**Find a + b, a - b, 4a + 5b, 4a - 5b, and ||a||.**

1. a = <2, -3>, b = <1, 4> 2. a = -<7, -2>, b = 4<-2, 1> 3. a = i + 2j, b = 3i - 5j

**Sketch vectors corresponding to a, b, a+b, 2a, and -3b.**

4. a = <-4, 6>, b = <-2, 3>5.a = <2, 0>, b = <-2, 0>



**Find the magnitude of the vector a and the smallest positive angle θ from the positive x-axis to the vector OP that corresponds to a.**

6. **a** = <-5, 0> 7. **a** = -4i + 5j 8. **a** = -18j

**The vectors a and b represent two forces acting at the same point, and θ is the smallest positive angle between a and b. Approximate the magnitude of the resultant force.**

9. ||a|| = 40 lb, ||b|| = 70 lb, θ = 45° 10. ||a|| = 2.0 lb, ||b|| = 8.0 lb, θ = 120°



**The magnitudes and directions of two forces acting at a point P are given in (a) and (b). Approximate the magnitude and direction of the resultant vector.**

11. (a) 90 lb, N75°W (b) 60 lb, S5°E 12. (a) 6.0 lb, 110° (b) 2.0 lb, (b) 215°



**Approximate the horizontal and vertical components of the vector that is described.**

13. A quarterback releases a football with a speed of 50 ft/sec at an angle of 35° with the horizontal.

14. A child pulls a sled through the snow by exerting a force of 20 pounds at an angle of 40° with the horizontal.

**Find a unit vector that has (a) the same direction as the vector a and (b) the opposite direction of the vector a.**

15. a = -8i + 15j 16. a = <2, -5>

17. Find a vector that has the same direction as <-6, 3> and

(a) twice the magnitude

(b) one-half the magnitude

18. Find a vector of magnitude 6 that has the opposite direction of a = 4i - 7j.

19. If forces F1, F2, ...Fn act at a point P, the net (or resultant) force F is the sum F1 + F2 + ... +Fn. If F = 0, the forces are said are said to be in equilibrium. The given forces act at the origin O of an xy-plane.

(a) Find the net force F. (b) Find an additional force G such that equilibrium occurs.

F1 = <-3, -1>, F2 = <0, -3>, F3 = <3, 4>

20. An airplane pilot wishes to maintain a true course in the direction of 250° with a ground speed of 400 mi/hr when the wind is blowing directly north at 50 mi/hr. Approximate the required airspeed and compass heading.



21. An airplane is flying in the direction 20° with an airspeed of 300 mi/hr. Its ground speed and true course are 350 mi/hr and 30°, respectively. Approximate the direction and speed of the wind.

22. The current in a river flows directly from the west at a rate of 1.5 ft/sec. A person who rows a boat at a rate of 4 ft/sec in still water wishes to row directly north across the river. Approximate, to the nearest degree, the direction in which the person should row.



23. For a motorboat moving at a speed of 30 mi/hr to travel directly north across a river, it must aim at a point that has the bearing N15°E. If the current is flowing directly west, approximate the rate at which it flows.

