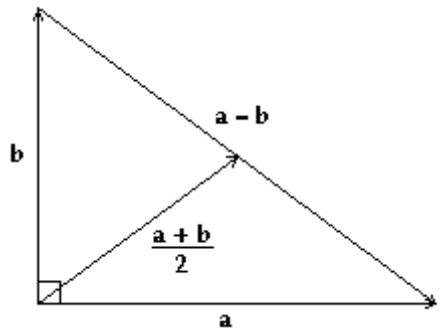
Exam

Name_____

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Solve the problem.

1) Show that the midpoint of the hypotenuse of a right triangle is equidistant from all three vertices. [Hint: See the figure below. Show that $\left|\frac{\mathbf{a}+\mathbf{b}}{2}\right| = \left|\frac{\mathbf{a}-\mathbf{b}}{2}\right|$.] 1) _____

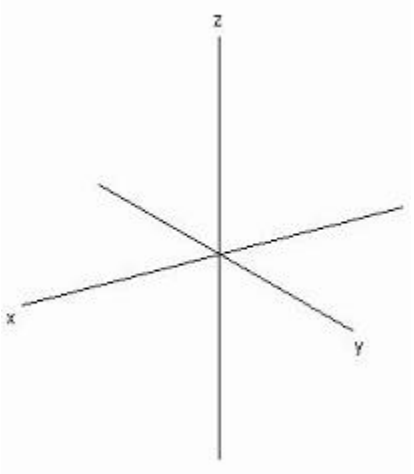


Determine whether the following is always true or not always true. Given reasons for your answers.

2) $(\mathbf{u} \times \mathbf{v}) \cdot \mathbf{v} = \mathbf{u} \cdot (\mathbf{u} \times \mathbf{v})$ 2) _____

Sketch the given surface.

3) $x^2 + y^2 = 4$ 3) _____



Determine whether the following is always true or not always true. Given reasons for your answers.

4) $\mathbf{u} \times (\mathbf{v} + \mathbf{w}) = \mathbf{u} \times \mathbf{v} + \mathbf{u} \times \mathbf{w}$ 4) _____

Solve the problem.

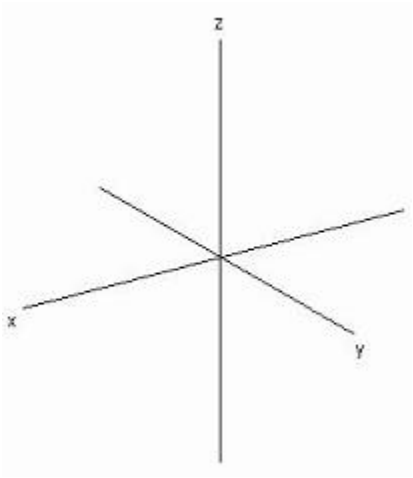
5) Show that $\mathbf{A} = a\mathbf{u} + b\mathbf{v}$ is orthogonal to $\mathbf{B} = b\mathbf{u} - a\mathbf{v}$, where $\mathbf{u}$ and $\mathbf{v}$ are orthogonal unit vectors. 5) _____

Determine whether the following is always true or not always true. Given reasons for your answers.

6) $(\mathbf{u} \times \mathbf{v}) \cdot \mathbf{w} = \mathbf{u} \cdot (\mathbf{w} \times \mathbf{v})$ 6) _____

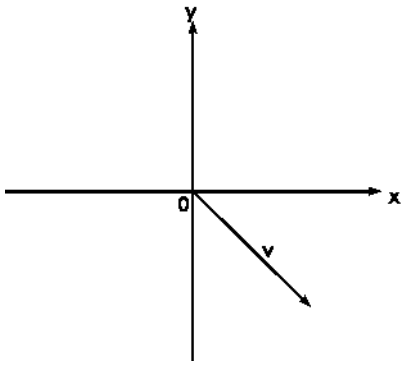
Sketch the given surface.

7) $x^2 + y^2 = z^2$ 7) _____



Solve the problem.

8) Shade in the points (x, y) for which $(x\mathbf{i} + y\mathbf{j}) \cdot \mathbf{v} \geq 0$. Justify your answer. 8) _____

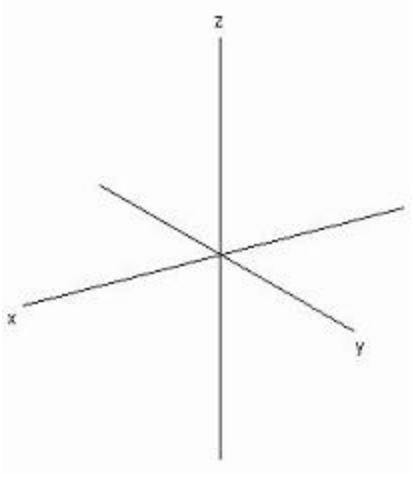


Determine whether the following is always true or not always true. Given reasons for your answers.

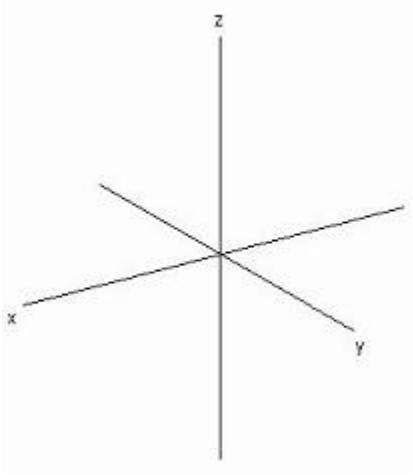
9) $(\mathbf{u} \times \mathbf{v}) \cdot \mathbf{v} = 0$ 9) _____

Sketch the given surface.

10) $x = 1 - y^2 - z^2$ 10) _____



11) $z = x^2 + 4y^2$ 11) _____



Determine whether the following is always true or not always true. Given reasons for your answers.

12) $c(\mathbf{u} \times \mathbf{v}) = c\mathbf{u} \times c\mathbf{v}$ (any number c) 12) _____

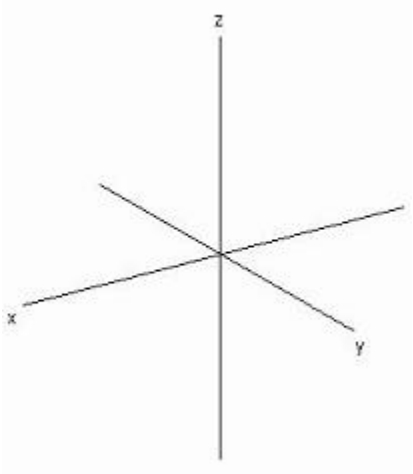
Sketch the coordinate axes and then include the vectors A, B, and A × B as vectors starting at the origin.

13) $\mathbf{u} = 2\mathbf{i} + \mathbf{j}$, $\mathbf{v} = \mathbf{i} - 2\mathbf{j}$ 13) _____

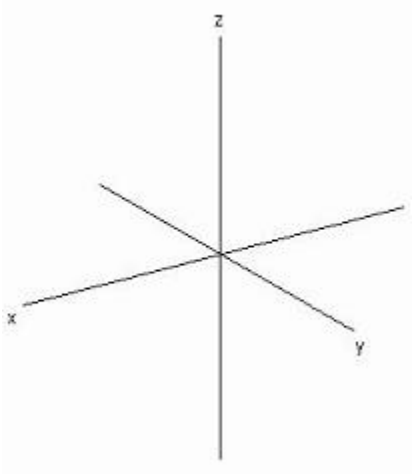
14) $\mathbf{u} = \mathbf{i} - \mathbf{j}$, $\mathbf{v} = \mathbf{k}$ 14) _____

Sketch the given surface.

15) $y = x^2$ 15) _____



16) $16x^2 + y^2 + z^2 = 16$ 16) _____



Determine whether the following is always true or not always true. Given reasons for your answers.

17) $\mathbf{u} \times \mathbf{v} = -(\mathbf{v} \times \mathbf{u})$ 17) _____

Solve the problem.

18) Show that the vectors $|\mathbf{a}|\,\mathbf{b} + |\mathbf{b}|\,\mathbf{a}$ and $|\mathbf{a}|\,\mathbf{b} - |\mathbf{b}|\,\mathbf{a}$ are orthogonal. 18) _____

Sketch the coordinate axes and then include the vectors A, B, and A × B as vectors starting at the origin.

19) $\mathbf{u} = \mathbf{i} + \mathbf{k}$, $\mathbf{v} = \mathbf{i} - \mathbf{k}$ 19) _____

Determine whether the following is always true or not always true. Given reasons for your answers.

20) $|\mathbf{u}| = \sqrt{\mathbf{u} \cdot \mathbf{u}}$ 20) _____

21) $c(\mathbf{u} \cdot \mathbf{v}) = c\mathbf{u} \cdot c\mathbf{v}$ (any number c) 21) _____

Solve the problem.

22) The unit vectors **u** and **v** are combined to produce two new vectors $\mathbf{a} = \mathbf{u} + \mathbf{v}$ and $\mathbf{b} = \mathbf{u} - \mathbf{v}$. Show that **a** and **b** are orthogonal. Assume $\mathbf{u} \neq \mathbf{v}$. 22) _____

Determine whether the following is always true or not always true. Given reasons for your answers.

23) $\mathbf{u} \times \mathbf{0} = \mathbf{0}$ 23) _____

Sketch the coordinate axes and then include the vectors A, B, and A × B as vectors starting at the origin.

24) $\mathbf{u} = \mathbf{i}$, $\mathbf{v} = \mathbf{k}$ 24) _____

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Find the triple scalar product (u x v) • w of the given vectors.

25) $\mathbf{u} = 2\mathbf{i} - 4\mathbf{j} + 3\mathbf{j}$; $\mathbf{v} = -4\mathbf{i} - 6\mathbf{j} + 4\mathbf{k}$; $\mathbf{w} = 9\mathbf{i} - 7\mathbf{j} + 3\mathbf{k}$ 25) _____

A) 140 B) –74 C) 458 D) 74

Find the vector $\text{proj}_{\mathbf{v}}\,\mathbf{u}$.

26) $\mathbf{v} = 7\mathbf{i} - 3\mathbf{j} + \mathbf{k},\ \mathbf{u} = -4\mathbf{j} + 3\mathbf{k}$ 26) _____

A) $-\frac{60}{59}\mathbf{j} + \frac{45}{59}\mathbf{k}$

B) $\frac{21}{5}\mathbf{i} - \frac{9}{5}\mathbf{j} + \frac{3}{5}\mathbf{k}$

C) $-\frac{12}{5}\mathbf{j} + \frac{9}{5}\mathbf{k}$

D) $\frac{105}{59}\mathbf{i} - \frac{45}{59}\mathbf{j} + \frac{15}{59}\mathbf{k}$

Find $\mathbf{v} \cdot \mathbf{u}$.

27) $\mathbf{v} = \left\langle \frac{1}{\sqrt{3}}, \frac{1}{\sqrt{11}} \right\rangle$ and $\mathbf{u} = \left\langle \frac{1}{\sqrt{3}}, \frac{-1}{\sqrt{11}} \right\rangle$ 27) _____

A) $\frac{1}{3} - \frac{1}{11}$ B) 0 C) $\frac{1}{3}\mathbf{i} - \frac{1}{11}\mathbf{j}$ D) $\frac{2}{\sqrt{3}}\mathbf{i}$

Find the indicated vector.

28) Let $\mathbf{u} = \langle 5, 7 \rangle$, $\mathbf{v} = \langle -4, -1 \rangle$. Find $\mathbf{v} - \mathbf{u}$. 28) _____

A) $\langle 2, 3 \rangle$ B) $\langle -9, -8 \rangle$ C) $\langle 1, 6 \rangle$ D) $\langle -6, -11 \rangle$

Identify the type of surface represented by the given equation.

29) $\frac{x^2}{2} + \frac{y^2}{9} + \frac{z^2}{7} = 1$ 29) _____

A) Elliptic cone

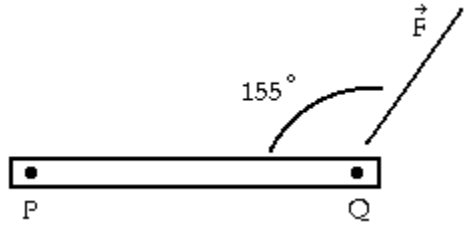
B) Sphere

C) Ellipsoid

D) Paraboloid

Solve the problem.

30) Find the magnitude of the torque in foot-pounds at point P for the following lever: 30) _____



$\left|\overrightarrow{PQ}\right| = 4$ in. and $|\mathbf{F}| = 15$ lb

A) -950.70 ft-lb B) 3407.50 ft-lb C) -3002.23 ft-lb D) 60 ft-lb

Find the center and radius of the sphere.

31) $3x^2 + 3y^2 + 3z^2 - 2x + 2y = 9$ 31) _____

A) $C\left(\frac{1}{3}, -\frac{1}{3}, 0\right)$, $a = \frac{\sqrt{29}}{3}$

B) $C\left(-\frac{1}{9}, \frac{1}{9}, 0\right)$, $a = \frac{\sqrt{29}}{9}$

C) $C\left(-\frac{1}{3}, \frac{1}{3}, 0\right)$, $a = \frac{29}{9}$

D) $C\left(-\frac{1}{3}, \frac{1}{3}, 0\right)$, $a = \frac{\sqrt{29}}{3}$

Describe the given set of points with a single equation or with a pair of equations.

32) The plane perpendicular to the y–axis and passing through the point (4, –2, –4) 32) _____

A) $y = -2$

B) $4x - 4z = 0$ and $y = -2$

C) $x - 2 + z = 0$

D) $x = 4$ and $z = -4$

Write u as the sum of a vector parallel to v and a vector orthogonal to v.

33) $\mathbf{u} = -8\mathbf{i} + 9\mathbf{k}$, $\mathbf{v} = 4\mathbf{i} + 3\mathbf{j}$ 33) _____

A) $\mathbf{u} = \left(-\frac{128}{25}\mathbf{i} - \frac{96}{25}\mathbf{j}\right) + \left(-\frac{72}{25}\mathbf{i} + \frac{96}{25}\mathbf{j} + 9\mathbf{k}\right)$

B) $\mathbf{u} = \left(\frac{256}{25}\mathbf{i} - \frac{288}{25}\mathbf{k}\right) + \left(\frac{356}{25}\mathbf{i} + 3\mathbf{j} - \frac{128}{25}\mathbf{k}\right)$

C) $\mathbf{u} = \left(-\frac{128}{25}\mathbf{i} - \frac{96}{25}\mathbf{j}\right) + \left(-\frac{328}{25}\mathbf{i} - \frac{96}{25}\mathbf{j} + 9\mathbf{k}\right)$

D) $\mathbf{u} = \left(\frac{256}{25}\mathbf{i} - \frac{288}{25}\mathbf{k}\right) + \left(-\frac{156}{25}\mathbf{i} + 3\mathbf{j} + \frac{128}{25}\mathbf{k}\right)$

Find the length and direction (when defined) of u × v.

34) $\mathbf{u} = -5\mathbf{i} - 2\mathbf{j} - 2\mathbf{k}$, $\mathbf{v} = 10\mathbf{i} + 4\mathbf{j} + 4\mathbf{k}$ 34) _____

A) 0; $\mathbf{0}$

B) $\sqrt{165}; \frac{1}{\sqrt{165}}(5\mathbf{i} + 2\mathbf{j} + 2\mathbf{k})$

C) $3\sqrt{11}; \frac{1}{3\sqrt{11}}(5\mathbf{i} + 2\mathbf{j} + 2\mathbf{k})$

D) 0; $5\mathbf{i} + 2\mathbf{j} + 2\mathbf{k}$

Find an equation for the sphere with the given center and radius.

35) Center (–10, 0, 0), radius = 8 35) _____

A) $x^2 + y^2 + z^2 + 20x = -36$

B) $x^2 + y^2 + z^2 - 20x = 8$

C) $x^2 + y^2 + z^2 - 20x = -36$

D) $x^2 + y^2 + z^2 + 20x = 8$

Find the length and direction (when defined) of u × v.

36) $\mathbf{u} = -\frac{1}{2}\mathbf{i} + \frac{3}{2}\mathbf{j} + \mathbf{k}$, $\mathbf{v} = \mathbf{i} + \mathbf{j} + 2\mathbf{k}$ 36) _____

A) $8; \frac{1}{4}\mathbf{i} - \frac{1}{4}\mathbf{j} + \frac{1}{2}\mathbf{k}$

B) $2\sqrt{3}; \frac{\sqrt{3}}{3}\mathbf{i} + \frac{\sqrt{3}}{3}\mathbf{j} - \frac{\sqrt{3}}{3}\mathbf{k}$

C) $2\sqrt{2}; -\frac{\sqrt{2}}{2}\mathbf{i} + \frac{\sqrt{2}}{2}\mathbf{j} - \frac{\sqrt{2}}{2}\mathbf{k}$

D) $8; \frac{1}{2}\mathbf{i} - \frac{1}{4}\mathbf{j} - \frac{1}{4}\mathbf{k}$

Solve the problem.

37) Find the volume of the solid bounded by the ellipsoid $\frac{x^2}{16} + \frac{y^2}{81} + \frac{z^2}{25} = 1$ and the planes $z = -2$ and $z = 2$. (The area of an ellipse with semiaxes a and b is πab) 37) _____

A) 105.60π units^3 B) 4907.52π units^3 C) 136.32π units^3 D) 151.68π units^3

Find the center and radius of the sphere.

38) $x^2 + y^2 + z^2 - 16x - 8y + 16z = -95$ 38) _____

A) C(–8, –4, 8), a = 7

B) C(8, 4, –8), a = 49

C) C(8, 4, –8), a = 7

D) C(8, 4, 8), a = 7

Identify the type of surface represented by the given equation.

39) $\frac{x^2}{7} - \frac{y^2}{8} - \frac{z^2}{3} = 1$ 39) _____

A) Elliptic cone
B) Hyperboloid of one sheet
C) Hyperboloid of two sheets
D) Ellipsoid

Find the component form of the specified vector.

40) The unit vector that makes an angle $-5\pi/3$ with the positive x–axis 40) _____

A) $\left(\frac{1}{2}, \frac{1}{2}\right)$ B) $\left(\frac{1}{2}, \frac{\sqrt{3}}{2}\right)$ C) $\left(\frac{-1}{2}, \frac{-\sqrt{3}}{2}\right)$ D) $\left(\frac{-\sqrt{3}}{2}, \frac{-1}{2}\right)$

Find parametric equations for the line described below.

41) The line through the point P(–2, –5, –2) and parallel to the line $x = 4t - 2$, $y = 3t + 6$, $z = 2t - 5$ 41) _____

A) $x = 4t + 2$, $y = 3t + 5$, $z = 2t + 2$
B) $x = 3t - 2$, $y = -4t$, $z = -2$
C) $x = 4t - 2$, $y = 3t - 5$, $z = 2t - 2$
D) $x = -2$, $y = 2t - 5$, $z = -3t - 2$

Find the triple scalar product $(\mathbf{u} \times \mathbf{v}) \cdot \mathbf{w}$ of the given vectors.

42) $\mathbf{u} = \mathbf{i} + \mathbf{j} + \mathbf{j}$; $\mathbf{v} = 3\mathbf{i} + 8\mathbf{j} + 4\mathbf{k}$; $\mathbf{w} = 10\mathbf{i} + 6\mathbf{j} + 3\mathbf{k}$ 42) _____

A) 97 B) –31 C) 93 D) –93

Describe the given set of points with a single equation or with a pair of equations.

43) The circle of radius 5 centered at the point (0, –10, –5) and lying in a plane parallel to the xy plane 43) _____

A) $(x - 0)^2 + (y - 10)^2 = 5^2$ and $x + y = -10$
B) $\left(\frac{x}{0}\right)^2 + \left(\frac{y}{-10}\right)^2 = 5^2$ and $z = -5$
C) $(x - 0)^2 + (y - 10)^2 = 5^2$ and $z = -5$
D) $\left(\frac{x}{0}\right)^2 + \left(\frac{y}{-10}\right)^2 + 1 = 5^2$

Calculate the requested distance.

44) The distance from the point S(7, 1, –5) to the line $x = -6 + 3t$, $y = -9 + 12t$, $z = 10 + 4t$ 44) _____

A) $\frac{73685}{169}$ B) $\frac{\sqrt{73,685}}{169}$ C) $\frac{73685}{13}$ D) $\frac{\sqrt{73,685}}{13}$

Find the component form of the specified vector.

45) The vector $\overrightarrow{PQ}$, where P = (–8, –2) and Q = (–4, 3) 45) _____

A) $\langle -10, 3 \rangle$ B) $\langle -12, 1 \rangle$ C) $\langle 4, 5 \rangle$ D) $\langle -4, -5 \rangle$

Find $\mathbf{v} \cdot \mathbf{u}$.

46) $\mathbf{v} = 4\mathbf{i} - 2\mathbf{j}$ and $\mathbf{u} = -7\mathbf{i} - 8\mathbf{j}$ 46) _____

A) $-28\mathbf{i} + 16\mathbf{j}$ B) $-3\mathbf{i} - 10\mathbf{j}$ C) –44 D) –12

Find the acute angle between the lines.

47) $-3x - 5y = 9$ and $8x - 6y = -8$ 47) _____

A) 1.468 radians B) 0.1031 radians C) 3.039 radians D) 0.1029 radians

Find $\mathbf{v} \cdot \mathbf{u}$.

48) $\mathbf{v} = 3\mathbf{i} - 8\mathbf{j}$ and $\mathbf{u} = -4\sqrt{13}\mathbf{i} + 2\mathbf{j}$ 48) _____

A) $-16\sqrt{13}\mathbf{i} - 12\mathbf{j}$ B) $(3 - 4\sqrt{13})\mathbf{i} - 6\mathbf{j}$ C) $-16 - 12\sqrt{13}$ D) $-16\sqrt{13} + 12$

Calculate the requested distance.

49) The distance from the point S(5, 2, 3) to the plane $2x + 2y + z = 7$ 49) _____

A) 6 B) 2 C) $\frac{10}{9}$ D) $\frac{10}{3}$

Match the equation with the surface it defines.

50) $\frac{x^2}{3^2} + \frac{z^2}{3^2} = \frac{y}{3}$ 50) _____

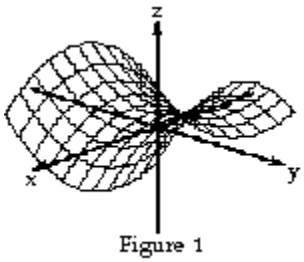


Figure 1

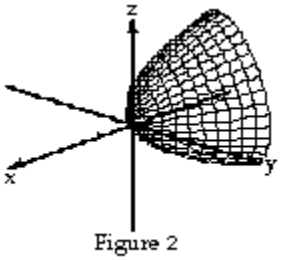


Figure 2

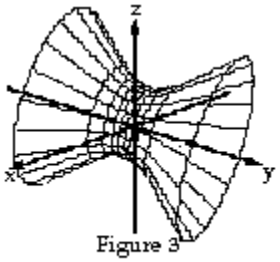


Figure 3

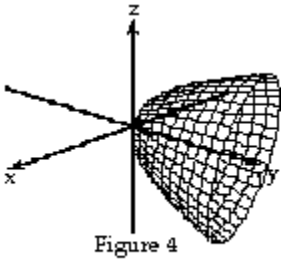


Figure 4

A) Figure 3 B) Figure 2 C) Figure 1 D) Figure 4

Express the vector in the form $\mathbf{v} = \mathbf{v} = v_1\mathbf{i} + v_2\mathbf{j} + v_3\mathbf{k}$.

51) $\overrightarrow{AB}$ if A is the point (–6, –4, 4) and B is the point (–1, –11, 7) 51) _____

A) $v = 5i - 7j + 3k$ B) $v = 5i + 7j - 3k$ C) $v = 5i + 7j + 3k$ D) $v = 5i - 7j - 3k$

Write the equation for the plane.

52) The plane through the point A(9, 7, 4) perpendicular to the vector from the origin to A. 52) _____

A) $9x + 7y + 4z = 146$ B) $9x + 7y + 4z = -146$

C) $9x + 7y + 4z = \sqrt{146}$ D) $9x + 7y + 4z = 20$

Find the vector $\text{proj}_{\mathbf{v}}\,\mathbf{u}$.

53) $\mathbf{v} = \mathbf{k}$, $\mathbf{u} = 6\mathbf{i} + 9\mathbf{j} + 2\mathbf{k}$ 53) _____

A) $\frac{2}{121}\mathbf{k}$ B) $\frac{12}{121}\mathbf{i} + \frac{18}{121}\mathbf{j} + \frac{4}{121}\mathbf{k}$

C) $\frac{12}{11}\mathbf{i} + \frac{18}{11}\mathbf{j} + \frac{4}{11}\mathbf{k}$ D) $2\mathbf{k}$

Write the equation for the plane.

54) The plane through the points P(5, –7, –20) , Q(–3, 6, –6) and R(–1, –4, 4). 54) _____

A) $2x + y + 5z = -9$ B) $5x + 2y + z = 9$ C) $5x + 2y + z = -9$ D) $2x + y + 5z = 9$

Find an equation for the line that passes through the given point and satisfies the given conditions.

55) P = (12, 12); perpendicular to $\mathbf{v} = 5\mathbf{i} - 6\mathbf{j}$ 55) _____

A) $5x - 6y = 61$

B) $y - 12 = \frac{18}{7}(x - 5)$

C) $5x - 6y = -12$

D) $-6x - 5y = -132$

Find the length and direction (when defined) of $\mathbf{u} \times \mathbf{v}$.

56) $\mathbf{u} = 4\mathbf{i} + 2\mathbf{j} + 8\mathbf{k}$, $\mathbf{v} = -\mathbf{i} - 2\mathbf{j} - 2\mathbf{k}$ 56) _____

A) $180; \frac{2\sqrt{5}}{15}\mathbf{i} + \frac{\sqrt{15}}{15}\mathbf{j} + \frac{\sqrt{5}}{15}\mathbf{k}$

B) $6\sqrt{5}; \frac{2\sqrt{5}}{5}\mathbf{i} - \frac{\sqrt{5}}{5}\mathbf{k}$

C) $180; \frac{1}{15}\mathbf{i} + \frac{1}{30}\mathbf{k}$

D) $6\sqrt{5}; \frac{2\sqrt{5}}{5}\mathbf{i} + \frac{\sqrt{5}}{5}\mathbf{k}$

Give a geometric description of the set of points whose coordinates satisfy the given conditions.

57) $x^2 + y^2 \leq 16$, $z = -10$ 57) _____

A) All points on or outside of the circle $x^2 + y^2 = 16$ and in the plane $z = -10$

B) All points on the cylinder with radius 4 along the z–axis

C) All points on or within the circle $x^2 + y^2 = 16$ and in the plane $z = -10$

D) All points within the parabola $x^2 + y^2 = 16$ in the plane $z = -10$

Find the acute angle between the lines.

58) $3x - y = 16$ and $2x + y = -5$ 58) _____

A) 45° B) 75° C) 60° D) 30°

Express the vector as a product of its length and direction.

59) $1\mathbf{i} + 2\mathbf{j} + 2\mathbf{k}$ 59) _____

A) $3\left(\frac{1}{3}\mathbf{i} + \frac{2}{3}\mathbf{j} + \frac{2}{3}\mathbf{k}\right)$ B) $3(\mathbf{i} + \mathbf{j} + \mathbf{k})$ C) $3\left(\frac{1}{9}\mathbf{i} + \frac{2}{9}\mathbf{j} + \frac{2}{9}\mathbf{k}\right)$ D) $3(1\mathbf{i} + 2\mathbf{j} + 2\mathbf{k})$

Find an equation for the line that passes through the given point and satisfies the given conditions.

60) P = (–8, –2); parallel to $\mathbf{v} = -2\mathbf{i} + 6\mathbf{j}$ 60) _____

A) $-2x + 6y = 4$ B) $-2x + 6y = 40$ C) $6x + 2y = -52$ D) $y + 2 = \frac{4}{3}(x + 2)$

Find the length and direction (when defined) of $\mathbf{u} \times \mathbf{v}$.

61) $\mathbf{u} = 2\mathbf{i} + 2\mathbf{j} - \mathbf{k}$, $\mathbf{v} = -\mathbf{i} + \mathbf{k}$ 61) _____

A) $3; -\frac{2}{3}\mathbf{i} + \mathbf{j} - \frac{2}{3}\mathbf{k}$ B) $9; \frac{2}{9}\mathbf{i} - \mathbf{j} + \frac{2}{9}\mathbf{k}$ C) $9; \frac{2}{9}\mathbf{i} - \mathbf{j} - \frac{2}{9}\mathbf{k}$ D) $3; \frac{2}{3}\mathbf{i} - \mathbf{j} + \frac{2}{3}\mathbf{k}$

Find the angle between the planes.

62) $5x - 4y + 5z = 1$ and $-3x - 9y + 3z = -9$ 62) _____

A) 0.616 B) 0.462 C) 1.109 D) 1.497

Find the intersection.

63) $x + y + z = -1$, $x + y = 5$ 63) _____

A) $x = t$, $y = 5 - t$, $z = -6$

B) $x = -t$, $y = 5 + t$, $z = -6$

C) $x = -t$, $y = 5 + t$, $z = 6$

D) $x = -1$, $y = 1 + 5t$, $z = -6t$

Identify the type of surface represented by the given equation.

64) $x = -5z^2$, no limit on y 64) _____

A) Parabolic cylinder B) Cylinder

C) Hyperboloid of two sheets D) Sphere

Write one or more inequalities that describe the set of points.

65) The seventh octant of the xyz coordinate system 65) _____

A) $x \geq 0, y \geq 0, z \leq 0$ B) $x \leq 0, y \geq 0, z \geq 0$ C) $x \geq 0, y \geq 0, z \geq 0$ D) $x \leq 0, y \leq 0, z \leq 0$

Find the indicated vector.

66) Let $\mathbf{u} = \langle -8, -5 \rangle$, $\mathbf{v} = \langle -2, 5 \rangle$. Find $\frac{4}{5}\mathbf{u} + \frac{3}{5}\mathbf{v}$. 66) _____

A) $\left\langle -1, -\frac{38}{5} \right\rangle$ B) $\left\langle -\frac{38}{5}, -1 \right\rangle$ C) $\langle -8, 0 \rangle$ D) $\left\langle -\frac{47}{5}, \frac{7}{5} \right\rangle$

Find the intersection.

67) $x = -2 - 2t$, $y = -5 + 2t$, $z = -3 + 2t$; $1x - 3y - 7z = 7$ 67) _____

A) $\left(\frac{5}{11}, -\frac{82}{11}, -\frac{60}{11} \right)$ B) $\left(-\frac{49}{11}, -\frac{28}{11}, -\frac{6}{11} \right)$

C) (0, –7, –5) D) (–4, –3, –1)

Find the acute angle between the lines.

68) $2x - 6y = -5$ and $2x - 2y = -1$ 68) _____

A) 1.107 radians B) 2.035 radians C) 0.4637 radians D) 0.8944 radians

69) $2x + 3y = -8$ and $3x + 7y = 6$ 69) _____

A) 0.9833 radians B) 1.388 radians C) 0.1830 radians D) 1.754 radians

Express the vector as a product of its length and direction.

70) $-4\mathbf{i} + 4\mathbf{j} + 4\mathbf{k}$ 70) _____

A) $4\sqrt{3}\left(-\frac{\sqrt{3}}{3}\mathbf{i} + \frac{\sqrt{3}}{3}\mathbf{j} + \frac{\sqrt{3}}{3}\mathbf{k} \right)$ B) $4\sqrt{3}\left(-\frac{1}{48}\mathbf{i} + \frac{1}{48}\mathbf{j} + \frac{1}{48}\mathbf{k} \right)$

C) $4(-\mathbf{i} + \mathbf{j} + \mathbf{k})$ D) $\frac{\sqrt{3}}{12}\left(-\frac{\sqrt{3}}{3}\mathbf{i} + \frac{\sqrt{3}}{3}\mathbf{j} + \frac{\sqrt{3}}{3}\mathbf{k} \right)$

Find parametric equations for the line described below.

71) The line through the point P(–7, –2, –2) and perpendicular to the vectors $\mathbf{u} = -8\mathbf{i} + 3\mathbf{j} - 5\mathbf{k}$ and $\mathbf{v} = 5\mathbf{i} + 3\mathbf{j} - 3\mathbf{k}$ 71) _____

A) $x = 16t - 7$, $y = -49t - 2$, $z = 2t - 2$ B) $x = 16t - 7$, $y = 49t - 2$, $z = -39t - 2$

C) $x = 16t - 7$, $y = -49t - 2$, $z = -39t - 2$ D) $x = 16t + 7$, $y = -49t + 2$, $z = 2t + 2$

Describe the given set of points with a single equation or with a pair of equations.

72) The circle of radius 4 centered at the point (9, –2, 1) and lying in a plane perpendicular to the x–axis 72) _____

A) $(y + 2)^2 + (z - 1)^2 = 4^2$ and $y + z = -1$ B) $\left(\frac{y}{-2} \right)^2 + \left(\frac{z}{1} \right)^2 + 1 = 4^2$

C) $\left(\frac{y}{-2} \right)^2 + \left(\frac{z}{1} \right)^2 = 4^2$ and $x = 9$ D) $(y + 2)^2 + (z - 1)^2 = 4^2$ and $x = 9$

Find the indicated vector.

73) Let $\mathbf{u} = \langle 4, -8 \rangle$. Find $8\mathbf{u}$. 73) _____

A) $\langle 32, -64 \rangle$ B) $\langle -32, 64 \rangle$ C) $\langle -32, -64 \rangle$ D) $\langle 32, 64 \rangle$

Find the distance between points P_1 and P_2.

74) $P_1(-1, -2, 6)$ and $P_2(9, 3, 16)$ 74) _____

A) 14 B) 15 C) 10 D) 18

Describe the given set of points with a single equation or with a pair of equations.

75) The plane through the point (6, –6, –5) and perpendicular to the x–axis 75) _____

A) $x = 6$ B) $y + z = -11$ C) $y = -6$ and $z = -5$ D) $6 + y + z = 0$

Solve the problem.

76) An airplane is flying in the direction 37° east of south at 626 km/hr. Find the component form of the velocity of the airplane, assuming that the positive x–axis represents due east and the positive y–axis represents due north. 76) _____

A) $\langle 499.9, -376.7 \rangle$ B) $\langle 0.6018, -0.7986 \rangle$ C) $\langle -402.9, -479.1 \rangle$ D) $\langle 376.7, -499.9 \rangle$

Find the distance between points P_1 and P_2.

77) $P_1(-4, 6, 5)$ and $P_2(-1, 1, 1)$ 77) _____

A) 25 B) $5\sqrt{2}$; C) 10 D) 50

Solve the problem.

78) Find a formula for the distance from the point P(x, y, z) to the xy plane. 78) _____

A) z B) $\sqrt{x^2 + y^2}$ C) y D) x

Express the vector as a product of its length and direction.

79) $\frac{8}{7}\mathbf{j} + \frac{15}{7}\mathbf{k}$ 79) _____

A) $\frac{17}{7}\left(\frac{8}{7}\mathbf{j} + \frac{15}{7}\mathbf{k}\right)$ B) $\frac{17}{7}(\mathbf{j} + \mathbf{k})$ C) $\frac{289}{49}\left(\frac{8}{7}\mathbf{j} + \frac{15}{7}\mathbf{k}\right)$ D) $\frac{17}{7}\left(\frac{8}{17}\mathbf{j} + \frac{15}{17}\mathbf{k}\right)$

Identify the type of surface represented by the given equation.

80) $\frac{x^2}{9} + \frac{z^2}{10} = \frac{y}{4}$ 80) _____

A) Elliptic cone B) Ellipsoid

C) Elliptic paraboloid D) Hyperbolic paraboloid

Find a parametrization for the line segment beginning at P_1 and ending at P_2.

81) $P_1(1, -2, 2)$ and $P_2\left(0, -2, \frac{1}{4}\right)$ 81) _____

A) $x = -1t + 1$, $y = -2t$, $z = -\frac{7}{4}t + 2$ B) $x = -1t + 1$, $y = -2$, $z = -\frac{7}{4}t + 2$

C) $x = 1t$, $y = -2t$, $z = \frac{7}{4}t + 1$ D) $x = 1t$, $y = -2$, $z = \frac{7}{4}t + 1$

Find parametric equations for the line described below.

82) The line through the points P(–1, –1, 4) and Q(3, 1, 1) 82) _____

A) $x = t - 4, y = t - 2, z = 4t + 3$

B) $x = 4t - 1, y = 2t - 1, z = -3t + 4$

C) $x = 4t + 1, y = 2t + 1, z = -3t - 4$

Find the vector $\text{proj}_{\mathbf{v}}\,\mathbf{u}$.

83) $\mathbf{v} = 2\mathbf{i} - 2\mathbf{j} - 4\mathbf{k}$, $\mathbf{u} = 5\mathbf{i} - 12\mathbf{k}$ 83) _____

A) $\frac{29}{12}\mathbf{i} - \frac{29}{12}\mathbf{j} - \frac{29}{12}\mathbf{k}$ B) $\frac{29}{6}\mathbf{i} - \frac{29}{6}\mathbf{j} - \frac{29}{3}\mathbf{k}$ C) $\frac{290}{13}\mathbf{i} - \frac{696}{169}\mathbf{k}$ D) $\frac{290}{169}\mathbf{i} - \frac{696}{169}\mathbf{k}$

Express the vector as a product of its length and direction.

84) $-\frac{3}{2}\mathbf{i} - 6\mathbf{j} + 2\mathbf{k}$ 84) _____

A) $\frac{13}{2}(-\mathbf{i} - \mathbf{j} + \mathbf{k})$ B) $\frac{169}{4}\left(-\frac{3}{13}\mathbf{i} - \frac{12}{13}\mathbf{j} + \frac{4}{13}\mathbf{k}\right)$

C) $\frac{2}{13}$ D) $\frac{13}{2}\left(-\frac{3}{13}\mathbf{i} - \frac{12}{13}\mathbf{j} + \frac{4}{13}\mathbf{k}\right)$

Write the equation for the plane.

85) The plane through the point P(3, 2, –2) and parallel to the plane $4\mathbf{x} + 5y + 3z = 17$. 85) _____

A) $4x + 5y + 3z = -16$ B) $5x + 3y + 4z = 16$

C) $3x + 2y - 2z = 16$ D) $4x + 5y + 3z = 16$

Find the angle between u and v in radians.

86) $\mathbf{u} = 4\mathbf{i}$, $\mathbf{v} = 8\mathbf{i} - 10\mathbf{j}$ 86) _____

A) 1.39 B) 0.67 C) 0.90 D) 1.56

Write the equation for the plane.

87) The plane through the point P(–10, –7, 9) and perpendicular to the line $x = 7 + 7t, y = -5 + 9t, z = 7 - t$. 87) _____

A) $7x + 9y - z = 25$ B) $7x + 9y + z = -142$

C) $7x + 9y - z = -142$ D) $7x + 9y - z = 142$

Find an equation for the line that passes through the given point and satisfies the given conditions.

88) P = (9, 6); perpendicular to $\mathbf{v} = 4\mathbf{i} + 2\mathbf{j}$ 88) _____

A) $4x + 2y = 48$ B) $y - 6 = \frac{4}{5}(x - 4)$ C) $2x - 4y = -6$ D) $4x + 2y = 20$

Express the vector as a product of its length and direction.

89) $-4\mathbf{i} - \frac{5}{3}\mathbf{j}$ 89) _____

A) $\frac{13}{3}(-\mathbf{i} - \mathbf{j})$ B) $\frac{13}{3}\left(-\frac{12}{13}\mathbf{i} - \frac{5}{13}\mathbf{j}\right)$ C) $\frac{169}{9}\left(-4\mathbf{i} - \frac{5}{3}\mathbf{j}\right)$ D) $\frac{13}{3}\left(-4\mathbf{i} - \frac{5}{3}\mathbf{j}\right)$

Find the vector $\text{proj}_{\mathbf{v}}\,\mathbf{u}$.

90) $\mathbf{v} = \mathbf{i} + \mathbf{j} + \mathbf{k}$, $\mathbf{u} = 3\mathbf{i} + 4\mathbf{j} + 12\mathbf{k}$ 90) _____

A) $\frac{19}{169}\mathbf{i} + \frac{19}{169}\mathbf{j} + \frac{19}{169}\mathbf{k}$ B) $\frac{19}{3}\mathbf{i} + \frac{19}{3}\mathbf{j} + \frac{19}{3}\mathbf{k}$

C) $\frac{19}{13}\mathbf{i} + \frac{19}{13}\mathbf{j} + \frac{19}{13}\mathbf{k}$ D) $\frac{20}{3}\mathbf{i} + \frac{20}{3}\mathbf{j} + \frac{20}{3}\mathbf{k}$

Find the intersection.

91) $5x - 2y = 8$, $-4y + 8z = -7$ 91) _____

A) $x = -16t - 46$, $y = -40t - 7$, $z = -20t$ B) $x = -16t - \frac{23}{10}$, $y = -40t - \frac{7}{4}$, $z = 20t$

C) $x = -16t + \frac{23}{10}$, $y = -40t + \frac{7}{4}$, $z = -20$ D) $x = -16t + \frac{23}{10}$, $y = -40t + \frac{7}{4}$, $z = -20t$

Solve the problem.

92) Find the area of the triangle determined by the points P(1, 1, 1), Q(−9, 5, 9), and R(−10, 1, 5). 92) _____

A) $\frac{\sqrt{4682}}{2}$ B) $\frac{\sqrt{27{,}582}}{2}$ C) $\sqrt{27{,}582}$ D) $\sqrt{4682}$

93) A bird flies from its nest 7 km in the direction 34° north of east, where it stops to rest on a tree. It then flies 10 km in the direction 22° south of west and lands atop a telephone pole. With an xy−coordinate system where the origin is the bird's nest, the x−axis points east, and the y−axis points north, at what point is the tree located? 93) _____

A) (−5.940, 3.704) B) (3.914, 5.803) C) (5.803, 3.914) D) (0.8290, 0.5592)

Match the equation with the surface it defines.

94) $\frac{y^2}{8^2} + \frac{z^2}{4^2} = 1$ 94) _____

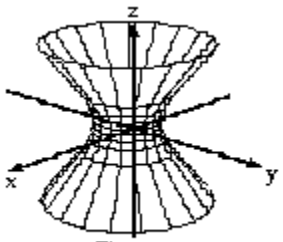


Figure 1

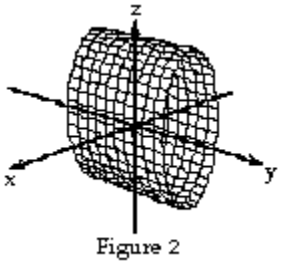


Figure 2

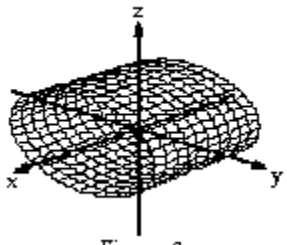


Figure 3

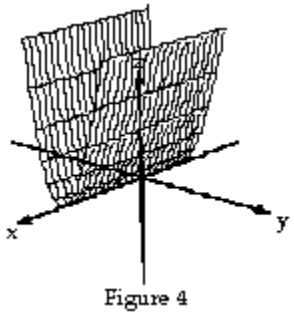


Figure 4

A) Figure 3 B) Figure 4 C) Figure 2 D) Figure 1

Find a parametrization for the line segment beginning at P_1 and ending at P_2.

95) $P_1(0, 0, 0)$ and $P_2(-4, 5, -5)$ 95) _____

A) $x = -4t, y = 5t, z = -5t$

B) $x = -4t + 4,\ y = 5t - 5, z = -5t + 5$

C) $x = 4t, y = -5t, z = 5t$

D) $x = -4t - 4,\ y = 5t + 5, z = -5t - 5$

Calculate the requested distance.

96) The distance from the point $S(3, 10, 7)$ to the line $x = 7 + 2t, y = -7 + 6t, z = 10 + 9t$ 96) _____

A) $\frac{33505}{121}$ B) $\frac{\sqrt{33,505}}{11}$ C) $\frac{33505}{11}$ D) $\frac{\sqrt{33,505}}{121}$

Find the angle between u and v in radians.

97) $\mathbf{u} = 10\mathbf{i} + 10\mathbf{j} + 5\mathbf{k}, \mathbf{v} = 7\mathbf{i} + 9\mathbf{j} + 6\mathbf{k}$ 97) _____

A) 1.06 B) 0.18 C) 1.50 D) 1.39

Find the angle between the curves.

98) $y = 7x^2$ and $y = 7x^3$ 98) _____

A) 1.546 radians B) 0.9997 radians C) 1.429 radians D) 0.02450 radians

Solve the problem.

99) Find the volume of the solid bounded by the hyperboloid of one sheet $\frac{x^2}{9} + \frac{y^2}{64} - \frac{z^2}{16} = 1$ and the planes $z = -4$ and $z = 4$. (The area of an ellipse with semiaxes a and b is πab) 99) _____

A) 208.00π units^3 B) 128.00π units^3 C) 256.00π units^3 D) 6144.00π units^3

Find the triple scalar product $(\mathbf{u} \times \mathbf{v}) \cdot \mathbf{w}$ of the given vectors.

100) $\mathbf{u} = 4\mathbf{i} + 2\mathbf{j} - \mathbf{j}; \mathbf{v} = 7\mathbf{i} + 5\mathbf{j} - 2\mathbf{k}; \mathbf{w} = 3\mathbf{i} + 7\mathbf{j} - 8\mathbf{k}$ 100) _____

A) −156 B) −238 C) 58 D) −38

Solve the problem.

101) Find the vector from the origin to the center of mass of a thin triangular plate (uniform density) whose vertices are A(3, 5, 4), B(6, 9, 10), and C(2, 10, 2). 101) _____

A) $\frac{5}{2}\mathbf{i} - 3\mathbf{j} + 1\mathbf{k}$ B) $\frac{11}{3}\mathbf{i} + 8\mathbf{j} + \frac{16}{3}\mathbf{k}$ C) $\frac{5}{3}\mathbf{i} - 2\mathbf{j} + \frac{2}{3}\mathbf{k}$ D) $\frac{5}{6}\mathbf{i} - 1\mathbf{j} + \frac{1}{3}\mathbf{k}$

Describe the given set of points with a single equation or with a pair of equations.

102) The plane through the point (5, 9, 3) and parallel to the yz−plane 102) _____

A) $5 + y + z = 0$

B) $9y + 3z = 0$ and $x = 5$

C) $y = 9$ and $z = 3$

D) $x = 5$

103) The set of points equidistant from the points (−3, 0, 0) and (9, 0, 0) 103) _____

A) $x = 3$

B) $y + z = 0$ and $-3 < x < 9$

C) $x > -3$ and $x < 9$

D) $y + z = 3$

Solve the problem.

104) Let $\mathbf{u} = 4\mathbf{i} + \mathbf{j}, \mathbf{v} = \mathbf{i} + \mathbf{j}$, and $\mathbf{w} = \mathbf{i} - \mathbf{j}$. Find scalars a and b such that $\mathbf{u} = a\mathbf{v} + b\mathbf{w}$. 104) _____

A) $4\mathbf{v} - 1\mathbf{w}$

B) $4\mathbf{v} + 1\mathbf{w}$

C) $0.4000\ \mathbf{v} + 0.6667\ \mathbf{w}$

D) $2.500\ \mathbf{v} + 1.500\mathbf{w}$

Match the equation with the surface it defines.

105) $-\frac{x^2}{6^2}+\frac{y^2}{3^2}+\frac{z^2}{9}=1$ 105) _____

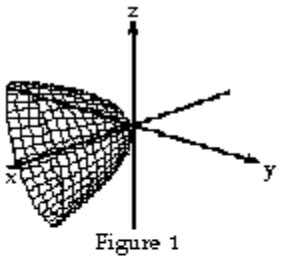


Figure 1

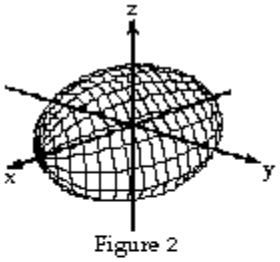


Figure 2

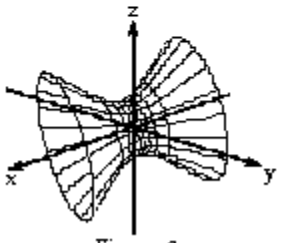


Figure 3

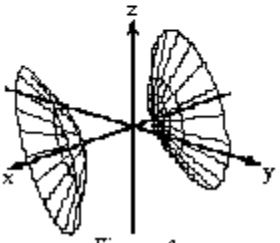


Figure 4

A) Figure 4 B) Figure 3 C) Figure 2 D) Figure 1

Find the angle between the planes.

106) $3x - 3y - 6z = 10$ and $-7x + 8y - 8z = 8$ 106) _____

A) 1.093 B) 1.540 C) 0.031 D) 1.510

Solve the problem.

107) Find the area of the parallelogram determined by the points P(7, –5, 5), Q(–7, –10, –9), R(–4, –6, –7) and S(–18, –11, –21). 107) _____

A) $\frac{\sqrt{113{,}921}}{2}$ B) $\frac{11\sqrt{33}}{2}$ C) $11\sqrt{33}$ D) $\sqrt{113{,}921}$

Find the intersection.

108) $x = -2 + 3t$, $y = 9 + 4t$, $z = 1 + 10t$; $8x + 3y + 6z = 5$ 108) _____

A) $\left(-\frac{19}{8}, \frac{5}{2}, -\frac{1}{4}\right)$ B) (1, 13, 11) C) (–5, 5, –9) D) $\left(-\frac{13}{8}, \frac{7}{2}, \frac{9}{4}\right)$

Find the indicated vector.

109) Let $\mathbf{u} = \langle -9, 6\rangle$. Find $-2\mathbf{u}$. 109) _____

A) $\langle -18, 12\rangle$ B) $\langle -18, -12\rangle$ C) $\langle 18, 12\rangle$ D) $\langle 18, -12\rangle$

110) Let $\mathbf{u} = \langle -6, -4\rangle$. Find $-6\mathbf{u}$. 110) _____

A) $\langle 36, -24\rangle$ B) $\langle -36, 24\rangle$ C) $\langle 36, 24\rangle$ D) $\langle -36, -24\rangle$

Find an equation for the line that passes through the given point and satisfies the given conditions.

111) P = (–8, –5); perpendicular to $\mathbf{v} = -6\mathbf{i} + 9\mathbf{j}$ 111) _____

A) $9x + 6y = -102$ B) $-6x + 9y = 117$ C) $y + 5 = 7(x + 6)$ D) $-6x + 9y = 3$

Solve the problem.

112) Find the volume of the solid bounded by the elliptical cone $\frac{x^2}{81} + \frac{y^2}{64} = \frac{z^2}{25}$ and the planes $z = 0$ and $z = 3$. (The area of an ellipse with semiaxes a and b is πab) 112) _____

A) $\frac{216}{25}\pi$ units^3 B) $\frac{648}{25}\pi$ units^3 C) $\frac{648}{25}$ units^3 D) $\frac{1944}{25}\pi$ units^3

Describe the given set of points with a single equation or with a pair of equations.

113) The circle in which the plane through the point (10, 2, –3) perpendicular to the x–axis meets the sphere of radius 26 centered at the origin. 113) _____

A) $y^2 + z^2 = 576$ and $x = 10$ B) $y^2 + z^2 = 476$

C) $x^2 + y^2 + z^2 = 676$ D) $y^2 + z^2 = 676$ and $x = 10$

Solve the problem.

114) Find the area of the triangle determined by the points P(–3, 6, –4), Q(2, –7, –3), and R(7, –6, –5). 114) _____

A) $5\sqrt{230}$ B) $\frac{9\sqrt{446}}{2}$ C) $9\sqrt{446}$ D) $\frac{5\sqrt{230}}{2}$

Find the indicated vector.

115) Let $\mathbf{u} = \langle -7, -1 \rangle$, $\mathbf{v} = \langle 9, -7 \rangle$. Find $-5\mathbf{u} + 6\mathbf{v}$. 115) _____

A) $\langle -19, 47 \rangle$ B) $\langle 40, 12 \rangle$ C) $\langle 89, -37 \rangle$ D) $\langle -10, -48 \rangle$

Match the equation with the surface it defines.

116) $\frac{x^2}{3^2} + \frac{y^2}{6^2} + \frac{z^2}{3^2} = 1$ 116) _____

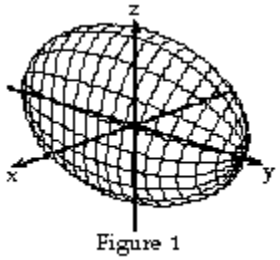


Figure 1

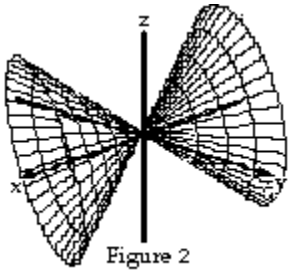


Figure 2

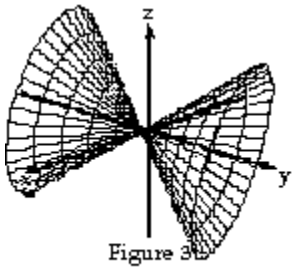


Figure 3

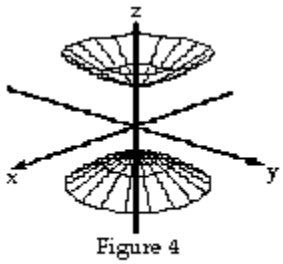


Figure 4

A) Figure 2 B) Figure 3 C) Figure 1 D) Figure 4

Solve the problem.

117) A ramp leading to the entrance of a building is inclined upward at an angle of $4°$. A suitcase is to be pulled up the ramp by a handle that makes an angle of $39°$ with the horizontal. How much force must be applied in the direction of the handle so that the component of the force parallel to the ramp is 50 lbs.? 117) _____

A) 64.18 lbs B) 9.184 lbs C) 40.96 lbs D) −122.6 lbs

Find the angle between the curves.

118) $y = 7\sqrt[3]{x}$ and $y = 7\sqrt{x}$ 118) _____

A) 1.444 radians B) 0.9920 radians C) 0.1266 radians D) 1.429 radians

119) $y = 5 \sin(x)$ and $y = 5 \cos(x)$ 119) _____

A) 1.373 radians B) 1.020 radians C) 0.5513 radians D) 0.8519 radians

Find the length and direction (when defined) of $\mathbf{u} \times \mathbf{v}$.

120) $\mathbf{u} = -8\mathbf{k}$, $\mathbf{v} = -7\mathbf{i}$ 120) _____

A) 8; $-7\mathbf{j}$ B) 56; $56\mathbf{j}$ C) 56; $-\mathbf{j}$ D) 56; $\mathbf{j}$

Find parametric equations for the line described below.

121) The line through the point P(6, 1, −5) parallel to the vector $2\mathbf{i} - 4\mathbf{j} - 3\mathbf{k}$ 121) _____

A) $x = 2t + 6$, $y = -4t + 1$, $z = -3t - 5$ B) $x = -2t - 6$, $y = 4t - 1$, $z = -3t + 5$

C) $x = 2t - 6$, $y = -4t - 1$, $z = -3t + 5$ D) $x = -2t + 6$, $y = -4t + 1$, $z = 3t - 5$

Write u as the sum of a vector parallel to v and a vector orthogonal to v.

122) $\mathbf{u} = 5\mathbf{i} - 7\mathbf{j}$, $\mathbf{v} = \mathbf{j} + \mathbf{k}$ 122) _____

A) $\mathbf{u} = \left(-\frac{7}{2}\mathbf{j} - \frac{7}{2}\mathbf{k}\right) + \left(5\mathbf{i} - \frac{21}{2}\mathbf{j} - \frac{7}{2}\mathbf{k}\right)$

B) $\mathbf{u} = \left(-\frac{7}{2}\mathbf{j} - \frac{7}{2}\mathbf{k}\right) + \left(5\mathbf{i} - \frac{7}{2}\mathbf{j} + \frac{7}{2}\mathbf{k}\right)$

C) $\mathbf{u} = \left(-\frac{35}{2}\mathbf{i} + \frac{49}{2}\mathbf{j}\right) + \left(-5\mathbf{i} - \frac{47}{2}\mathbf{j} + \mathbf{k}\right)$

D) $\mathbf{u} = \left(-\frac{35}{2}\mathbf{i} + \frac{49}{2}\mathbf{j}\right) + \left(-\frac{35}{2}\mathbf{i} + \frac{51}{2}\mathbf{j} + \mathbf{k}\right)$

Express the vector as a product of its length and direction.

123) $\frac{1}{\sqrt{6}}\mathbf{i} + \frac{1}{\sqrt{6}}\mathbf{j} - \frac{1}{\sqrt{6}}\mathbf{k}$ 123) _____

A) $\frac{1}{2}\left(\frac{1}{\sqrt{6}}\mathbf{i} + \frac{1}{\sqrt{6}}\mathbf{j} - \frac{1}{\sqrt{6}}\mathbf{k}\right)$

B) $\frac{1}{6}\left(\frac{6}{\sqrt{6}}\mathbf{i} + \frac{6}{\sqrt{6}}\mathbf{j} - \frac{6}{\sqrt{6}}\mathbf{k}\right)$

C) $\frac{1}{3}\left(\frac{3}{\sqrt{6}}\mathbf{i} + \frac{3}{\sqrt{6}}\mathbf{j} - \frac{3}{\sqrt{6}}\mathbf{k}\right)$

D) $\frac{1}{2}\left(\frac{2}{\sqrt{6}}\mathbf{i} + \frac{2}{\sqrt{6}}\mathbf{j} - \frac{2}{\sqrt{6}}\mathbf{k}\right)$

Find the angle between u and v in radians.

124) $\mathbf{u} = -5\mathbf{i} - 5\mathbf{j}$, $\mathbf{v} = 2\mathbf{i} + 6\mathbf{j} + 8\mathbf{k}$ 124) _____

A) 1.58 B) 2.16 C) −0.59 D) 1.83

Calculate the direction of $\overrightarrow{P_1P_2}$ and the midpoint of line segment P_1P_2.

125) $P_1(4, 2, 7)$ and $P_2(6, 5, 1)$ 125) _____

A) $\frac{2}{\sqrt{7}}\mathbf{i} + \frac{3}{\sqrt{7}}\mathbf{j} - \frac{6}{\sqrt{7}}\mathbf{k}; \left(5, \frac{7}{2}, 4\right)$

B) $\frac{4}{\sqrt{7}}\mathbf{i} + \frac{2}{\sqrt{7}}\mathbf{j} + \frac{7}{\sqrt{7}}\mathbf{k}; \left(2, 1, \frac{7}{2}\right)$

C) $\frac{2}{7}\mathbf{i} + \frac{3}{7}\mathbf{j} - \frac{6}{7}\mathbf{k}; \left(5, \frac{7}{2}, 4\right)$

D) $\frac{2}{7}\mathbf{i} + \frac{3}{7}\mathbf{j} - \frac{6}{7}\mathbf{k}; \left(3, \frac{5}{2}, \frac{1}{2}\right)$

Write u as the sum of a vector parallel to v and a vector orthogonal to v.

126) $\mathbf{u} = -8\mathbf{i} + 15\mathbf{j}$, $\mathbf{v} = -3\mathbf{j} - 2\mathbf{k}$ 126) _____

A) $\mathbf{u} = \left(\frac{360}{13}\mathbf{i} - \frac{675}{13}\mathbf{j}\right) + \left(-\frac{360}{13}\mathbf{i} + \frac{636}{13}\mathbf{j} - 45\mathbf{k}\right)$

B) $\mathbf{u} = \left(\frac{135}{13}\mathbf{j} + \frac{90}{13}\mathbf{k}\right) + \left(-8\mathbf{i} + \frac{330}{13}\mathbf{j} + \frac{90}{13}\mathbf{k}\right)$

C) $\mathbf{u} = \left(\frac{360}{13}\mathbf{i} - \frac{675}{13}\mathbf{j}\right) + \left(\frac{360}{13}\mathbf{i} - \frac{714}{13}\mathbf{j} - 45\mathbf{k}\right)$

D) $\mathbf{u} = \left(\frac{135}{13}\mathbf{j} + \frac{90}{13}\mathbf{k}\right) + \left(-8\mathbf{i} + \frac{60}{13}\mathbf{j} - \frac{90}{13}\mathbf{k}\right)$

Solve the problem.

127) Find a formula for the distance from the point P(x, y, z) to the z–axis. 127) _____

A) $\sqrt{x^2 + y^2}$ B) $\sqrt{z + y}$ C) $\sqrt{x + y}$ D) $\sqrt{z^2 + y^2}$

Calculate the requested distance.

128) The distance from the point S(–8, –10, –8) to the line $x = -4 + 1t$, $y = -9 + 2t$, $z = -3 + 2t$ 128) _____

A) $\frac{\sqrt{122}}{3}$ B) $\frac{122}{3}$ C) $\frac{\sqrt{122}}{9}$ D) $\frac{122}{9}$

Solve the problem.

129) How much work does it take to slide a box 41 meters along the ground by pulling it with a 257 N force at an angle of 26° from the horizontal? 129) _____

A) 6817 joules B) 9471 joules C) 231.0 joules D) 10,537 joules

130) How much work does it take to slide a box 29 meters along the ground by pulling it with a 180 N force at an angle of 45° from the horizontal? 130) _____

A) $2610\sqrt{2}$ joules B) 5220 joules C) $\frac{5220}{\sqrt{2}}$ joules D) $5220\sqrt{2}$ joules

Find the vector $\text{proj}_{\mathbf{v}}\,\mathbf{u}$.

131) $\mathbf{v} = 3\mathbf{i} - \mathbf{j} + 3\mathbf{k}$, $\mathbf{u} = 11\mathbf{i} + 2\mathbf{j} + 10\mathbf{k}$ 131) _____

A) $\frac{671}{15}\mathbf{i} + \frac{122}{15}\mathbf{j} + \frac{122}{3}\mathbf{k}$

B) $\frac{183}{19}\mathbf{i} - \frac{61}{19}\mathbf{j} + \frac{183}{19}\mathbf{k}$

C) $\frac{671}{225}\mathbf{i} + \frac{122}{225}\mathbf{j} + \frac{122}{45}\mathbf{k}$

D) $\frac{195}{19}\mathbf{i} - \frac{65}{19}\mathbf{j} + \frac{195}{19}\mathbf{k}$

Match the equation with the surface it defines.

132) $\frac{z^2}{10^2} - \frac{x^2}{10^2} - \frac{y^2}{100} = 1$ 132) _____

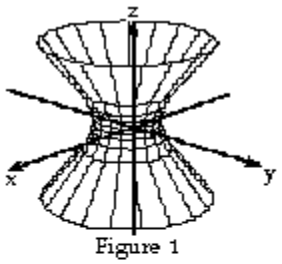


Figure 1

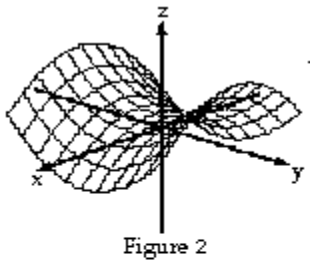


Figure 2

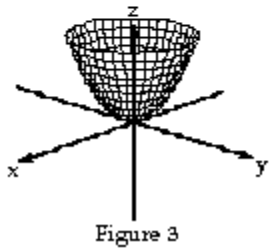


Figure 3

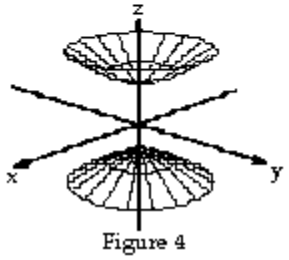


Figure 4

A) Figure 4 B) Figure 2 C) Figure 1 D) Figure 3

Solve the problem.

133) A bullet is fired with a muzzle velocity of 1106 ft/sec from a gun aimed at an angle of 28° above the horizontal. Find the vertical component of the velocity. 133) _____

A) 588.1 ft/sec B) 519.2 ft/sec C) −1065 ft/sec D) 976.5 ft/sec

134) A bullet is fired with a muzzle velocity of 1163 ft/sec from a gun aimed at an angle of 32° above the horizontal. Find the horizontal component of the velocity. 134) _____

A) 970.2 ft/sec B) 726.7 ft/sec C) 986.3 ft/sec D) 616.3 ft/sec

Calculate the direction of $\overrightarrow{P_1P_2}$ and the midpoint of line segment P_1P_2.

135) $P_1(3, 8, -5)$ and $P_2(7, 5, -10)$ 135) _____

A) $\frac{2}{25}\mathbf{i} - \frac{3}{50}\mathbf{j} - \frac{1}{10}\mathbf{k}; \left(\frac{3}{2}, 4, -\frac{5}{2}\right)$

B) $\frac{4}{5}\sqrt{2}\mathbf{i} - \frac{3}{5}\sqrt{2}\mathbf{j} - 1\sqrt{2}\mathbf{k}; \left(\frac{7}{2}, \frac{5}{2}, -5\right)$

C) $\frac{2}{25}\mathbf{i} - \frac{3}{50}\mathbf{j} - \frac{1}{10}\mathbf{k}; \left(5, \frac{13}{2}, -\frac{15}{2}\right)$

D) $\frac{4}{5}\sqrt{2}\mathbf{i} - \frac{3}{5}\sqrt{2}\mathbf{j} - 1\sqrt{2}\mathbf{k}; \left(5, \frac{13}{2}, -\frac{15}{2}\right)$

Find the center and radius of the sphere.

136) $2x^2 + 2y^2 + 2z^2 - x + y - z = 9$ 136) _____

A) $C\left(\frac{1}{4}, -\frac{1}{4}, \frac{1}{4}\right), a = \frac{5\sqrt{6}}{2}$

B) $C\left(\frac{1}{4}, -\frac{1}{4}, \frac{1}{4}\right), a = \frac{5\sqrt{6}}{4}$

C) $C\left(-\frac{1}{4}, \frac{1}{4}, -\frac{1}{4}\right), a = \frac{75}{8}$

D) $C\left(-\frac{1}{4}, \frac{1}{4}, -\frac{1}{4}\right), a = \frac{5\sqrt{3}}{4}$

Solve the problem.

137) A bird flies from its nest 5 km in the direction 3° north of east, where it stops to rest on a tree. It then flies 8 km in the direction 4° south of west and lands atop a telephone pole. With an xy–coordinate system where the origin is the bird's nest, the x–axis points east, and the y–axis points north, at what point is the telephone pole located? 137) _____

A) (–7.981, –0.5581) B) (–2.987, –7.727) C) (4.993, 0.2617) D) (0.2792, 8.626)

Find the acute angle between the lines.

138) $(1 + \sqrt{3})\,x + (1 - \sqrt{3})\,y = -4$ and $\sqrt{3}\,x + y = -12$ 138) _____

A) 45° B) 60° C) 75° D) 30°

Write the equation for the plane.

139) The plane through the point P(–7, 5, 6) and normal to $\mathbf{n} = 5\mathbf{i} + 2\mathbf{j} + 6\mathbf{k}$. 139) _____

A) $5x + 2y + 6z = 11$ B) $7x - 5y - 6z = 11$

C) $-7x + 5y + 6z = 11$ D) $-5x - 2y - 6z = 11$

Solve the problem.

140) Find the volume of the solid bounded by the paraboloid $\frac{x^2}{49} + \frac{y^2}{100} = \frac{z}{5}$ and the planes $z = 0$ and $z = 8$. (The area of an ellipse with semiaxes a and b is πab) 140) _____

A) $448\pi^2$ units^3 B) 896π units^3 C) 448 units^3 D) 448π units^3

Find $\mathbf{v} \cdot \mathbf{u}$.

141) $\mathbf{v} = -4\mathbf{i} + 9\mathbf{j}$ and $\mathbf{u} = 6\mathbf{i} + 9\mathbf{j}$ 141) _____

A) $2\mathbf{i} + 18\mathbf{j}$ B) –105 C) 57 D) $-24\mathbf{i} + 81\mathbf{j}$

Write the equation for the plane.

142) The plane through the point P(–6, 7, –6) and normal to $\mathbf{n} = -7\mathbf{i} - 5\mathbf{j} + 3\mathbf{k}$. 142) _____

A) $-6x + 7y + 6z = 95$ B) $7x + 5y - 3z = 95$

C) $6x - 7y - 6z = 95$ D) $-7x - 5y + 3z = -11$

Find the center and radius of the sphere.

143) $x^2 + y^2 + z^2 - 8x - 8y - 20z = -123$ 143) _____

A) C(–4, –4, –10), a = 9 B) C(–4, –4, –10), a = 3

C) C(4, 4, 10), a = 9 D) C(4, 4, 10), a = 3

Find the distance between points P_1 and P_2.

144) $P_1(1, -2, -4)$ and $P_2(2, -3, -5)$ 144) _____

A) $\sqrt{3}$ B) 3 C) 9 D) 2

Identify the type of surface represented by the given equation.

145) $y^2 + z^2 = 3$ 145) _____

A) Ellipsoid

B) Parabolic cylinder

C) Cylinder

D) Paraboloid

Calculate the requested distance.

146) The distance from the point S(−5, 5, 1) to the plane $3x + 4y = 4$ 146) _____

A) $\frac{1}{25}$ B) $\frac{1}{5}$ C) $\frac{31}{25}$ D) $\frac{39}{5}$

Give a geometric description of the set of points whose coordinates satisfy the given conditions.

147) $x = 7, z = 3$ 147) _____

A) All points in the x–z plane

B) The line through the point (7, 0, 3) and parallel to the y–axis

C) The line through the point (7, 3, 0) and parallel to the z–axis

D) The point (7, 3)

Solve the problem.

148) Show that the point P(−5, 3, −6) is equidistant from the points A(−6, 1, −5) and B(−4, 5, −7). 148) _____

A) The distance between P and A is $\sqrt{5}$; the distance between P and B is $\sqrt{5}$

B) The distance between P and A is $\sqrt{6}$; the distance between P and B is $\sqrt{6}$

C) The distance between P and A is 3; the distance between P and B is 3

D) The distance between P and A is 2; the distance between P and B is 2

Find $\mathbf{v} \cdot \mathbf{u}$.

149) $\mathbf{v} = \left\langle \frac{1}{\sqrt{17}}, \frac{1}{\sqrt{17}} \right\rangle$ and $\mathbf{u} = \left\langle \frac{1}{\sqrt{17}}, \frac{-1}{\sqrt{17}} \right\rangle$ 149) _____

A) $\frac{2}{17}$ B) $\frac{1}{\sqrt{17}}\mathbf{i} - \frac{1}{\sqrt{17}}\mathbf{j}$ C) $\frac{2}{\sqrt{17}}\mathbf{i} - \frac{2}{\sqrt{17}}\mathbf{j}$ D) 0

Identify the type of surface represented by the given equation.

150) $\frac{x^2}{9} + \frac{z^2}{9} = \frac{y}{2}$ 150) _____

A) Elliptic cone B) Paraboloid

C) Hyperbolic paraboloid D) Ellipsoid

Find an equation for the line that passes through the given point and satisfies the given conditions.

151) P = (−9, 5); perpendicular to $\mathbf{v} = -4\mathbf{i} - 3\mathbf{j}$ 151) _____

A) $-4x - 3y = 21$ B) $-4x - 3y = 25$

C) $-3x + 4y = 47$ D) $y - 5 = -\frac{8}{5}(x + 4)$

Find parametric equations for the line described below.

152) The line through the point P(−1, 2, 0) and perpendicular to the plane $4x + 6y + 4z = 5$ 152) _____

A) $x = -6t - 1, y = -6t - 1, z = 0$ B) $x = 4t + 1, y = 6t - 2, z = 4t$

C) $x = 4t - 1, y = 6t + 2, z = 4t$ D) $x = -4t + 1, y = -6t - 2, z = -4t$

Write the equation for the plane.

153) The plane through the point P(1, −6, 2) and parallel to the plane $-3\mathbf{x} - 4y + 5\mathbf{z} = 28$. 153) _____

A) $-3x - 4y + 5z = 31$ B) $-3x - 4y + 5z = -11$

C) $-3x - 4y + 5z = -31$ D) $4y = 31$

Solve the problem.

154) Find the work done by a force of $17\mathbf{i}$ (newtons) in moving as object along a line from the origin to the point (10, 3) (distance in meters). 154) _____

A) 177.5 joules B) 17.75 joules C) 169.6 joules D) 170.0 joules

Calculate the requested distance.

155) The distance from the point S(3, –2, 2) to the line $x = 2 + 11t$, $y = -1 + 2t$, $z = -6 + 10t$ 155) _____

A) $\frac{6929}{15}$ B) $\frac{13\sqrt{41}}{15}$ C) $\frac{13\sqrt{41}}{225}$ D) $\frac{6929}{225}$

Write one or more inequalities that describe the set of points.

156) The half–space consisting of the points on and behind the yz–plane 156) _____

A) $x > 0$ B) $y > 0, z > 0$ C) $x \leq 0$ D) $y \leq 0, z \leq 0$

Find the length and direction (when defined) of $\mathbf{u} \times \mathbf{v}$.

157) $\mathbf{u} = -2\mathbf{i} - 4\mathbf{i}$, $\mathbf{v} = \mathbf{i} - \mathbf{j}$ 157) _____

A) 2; $2\mathbf{k}$ B) 2; $-2\mathbf{k}$ C) 6; $-6\mathbf{k}$ D) 6; $6\mathbf{k}$

Find an equation for the line that passes through the given point and satisfies the given conditions.

158) P = (–5, 8); parallel to $\mathbf{v} = -2\mathbf{i} - 9\mathbf{j}$ 158) _____

A) $-9x + 2y = 61$ B) $y - 8 = -\frac{17}{3}(x + 2)$

C) $-2x - 9y = -62$ D) $-2x - 9y = 85$

Solve the problem.

159) For the vectors $\mathbf{u}$ and $\mathbf{v}$ with magnitudes $|\mathbf{u}| = 6$ and $|\mathbf{v}| = 7$, find the angle θ between $\mathbf{u}$ and $\mathbf{v}$ which makes $|\text{proj}_{\mathbf{u}}\, \mathbf{v}| = 2$ 159) _____

A) 70.53 B) 31.00 C) 19.47 D) 73.40

Give a geometric description of the set of points whose coordinates satisfy the given conditions.

160) $(x - 5)^2 + (y - 10)^2 + (z - 4)^2 < 16$, $-4 \leq z \leq 0$ 160) _____

A) All points within the lower hemisphere centered at (5, 10, 4)

B) All points on the lower hemisphere centered at (5, 10, 4)

C) No set of points satisfy the given relations.

D) All points outside the lower hemisphere centered at (5, 10, 4)

Solve the problem.

161) A force of magnitude 6 pounds pulling on a suitcase makes an angle of 30° with the ground. Express the force in terms of its $\mathbf{i}$ and $\mathbf{j}$ components. 161) _____

A) $0.8660\mathbf{i} + + 0.5000\mathbf{j}$ B) $3.000\mathbf{i} + 5.196\mathbf{j}$

C) $5.196\mathbf{i} + 3.000\,\mathbf{j}$ D) $0.9255\mathbf{i} - 5.928\mathbf{j}$

Calculate the requested distance.

162) The distance from the point S(10, –2, 5) to the plane $10x + 11y + 2z = -10$ 162) _____

A) $\frac{98}{225}$ B) $\frac{98}{15}$ C) $\frac{58}{225}$ D) $\frac{58}{15}$

Write u as the sum of a vector parallel to v and a vector orthogonal to v.

163) $\mathbf{u} = -7\mathbf{i} - 11\mathbf{j} + 1\mathbf{k}, \mathbf{v} = \mathbf{i} - 4\mathbf{j} - \mathbf{k}$ 163) _____

A) $\mathbf{u} = (-14\mathbf{i} - 22\mathbf{j} + 2\mathbf{k}) + (-13\mathbf{i} - 26\mathbf{j} - \mathbf{k})$

B) $\mathbf{u} = (2\mathbf{i} - 8\mathbf{j} - 2\mathbf{k}) + (-9\mathbf{i} - 3\mathbf{j} + 3\mathbf{k})$

C) $\mathbf{u} = (-14\mathbf{i} - 22\mathbf{j} + 2\mathbf{k}) + (15\mathbf{i} + 18\mathbf{j} - \mathbf{k})$

D) $\mathbf{u} = (2\mathbf{i} - 8\mathbf{j} - 2\mathbf{k}) + (-5\mathbf{i} - 19\mathbf{j} - 1\mathbf{k})$

Write one or more inequalities that describe the set of points.

164) The rectangular solid in the first octant bounded by the planes $x = 1$, $x = 4$, $y = 4$, $y = 5$, $z = 5$ and $z = 7$ (planes excluded) 164) _____

A) $1 < x < 4; 4 < y < 5; 5 < z < 7$

B) $x < y < z$

C) The given planes do not form a rectangular solid

D) $x < 1,\ x > 4; y < 4,\ y > 5; z < 5, z > 7$

Find the intersection.

165) $x = 9 + 6t, y = 3 - 3t, z = 2 + 6t ; 10x + 7y - 4z = 2$ 165) _____

A) $\left(-\frac{157}{5}, \frac{116}{5}, -\frac{192}{5}\right)$

B) $\left(\frac{247}{5}, -\frac{86}{5}, \frac{668}{15}\right)$

C) (3, 6, –4)

D) (15, 0, 8)

Find the indicated vector.

166) Let $\mathbf{u} = \langle 3, 1\rangle$, $\mathbf{v} = \langle 7, -5\rangle$. Find $\mathbf{u} - \mathbf{v}$. 166) _____

A) $\langle 10, -4\rangle$ B) $\langle 8, -6\rangle$ C) $\langle -4, 6\rangle$ D) $\langle 2, 12\rangle$

Find a parametrization for the line segment beginning at P_1 and ending at P_2.

167) $P_1(-2, 0, -5)$ and $P_2(0, -5, 0)$ 167) _____

A) $x = -2t, y = 5t - 5, z = -5t$

B) $x = 2t - 2, y = -5t, z = 5t - 5$

C) $x = 3t - 2, y = 6t, z = 6t - 5$

D) $x = 3t, y = 6t - 5, z = 6t$

Describe the given set of points with a single equation or with a pair of equations.

168) The circle in which the plane through the point (2, 4, –7) perpendicular to the y–axis meets the sphere of radius 5 centered at the origin. 168) _____

A) $x^2 + z^2 = 16$ and $y = 4$

B) $x^2 + z^2 = 9$ and $y = 4$

C) $x^2 + z^2 = -7$ and $y = 4$

D) $x^2 + z^2 = 25$ and $y = 4$

Find parametric equations for the line described below.

169) The line through the point P(–7, 0, –6) and parallel to the line $x = 3t - 6, y = 5t + 7, z = 3t - 6$ 169) _____

A) $x = 3t - 7, y = 5t, z = 3t - 6$

B) $x = -7, y = 3t, z = -5t - 6$

C) $x = 3 + 7, y = 5t, z = 3t + 6$

D) $x = 5t - 7, y = -3t, z = -6$

Write one or more inequalities that describe the set of points.

170) The slab bounded by the planes $x = 2$ and $x = 3$ (planes included) 170) _____

A) $x \le 2$ and $x \ge 3$

B) $2 \le x \le 3$

C) $-\infty < y < \infty$ and $-\infty < z < \infty$

D) $x = 2$ and $x = 3$

171) The closed region bounded by the spheres of radius 2 and 10, both centered at the origin, and the planes $x = 5$ and $x = 8$ 171) _____

A) $4 < x^2 + y^2 + z^2 < 100$ and $5 < x < 8$
B) $2 < x^2 + y^2 + z^2 < 10$ and $x = 5$ and $x = 8$
C) $2 \le x^2 + y^2 + z^2 \le 10$ and $x = 5$ and $x = 8$
D) $4 \le x^2 + y^2 + z^2 \le 100$ and $5 \le x \le 8$

Find the center and radius of the sphere.

172) $x^2 + (y + 7)^2 + (z - 3)^2 = 9$ 172) _____

A) C(0, 7, –3), a = 3
B) C(0, –7, 3), a = 9
C) C(0, 7, –3), a = 9
D) C(0, –7, 3), a = 3

Find an equation for the line that passes through the given point and satisfies the given conditions.

173) P = (9, 10); parallel to $\mathbf{v} = 5\mathbf{i} - 6\mathbf{j}$ 173) _____

A) $-6x - 5y = -104$
B) $5x - 6y = 61$
C) $y - 10 = 4(x - 5)$
D) $5x - 6y = -15$

Write the equation for the plane.

174) The plane through the point A(–6, –2, 10) perpendicular to the vector from the origin to A. 174) _____

A) $6x - 2y - 10z = -2$
B) $6x + 2y - 10z = -140$
C) $-6x - 2y + 10z = -140$
D) $6x + 2y - 10z = \sqrt{140}$

Give a geometric description of the set of points whose coordinates satisfy the given conditions.

175) $y^2 + z^2 = 25$, $x = -2$ 175) _____

A) The circle $y^2 + z^2 = 25$ in the plane $x = -2$
B) All points more than $\sqrt{25}$ units from the origin
C) The line tangent to the circle $y^2 + z^2 = 25$ at the point $x = -2$
D) The cylinder with the radius $\sqrt{25}$ along the x–axis

Find the angle between u and v in radians.

176) $\mathbf{u} = 2\mathbf{i} - 3\mathbf{j} - 10\mathbf{k}$, $\mathbf{v} = 3\mathbf{i} + 4\mathbf{j} - 5\mathbf{k}$ 176) _____

A) 0.95
B) 1.56
C) 0.63
D) 1.30

Find the acute angle between the lines.

177) $y = \sqrt{3}\,x + 16$ and $y = -\sqrt{3}\,x + 9$ 177) _____

A) 30°
B) 60°
C) 75°
D) 45°

Match the equation with the surface it defines.

178) $\frac{y^2}{8^2} - \frac{x^2}{8^2} = \frac{z}{3}$ 178) _____

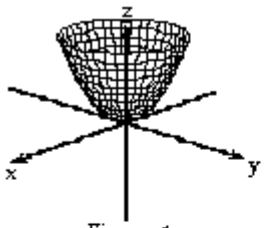


Figure 1

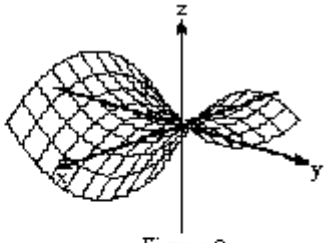


Figure 2

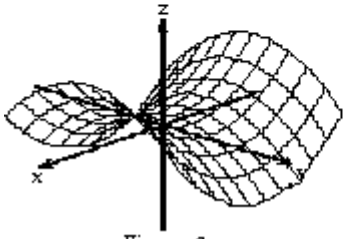


Figure 3

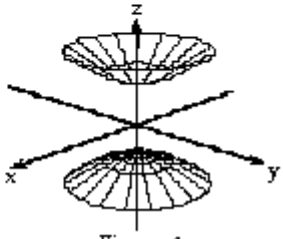


Figure 4

A) Figure 3 B) Figure 4 C) Figure 2 D) Figure 1

Solve the problem.

179) Find the perimeter of the triangle with vertices A(1, 2, 3), B(2, –2, 6), and C(3, 5, 7). 179) _____

A) $\sqrt{98} + \sqrt{51} + \sqrt{113}$ B) $\sqrt{34} + \sqrt{51} + \sqrt{41}$

C) $\sqrt{10} + \sqrt{51} + \sqrt{69}$ D) $\sqrt{26} + \sqrt{51} + \sqrt{29}$

Find the angle between u and v in radians.

180) $\mathbf{u} = -8\mathbf{j}$ and $\mathbf{v} = 9\mathbf{i} - 4\mathbf{k}$ 180) _____

A) 0.10 B) 0.00 C) 1.67 D) 1.57

Calculate the direction of $\overrightarrow{P_1P_2}$ and the midpoint of line segment P_1P_2.

181) $P_1(-5, 7, 7)$ and $P_2(-4, 8, 8)$ 181) _____

A) $\frac{1}{3}\mathbf{i} + \frac{1}{3}\mathbf{j} + \frac{1}{3}\mathbf{k}; \left(-\frac{9}{2}, \frac{15}{2}, \frac{15}{2}\right)$ B) $\frac{5}{\sqrt{3}}\mathbf{i} + \frac{7}{\sqrt{3}}\mathbf{j} + \frac{7}{\sqrt{3}}\mathbf{k}; \left(-\frac{5}{2}, \frac{7}{2}, \frac{7}{2}\right)$

C) $\frac{1}{\sqrt{3}}\mathbf{i} + \frac{1}{\sqrt{3}}\mathbf{j} + \frac{1}{\sqrt{3}}\mathbf{k}; (-2, 4, 4)$ D) $\frac{1}{\sqrt{3}}\mathbf{i} + \frac{1}{\sqrt{3}}\mathbf{j} + \frac{1}{\sqrt{3}}\mathbf{k}; \left(-\frac{9}{2}, \frac{15}{2}, \frac{15}{2}\right)$

Express the vector in the form $\mathbf{v} = \mathbf{v} = v_1\mathbf{i} + v_2\mathbf{j} + v_3\mathbf{k}$.

182) $\overrightarrow{P_1P_2}$ if P_1 is the point (–1, –3, –1) and P_2 is the point (1, –6, –5) 182) _____

A) v = –2i – 3j + 4k B) v = –2i + 3j – 4k C) v = 2i – 3j – 4k D) v = –2i + 3j + 4k

Find the acute angle between the lines.

183) 9x – 8y = 6 and 6x + 5y = 6 183) _____

A) 0.1495 radians B) 2.992 radians C) 1.421 radians D) 0.1489 radians

Find $\mathbf{v} \cdot \mathbf{u}$.

184) $\mathbf{v} = 2\mathbf{i} + 2\mathbf{j}$ and $\mathbf{u} = 9\mathbf{i} + 9\mathbf{j}$ 184) _____

A) $18\mathbf{i} + 18\mathbf{j}$ B) $11\mathbf{i} + 11\mathbf{j}$ C) 36 D) 0

Find the angle between the planes.

185) $-2x - 3y - 5z = -2$ and $5x + 4y - 7z = -1$ 185) _____

A) 0.224 B) 1.347 C) 1.399 D) 0.972

Express the vector as a product of its length and direction.

186) $\frac{1}{\sqrt{3}}\mathbf{i} - \frac{1}{\sqrt{6}}\mathbf{j} - \frac{1}{\sqrt{2}}\mathbf{k}$ 186) _____

A) $\frac{2}{3}\left(\frac{3}{2\sqrt{3}}\mathbf{i} - \frac{3}{2\sqrt{6}}\mathbf{j} - \frac{3}{2\sqrt{2}}\mathbf{k}\right)$ B) $\frac{1}{6}\left(\frac{6}{\sqrt{3}}\mathbf{i} - \frac{6}{\sqrt{6}}\mathbf{j} - \frac{6}{\sqrt{2}}\mathbf{k}\right)$

C) $1\left(\frac{1}{\sqrt{3}}\mathbf{i} - \frac{1}{6}\mathbf{j} - \frac{1}{2}\mathbf{k}\right)$ D) $\frac{1}{2}\left(\frac{2}{3}\mathbf{i} - \frac{2}{\sqrt{6}}\mathbf{j} - \frac{2}{\sqrt{2}}\mathbf{k}\right)$

Find parametric equations for the line described below.

187) The line through the point P(–2, –5, –5) parallel to the vector $-2\mathbf{i} + 5\mathbf{j} - 6\mathbf{k}$ 187) _____

A) $x = 2t + 2$, $y = 5t + 5$, $z = -6t + 5$ B) $x = -2t + 2$, $y = 5t + 5$, $z = -6t + 5$

C) $x = -2t - 2$, $y = 5t - 5$, $z = -6t - 5$ D) $x = 2t - 2$, $y = 5t - 5$, $z = -6t - 5$

Find an equation for the sphere with the given center and radius.

188) Center (–2, 1, 0), radius = 9 188) _____

A) $x^2 + y^2 + z^2 + 4x - 2y = 76$ B) $x^2 + y^2 + z^2 - 4x + 2y = 76$

C) $x^2 + y^2 + z^2 + 4x + 2y = 76$ D) $x^2 + y^2 + z^2 - 4x - 2y = 76$

Solve the problem.

189) A garden hose is spraying a stream of water at a box on the ground with a force of2.6 pounds. The water stream makes an angle of 60 with the ground. What is the horizontal component of the force? 189) _____

A) 0.5000 B) –2.476 C) 1.300 D) 2.252

Calculate the direction of $\overrightarrow{P_1P_2}$ and the midpoint of line segment P_1P_2.

190) $P_1(4, -1, -4)$ and $P_2(8, 3, -2)$ 190) _____

A) $\frac{2}{3}\mathbf{i} + \frac{2}{3}\mathbf{j} + \frac{1}{3}\mathbf{k}; \left(4, \frac{3}{2}, -1\right)$ B) $\frac{4}{3}\mathbf{i} + \frac{1}{3}\mathbf{j} + \frac{4}{3}\mathbf{k}; \left(2, -\frac{1}{2}, -2\right)$

C) $\frac{2}{3}\mathbf{i} + \frac{2}{3}\mathbf{j} + \frac{1}{3}\mathbf{k}; (2, 2, 1)$ D) $\frac{2}{3}\mathbf{i} + \frac{2}{3}\mathbf{j} + \frac{1}{3}\mathbf{k}; (6, 1, -3)$

Find a parametrization for the line segment beginning at P_1 and ending at P_2.

191) $P_1(4, 3, 4)$ and $P_2(0, 3, 7)$ 191) _____

A) $x = -4t + 4$, $y = 3t$, $z = 3t + 4$ B) $x = -4t + 4$, $y = 3$, $z = 3t + 4$

C) $x = 4t$, $y = 3t$, $z = -3t + 7$ D) $x = 4t$, $y = 3$, $z = -3t + 7$

Find the length and direction (when defined) of $\mathbf{u} \times \mathbf{v}$.

192) $\mathbf{u} = -7\mathbf{i} + 2\mathbf{i} + 2\mathbf{k}$, $\mathbf{v} = 0$ 192) _____

A) $0; \frac{1}{\sqrt{57}}(-7\mathbf{i} + 2\mathbf{i} + 2\mathbf{k})$

B) 0; 0

C) $0; -7\mathbf{i} + 2\mathbf{i} + 2\mathbf{k}$

D) $\sqrt{57}; \frac{1}{\sqrt{57}}(-7\mathbf{i} + 2\mathbf{i} + 2\mathbf{k})$

Solve the problem.

193) Let $\mathbf{u} = -2\mathbf{i} + 8\mathbf{j}$, $\mathbf{v} = 2\mathbf{i} + 3\mathbf{j}$, and $\mathbf{w} = \mathbf{i} - \mathbf{j}$. Write $\mathbf{u} = \mathbf{u_1} + \mathbf{u_2}$ where $\mathbf{u_1}$ is parallel to $\mathbf{v}$ and $\mathbf{u_2}$ is parallel to $\mathbf{w}$. 193) _____

A) $\mathbf{u_1} = 3\mathbf{v}$, $\mathbf{u_2} = 2\mathbf{w}$

B) $\mathbf{u_1} = -4\mathbf{v}$, $\mathbf{u_2} = -24\mathbf{w}$

C) $\mathbf{u_1} = 0.8333\,\mathbf{v}$, $\mathbf{u_2} = -0.2273\mathbf{w}$

D) $\mathbf{u_1} = 1.200\,\mathbf{v}$, $\mathbf{u_2} = -4.400\mathbf{w}$

Find the angle between the curves.

194) $y = x^2 - 9$ and $y = 9 - x^2$ 194) _____

A) 0.3304 radians B) 1.571 radians C) 0.9459 radians D) 1.240 radians

Describe the given set of points with a single equation or with a pair of equations.

195) The set of points equidistant from the points (0, 0, –8) and (0, 0, 1) 195) _____

A) $z > -8$ and $z < 1$

B) $x + y = 0$ and $-8 < z < 1$

C) $x + y = -3.5$

D) $z = -3.5$

Find parametric equations for the line described below.

196) The line through the point P(3, 2, –5) and perpendicular to the plane $-3x + 6y + 5z = 5$ 196) _____

A) $x = -3t + 3$, $y = 6t + 2$, $z = 5t - 5$

B) $x = -3t - 3$, $y = 6t - 2$, $z = 5t + 5$

C) $x = 3t - 3$, $y = -6t - 2$, $z = -5t + 5$

D) $x = -6t + 3$, $y = -3t + 2$, $z = -5$

Write u as the sum of a vector parallel to v and a vector orthogonal to v.

197) $\mathbf{u} = \mathbf{i} - \mathbf{k}$, $\mathbf{v} = \mathbf{i} + \mathbf{j}$ 197) _____

A) $\mathbf{u} = \left(\frac{1}{2}\mathbf{i} - \frac{1}{2}\mathbf{k}\right) + \left(\frac{1}{2}\mathbf{i} + \mathbf{j} - \frac{1}{2}\mathbf{k}\right)$

B) $\mathbf{u} = \left(\frac{1}{2}\mathbf{i} + \frac{1}{2}\mathbf{k}\right) + \left(\frac{1}{2}\mathbf{i} - \mathbf{j} + \frac{1}{2}\mathbf{k}\right)$

C) $\mathbf{u} = \left(\frac{1}{2}\mathbf{i} + \frac{1}{2}\mathbf{j}\right) + \left(\frac{1}{2}\mathbf{i} - \frac{1}{2}\mathbf{j} - \mathbf{k}\right)$

D) $\mathbf{u} = \left(\frac{1}{2}\mathbf{i} + \frac{1}{2}\mathbf{j}\right) + \left(\frac{1}{2}\mathbf{i} - \frac{1}{2}\mathbf{j} + \mathbf{k}\right)$

Find the acute angle between the lines.

198) $x - \sqrt{3}\,y = -2$ and $\sqrt{3}\,x - y = 15$ 198) _____

A) 60° B) 75° C) 30° D) 45°

Find the indicated vector.

199) Let $\mathbf{u} = \langle 2, -9\rangle$, $\mathbf{v} = \langle -5, 4\rangle$. Find $\mathbf{u} + \mathbf{v}$. 199) _____

A) $\langle 6, -14\rangle$ B) $\langle -3, -5\rangle$ C) $\langle 7, -13\rangle$ D) $\langle -7, -1\rangle$

Write u as the sum of a vector parallel to v and a vector orthogonal to v.

200) $\mathbf{u} = 5\mathbf{i} - 8\mathbf{j} + 3\mathbf{k}$, $\mathbf{v} = -2\mathbf{i} + 4\mathbf{j} - 4\mathbf{k}$ 200) _____

A) $\mathbf{u} = \left(3\mathbf{i} - 6\mathbf{j} + 6\mathbf{k}\right) + \left(2\mathbf{i} - 2\mathbf{j} - 3\mathbf{k}\right)$

B) $\mathbf{u} = \left(3\mathbf{i} - 6\mathbf{j} + 6\mathbf{k}\right) + \left(8\mathbf{i} - 14\mathbf{j} + 9\mathbf{k}\right)$

C) $\mathbf{u} = \left(-\frac{15}{2}\mathbf{i} + 12\mathbf{j} - \frac{9}{2}\mathbf{k}\right) + \left(-\frac{19}{2}\mathbf{i} + 16\mathbf{j} - \frac{17}{2}\mathbf{k}\right)$

D) $\mathbf{u} = \left(-\frac{15}{2}\mathbf{i} + 12\mathbf{j} - \frac{9}{2}\mathbf{k}\right) + \left(\frac{11}{2}\mathbf{i} - 8\mathbf{j} + \frac{1}{2}\mathbf{k}\right)$

Give a geometric description of the set of points whose coordinates satisfy the given conditions.

201) $x^2 + y^2 + z^2 = 49$, $z = 1$ 201) _____

A) All points on the sphere $x^2 + y^2 + z^2 = 49$ and above the plane $z = 1$

B) The sphere $x^2 + y^2 + z^2 = 1$

C) All points within the sphere $x^2 + y^2 + z^2 = 49$ and above the plane $z = 1$

D) The circle $x^2 + y^2 = 48$ in the plane $z = 1$

Identify the type of surface represented by the given equation.

202) $\frac{x^2}{5} + \frac{y^2}{9} = 7$ 202) _____

A) Parabolic cylinder B) Paraboloid

C) Elliptical cylinder D) Ellipsoid

203) $\frac{x^2}{9} + \frac{y^2}{3} = \frac{z^2}{5}$ 203) _____

A) Hyperbolic paraboloid

B) Paraboloid

C) Ellipsoid

D) Elliptic cone

Find $\mathbf{v} \cdot \mathbf{u}$.

204) $\mathbf{v} = 2\mathbf{i} - 3\mathbf{j}$ and $\mathbf{u} = -6\mathbf{i} + 7\mathbf{j}$ 204) _____

A) −33 B) 9 C) $-12\mathbf{i} - 21\mathbf{j}$ D) $-4\mathbf{i} + 4\mathbf{j}$

Solve the problem.

205) Find a unit vector perpendicular to plane PQR determined by the points P(3, −3, −1), Q(2, 1, −1), and R(2, −2, − 1). 205) _____

A) $\pm\left(\frac{2}{3}\mathbf{i} + \frac{1}{3}\mathbf{j} + \frac{2}{3}\mathbf{k}\right)$ B) $\pm\left(\frac{2}{9}\mathbf{i} + \frac{1}{9}\mathbf{j} + \frac{2}{9}\mathbf{k}\right)$

C) $\pm\left(\frac{2}{9}\mathbf{i} + \frac{2}{9}\mathbf{j} + \frac{1}{9}\mathbf{k}\right)$ D) $\pm\left(\frac{2}{3}\mathbf{i} + \frac{2}{3}\mathbf{j} + \frac{1}{3}\mathbf{k}\right)$

Write the equation for the plane.

206) The plane through the points P(−1, −4, −5) , Q(2, −1, 13) and R(1, −7, 17). 206) _____

A) $8x - 2y - z = -5$ B) $8x + 2y + z = 5$ C) $8x + 2y + z = -5$ D) $8x - 2y - z = 5$

Find the distance between points P_1 and P_2.

207) $P_1(-4, -8, -8)$ and $P_2(-2, -2, -11)$ 207) _____

A) $\sqrt{7}$ B) 7 C) 5 D) 6

Solve the problem.

208) Find the work done by a force of $9\mathbf{i}$ (newtons) in moving as object along a line from the origin to the point (10, 10) (distance in meters). 208) _____

A) 63.64 joules B) 90 joules C) $90\sqrt{2}$ joules D) $9\sqrt{2}$ joules

Match the equation with the surface it defines.

209) $x^2 + y^2 = 16$ 209) _____

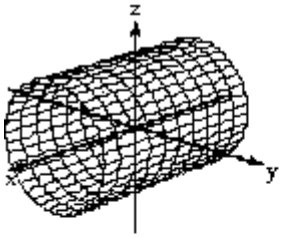


Figure 1

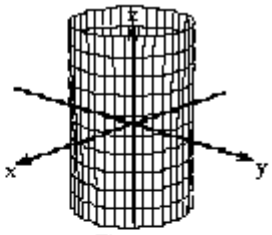


Figure 2

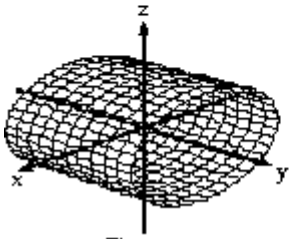


Figure 3

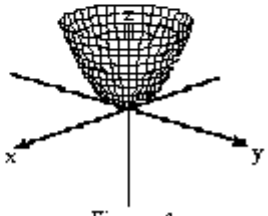


Figure 4

A) Figure 3 B) Figure 1 C) Figure 2 D) Figure 4

Find the component form of the specified vector.

210) The vector from the point A(8, 5) to the origin 210) _____

A) (–8, –5) B) (–8, 5) C) (8, 5) D) (8, –5)

Find the triple scalar product $(\mathbf{u} \times \mathbf{v}) \cdot \mathbf{w}$ of the given vectors.

211) $\mathbf{u} = -5\mathbf{i} - 3\mathbf{j} + 4\mathbf{j}$; $\mathbf{v} = 4\mathbf{i} - 8\mathbf{j} + 8\mathbf{k}$; $\mathbf{w} = 6\mathbf{i} - 5\mathbf{j} - 9\mathbf{k}$ 211) _____

A) –868 B) 32 C) –796 D) –196

Solve the problem.

212) A bullet is fired with a muzzle velocity of 1438 ft/sec from a gun aimed at an angle of 19° above the horizontal. Find the horizontal component of the velocity. 212) _____

A) 1360 ft/sec B) 495.1 ft/sec C) 1422 ft/sec D) 468.2 ft/sec

Express the vector as a product of its length and direction.

213) $3\mathbf{i} - \frac{9}{2}\mathbf{j} - 1\mathbf{k}$ 213) _____

A) $\frac{11}{2}\left(\frac{6}{11}\mathbf{i} - \frac{9}{11}\mathbf{j} - \frac{2}{11}\mathbf{k}\right)$ B) $\frac{11}{2}\left(\frac{6}{121}\mathbf{i} - \frac{9}{121}\mathbf{j} - \frac{2}{121}\mathbf{k}\right)$

C) $\frac{11}{2}\left(3\mathbf{i} - \frac{9}{2}\mathbf{j} - 1\mathbf{k}\right)$ D) $\frac{11}{2}(\mathbf{i} - \mathbf{j} - \mathbf{k})$

Find the indicated vector.

214) Let $\mathbf{u} = \langle 4, 9\rangle$. Find $7\mathbf{u}$. 214) _____

A) $\langle 28, 63\rangle$ B) $\langle -28, 63\rangle$ C) $\langle 28, -63\rangle$ D) $\langle -28, -63\rangle$

Find the angle between the curves.

215) $y = \sin(4x)$ and $y = 8x$ 215) _____

A) 0.1206 radians B) 0.9927 radians C) 1.571 radians D) 1.450 radians

Solve the problem.

216) An airplane is flying in the direction 72° west of north at 765 km/hr. Find the component form of the velocity of the airplane, assuming that the positive x–axis represents due east and the positive y–axis represents due north. 216) _____

A) $\langle -0.9511, 0.3090\rangle$ B) $\langle -236.4, 727.6\rangle$ C) $\langle -194.2, -739.9\rangle$ D) $\langle -727.6, 236.4\rangle$

Find the angle between the planes.

217) $8x + 3y + 4z = -3$ and $2x + 9y + 8z = -1$ 217) _____

A) 0.862 B) 0.709 C) 1.440 D) 1.189

Write the equation for the plane.

218) The plane through the point P(–10, 8, –5) and perpendicular to the line $x = 9 + 9t$, $y = 6 + 6t$, $z = 4 + 6t$ 218) _____

A) $9x + 6y + 6z = -72$ B) $9x + 6y + 6z = 21$

C) $9x + 6y + 6z = 72$ D) $9x + 6y + 6z = -7$

Identify the type of surface represented by the given equation.

219) $\frac{z^2}{10} - \frac{x^2}{9} = \frac{y}{6}$ 219) _____

A) Ellipsoid B) Hyperbolic paraboloid

C) Paraboloid D) Parabolic cylinder

Express the vector as a product of its length and direction.

220) $\frac{6}{5}\mathbf{j} - \frac{8}{5}\mathbf{k}$ 220) _____

A) $2(\mathbf{j} - \mathbf{k})$ B) $2\left(\frac{6}{5}\mathbf{j} - \frac{8}{5}\mathbf{k}\right)$ C) $2\left(\frac{3}{5}\mathbf{j} - \frac{4}{5}\mathbf{k}\right)$ D) $4\left(\frac{3}{5}\mathbf{j} - \frac{4}{5}\mathbf{k}\right)$

Find the angle between the curves.

221) $y = 6x^2$ and $y = 9x^3$ 221) _____

A) 1.530 radians B) 0.9992 radians C) 0.9828 radians D) 0.04121 radians

Find an equation for the line that passes through the given point and satisfies the given conditions.

222) P = (9, 3); parallel to $\mathbf{v} = 2\mathbf{i} + 5\mathbf{j}$ 222) _____

A) $y - 3 = -\frac{2}{7}(x - 2)$ B) $2x + 5y = 29$ C) $2x + 5y = 33$ D) $5x - 2y = 39$

Give a geometric description of the set of points whose coordinates satisfy the given conditions.

223) $5 \le y \le 6, 5 \le z \le 6$ 223) _____

A) The infinitely long square prism parallel to the x–axis

B) The line between the points (0, 5, 5) and (0, 6, 6)

C) The cube located in the first quadrant and with sides 5 units in length

D) The square with corners at (0, 5, 5), (0, 5, 6), (0, 6, 5), and (0, 6, 6)

Find an equation for the sphere with the given center and radius.

224) Center (0, –3, –1), radius = 2 224) _____

A) $x^2 + y^2 + 2z^2 + 6y + 2z = -6$ B) $x^2 + y^2 + z^2 + 6y + 2z = -6$

C) $x^2 + y^2 + 2z^2 + 6y - 2z = -6$ D) $x^2 + y^2 + z^2 + 6y - 2z = -6$

Write one or more inequalities that describe the set of points.

225) The interior of the sphere of radius 4 centered at the point (4, 2, 1) 225) _____

A) $(x - 4)^2 + (x - 2)^2 + (x - 1)^2 > 16$ B) $(x + 4)^2 + (x + 2)^2 + (x + 1)^2 \ge 16$

C) $(x - 4)^2 + (x - 2)^2 + (x - 1)^2 < 16$ D) $(x + 4)^2 + (x + 2)^2 + (x + 1)^2 > 16$

Identify the type of surface represented by the given equation.

226) $\frac{x^2}{8} + \frac{y^2}{5} - \frac{z^2}{5} = 1$ 226) _____

A) Hyperboloid of one sheet B) Elliptic cone

C) Hyperboloid of two sheets D) Ellipsoid

Give a geometric description of the set of points whose coordinates satisfy the given conditions.

227) $-8 \le z \le -7$ 227) _____

A) No set of points satisfies the given relation

B) All points between z = –8 and z = –7 in the x–y plane

C) The slab between the planes z = –8 and z = –7 (including planes)

D) The line from z = –8 to z = –7

Find the center and radius of the sphere.

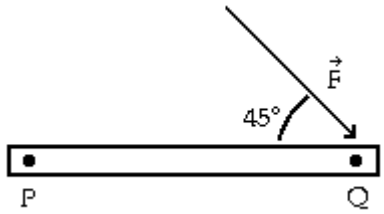
228) $(x + 4)^2 + (y + 7)^2 + (z + 4)^2 = \frac{1}{49}$ 228) _____

A) C(–4, –7, –4), $a = \frac{1}{7}$ B) C(4, 7, 4), $a = \frac{1}{49}$

C) C(4, 7, 4), $a = \frac{1}{7}$ D) C(–4, –7, –4), $a = \frac{1}{49}$

Solve the problem.

229) Find the magnitude of the torque in foot-pounds at point P for the following lever: 229) _____



$\left|\overrightarrow{PQ}\right| = 10$ in. and $|\mathbf{F}| = 25$ lb

A) 250 ft–lb B) –12,188.30 ft–lb C) 1706.36 ft–lb D) 12,188.30 ft–lb

Find the indicated vector.

230) Let $\mathbf{u} = \langle 4, -2\rangle$, $\mathbf{v} = \langle -6, -7\rangle$. Find $\frac{5}{13}\mathbf{u} - \frac{12}{13}\mathbf{v}$. 230) _____

A) $\left\langle \frac{74}{13}, \frac{92}{13} \right\rangle$ B) $\left\langle \frac{44}{13}, \frac{54}{13} \right\rangle$ C) $\left\langle \frac{50}{13}, \frac{60}{31} \right\rangle$ D) $\left\langle \frac{92}{13}, \frac{74}{13} \right\rangle$

Give a geometric description of the set of points whose coordinates satisfy the given conditions.

231) $x^2 + y^2 + z^2 > 49$ 231) _____

A) All points outside the sphere of radius 7

B) All points on the surface of the cylinder with radius 7

C) All points outside the cylinder with radius 7

D) All points in space

Find the angle between the curves.

232) $y = e^{2x}$ and $y = e^{8x}$ 232) _____

A) 1.326 radians B) 0.8321 radians C) 0.9828 radians D) 0.5880 radians

Find the intersection.

233) $-8x + 7y + 9z = -9$, $5x - 4y + 8z = 7$ 233) _____

A) $x = -276t + 13$, $y = -327t + 11$, $z = 3t$ B) $x = -92t - 13$, $y = -109t + -11$, $z = 3t$

C) $x = 92t + \frac{13}{3}$, $y = 109t + \frac{11}{3}$, $z = -3t$ D) $x = 92t + 13$, $y = 109t - 11$, $z = 3t$

Express the vector in the form $\mathbf{v} = \mathbf{v} = v_1\mathbf{i} + v_2\mathbf{j} + v_3\mathbf{k}$.

234) $4u - 3v$ if $u = \langle 1, 1, 0\rangle$ and $v = \langle 3, 0, 1\rangle$ 234) _____

A) $v = 13i + 4j - 3k$ B) $v = -5i + 7j - 3k$ C) $v = -5i + 4j - 3k$ D) $v = 4i + 4j - 3k$

Calculate the requested distance.

235) The distance from the point S(–3, –6, 2) to the plane $-9x + 2y + 6z = 10$ 235) _____

A) $\frac{17}{11}$ B) $\frac{17}{121}$ C) $\frac{13}{121}$ D) $\frac{13}{11}$

Find an equation for the sphere with the given center and radius.

236) Center (0, 0, 5), radius = 6 236) _____

A) $x^2 + y^2 + z^2 - 10z = 11$ B) $x^2 + y^2 + 6z^2 - 10z = 11$

C) $x^2 + y^2 + z^2 + 10z = 11$ D) $x^2 + y^2 + 6z^2 + 10z = 11$

Find the angle between u and v in radians.

237) $\mathbf{u} = 3\mathbf{j} - 6\mathbf{k}$, $\mathbf{v} = 6\mathbf{i} - 9\mathbf{j} - 6\mathbf{k}$ 237) _____

A) 1.46 B) 1.53 C) 0.11 D) 1.57

Describe the given set of points with a single equation or with a pair of equations.

238) The plane through the point (5, –4, –4) and parallel to the xy–plane 238) _____

A) x + y – 8 = 0 B) z = –8 C) x + y = 15 D) x = 5 and y = 10

Match the equation with the surface it defines.

239) $\frac{x^2}{6^2} + \frac{y^2}{6^2} = \frac{z^2}{36}$ 239) _____

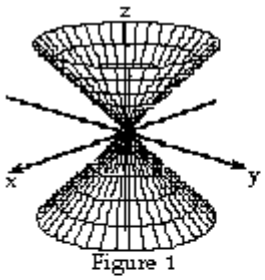


Figure 1

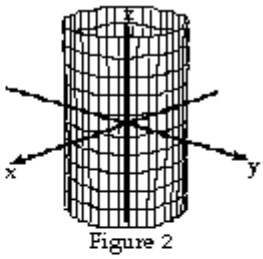


Figure 2

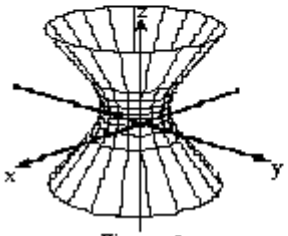


Figure 3

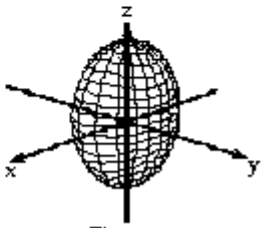


Figure 4

A) Figure 1 B) Figure 4 C) Figure 3 D) Figure 2

Solve the problem.

240) For the triangle with vertices located at A(4, 3, 3), B(2, 5, 2), and C(1, 1, 1) , find a vector from vertex C to the midpoint of side AB. 240) _____

A) $2\mathbf{i} + 3\mathbf{j} + \frac{3}{2}\mathbf{k}$ B) $1\mathbf{i} + \frac{1}{2}\mathbf{j} + \frac{1}{2}\mathbf{k}$ C) $3\mathbf{i} + 4\mathbf{j} + \frac{5}{2}\mathbf{k}$ D) $4\mathbf{i} + 5\mathbf{j} + \frac{7}{2}\mathbf{k}$

241) Find a unit vector perpendicular to plane PQR determined by the points P(1, –1, –1), Q(–1, 1, $\frac{5}{3}$), and R(–2, 4, 5). 241) _____

A) $\pm\left(\frac{-6}{121}\mathbf{i} + \frac{2}{121}\mathbf{j} + \frac{6}{121}\mathbf{k}\right)$ B) $\pm\left(\frac{-6}{121}\mathbf{i} - \frac{2}{121}\mathbf{j} - \frac{6}{121}\mathbf{k}\right)$

C) $\pm\left(\frac{-6}{11}\mathbf{i} - \frac{2}{11}\mathbf{j} - \frac{6}{11}\mathbf{k}\right)$ D) $\pm\left(\frac{-6}{11}\mathbf{i} + \frac{2}{11}\mathbf{j} + \frac{6}{11}\mathbf{k}\right)$

Express the vector as a product of its length and direction.

242) $6\mathbf{j}$ 242) _____

A) $6(6\mathbf{j})$ B) $\frac{1}{6}\mathbf{j}$ C) $6\mathbf{j}$ D) $6\left(\frac{1}{6}\mathbf{j}\right)$

Find the angle between u and v in radians.

243) $\mathbf{u} = -8\mathbf{i} + 6\mathbf{j} - 8\mathbf{k}$, $\mathbf{v} = 7\mathbf{i} + 6\mathbf{j} - 9\mathbf{k}$ 243) _____

A) 1.57 B) 1.25 C) 0.32 D) 1.41

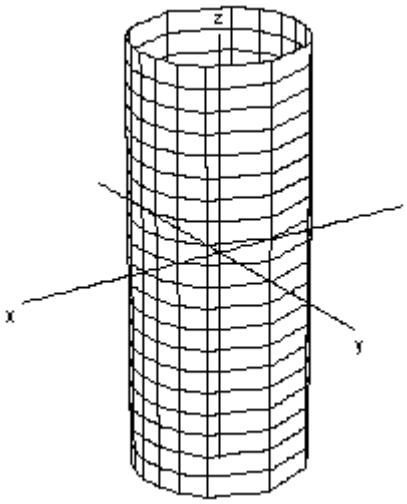
Find the vector $\text{proj}_{\mathbf{v}}\,\mathbf{u}$.

244) $\mathbf{v} = 3\mathbf{j}$, $\mathbf{u} = 4\mathbf{i} + 3\mathbf{k}$ 244) _____

A) 0 B) $\frac{4}{9}\mathbf{i} + \frac{1}{3}\mathbf{j}$ C) $\frac{3}{10}\mathbf{j}$ D) $\frac{4}{9}\mathbf{i} + \frac{1}{3}\mathbf{j} + \frac{1}{3}\mathbf{k}$

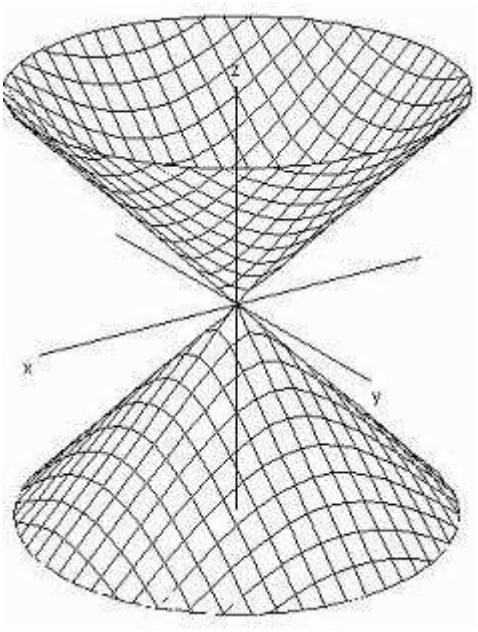
1) Verify that $\left|\frac{\mathbf{a}+\mathbf{b}}{2}\right| = \left|\frac{\mathbf{a}-\mathbf{b}}{2}\right|$.

   Cancel the 2's and square both sides:
   $|\mathbf{a}+\mathbf{b}|^2 = |\mathbf{a}-\mathbf{b}|^2$ or
   $(\mathbf{a}+\mathbf{b})\cdot(\mathbf{a}+\mathbf{b}) = (\mathbf{a}-\mathbf{b})\cdot(\mathbf{a}-\mathbf{b})$ or
   $\mathbf{a}\cdot\mathbf{a} + 2\mathbf{a}\cdot\mathbf{b} + \mathbf{b}\cdot\mathbf{b} = \mathbf{a}\cdot\mathbf{a} - 2\mathbf{a}\cdot\mathbf{b} + \mathbf{b}\cdot\mathbf{b}$ [$2\mathbf{a}\cdot\mathbf{b} = 0$ since **a** and **b** are orthogonal]
   $\mathbf{a}\cdot\mathbf{a} + \mathbf{b}\cdot\mathbf{b} = \mathbf{a}\cdot\mathbf{a} + \mathbf{b}\cdot\mathbf{b}$ Verified.
   Thus, the midpoint is equidistant from all three vertices.
2) Not always true; The statement is false if $\mathbf{u} \neq \mathbf{v}$.
3)

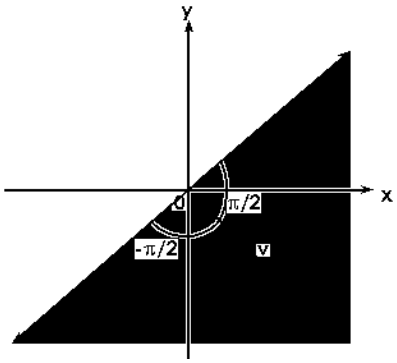


4) Always true by distributive property
5) $\mathbf{A}\cdot\mathbf{B} = (a\mathbf{u} + b\mathbf{v})\cdot(b\mathbf{u} - a\mathbf{v}) = ab\mathbf{u}\cdot\mathbf{u} - a^2\mathbf{u}\cdot\mathbf{v} + b^2\mathbf{u}\cdot\mathbf{v} - ab\mathbf{v}\cdot\mathbf{v} = ab - ab = 0$
   Since the dot product is zero and since neither **A** nor **B** is identically zero, **A** and **B** are orthogonal.
6) Not always true; $(\mathbf{u}\times\mathbf{v})\cdot\mathbf{w} = \mathbf{u}\cdot(\mathbf{v}\times\mathbf{w})$, but $\mathbf{v}\times\mathbf{w} = -(\mathbf{w}\times\mathbf{v})$ from which it follows that the original equation false if $\mathbf{w}\times\mathbf{v} \neq \mathbf{0}$.

7)

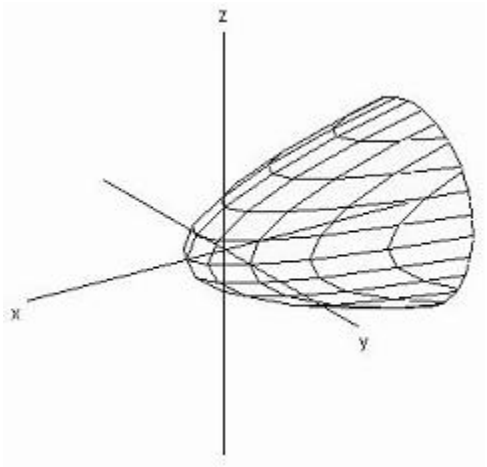


8) Let $\mathbf{w} = x\mathbf{i} + y\mathbf{j}$. Then the dot product is $\mathbf{w} \cdot \mathbf{v} = |\mathbf{w}||\mathbf{v}| \cos\theta \geq 0$. The relation is satisfied for all θ between $-\frac{\pi}{2}$ and $\frac{\pi}{2}$.

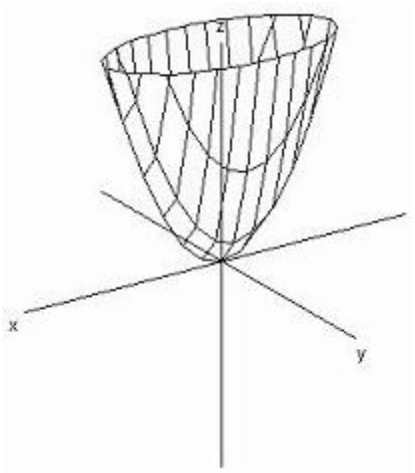


9) Always true because $\mathbf{u} \times \mathbf{v}$ and $\mathbf{v}$ are orthogonal

10)

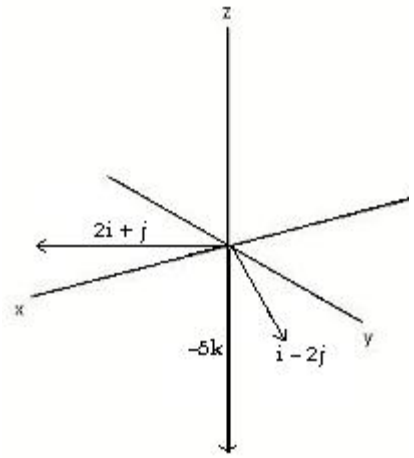


11)

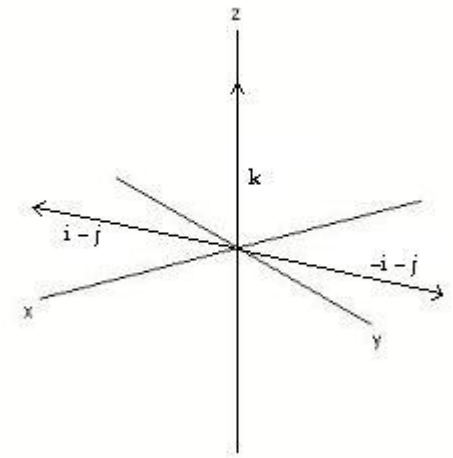


12) Not always true; The statement if false if $c \neq 0,1$.

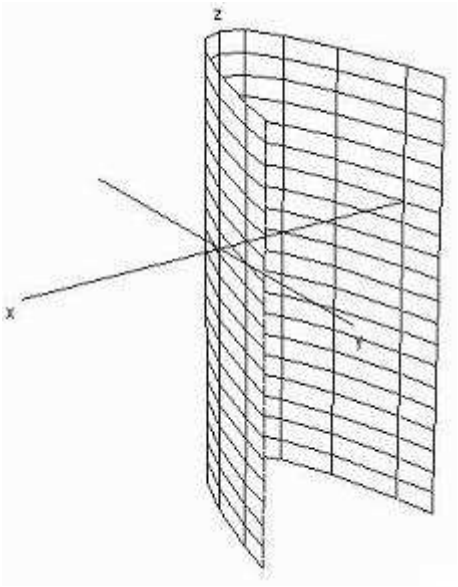
13)



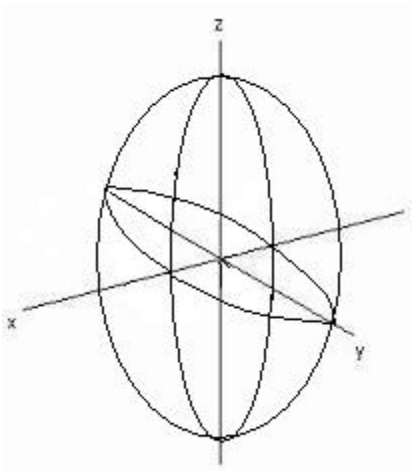
14)



15)



16)



17) Always true by definition of the cross product

18) Take the dot product:

$(|\mathbf{a}|\,\mathbf{b} + |\mathbf{b}|\,\mathbf{a}) \cdot (|\mathbf{a}|\,\mathbf{b} - |\mathbf{b}|\,\mathbf{a}) = (|\mathbf{a}|\,\mathbf{b} + |\mathbf{b}|\,\mathbf{a}) \cdot |\mathbf{a}|\,\mathbf{b} - (|\mathbf{a}|\,\mathbf{b} + |\mathbf{b}|\,\mathbf{a}) \cdot |\mathbf{b}|\,\mathbf{a}$

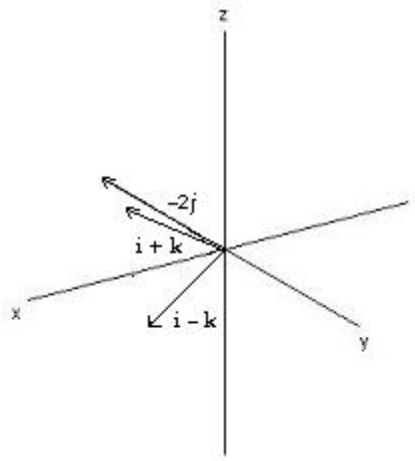
$= (|\mathbf{a}|\,\mathbf{b}) \cdot (|\mathbf{a}|\,\mathbf{b}) + (|\mathbf{b}|\,\mathbf{a}) \cdot (|\mathbf{a}|\,\mathbf{b}) - (|\mathbf{a}|\,\mathbf{b}) \cdot (|\mathbf{b}|\,\mathbf{a}) - (|\mathbf{b}|\,\mathbf{a}) \cdot (|\mathbf{b}|\,\mathbf{a})$

$= |\mathbf{a}|^2 \mathbf{b} \cdot \mathbf{b} + |\mathbf{a}||\mathbf{b}|\,\mathbf{a} \cdot \mathbf{b} - |\mathbf{a}||\mathbf{b}|\,\mathbf{a} \cdot \mathbf{b} - |\mathbf{b}|^2\,\mathbf{a} \cdot \mathbf{a}$

$= |\mathbf{a}|^2 |\mathbf{b}|^2 - |\mathbf{b}|^2 |\mathbf{a}|^2 = 0$

Since the dot product is zero and since neither vector is identically zero, then the vectors are orthogonal.

19)



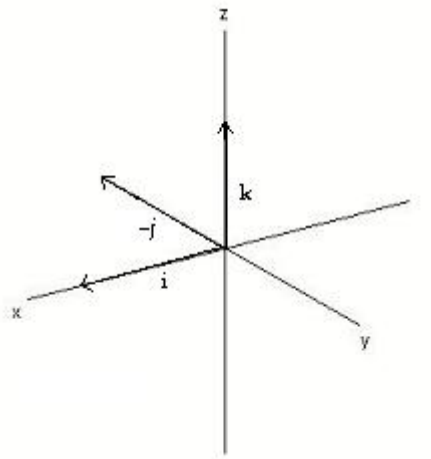
20) Always true by definition
21) Not always true; The statement if false if $c \neq 0,1$.
22) $\mathbf{u} = u_X\,\mathbf{i} + u_Y\mathbf{j}$ and $\mathbf{v} = v_X\,\mathbf{i} + v_Y\mathbf{j}$, so
$\mathbf{a} = \mathbf{u} + \mathbf{v} = (u_X + v_X)\,\mathbf{i} + (u_Y + v_Y)\mathbf{j}$ and $\mathbf{b} = \mathbf{u} - \mathbf{v} = (u_X - v_X)\,\mathbf{i} + (u_Y - v_Y)\mathbf{j}$

Take the dot product $\mathbf{a} \cdot \mathbf{b}$:
$\mathbf{a} \cdot \mathbf{b} = (\mathbf{u} + \mathbf{v}) \cdot (\mathbf{u} - \mathbf{v}) = (u_X + v_X)(u_X - v_X) + (u_Y + v_Y)(u_Y - v_Y)$

$= u_x^2 - v_x^2 + u_y^2 - v_y^2 = (u_x^2 + u_y^2) - (v_x^2 + v_y^2)$

$= |\mathbf{u}| - |\mathbf{v}| = 1 - 1 = 0$

Since the dot product of the two non-zero vectors is zero they are orthogonol.
23) Always true by definition of $\mathbf{0}$
24)



25) D
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30) C

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219) B
220) C
221) D
222) D
223) A
224) B
225) C
226) A
227) C
228) A
229) D
230) D

Answer Key
Testname: TEST 3

231) A
232) D
233) C
234) C
235) A
236) A
237) A
238) B
239) A
240) A
241) C
242) C
243) B
244) A