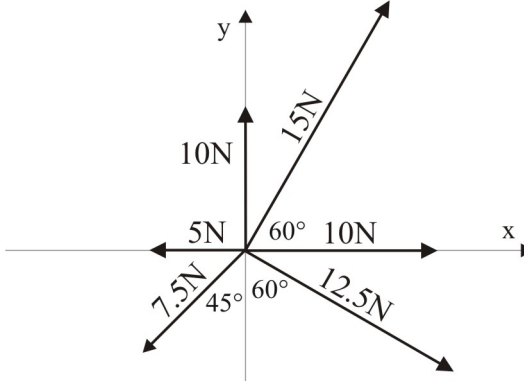
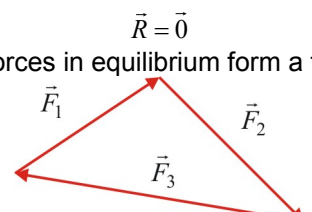
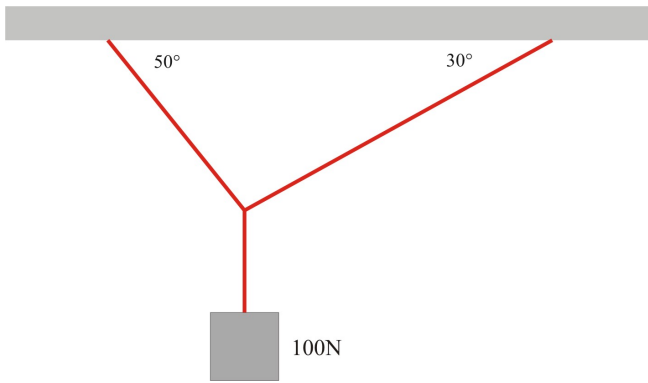


**7.1 Vectors as Forces**

<p><b>A Vector Force</b> The force is a vector and the measurement unit is N (Newton).</p>	<p><b>B Resultant Force</b> The vector sum of a system of forces is called resultant. <math>\vec{R} = \vec{F}_1 + \vec{F}_2 + \dots + \vec{F}_n</math></p>
<p>Ex 1. Two forces are applied to a boat <math>\vec{F}_1 = 1000N[N30^\circ E]</math> and <math>\vec{F}_2 = 2000N[E]</math>. Find the resultant force (magnitude and direction).</p>	
<p><b>C Algebraic Resultant Force</b> The scalar components of the resultant force are given by:</p> $R_x = F_{1x} + F_{2x} + \dots + F_{nx}$ $R_y = F_{1y} + F_{2y} + \dots + F_{ny}$ <p>The magnitude and the direction of the resultant force are given by:</p> $\ \vec{R}\  = \sqrt{R_x^2 + R_y^2}$ $\tan \theta = \frac{R_y}{R_x}$	<p>Ex 2. Find the resultant of the following system of forces (magnitude and direction).</p> 
<p><b>D Equilibrium</b> A system of forces is the state of equilibrium if the resultant force is <math>\vec{0}</math>.</p> <p>Note. Three forces in equilibrium form a triangle.</p>  <p>Consequently:</p> <ol style="list-style-type: none"> <li>the forces are coplanar</li> <li>the largest magnitude is less or equal to the sum of the other two magnitudes</li> </ol>	<p>Ex 3. Find if a system of three forces with <math>\ \vec{F}_1\  = 12</math>, <math>\ \vec{F}_2\  = 3</math> and <math>\ \vec{F}_3\  = 5</math> may be in equilibrium.</p>

Ex 4. Find the tensions in each string such that the body is at equilibrium.



Method #1 (using geometric vectors)

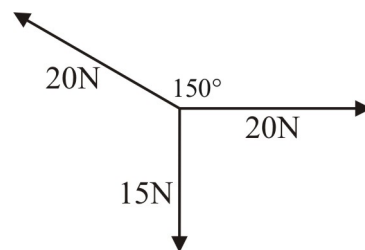
Method #2 (using scalar components)

### E Equilibrant Force

The equilibrant force is the vector force  $\vec{E}$  required to be added to a system of forces with a resultant force  $\vec{R}$  such that the new system of forces is at equilibrium.

$$\vec{R} + \vec{E} = \vec{0}$$

Ex 5. Find an equilibrant for the following system of forces.



**Reading:** Nelson Textbook, Pages 352-362

**Homework:** Nelson Textbook: Page 362 #2, 5a, 6ac, 8, 9, 11, 12, 13, 15, 16, 19