

3-5

November 9, 2025

In Exercises 1-2, let  $\mathbf{u} = (3, 2, -1)$   $\mathbf{v} = (0, 2, -3)$  , and  $\mathbf{w} = (2, 6, 7)$  .  
Compute the indicated vectors.

1 c)

$$(\mathbf{u} + \mathbf{v}) \times \mathbf{w}$$

d)

$$\mathbf{v} \cdot (\mathbf{v} \times \mathbf{w})$$

In Exercises 7-8, use the cross product to find a vector that is orthogonal to both  $\mathbf{u}$  and  $\mathbf{v}$ .

**7**

$$\mathbf{u} = (-6, 4, 2), \mathbf{v} = (3, 1, 5)$$

In Exercises 9-10, find the area of the parallelogram determined by the given vectors  $\mathbf{u}$  and  $\mathbf{v}$ .

**9**

$$\mathbf{u} = (1, -1, 2), \mathbf{v} = (0, 3, 1)$$

In Exercises 11-12, find the area of the parallelogram with the given vertices.

**11**

$$P_1(1, 2) \ P_2(4, 4) \ P_3(7, 5) \ P_4(4, 3)$$

In Exercises 15-16, find the area of the triangle in 3-space that has the given vertices.

**15**

$$P_1(2, 6, -1) \ P_2(1, 1, 1) \ P_3(4, 6, 2)$$

In Exercises 17-18, find the volume of the parallelepiped with sides  $\mathbf{u}$ ,  $\mathbf{v}$ , and  $\mathbf{w}$ .

**17**

$$\mathbf{u} = (2, -6, 2), \mathbf{v} = (0, 4, -2), \mathbf{w} = (2, 2, -4)$$

In Exercises 19-20, determine whether  $\mathbf{u}$ ,  $\mathbf{v}$ , and  $\mathbf{w}$  lie in the same plane when positioned so that their initial points coincide.

**19**

$$\mathbf{u} = (-1, -2, 1), \mathbf{v} = (3, 0, -2), \mathbf{w} = (5, -4, 0)$$

In Exercises 21-24, compute the scalar triple product  $\mathbf{u} \cdot (\mathbf{v} \times \mathbf{w})$ .

**21**

$$\mathbf{u} = (-2, 0, 6), \mathbf{v} = (1, -3, 1), \mathbf{w} = (-5, -1, 1)$$

## Answers

1. (a)  $(32, -6, -4)$  (b)  $(-32, 6, 4)$  (c)  $(52, -29, 10)$  (d)  $0$  (e)  $(0, 0, 0)$  (f)  $(0, 0, 0)$
3.  $\|\mathbf{u} \times \mathbf{w}\|^2 = 1125$
5.  $\mathbf{u} \times (\mathbf{v} \times \mathbf{w}) = (-14, -20, -82)$
7.  $\mathbf{u} \times \mathbf{v} = (18, 36, -18)$
9.  $\sqrt{59}$
11. 3
13. 7
15.  $\frac{\sqrt{374}}{2}$
17. 16
19. The vectors do not lie in the same plane.
21. -92