

Homework Solutions  
8/29/2007

NOTE: I believe the book is counting 120 as having 3 sig figs, so I'm going to go with that for these solutions.

Chapter 3

Conceptual Questions

2. If both vectors have the same direction. If both vectors are in opposite directions and have the same magnitude.
4. No, their sum cannot be zero because they would need to be equal in magnitude and opposite in direction to completely cancel each other.
6. The hypotenuse of a right triangle is always the longest side. By definition, components of a vector must be perpendicular so therefore the components cannot be longer than the original vector.
8. The components of a vector would have equal magnitudes when the angle between the vector and the components is 45 degrees.

Problems

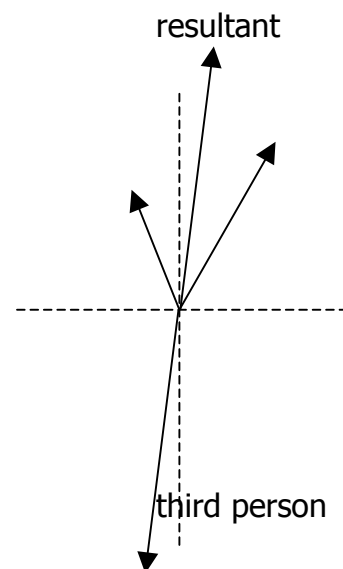
18.  $F_{1x} = 120\text{N} \cdot \cos 60^\circ = 60\text{N}$  or 60N to the right  
 $F_{1y} = 120\text{N} \cdot \sin 60^\circ = 103.9\text{N}$  up  
 $F_{2x} = 80\text{N} \cdot \cos 75^\circ = -20.7\text{N}$  or 20.7N to the left  
 $F_{2y} = 80\text{N} \cdot \sin 75^\circ = 77.3\text{N}$  up  
 $x_{\text{total}} = 39.3\text{N}$  to the right  
 $y_{\text{total}} = 181.2\text{N}$  up

$$\sqrt{(39.3)^2 + 181.2^2} = 185.4\text{N} = 190\text{N}$$

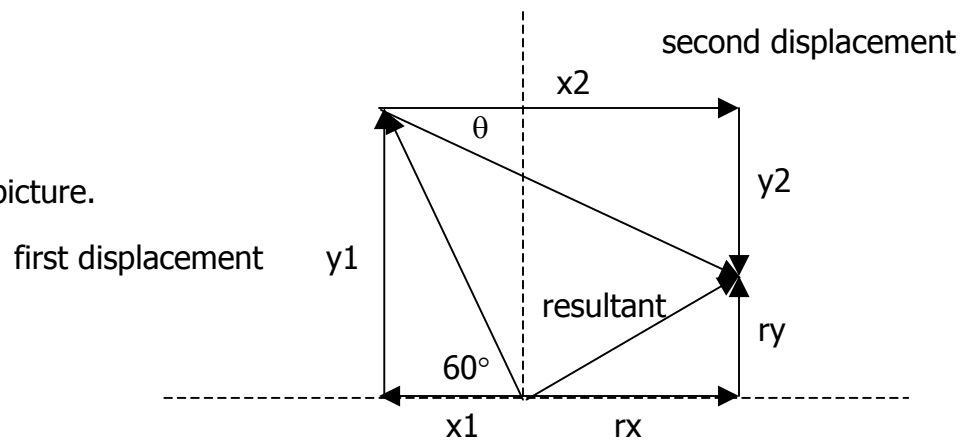
$$\theta = \tan^{-1}\left(\frac{39.3}{181.2}\right) = 12.24^\circ = 12^\circ$$

If due north is  $0^\circ$ , east is  $90^\circ$ , south is  $180^\circ$  and west is  $270^\circ$ , then this  $12^\circ$  is correct since it is east of north.

To completely cancel out this force a third person must apply 190N in a direction opposite of this net force, or  $12^\circ + 180^\circ = 192^\circ$ .



19. First, draw a picture.



$$\begin{aligned}
 x1 &= 150\text{cm} \cdot \cos 60^\circ = 75\text{cm} \\
 y1 &= 150\text{cm} \cdot \sin 60^\circ = 129.9\text{cm} \\
 x2 &= x1 + rx = 189.7\text{cm} \\
 y2 &= y1 - ry = 49.6\text{cm} \\
 rx &= 140\text{cm} \cdot \cos 35^\circ = 114.7\text{cm} \\
 ry &= 140\text{cm} \cdot \sin 35^\circ = 80.3\text{cm}
 \end{aligned}$$

$$\sqrt{(49.6^2 + 189.7^2)} = 196.08\text{cm} = 196\text{cm}$$

$$\theta = \tan^{-1}\left(\frac{49.6}{189.7}\right) = 14.65^\circ = 14.7^\circ$$

The 2<sup>nd</sup> displacement was 196cm at an angle of 14.7° below the x-axis.

You may have two issues with this problem compared to the ones we completed in class today. First, the first displacement was 120° to the x-axis. Thus it makes an angle of 60° to the negative part of the x-axis (or 30° to the y-axis). Second, the math for solving for the x2 and y2 components might be a little confusing. Here it is:

$rx = x1 + x2$  but we need to subtract x1 from both sides because we need to solve for x2 so we get

$x2 = rx - x1$  however since x1 is in the negative x direction this is like adding x1 to rx

$$x2 = rx + x1$$