1. What is the norm of the vector v = (11, -2, 7)?
2. 174
3. 147

**EXPLANATION:**

Given vector v in R3, the norm of the vector v is

||v|| =

Applying the formula to the problem:

||v|| =

||v|| =

1. Evaluate: k × (-3j × 2j)
2. i
3. j
4. k

→

1. 0

**EXPLANATION:**

k × (-3j × 2j)

k × (-3)( j × 2j)

k × (-3)(2)( j × j)

→

k × (-6)(0)

→

k × 0

→

0

1. What is the graph of the vector v = (1, -1, 4)?



6. Let u be a zero vector and v be a nonzero vector. What is the vector component of u orthogonal to v?
7. -projvu
8. projvu
9. -v
10. v

**EXPLANATION:**

The vector component of u orthogonal to v is (u - projvu), where projvu is the orthogonal projection of u onto v.

Since u is a zero vector, then

u - projvu = (0, 0) - projvu

= -projvu

1. Let P = (-8, 5) and Q = (0, 7). What is the midpoint of segment PQ?
2. (-8, 12)
3. (-4, 6)
4. (8, -12)
5. (4, -6)

**EXPLANATION:**

The midpoint M of any segment is:

M = ½ (P + Q)

By substitution,

M = ½ ((-8, 5) + (0, 7))

M = ½ (-8, 12)

M = (-4, 6)

1. What is the component of the vector with an initial point (12, -9) and terminal point (-2, -3)?
2. (14, -6)
3. (10, -12)
4. (-14, -12)
5. (-24, 27)

**EXPLANATION:**

→

The component of a vector PQ in R2 is (x2 – x1, y2 – y1) --> terminal point minus initial point.

= (-2 – 12, -3, – 9)

= (-14, -12)

1. Which of the following is NOT true?
2. The cross product is associative.
3. The zero vector in Rn is orthogonal to all vectors in Rn.
4. The dot product is also known as Euclidean inner product.
5. The distance between u & v is 0 iff. u = v.

**EXPLANATION:**

By Theorem 5.1,

u × (v × w) = (u ⋅ w)(v) - (u ⋅ v)(w)

(u × v) × w = (u ⋅ w)(v) - (v ⋅ w)(u)

Thus, u × (v × w) ≠ (u × v) × w.

1. Let a = (-2, 7, 9, -4) and b = (5, 0, -3, 8). What is -a – 3b?
   1. (-13, -7, 0, -20)
   2. (17, -7, -18, 28)
   3. (-13, 7, 0, -20)
   4. (-17, 7, 18, -28)

**EXPLANATION:**

-a – 3b = -(-2, 7, 9, -4) – 3(5, 0, -3, 8)

= (2, -7, -9, 4) + (-15, 0, 9, -24)

= (-13, -7, 0, -20)

1. Which of the following pairs of planes are orthogonal?
2. 3z + 7y = x - 3 and 2x - 6z - 14y = 4
3. 8y = z - 2x + 5 and 6x + 2y = 2 + 3z
4. 15z - 1 = 3y + 3x and y = x - 5z + 4
5. 8x - 1 = 7z - 9y and 3x - 3z = 5y – 10

**EXPLANATION:**

Two planes are orthogonal if they have orthogonal vectors. Two vectors are orthogonal if their dot product is 0. 8x - 1 = 7z - 9y and 3x - 3z = 5y - 10 normal vectors are n1 = (8, 9, -7) and n2 = (3, -5, -3) (defined by the numerical coefficients of the plane equation).

Solving for their dot products:

n1  ⋅ n2 = (8)(3) + (9)(-5) + (-7)(-3)

n1  ⋅ n2 = 0

1. What is the distance between point (6, -8) and the line 7y - x + 4 = 12
2. 10
3. 12
4. 14
5. 16

**EXPLANATION:**

The distance between the point and a line is

D =

where (x0, y0) is the point and a, b, and c are the coefficients of the line ax + by + c = 0.

Note that

x0 = 6

y0 = -8

a = -1

b = 7

c = -8

By substitution,

D = ≈ 9.89949… ≈ 10

1. Let u = (2, 0, -7) and v = (1, -10, 8). What is -(v × u)?
2. (70, 9, -20)
3. (70, 23, -20)
4. (-70, -23, -20)
5. (-70, -9, -20)

**EXPLANATION:**

Note that -(v × u) = u × v.

The cross product of u and v is

u × v =

u × v = ([0 – (-7)(-10)], -[(2)(8) – (-7)(1)], [(2)(-10) – (0)(1)])

u × v = (-70, -23, -20)

1. What is the angle between the planes x + 6z – 1 – 4y = 0 and 2 = 3y – 8x + z = 2?
   1. 90°
   2. 77.08°
   3. 62.3°
   4. 106.49°

**EXPLANATION:**

The angle between two planes is determined by their normal vectors. Let n1 = (1, -4, 6) and n2 = (-8, 3, 1).

The angle θ between two planes is:

θ = cos-1

θ = cos-1

θ ≈ 77.08

1. If i = (1, 0, 0), j = (0, 1, 0), and k = (0, 0, 1), what is (i + j + k) 2k?
   1. 0
   2. 1
   3. 2
   4. 3

**EXPLANATION:**

(i + j + k) 2k = [(1, 0, 0) + (0, 1, 0) + (0, 0, 1)] 2(0, 0, 1)

= (1, 1, 1) (0, 0, 2)

= 2

1. A plane passes through point (13, -7, 3) and is orthogonal to vector n = (-1, -5, 2). Determine the z-intercept of the plane.
   1. (0, 0, 14)
   2. (0, 0, -28)
   3. (0, 0, -14)
   4. (0, 0, 28)

**EXPLANATION:**

The point-normal equation of the plane is

a(x – x0) + b(y – y0) + c(z – z0) = 0

Let P0 = (x­0, y0, z­0) = (13, -7, 3) and the normal vector n = (a, b, c) = (-1, -5, 2).

By substitution,

-1(x – 13) - 5(y + 7) + 2(z - 3) = 0

-x + 13 – 5y – 35 + 2z – 6 = 0

-x – 5y + 2z – 28 = 0

To find the z-intercepts of the plane, set the value of x and y as 0 and solve for z.

0 – 5(0) + 2z – 28 = 0

2z = 28

z = 14

Thus, z-intercept: (0, 0, 14)