

## Cross product aerobics

(A) You see a friend trying to close a door by pushing on it with a force of 85 N at 60. degrees to the door, at a distance of 0.80 m from the hinge. You explain to him that if only he had taken PHY2048C he would know how to get the maximum turning effect. If the door is 1.0 m wide, what is the ratio of the maximum torque he can apply with this force compared to the torque he is applying?

(B) A particle of mass  $m = 0.20$  kg moves by an origin with a distance of closest approach of 0.30 m with a velocity of 2.5 m/s. What is its angular momentum relative to that origin?

Turn over...

(C) Recall that  $\mathbf{i}$ ,  $\mathbf{j}$  and  $\mathbf{k}$  are unit vectors along the x, y, and z axes, respectively. What is  $\mathbf{i} \times \mathbf{j}$ ? What is  $\mathbf{k} \times \mathbf{j}$ ? What is  $\mathbf{k} \times \mathbf{i}$ ?

(D) For the vectors shown below, can you find the angle between  $\mathbf{A}$  and  $\mathbf{B}$  using the dot product? What are the magnitude and direction of  $\mathbf{A} \times \mathbf{B}$ ? What are the magnitude and direction of  $\mathbf{B} \times \mathbf{A}$ ? What is  $\mathbf{A} \times \mathbf{A}$ ?

