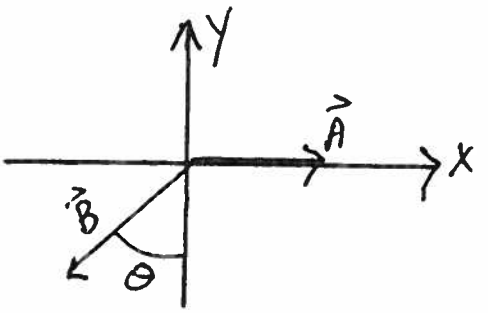
1. (20 Points) There are three vectors, $\vec{A}$, $\vec{B}$ and $\vec{C}$. The vectors $\vec{A}$ and $\vec{B}$ have known lengths A and B. The vector $\vec{A}$ lies along the x axis and $\vec{B}$ is at the known angle θ shown below. What must be the components of the vector $\vec{C}$ in order for the sum of the three vectors to be zero?



Law or Definition

Application

Result

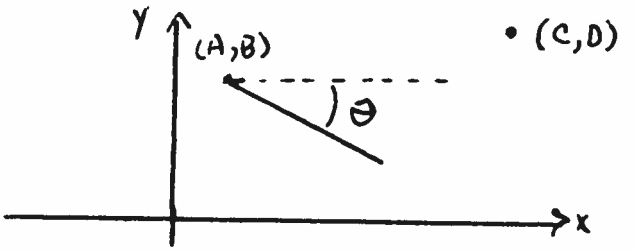
2. (30 Points) A block is attached to the wall by some complicated spring-like device. It starts at the point $x = A$ at time $t = 0$ moving to the right with a velocity whose magnitude varies with time according to $v(t) = c_1 t - c_2 t^2$ where c_1 and c_2 are known constants. How far will it travel before starting back to the left?

Law or Definition

Application

Result

3. (25 Points) This problem is continued in Problem 4. Two robots are placed at rest in the horizontal x,y plane: robot #1 at the point (A,B) and the robot #2 at the point (C,D). At $t = 0$ they begin to move. The first robot moves with a constant, known acceleration of magnitude k, for a known amount of time t_0 seconds, along the line at the known angle θ shown below. After t_0 seconds it has zero acceleration. Find its x and y coordinates at the time $t = t_0$ and its x coordinate as a function of time for any time greater than t_0.



Law or Definition

Application

Result

4. (25 Points) (The figure is shown in problem 3.) The second robot has an acceleration given by $\vec{a}_2 = \alpha t\vec{i} + \beta t^2\vec{j}$. Here α and β are constants but only α is known. Obtain the algebraic equations that could be solved for β in order for the two robots to collide, assuming the first robot has known coordinates $x_1(t)$ and $y_1(t)$.

Law or Definition

Application

Result