

Chapter 3 Test

Unless otherwise specified, express magnitude to the nearest tenth of a unit, and express direction to the nearest degree.

1. State whether the following quantities represent vectors or scalars.

- a) 18 m/s
- b) 9 m due west
- c) 18 words per min
- d) N30°E
- e) 100 N, 30° up from the horizontal

2. For each pair of words, identify which word is associated with vectors.

- a) mass, weight
- b) velocity, speed
- c) displacement, distance

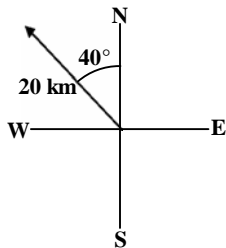
3. a) Express a true bearing of 200° as a quadrant bearing.

b) Express S45°E as a true bearing.

4. Is the following statement true or false?

Explain. *Opposite vectors are any vectors that are opposite in direction.*

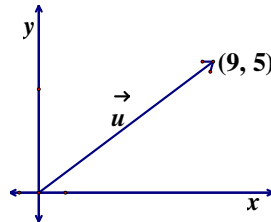
5. Describe in words the vector represented by the following diagram.



6. State the magnitude and direction of the resultant vector for each of the following.

- a) A bicyclist travels 100 km east then turns and goes 75 km west.
- b) A jet has an airspeed of 400 km/h due south, while there is a wind from the north at 50 km/h.

7. Vector \vec{u} is shown on the diagram.



a) State the magnitude of vector \vec{u} , to the nearest tenth of a unit.

b) If vector \vec{u} was moved so that its tail was at $(-2, 3)$, what would be the coordinates of its tip?

c) If the tail of $-\vec{u}$ was at $(6, 7)$, what would be the coordinates of its tip?

8. A jogger runs 8 km east, then turns north and runs another 6 km.

a) Show this information on a diagram.

b) Determine the magnitude of the resultant displacement.

c) Determine the direction of the resultant displacement.

9. A vehicle travels 30 km east, then 20 km north, and then 8 km west.

a) Show this information on a diagram.

b) Determine the magnitude of the resultant displacement.

c) Determine the direction of the resultant displacement as a quadrant bearing.

10. A jet takes off travelling 400 km/h at an angle of 20° from the ground.

a) What is the horizontal component of the jet's velocity, to the nearest kilometre per hour?

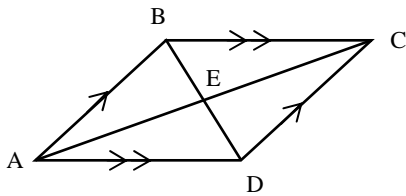
b) Determine the height of the jet, to the nearest metre, after being in the air for 1 min.



11. A helicopter flies from Toronto to Barrie, a distance of 90 km, in 45 min. It then flies to Peterborough, a distance of 16 km, in 75 min. Finally, the helicopter returns to Toronto, travelling 140 km in 60 min.
- Calculate the helicopter's average speed during the entire trip, to the nearest kilometre per hour.
 - What is the average velocity for the trip? Explain.

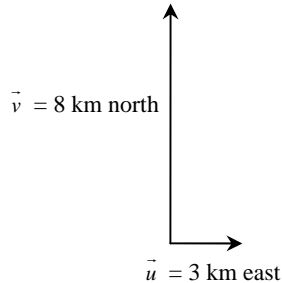
12. A skateboarder with a mass of 1800 N is moving down a ramp inclined at 15° to the horizontal.
- Determine the magnitude of the force that the skateboarder exerts perpendicular to the ramp.
 - Determine the amount of the force causing the skateboarder to move parallel to the surface of the ramp.

13. Parallelogram ABCD is shown below. Write a single vector that is equivalent to each of the given expressions.



- $\overline{AB} + \overline{AD}$
- $\overline{AE} + \overline{BE}$
- $\overline{AC} - \overline{BC}$
- $\overline{AB} + \overline{BD} - \overline{BC}$

14. For the vectors \vec{u} and \vec{v} in the diagram shown, answer the following questions.



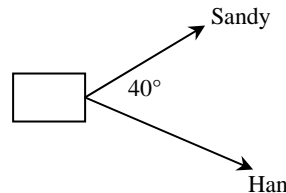
- Draw the resultant, $\vec{u} + \vec{v}$.
- What is the magnitude of $\vec{u} + \vec{v}$?
- What is the direction of $\vec{u} + \vec{v}$, expressed as a true bearing?

15. Describe the conditions for which $|\vec{u} + \vec{v}| = |\vec{u}| + |\vec{v}|$ would be true.

16. A ship has a speed of 20 km/h. There is a current from the west of 5 km/h.
- Show this information on a diagram.
 - How long would it take the ship to travel to a port 100 km due north?
 - What heading must the ship take in order to travel due north?

17. A baseball player is running east at a velocity of 14 km/h. She throws a ball with a velocity of 50 km/h in the direction $N75^\circ E$.
- Show this information on a diagram.
 - Determine the magnitude and direction of the resultant velocity of the ball.

18. Sandy and Han are using ropes to pull a wagon, as shown in the diagram. Sandy is pulling with a force of 80 N. Han is pulling with a force of 120 N.



- Determine the magnitude of the resultant force.
 - Determine the direction of the resultant force, relative to the direction of the force being applied by Han.
19. The mass of a lawnmower exerts a force of 150 N. The mower is being pushed with a force of 80 N, 30° down from the horizontal.
- Determine the horizontal and vertical components of the resultant force, to the nearest newton.
 - The mower was pulled with the same force and at an angle 30° up from the horizontal. What effect would this change have on the horizontal and vertical components of the resultant force? Would it now be easier or more difficult to move the mower? Explain.

