

63. (a) We use coordinates with  $+x$  eastward and  $+y$  northward, and employ magnitude-angle notation which is well suited for computations with vector-capable calculators. Positive angles are measured counterclockwise from the  $+x$  axis (negative angles are clockwise). Length is in meters and time is in seconds. The mass of each piece is designated  $m$ . Thus, the conservation of momentum becomes

$$\begin{aligned}\vec{p}_0 &= \vec{p}_1 + \vec{p}_2 + \vec{p}_3 \\ \vec{p}_0 &= m(7.0 \angle 90^\circ) + m(4.0 \angle 210^\circ) + m(4.0 \angle -30^\circ) \\ \vec{p}_0 &= m(3.0 \angle 90^\circ)\end{aligned}$$

which implies that the velocity of the package had magnitude  $|\vec{p}|/(3m) = 1.0 \text{ m/s}$  and was directed north.

- (b) The center of mass proceeds at  $1.0 \text{ m/s}$  unaffected by the explosion. Its displacement during the  $3.0 \text{ s}$  interval is  $(1.0 \text{ m/s})(3.0 \text{ s}) = 3.0 \text{ m}$ . The displacement is directed north, in accordance with its velocity.