Physics 122: Applications of Vectors

1. Find the acceleration of an object that goes from 15.0 m/s [S] to 15 m/s [W] in 2.0 seconds. {a = 10.6 m/s^2 [W45^{o}N]}

2. A car is initially moving 7.5 m/s [N]. After 3.0 seconds it is moving 10.0 m/s [E40^{o}N]. Calculate:
    a. The acceleration. {a = 2.57 m/s^2 [E8.1^{o}S]}
    b. The velocity after 6.0 s if the acceleration remains constant. {v_f = 16.2 m/s [E19^{o}N]}

3. What is the acceleration of a car that changes its velocity from 20.0 m/s [N] to 20.0 m/s [E45^{o}N] in a time of 5.00 s? {a = 3.06 m/s^2 [E23^{o}S]}

4. A 500 kg airplane in initially flying 200 m/s [E45^{o}N] turns such that after 7.00 s the velocity is 140 m/s [E]. Find:
    a. The acceleration. {a = 20.2 m/s^2 [W89^{o}S]}
    b. The average force acting during the turn. {F = 10100 N [W89^{o}S]}

5. What is the force required to change to change the velocity of a 1200 kg car from 26.0 m/s [E] to 30.0 m/s [E30^{o}S] in a time of 5.00 seconds? {F = 3600 N [S]}

6. Three forces act simultaneously on an object. One force is 10.0 N [N], the second is 15 N [W], and the third is 15.0 N [E60^{o}N]. Determine the net force? {F = 24.2 N [W72^{o}N]}

7. On a boat you are sailing 6.5 m/s [E20^{o}S]. A gust of wind provides an acceleration equal to 2.1 m/s^2 [E60^{o}N] for 18 seconds.
    a. What is your velocity after the 18 seconds? {v = 39.4 m/s [E51^{o}N]}
    b. What is the displacement in during that time? {d = 378 m [E42^{o}N]}

8. A glider is flying 9.2 m/s [E25^{o}N]. A gust of wind changes the glider's trajectory to 11 m/s [E14^{o}S] in 7.9 seconds.
    a. What was the acceleration of the glider? {a = 0.88 m/s^2 [E70^{o}S]}
    b. What was the displacement of the glider during that time? {d = 75 m [E3.7^{o}N]}
    c. What was the average force if the glider has a mass of 55 kg? {F = 48 N [E70^{o}S]]}

9. You are 37 km [W20^{o}N] from Miramichi and must move to a position 15 km due West of the city. What displacement is required?{d = 23 km [E31^{o}S]}

10. A coast guard boat (with a helicopter) is 75 km [E67^{o}N] from port. A distress call comes in from a fishing vessel located 93km [E26^{o}S] from port.
    a. How far is the fishing boat from the coast guard boat? {d = 122 km [E64^{o}S]}
    b. What is the minimum velocity of the helicopter to reach the boat in distress within 0.5 hours? {v = 244 km/s [E64^{o}S]}

11. On a day when the wind is 80.0 km/h [E], an airplane is aimed [E65^{o}N] and flown at a speed of 320 km/h. How far and in which direction will the plane fly in 0.33 hours? {d = 119 km [E53^{o}N]}

Physics 122: Applications of Vectors

12. A boat's heading is directly across a river at 5.0 km/h. The river is flowing east at 3.0 km/h.
    a. What is the velocity of the boat relative to someone standing on the dock where the boat departed? {v = 5.8 km/h [E53°N]}
    b. How far down stream does it land if the trip takes 0.5 h? {d_E = 1.5 km}
    c. How wide is the river? {d_N = 2.5 km}

13. On a day when the wind is blowing 70 km/h [W40°S] you wish to fly to a destination 830 km [E60°S] in 1.5 hours. What heading and speed should you fly your plane? {v = 545 km/h [E53°S]}

14. A river has a current of 6.0 m/s [E]. What speed must a boat be able to travel to go straight across the river when it is aimed 75° upstream? {v = 23.2 m/s}

15. It is a distance of 500 m straight east to get across a river. The river has a current of 3.7 m/s due south. You have a boat that can travel 10 m/s.
    a. Which way should you aim your boat to get directly across the river? {E22°N}
    b. How long will it take to cross the river? {54 s}

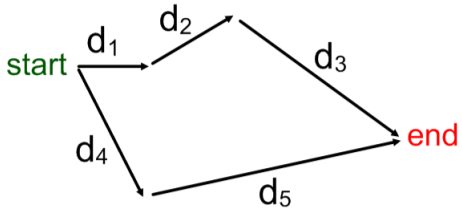
16. A boat can travel 7.5 m/s. Which way must it be aimed to travel directly across a river with a current of 3.6 m/s? {29° upstream}

17. ***Challenge***: A Canadian submarine is 185 km [E22°S] of Halifax. An enemy sub is spotted 425 km [E67°N] of Halifax. The enemy is heading directly towards Halifax at 45 km/h. What velocity is required for the Canadian submarine to intercept the enemy sub 200 km from Halifax? {v_{sub} = 54 km/h [W70°N]}

18. An object is moving 35 m/s [E40°N] and undergoes an acceleration of 3.7 m/s^2 [W10°N]. How much time is required for the displacement to be 609 m [W72°N]? {t = 20 s}

19. Given the information below, solve for the missing vector:

(diagram is not to scale)



d_1 = 7.5 m [E]

d_2 = 12 m [E25N]

d_3 = ?

d_4 = 24 m [E55S]

d_5 = 36 m [E20N]