultant of the forces shown on the figure below.



*Answer:* 225 N,  $124.6^\circ$

My Marina site has a power point presentation on vectors. Period 1.

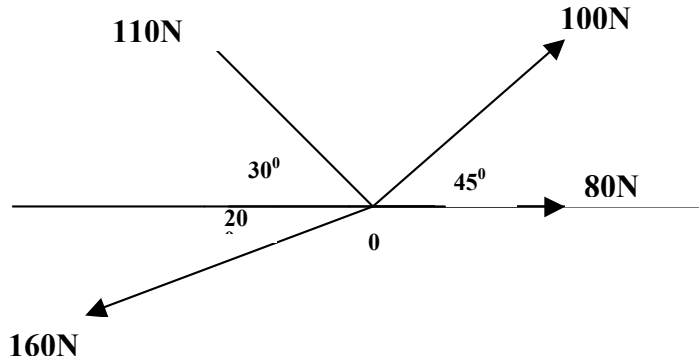
Two good web sites that you might find helpful are:

[http://www.explorescience.com/activities/Activity\\_page.cfm?ActivityID=15](http://www.explorescience.com/activities/Activity_page.cfm?ActivityID=15)

<http://www.glenbrook.k12.il.us/gbssci/phys/Class/vectors/vectoc.html>

# Vector Worksheet

14. Four coplanar forces act on a body at point O as shown in the figure below. Find their resultant.



*Answer:* 119 N at  $143^\circ$

15. Find the scalar x- and y- components of the following displacements in the xy-plane:

(a) 300.0 cm at  $126^\circ$  and (b) 500.0 cm at  $220^\circ$

*Answer:* (a) -176 cm, 242 cm; (b) -383 cm, -321 cm

16. A bug starts at point A, crawls 8.0 cm east, then 5.0 cm south, 3.0 cm west, and 4.0 cm north to point B. (a) How far south and east is B from A? (b) Find the displacement from A to B.

*Answer:* (a) 5.0 cm - east, 1.0 cm - south; (b) 5.10 cm -  $348.7^\circ$

17. Compute the resultant of the following coplanar forces: 100 N at  $30^\circ$ , 141.4 N at  $45^\circ$ , and 100 N at  $240^\circ$ .

*Answer:* (a) 0.15 kN at  $25^\circ$

18. Compute the resultant of the following coplanar displacements: 20.0 m at  $30.0^\circ$ , 40.0 m at  $120.0^\circ$ , 25.0 m at  $180.0^\circ$ , 42.0 m at  $270.0^\circ$ , and 12.0 m at  $315^\circ$ .

*Answer:* 20.1 m at  $197^\circ$

19. Two forces, 80 N and 100 N acting at an angle of  $60^\circ$  with each other, pull on an object. (a) What single force would replace the two forces? (b) What single force (called the equilibrant) would balance the two forces?

*Answer:* (a) **R:** 0.16 kN at  $34^\circ$  with 80 N force; (b) **-R:** 0.16 kN at  $214^\circ$  with the 80 N force

20. What displacement at  $70^\circ$  has an x-component of 450 m? What is its y-component?

*Answer:* 1.3 km, 1.2 km

21. What displacement must be added to a 50 cm displacement in the +x-direction to give a resultant displacement of 85 cm at  $25^\circ$ ?

*Answer:* 45 cm at  $53^\circ$

22. A woman walks 4 km east and then 8 km north. Find her displacement.

*Answer:* 8.94 km,  $63.4^\circ$  N of E

23. Find the x and y components of: (a) a displacement of 200 km at  $34^\circ$ , (b) a velocity of 40 km/h at  $120^\circ$ , and (c) a force of 50 N at  $330^\circ$ .

*Answer:* (a) 166 km, 112 km; (b) -20 km, 34.6 km/h; (c) 43.3 N, -25 N

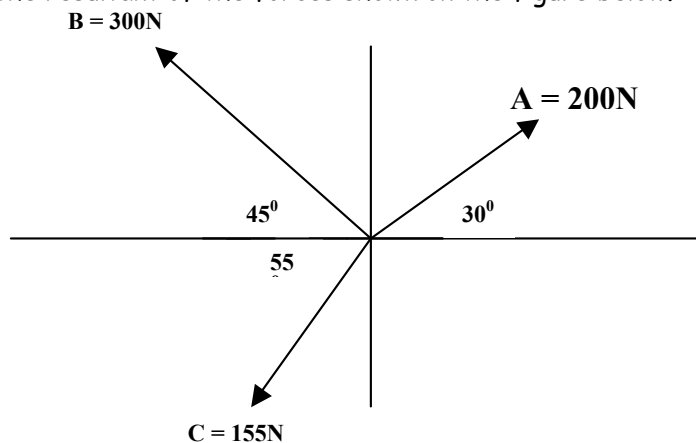
24. Find the resultant of the following perpendicular forces: (a) 400 N,  $0^\circ$ ; (b) 820 N,  $270^\circ$ ; (c) 650 N,  $180^\circ$ ; and (d) 500 N,  $90^\circ$ .

*Answer:* 406 N,  $232^\circ$

25. Determine the resultant of the following forces by the component method of vector addition: A = (200 lb.,  $30^\circ$ ); B = (300 lb.,  $330^\circ$ ); and C = (400 lb.,  $250^\circ$ )

*Answer:* 518.76 N,  $-55.18^\circ$

26. Determine the resultant of the forces shown on the figure below.



*Answer:* 225 N,  $124.6^\circ$

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