
1. Consider the four vectors

\[ u = 2i - 6j + 4k \]
\[ v = i + j + k \]
\[ w = -i - 2j + 3k \]
\[ r = -i + 3j - 2k \]

(a) Which of them is shortest? What is its length?
(b) Which of the four vectors are parallel to each other?
(c) Which of the four vectors are perpendicular to each other?


3. Suppose you have a nautical chart with squares whose sides are each 1 nautical mile. As usual, north is up, east is right, etc. A ship at position (1,0) sights an iceberg at position (2,4).

(a) What is the vector giving the displacement from ship to iceberg?
(b) What angle \( \theta \) does this vector make with due north? (This is called the bearing of the iceberg from the ship.)
(c) Suppose the ship is pointing north and travelling at 4 knots per hour. (1 knot is 1 nautical mile per hour.) What is its velocity vector?
(d) Now suppose there is a current flowing due east at 1 knot. What is the velocity vector of the current?
(e) With the current, what is the velocity vector of the ship (relative to the sea floor)?
(f) Should the ship change its course?

4. A calculus professor records student grades as vectors

\[ G = (HW, \text{Exam1, Exam2, FinalExam}) \]

with each component having a value 0−100. Using our rule for computing final grades, write a vector \( W \), such that \( G \cdot W \) gives the correct cumulative (i.e. weighted) score with value 0 − 100. From past experience, what vector \( W \) would you prefer?