Announcements

1. WebAssign count will be done on 9/6/02.
2. Zac Caulder (please see me after class)
3. On line quizes and homework assignments. (Quiz q*N* is due before lecture *N* and HW*N* is due before lecture *N+1*.) Due time extended to 5 PM the day of the lecture???
4. How are the tutorials? Other feedback?

Vector manipulations

1. Definition
2. Addition, subtraction, multiplication
3. Examples

On line quiz

Suppose that receive information from a reliable source that there is buried treasure located 30 m East and 40 m South of your dorm room. Starting at your dorm room, which of the following method(s) will get you to the treasure?

(a) You should walk 70 m in the Southeast direction.

(b) You should walk first 30 m East and then 40 m South.

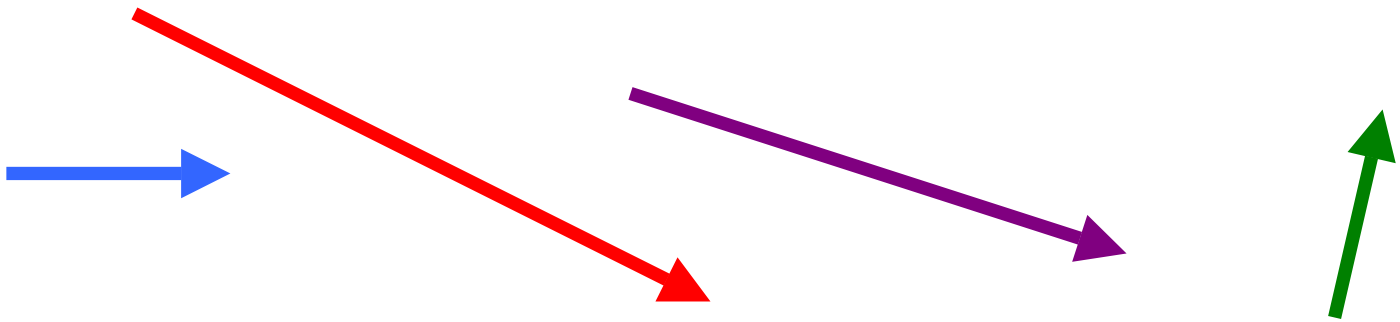
(c) You should walk first 40 m South and then 30 m East.

(d) You should walk walk 50 m in a direction 53.1 degrees South of East.

(e) You should walk walk 50 m in a direction 36.9 degrees South of East.

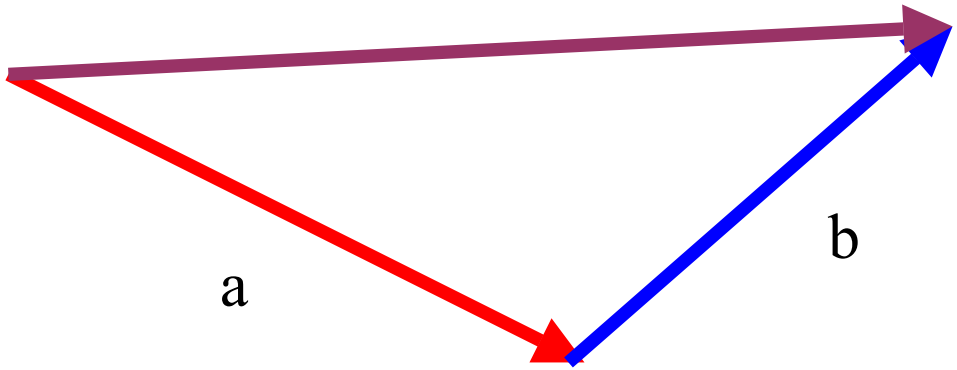
Definition of a vector

1. A vector can be visualized its length and direction.

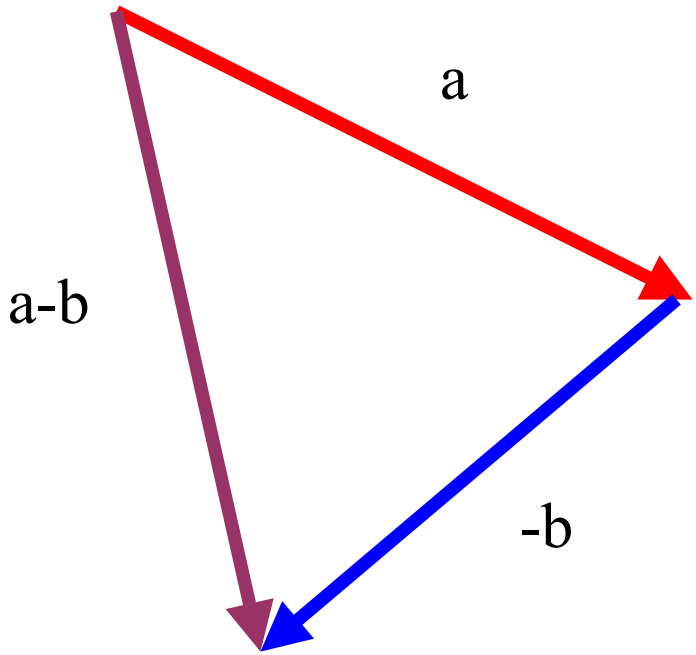


2. Addition, substraction, and two forms of multiplication can be defined
3. Coordinate representations, and abstract extensions.

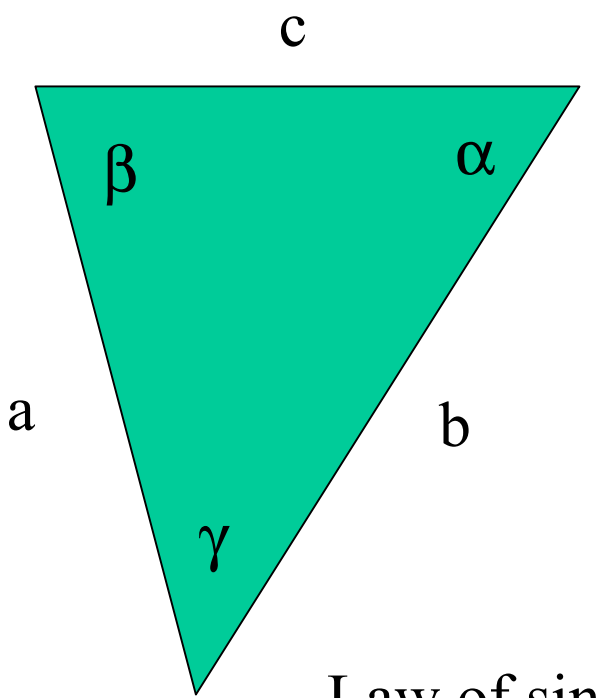
Vector addition:



Vector subtraction:



Some useful trigonometric relations



Law of cosines:

$a^2=b^2+c^2-2bc\cos\alpha$

$b^2=c^2+a^2-2ca\cos\beta$

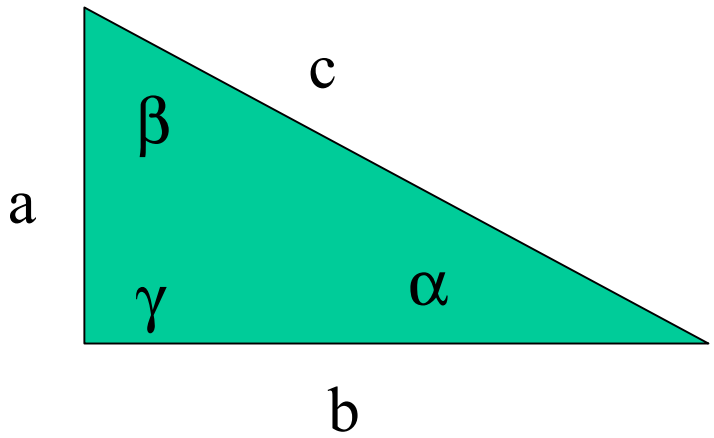
$c^2=a^2+b^2-2ab\cos\gamma$

Law of sines:

$$\frac{a}{\sin\alpha}=\frac{b}{\sin\beta}=\frac{c}{\sin\gamma}$$

Right triangle relations

$$c = \sqrt{a^2 + b^2}$$

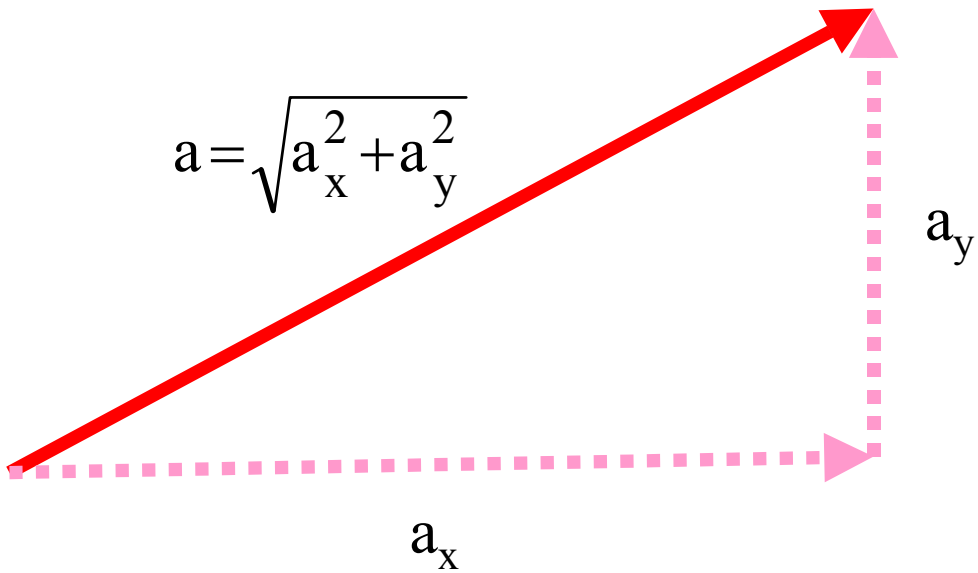


$\tan \alpha = a/b$

$\sin \alpha = a/c$

$\cos \alpha = b/c$

Vector components:



Vector components

$$\mathbf{R}_1 = x_1\hat{\mathbf{x}} + y_1\hat{\mathbf{y}} + z_1\hat{\mathbf{z}}$$

$$\mathbf{R}_2 = x_2\hat{\mathbf{x}} + y_2\hat{\mathbf{y}} + z_2\hat{\mathbf{z}}$$

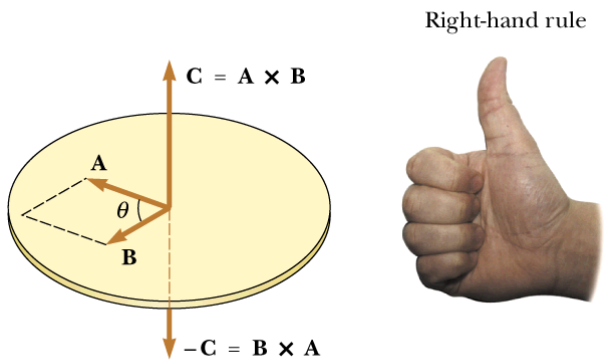
$$\mathbf{R}_1 + \mathbf{R}_2 = (x_1 + x_2)\hat{\mathbf{x}} + (y_1 + y_2)\hat{\mathbf{y}} + (z_1 + z_2)\hat{\mathbf{z}}$$

Vector multiplication

"Dot" product $\mathbf{A} \bullet \mathbf{B} \equiv AB\cos\theta_{AB}$; $\hat{\mathbf{x}} \bullet \hat{\mathbf{x}} = 1$

"Cross" product $|\mathbf{A} \times \mathbf{B}| \equiv AB\sin\theta_{AB}$; $\hat{\mathbf{x}} \times \hat{\mathbf{y}} = \hat{\mathbf{z}}$

Serway, Physics for Scientists and Engineers, 5/e
Figure 11.8



Examples of vectors: Position & Velocity

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Figure 4.1

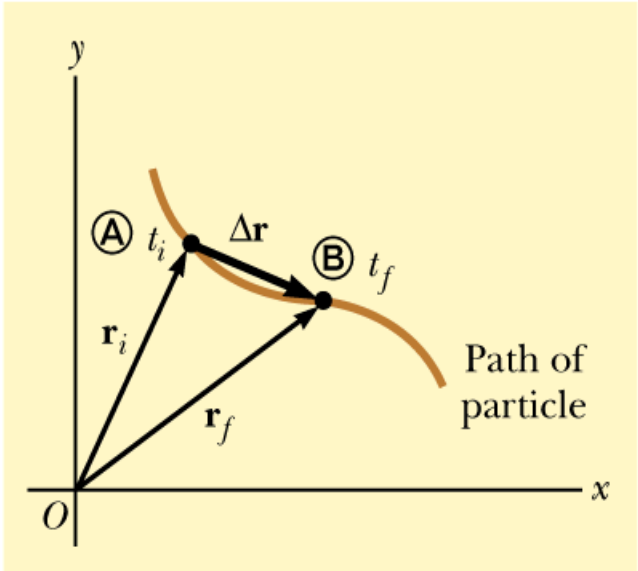

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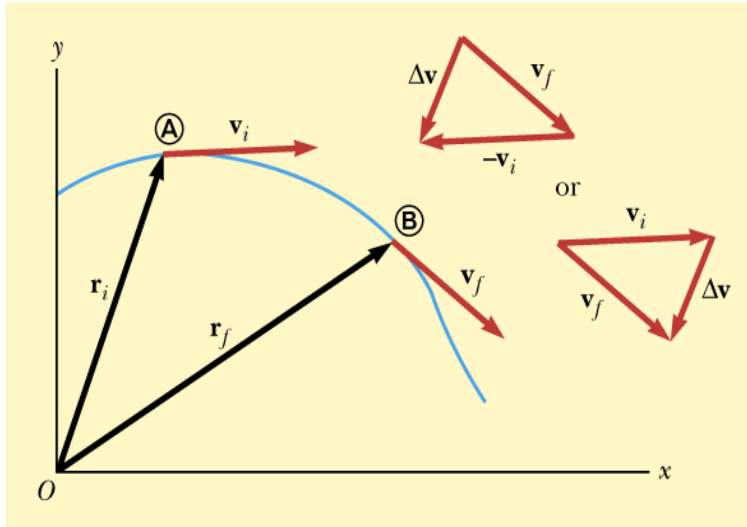
Figure 4.3



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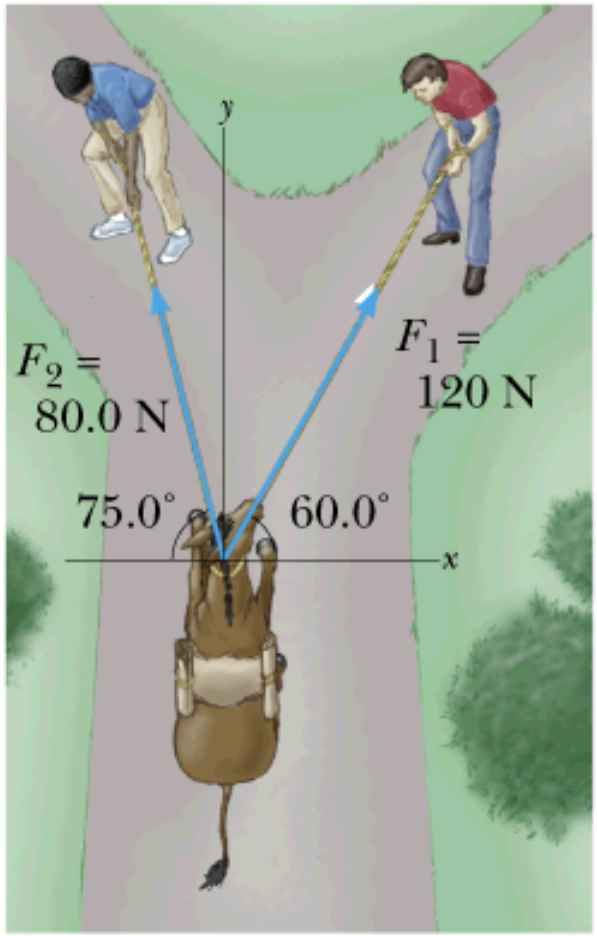
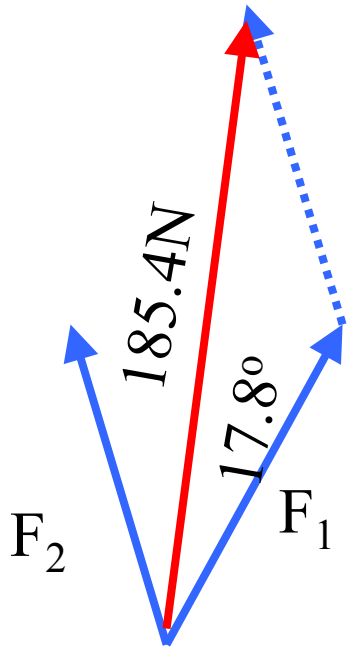
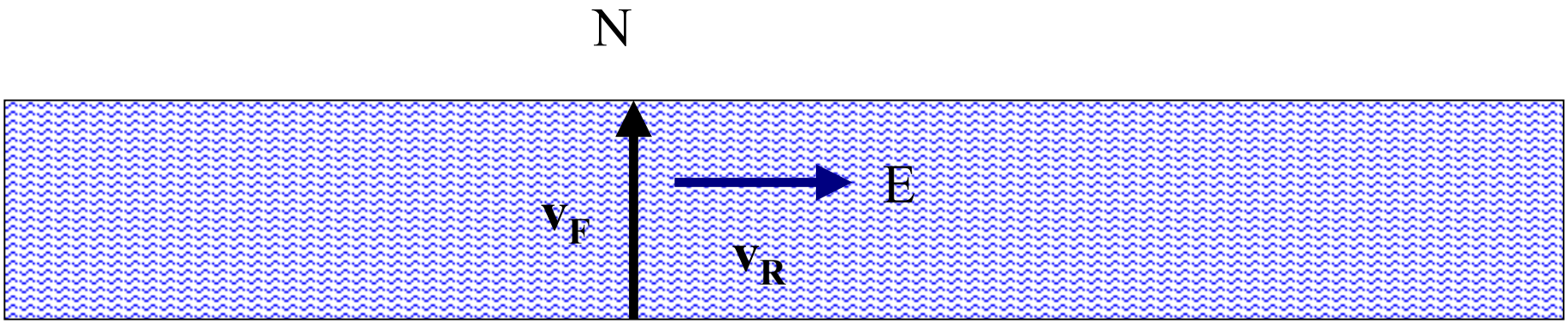
Problem 3.37





Peer instruction question



Suppose a Ferry moves due *north* at $\mathbf{v_F}$=4m/s across a river which is flowing *east* at a velocity of $\mathbf{v_R}$=3m/s. What is the velocity of the Ferry relative to the water?

(a)4m/s (north) (b) 7m/s 37^O(east of north)

(c) 5m/s 37^O(east of north) (d) 5m/s (west of north)