

## 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  $\mathbf{w}$ ?



6. An airplane pilot is trying to get to a destination which is at a bearing of S  $60^\circ$  E from the airport. He wants to maintain a true speed of 300 mi/hr. The wind is blowing N  $45^\circ$  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  $30^\circ$  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?