

Axis Vectors

Represent each situation accurately before calculating. Draw and label all vectors, directions, angles, and resultants where appropriate.

Part A — Drawing Along the Axes

Draw each vector or sequence of vectors accurately. For multiple vectors, draw them head-to-tail.

1. Draw 10 m north.
2. Draw 15 m/s west.
3. Travel 1.0 m north and then 0.5 m south.
4. Travel 12 m east and then 25 m west.
5. Travel 150 km north and then 240 km west.
6. Travel 8.0 m west and then 10.0 m south.

Part B — Resultants Along the Axes

Draw the vectors head-to-tail. Draw the resultant from the starting point to the final position before calculating.

7. Travel 0.50 m south and then 1.20 m north. Determine the resultant displacement.
8. Travel 6.0 m east and then 8.0 m north.
 - a. Draw the two vectors head-to-tail.
 - b. Draw and label the resultant displacement. Do not calculate its magnitude.
9. Travel 19 m west and then 19 m south. Determine the resultant displacement.
10. Travel 145 m south and then 82 m west. Determine the resultant displacement.

Part C — Drawing a Single Angled Vector

Draw each vector accurately. Label the magnitude, direction, and angle.

11. Draw 150 m/s, 10° north of east.
12. Draw 11 m, 40° south of west.
13. Draw 24 m/s, 20° east of south.
14. Draw 5.3 m, 20° west of south.

Part D — Components of a Single Vector

For each vector: a) draw the vector; b) draw and label its horizontal and vertical components; Do not calculate their lengths.

15. Draw 20 m, 30° north of east.
16. 14 N, 45° north of east.
17. 910 m/s, 5.0° south of east.
18. 25 m/s, 22° north of west.

Part E — Components of a Single Vector

For each vector: a) draw the vector; b) draw and label its horizontal and vertical components; c) determine the magnitude and direction of each component.

19. Determine the components of 10 m, 30° east of south.
20. Determine the components of 15 m, 25° east of south.
21. Determine the components of 55 m, 15° west of south.

22. Determine the components of 1.6 m/s^2 , 33° west of north.
23. A skier travels 360 m down a slope angled 40.0° below the horizontal.
 - a. How far does the skier travel horizontally?
 - b. How far does the skier travel vertically?
24. A student rides up an escalator angled 25° above the horizontal. While the student moves 2.8 m horizontally, how far do they move vertically?
25. A ramp rises at 30° above the horizontal. The ramp rises 5.0 m vertically. How long is the ramp?
26. Katelyn drives down a 15° incline. If she descends 20.0 m vertically, how far does she drive along the incline?

Part F — Change Between Axis-Aligned Vectors

Draw the initial and final vectors from the same origin. Draw the change vector from the initial vector to the final vector before calculating.

27. An object is initially 6.0 m east of the origin and later 8.0 m north of the origin.
 - a. Draw both position vectors from the same origin.
 - b. Draw the displacement from the initial position to the final position. Do not calculate its magnitude.
28. An object's initial position is 3.0 m east of the origin. Its final position is 10.0 m west of the origin. Determine its displacement.
29. An object's initial position is 320 km east of the origin. Its final position is 110 km north of the origin. Determine its displacement.
30. A duck is initially swimming 20.0 cm/s east. Its velocity later changes to 20.0 cm/s south. Determine its change in velocity.
31. A car is initially travelling 15 m/s south. Its velocity later changes to 25 m/s west. Determine its change in velocity.

Part G — Relative Velocity Along the Axes

Draw the velocity vectors head-to-tail and draw the resultant velocity before calculating.

32. A swimmer moves east relative to the water while the current moves south relative to the shore.
 - a. Draw the swimmer's velocity relative to the water.
 - b. From its head, draw the current's velocity relative to the shore.
 - c. Draw the swimmer's resultant velocity relative to the shore.
 - d. Do not calculate.
33. An airplane travels 75 m/s north relative to the air while the wind blows 18 m/s west. Determine the airplane's speed relative to the ground.
34. Bob swims 2.6 m/s east relative to the water while the current moves 1.4 m/s south. Determine Bob's velocity relative to the shore.
35. A swimmer moves 6.2 km/h east relative to the water while the current moves 3.0 km/h south.
 - a. Determine the swimmer's velocity relative to the shore.
 - b. A floating log moves with the current. Determine the swimmer's speed relative to the log.
36. An aircraft flies 56 m/s south relative to the air and has a ground speed of 62 m/s . The wind blows from the east.
 - a. Determine the speed of the wind.
 - b. Determine the direction of the aircraft's path over the ground.