

Math 150 Week-in-Review 10 Problem Set

(Problem 15 was taken from *Precalculus: Functions and Graphs* by Swokowski/Cole)

1. A vector \mathbf{v} has initial point $(2, 3)$ and terminal point $(-1, 7)$.
 - (a) What is \mathbf{v} ?
 - (b) What is $|\mathbf{v}|$?
2. Let $\mathbf{u} = \langle 4, -2 \rangle$ and $\mathbf{v} = \langle 1, 6 \rangle$.
 - (a) Evaluate $3\mathbf{u} - 2\mathbf{v}$.
 - (b) Evaluate $|-2\mathbf{u} + \mathbf{v}|$.
 - (c) If $-4\mathbf{u} + 5\mathbf{w} = -21\mathbf{i} + 23\mathbf{j}$, what is the vector \mathbf{w} ?
3. If $|\mathbf{v}| = 3$ and $\theta = 210^\circ$, what is the vector \mathbf{v} in component form?
4. Find the direction of the vector $\mathbf{u} = \langle \frac{\sqrt{3}}{3}, -\frac{1}{3} \rangle$.
5. A boat is traveling at 15 mi/hr with a bearing of S 30° W relative to the water. The water is flowing due north at 3 mi/hr.
 - (a) What is the true velocity of the boat?
 - (b) What is the true speed of the boat?
 - (c) What is the true bearing of the boat?
6. An airplane pilot is trying to get to a destination which is at a bearing of S 60° E from the airport. He wants to maintain a true speed of 300 mi/hr. The wind is blowing N 45° W at 40 mi/hr. In what direction should he head the plane and at what speed?
7. Find the dot product of the following pairs of vectors.
 - (a) $\mathbf{u} = \langle -4, 7 \rangle$ and $\mathbf{v} = \langle 3, 5 \rangle$
 - (b) $\mathbf{u} = -2\mathbf{i}$, $\mathbf{v} = 10\mathbf{i} - 13\mathbf{j}$
8. Find the angle between the vectors $\mathbf{u} = \langle -1, \sqrt{3} \rangle$ and $\mathbf{v} = \langle -\sqrt{3}, -3 \rangle$. Are these vectors orthogonal?
9. Let $\mathbf{u} = -9\mathbf{i} + 5\mathbf{j}$ and $\mathbf{v} = a\mathbf{i} - 6\mathbf{j}$. Find the value of a that would make these vectors orthogonal.
10. Find a unit vector that has the same direction as the vector $\langle -3, 1 \rangle$.
11. For the vectors $\mathbf{u} = 2\mathbf{i} - 5\mathbf{j}$ and $\mathbf{v} = 3\mathbf{i} + \mathbf{j}$, evaluate:
 - (a) the component of \mathbf{u} along \mathbf{v} .
 - (b) the component of \mathbf{v} along \mathbf{u} .
12. Find $\text{proj}_{\mathbf{v}}\mathbf{u}$ for the vectors $\mathbf{u} = \langle 1, 9 \rangle$ and $\mathbf{v} = \langle -7, 2 \rangle$.
13. Find the work done in moving an object from the point $(3, 7)$ to the point $(6, -2)$ with a constant force of $\mathbf{F} = 8\mathbf{i} - \mathbf{j}$.

14. A person pushes a vacuum cleaner across a level floor by exerting a force of 25 pounds. The vacuum cleaner makes an angle of 30° with the ground. Find the work done in pushing the vacuum 30 feet.

15. Solve the following systems of equations.

$$(a) \begin{cases} x^2y = 20 \\ x^2 + y = 9 \end{cases}$$

$$(b) \begin{cases} 7x - 8y = 9 \\ 4x + 3y = -10 \end{cases}$$

16. The sum of two numbers is 4 and the sum of their squares is 40. What are the two numbers?