

7. $v = 3i + 4j$, $w = 4i + 3j$
 8. $v = i$, $w = -3j$

8. $v = 3i - 4j$, $w = 4i - 3j$

9. $v = 4i$, $w = j$

10. Find a so that vectors $v = i - aj$ and $w = 2i + 3j$ are orthogonal.
 11. Find b so that vectors $v = i + j$ and $w = i + bj$ are orthogonal.

Problems 13–18, decompose v into two vectors v_1 and v_2 , where v_1 is parallel to w and v_2 is orthogonal to w .

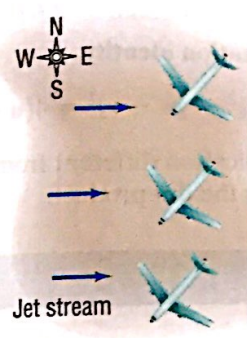
13. $v = 2i - 3j$, $w = i - j$
 14. $v = 2i - j$, $w = i - 2j$

14. $v = -3i + 2j$, $w = 2i + j$
 15. $v = i - j$, $w = i + 2j$

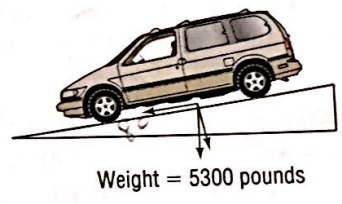
17. $v = 3i + j$, $w = -2i - j$

18. $v = i - 3j$, $w = 4i - j$

Finding the Actual Speed and Direction of an Aircraft
 A DC-10 jumbo jet maintains an airspeed of 550 miles per hour in a southwesterly direction. The velocity of the jet stream is a constant 80 miles per hour from the west. Find the actual speed and direction of the aircraft.



23. Braking Load A Toyota Sienna with a gross weight of 5300 pounds is parked on a street with a slope of 8° . See the figure. Find the force required to keep the Sienna from rolling down the hill. What is the force perpendicular to the hill?



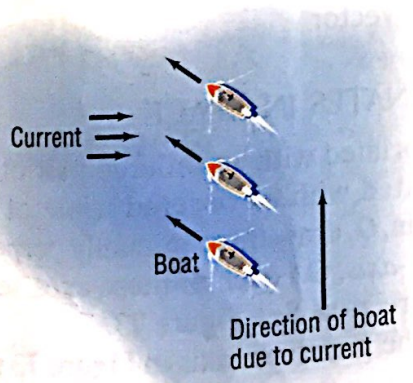
24. Braking Load A Pontiac Bonneville with a gross weight of 4500 pounds is parked on a street with a slope of 10° . Find the force required to keep the Bonneville from rolling down the hill. What is the force perpendicular to the hill?

20. Finding the Correct Compass Heading The pilot of an aircraft wishes to head directly east, but is faced with a wind speed of 40 miles per hour from the northwest. If the pilot maintains an airspeed of 250 miles per hour, what compass heading should be maintained? What is the actual speed of the aircraft?

25. Ground Speed and Direction of an Airplane An airplane has an airspeed of 500 kilometers per hour bearing $N45^\circ E$. The wind velocity is 60 kilometers per hour in the direction $N30^\circ W$. Find the resultant vector representing the path of the plane relative to the ground. What is the ground speed of the plane? What is its direction?

21. Correct Direction for Crossing a River A river has a constant current of 3 kilometers per hour. At what angle to a boat dock should a motorboat, capable of maintaining a constant speed of 20 kilometers per hour, be headed in order to reach a point directly opposite the dock? If the river is $\frac{1}{2}$ kilometer wide, how long will it take to cross?

26. Ground Speed and Direction of an Airplane An airplane has an airspeed of 600 kilometers per hour bearing $S30^\circ E$. The wind velocity is 40 kilometers per hour in the direction $S45^\circ E$. Find the resultant vector representing the path of the plane relative to the ground. What is the ground speed of the plane? What is its direction?



27. Crossing a River A small motorboat in still water maintains a speed of 20 miles per hour. In heading directly across a river (that is, perpendicular to the current) whose current is 3 miles per hour, find a vector representing the speed and direction of the motorboat. What is the true speed of the motorboat? What is its direction?

28. Crossing a River A small motorboat in still water maintains a speed of 10 miles per hour. In heading directly across a river (that is, perpendicular to the current) whose current is 4 miles per hour, find a vector representing the speed and direction of the motorboat. What is the true speed of the motorboat? What is its direction?

29. Computing Work Find the work done by a force of 3 pounds acting in the direction 60° to the horizontal in moving an object 2 feet from $(0, 0)$ to $(2, 0)$.

22. Correct Direction for Crossing a River Repeat Problem 21 if the current is 5 kilometers per hour.