1) Suppose that \( \vec{C} = \vec{A} + \vec{B} \) and \( \vec{D} = \vec{A} - \vec{B} \)
   a. In general, show that \( C \leq A + B \) with a geometric argument.
   b. Write an expression for \( \vec{A} \cdot \vec{B} \) in terms of \( A, B \) and \( C \).
   c. Write an expression for \( \vec{A} \cdot \vec{B} \) in terms of \( C^2 \) and \( D^2 \).
   d. If \( C = A - B \), what must be true about the relative orientation of these three vectors? Draw a sketch to illustrate your answer. In this case what is \( D \) (i.e. the magnitude)?
   e. If \( C = A + B \), what must be true about the relative orientation of these three vectors?

2) Consider the vectors shown in Figure 1-1. Plot them out on graph paper:
   a. Graphically determine the magnitude and direction of: \( \vec{P} + \vec{Q} \)
   b. Graphically determine the magnitude and direction of: \( \vec{P} - \vec{Q} \)
   c. Determine the value of \( \vec{P} \cdot \vec{Q} \).

3) If John walks east 3km at a speed of 4km/hr and then runs west at a speed of 12km/hr for 2hr, what is his average velocity?

4) A car is initially traveling at a speed of 30km/hr. After it accelerates at a constant rate and travels a distance of 20km down the road, it is moving at a speed of 50km/hr.
   a. What is the acceleration of the car?
   b. How long does it take to cover the 20km?
5) Suppose that the acceleration versus time of a particle constrained to move on the x-axis is as shown in Figure 1-2. If at $t=0\,s$; $x=1\,m$ and $v_x=2\,m/s$, draw an accurate graph of:

a. The velocity versus time for the particle.

b. Where is the particle located at $t=8\,s$?

![Figure 1-2 Acceleration of a Particle](image-url)