Instructions of as use the new runVector3d.py program

In **Windows operating system**:

After the download the **repository** access the runVector3d.py program and give two clicks and follow the news instructions in display. Too will can run the runVector3d.py program using the Command Prompt or Windows Power Shell in **Windows 11** typed the following command:

C:\Users\UserName> py runVector3d.py program
Or
C:\Users\UserName> python runVector3d.py program

[Warning]: No type the following command:

C:\Users\UserName> python3 runVector3d.py program

to run the runVector3d.py program in Command Prompt or Windows Power Shell in **Windows 11**.

In **Linux operating system**:

After the download the **repository** access the runVector3d.py program file. Exist two options to run the runVector3d.py program.

1.) In any Terminal linux type the following command:

python3 runVector3d.py after key ENTER

2.) Open and run the runVector3d.py program file using the IDLE3 and use the Run ==> Run Module options. After follow the news instructions in display.

-_- *[Warning]: When using the runVector3d.py program file in Command Prompt or Windows Power Shell in **Windows 11** or in any Terminal linux and this program request any [data enter] type the [components] of the Vectors or the [coordinates] of the given points, and after key ENTER to continue, Ok!

Now will use the runVector3d.py program in examples below.

Example1 – Given the vectors a = <7,-2,-11> and b = <-18, 3,17>, find the addition a + b and too the subtraction a – b.

Solution: Begin the runVector3d.py program and select the option[16]. After follow the instructions requested in accordance with showed in the display.

[WELCOME IN USING THE [RUNVECTOR3D.PY] PROGRAM]
[TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] IN THE [SPACE]]
--[Version: 2.0 -- Stable]--

[INSTRUCTIONS OF USE]

- To find the [value] of the [Dot Product] of [two vectors]: vectorA and vectorB using the [Definition]: a * b = a1*b1 + a2*b2 + a3*b3 key [1]
- To Determine the [value] of the [Dot Product] of [two vectors]: vectorA and vectorB using the [Theorem]: a * b = ||a||*||b||*cos(theta) key [2]
- To get the [Cross Product] with the given [Components] of [two vectors]: vectorA and vectorB or using the given [Coordinates] of the [points]: P, Q, and R key [3]

- To calculate the [value] of the [Theta Sine] between [two vectors]: vectorA and vectorB key [4]
- To find the [value] of the [Scalar Triple Product] of [three vectors]: vectorA, vectorB, and vectorC key [5]
- To determine the [value] of the [Theta angle in degrees] between the [two vectors]: vectorA and vectorB key [6]
- To get the [value] of the [Theta Cosine] between [two vectors]: vectorA and vectorB key [7]
- To find the [Vectors: vectorA, vectorB, vectorC, and vectorD] and [Modules] using the [Theorem] of the [Distance] between any [two points]: P and Q or P and R or Q and R or R and S key [8]
- To calculate the [Area(S)] of the [Triangle(PQR)] with the given [Coordinates] of the [points]: P, Q, and R or the given [Components] of [two vectors]: vectorA and vectorB key [9]
- To find the [height(h)] and [Area(P)] of the [Parallelogram(PQRS)] determined to [two adjacent vectors]: vectorA and vectorB or with given [Coordinates] of the [vertice points: P, Q, and R] key [10]
- To get the [Volume_V(P)], and [Height(h)] of a [Parallelepiped] and too the [Volume_V(T)] of a [Tetrahedron] with the given [Coordinates] of the [four points]: P, Q, R, and S or with the given [Components] of the [three vectors]: vector_A, vector_B, and vector_C key [11]
- To calculate the [three Inner Angles: Alpha, Beta, and Gama] of the [TrianglePQR] with the given [Coordinates] of the given [points]: P, Q, and R key [12]
- To Determine the following [Middle Points]: K(xK,yK,zK), L(xL,yL,zL), M(xM,yM,zM), and N(xN,yN,zN) between [points]: P(xP,yP,zP), Q(xQ,yQ,zQ), R(xR,yR,zR), and S(xS,yS,zS) or in [sides]: PQ, PR, and QR of a Triangle(PQR).key [13]
- To find the [Centroid: G(xG, yG, zG)] of the Triangle(PQR) key [14]
- To determine the [Medians: PM, QL, and RK] of a Triangle(PQR) key [15]
- To get the [Addition] and [Subraction] between [Two Vectors]: vectorA and vectorB key [16]
- Provide the given [Components] of a [vectorA] or find a [new vectorA] that represent a [oriented segmentPQ] with the given [Coordinates] of [two points]: P and Q and calculate the [Direction Cosines] and [Direction Angles] key [17]
- To find the [Addition] and [Subraction] between [two vectors]: vectorA and vectorB multiplyed by [two scalars]: [coeffic1 and coeffic2] key [18]
- To calculate the [dimensions]: [Perimeter(P)], [Heights(h1,h2,h3)], and [Area(A)] of a [TrianglePQR] with the given [Coordinates] of the [three points]: P, Q, and R key [19]
- To get the [dimensions]: [Perimeter(P)], [heights(h1,h2)], and [Area(S)] of a [Parallelogram(PQRS)] key [20]
- Given the [Coordinates] of the [Middle Points]: K(xK,yK,zK), L(xL,yL,zL), and M(xM,yM,zM) will calculate the [Coordinates] of the [vertice points]: P, Q, and R of a Triangle(PQR). key [21]

[§] Select an previous [option] that will used--Ok!

[º>º] Provide the [new] value? 16

[GIVE THE [COMPONENTS] OF [TWO VECTORS]: VECTOR_A AND VECTOR_B OR]
[PROVIDE THE [COORDINATES] OF [THREE POINTS]: P, Q, AND R IN [SPACE |R³]]
[AFTER FIND THE [TWO VECTORS]: VECTOR_A AND VECTOR_B AND FOLLOW]
[TO CALCULATE THE [ADDITION] AND [SUBTRACTION] OF THIS [VECTORS]]

[NEW INSTRUCTIONS]

- To introduce the [Coordinates] of the [points: P, Q, and R] type [1].
- To enter the [Components] of the [vectors: A and B] type [2].
(º_º) Give the [new] value? 2

- Attribute the [Components] of the [1º vectorA].

- Enter the [coefficient] of the [Component: (i) or (a1)]?
(ª<ª) Enter the [new] value? 7

- Introduce the [coefficient] of the [Component: (j) or (a2)]?
(ª<ª) Enter the [new] value? -2

- Give the [coefficient] of the [Component: (k) or (a3)]?
(ª<ª) Enter the [new] value? -11

- Provide the [Components] of the [2º vectorB].

- Enter the [coefficient] of the [Component: (i) or (b1)]?
(ª<ª) Enter the [new] value? -18

- Introduce the [coefficient] of the [Component: (j) or (b2)]?
(ª<ª) Enter the [new] value? 3

- Give the [coefficient] of the [Component: (k) or (b3)]?
(ª<ª) Enter the [new] value? 17

[Answer]

-- The [vectorA]: vectorA [7.0, -2.0, -11.0]
-- The [vectorB]: vectorB [-18.0, 3.0, 17.0]

-- The [Addition]: vector(A+B) [-11.0, 1.0, 6.0]
-- The [Subtraction]: vector(A-B) [25.0, -5.0, -28.0]

. . . Key [ENTER] to exit -- Ok! . . .

Example2 – If **a = 2i – 3k**, **b = i + j + K**, and **c = 4j – k** then find the Scalar Triple Product [a * (bxc)], the volume V = |a*(bxc)| of a Parallelepiped as too the volume: V = (1/6)* a*(bxc)| of a Tetrahedron.

Solution: Begin the runVector3d.py program and select the option[11]. After follow key option[2] and type the given [components] of the [vectors]: a1 = 2, a2 = 0, a3 = -3, b1 = 1, b2 = 1, b3 = 1, c1 = 0, c2 = 4, and c3 = -1. Continue follow the instructions in accordance with showed in the display.

[WELCOME IN USING THE [RUNVECTOR3D.PY] PROGRAM]
[TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] IN THE [SPACE]]
--[Version: 2.0 -- Stable]--

[INSTRUCTIONS OF USE]

- To find the [value] of the [Dot Product] of [two vectors]: vectorA and vectorB using the [Definition]: a * b = a1*b1 + a2*b2 + a3*b3 key [1]
- To Determine the [value] of the [Dot Product] of [two vectors]: vectorA and vectorB using the [Theorem]: a * b = ||a||*||b||*cos(theta) key [2]
- To get the [Cross Product] with the given [Components] of [two vectors]: vectorA and vectorB or using the given [Coordinates] of the [points]: P, Q, and R key [3]
- To calculate the [value] of the [Theta Sine] between [two vectors]: vectorA and vectorB key [4]
- To find the [value] of the [Scalar Triple Product] of [three vectors]: vectorA, vectorB, and vectorC key [5]
- To determine the [value] of the [Theta angle in degrees] between the [two vectors]: vectorA and vectorB key [6]
- To get the [value] of the [Theta Cosine] between [two vectors]: vectorA and vectorB key [7]
- To find the [Vectors: vectorA, vectorB, vectorC, and vectorD] and [Modules] using the [Theorem] of the [Distance] between any [two points]: P and Q or P and R or Q and R or R and S key [8]
- To calculate the [Area(S)] of the [Triangle(PQR)] with the given [Coordinates] of the [points]: P, Q, and R or the given [Components] of [two vectors]: vectorA and vectorB key [9]
- To find the [height(h)] and [Area(P)] of the [Parallelogram(PQRS)] determined to [two adjacent vectors]: vectorA and vectorB or with given [Coordinates] of the [vertice points: P, Q, and R] key [10]
- To get the [Volume_V(P)], and [Height(h)] of a [Parallelepiped] and too the [Volume_V(T)] of a [Tetrahedron] with the given [Coordinates] of the [four points]: P, Q, R, and S or with the given [Components] of the [three vectors]: vector_A, vector_B, and vector_C key [11]
- To calculate the [three Inner Angles: Alpha, Beta, and Gama] of the [TrianglePQR] with the given [Coordinates] of the given [points]: P, Q, and R key [12]
- To Determine the following [Middle Points]: K(xK,yK,zK), L(xL,yL,zL), M(xM,yM,zM), and N(xN,yN,zN) between [points]: P(xP,yP,zP), Q(xQ,yQ,zQ), R(xR,yR,zR), and S(xS,yS,zS) or in [sides]: PQ, PR, and QR of a Triangle(PQR).key [13]
- To find the [Centroid: G(xG, yG, zG)] of the Triangle(PQR) key [14]
- To determine the [Medians: PM, QL, and RK] of a Triangle(PQR) key [15]
- To get the [Addition] and [Subraction] between [Two Vectors]: vectorA and vectorB key [16]

- Provide the given [Components] of a [vectorA] or find a [new vectorA] that represent a [oriented segmentPQ] with the given [Coordinates] of [two points]: P and Q and calculate the [Direction Cosines] and [Direction Angles] key [17]
- To find the [Addition] and [Subraction] between [two vectors]: vectorA and vectorB multiplyed by [two scalars]: [coeffic1 and coeffic2] key [18]
- To calculate the [dimensions]: [Perimeter(P)], [Heights(h1,h2,h3)], and [Area(A)] of a [TrianglePQR] with the given [Coordinates] of the [three points]: P, Q, and R key [19]
- To get the [dimensions]: [Perimeter(P)], [heights(h1,h2)], and [Area(S)] of a [Parallelogram(PQRS)] key [20]
- Given the [Coordinates] of the [Middle Points]: K(xK,yK,zK), L(xL,yL,zL), and M(xM,yM,zM) will calculate the [Coordinates] of the [vertice points]: P, Q, and R of a Triangle(PQR). key [21]

[§] Select an previous [option] that will used--Ok!

[º>º] Provide the [new] value? 11

[GIVENS THE [COORDINATES] OF THE POINTS: P, Q, R, AND S OR]
[THE [COMPONENTS] OF THE VECTORS: VECTOR_A, VECTOR_B, AND VECTOR_C FIND:]
[THE [MIXED PRODUCT], HEIGHT(H), AND THE VOLUME_V(P) OF THE PARALLELEPIPED AND]
[TOO THE [VOLUME_V(T)] OF A [TETRAHEDRON]]

[NEW INSTRUCTIONS]

* Type [1] to enter all the [Coordinate] points: P, Q, R and S or
* Type [2] and provide all the [Component] vectors: vectorA, vectorB and vectorC.

(º_º) Give the [new] value? 2

- Attribute the [Components] of the [1º vectorA].

- Enter the [coefficient] of the [Component: (i) or (a1)]?
(ª<ª) Enter the [new] value? 2

- Introduce the [coefficient] of the [Component: (j) or (a2)]?
(ª<ª) Enter the [new] value? 0

- Give the [coefficient] of the [Component: (k) or (a3)]?
(ª<ª) Enter the [new] value? -3

- Provide the [Components] of the [2º vectorB].

- Enter the [coefficient] of the [Component: (i) or (b1)]?
(ª<ª) Enter the [new] value? 1

- Introduce the [coefficient] of the [Component: (j) or (b2)]?
(ª<ª) Enter the [new] value? 1

- Give the [coefficient] of the [Component: (k) or (b3)]?
(ª<ª) Enter the [new] value? 1

- Give the [Components] of the [3º vectorC].

- Enter the [coefficient] of the [Component: (i) or (c1)]?
(ª<ª) Enter the [new] value? 0

- Introduce the [coefficient] of the [Component: (j) or (c2)]?
(ª<ª) Enter the [new] value? 4

- Give the [coefficient] of the [Component: (k) or (c3)]?
(ª<ª) Enter the [new] value? -1

[Answer]

-- The [vectorA]: vectorA [2.0, 0.0, -3.0]
-- The [vectorB]: vectorB [1.0, 1.0, 1.0]
-- The [vectorC]: vectorC [0.0, 4.0, -1.0]

-- The value of the [Mixed Product: a * (b x c)] finded: -22.0
-- The [vectorAxB]: vectorAxB [3.0, -5.0, 2.0]
-- The ||normVectorAxB|| is 6.16

-- The [Height(h)] of a Parallelepiped is 3.57
-- The [Volume_V(P)] of a Parallelepiped is 22.00
-- The [Volume_V(T)] of a [Tetrahedron] is 3.67

. . . Key [ENTER] to exit -- Ok! . . .

Example3 – A trianglePQR in $|R^3$ has vertices P(0, 2, -1), Q(1, 1, 3), and R(1, 0, -4).
a.) Find the perimeter(P) of the triangle(PQR)
b.) Find the area(A)of the triangle(PQR)
c.) Find the three vertex angles of the triangle(PQR). (Round to the nearest degree)

Solution: – Run the runVector3d.py program and key the option[19] and after follow key in option[2] and type the given [coordinates] of the [vertices]: P, Q, and R.

[WELCOME IN USING THE [RUNVECTOR3D.PY] PROGRAM]
[TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] IN THE [SPACE]]
--[Version: 2.0 -- Stable]--

[INSTRUCTIONS OF USE]

- To find the [value] of the [Dot Product] of [two vectors]: vectorA and vectorB using the [Definition]: a * b = a1*b1 + a2*b2 + a3*b3 key [1]
- To Determine the [value] of the [Dot Product] of [two vectors]: vectorA and vectorB using the [Theorem]: a * b = ||a||*||b||*cos(theta) key [2]
- To get the [Cross Product] with the given [Components] of [two vectors]: vectorA and vectorB or using the given [Coordinates] of the [points]: P, Q, and R key [3]
- To calculate the [value] of the [Theta Sine] between [two vectors]: vectorA and vectorB key [4]
- To find the [value] of the [Scalar Triple Product] of [three vectors]: vectorA, vectorB, and vectorC key [5]
- To determine the [value] of the [Theta angle in degrees] between the [two vectors]: vectorA and vectorB key [6]
- To get the [value] of the [Theta Cosine] between [two vectors]: vectorA and vectorB key [7]
- To find the [Vectors: vectorA, vectorB, vectorC, and vectorD] and [Modules] using the [Theorem] of the [Distance] between any [two points]: P and Q or P and R or Q and R or R and S key [8]
- To calculate the [Area(S)] of the [Triangle(PQR)] with the given [Coordinates] of the [points]: P, Q, and R or the given [Components] of [two vectors]: vectorA and vectorB key [9]
- To find the [height(h)] and [Area(P)] of the [Parallelogram(PQRS)] determined to [two adjacent vectors]: vectorA and vectorB or with given [Coordinates] of the [vertice points: P, Q, and R] key [10]
- To get the [Volume_V(P)], and [Height(h)] of a [Parallelepiped] and too the [Volume_V(T)] of a [Tetrahedron] with the given [Coordinates] of the [four points]: P, Q, R, and S or with the given [Components] of the [three vectors]: vector_A, vector_B, and vector_C key [11]
- To calculate the [three Inner Angles: Alpha, Beta, and Gama] of the [TrianglePQR] with the given [Coordinates] of the given [points]: P, Q, and R key [12]
- To Determine the following [Middle Points]: K(xK,yK,zK), L(xL,yL,zL), M(xM,yM,zM), and N(xN,yN,zN) between [points]: P(xP,yP,zP), Q(xQ,yQ,zQ), R(xR,yR,zR), and S(xS,yS,zS) or in [sides]: PQ, PR, and QR of a Triangle(PQR).key [13]
- To find the [Centroid: G(xG, yG, zG)] of the Triangle(PQR) key [14]
- To determine the [Medians: PM, QL, and RK] of a Triangle(PQR) key [15]
- To get the [Addition] and [Subraction] between [Two Vectors]: vectorA and vectorB key [16]

- Provide the given [Components] of a [vectorA] or find a [new vectorA] that represent a [oriented segmentPQ] with the given [Coordinates] of [two points]: P and Q and calculate the [Direction Cosines] and [Direction Angles] key [17]
- To find the [Addition] and [Subraction] between [two vectors]: vectorA and vectorB multiplyed by [two scalars]: [coeffic1 and coeffic2] key [18]
- To calculate the [dimensions]: [Perimeter(P)], [Heights(h1,h2,h3)], and [Area(A)] of a [TrianglePQR] with the given [Coordinates] of the [three points]: P, Q, and R key [19]
- To get the [dimensions]: [Perimeter(P)], [heights(h1,h2)], and [Area(S)] of a [Parallelogram(PQRS)] key [20]
- Given the [Coordinates] of the [Middle Points]: K(xK,yK,zK), L(xL,yL,zL), and M(xM,yM,zM) will calculate the [Coordinates] of the [vertice points]: P, Q, and R of a Triangle(PQR). key [21]

[§] Select an previous [option] that will used--Ok!

[º>º] Provide the [new] value? 19

[DETERMINE THE DIMENSIONS:[PERIMETER(P), [HEIGHTS(H1,H2,H3)], AND [AREA(A)]]
[OF A TRIANGLE(PQR) WITH THE [COORDINATES] GIVEN POINTS: P, Q, AND, R USING THE]
[SCALAR PRODUCT OF VECTORS.]

-- Enter the [coordinates]: (xP, yP, zP) of the (point P)?

* Introduce the 1º[Coordinate(x)].
(ª<ª) Enter the [new] value? 0

* Enter with the 2º[Coordinate(y)].
(ª<ª) Enter the [new] value? 2

* Provide the 3º[Coordinate(z)].
(ª<ª) Enter the [new] value? -1

-- Introduce the [coordinates]: (xQ, yQ, zQ) of the (point Q)?

* Introduce the 1º[Coordinate(x)].
(ª<ª) Enter the [new] value? 1

* Enter with the 2º[Coordinate(y)].
(ª<ª) Enter the [new] value? 1

* Provide the 3º[Coordinate(z)].
(ª<ª) Enter the [new] value? 3

-- Provide the [coordinates]: (xR, yR, zR) of the (point R)?

* Introduce the 1º[Coordinate(x)].
(ª<ª) Enter the [new] value? 1

* Enter with the 2º[Coordinate(y)].
(ª<ª) Enter the [new] value? 0

* Provide the 3º[Coordinate(z)].
(ª<ª) Enter the [new] value? -4

- The (Point P): P (0.0, 2.0, -1.0)
- The (Point Q): Q (1.0, 1.0, 3.0)
- The (Point R): R (1.0, 0.0, -4.0)

[Answer]

==========
[EXIST THE TRIANGLE(PQR) WITH THE GIVEN POINTS: P, Q, AND R -- OK!]
==========

-- The [vectorA] = vectorQR [0.0, -1.0, -7.0]
-- The [vectorB] = vectorRP [-1.0, 2.0, 3.0]
-- The [vectorC] = vectorPQ [1.0, -1.0, 4.0]

-- The [sideA] = ||vectorQR|| of the triangle(PQR) is: 7.07
-- The [sideB] = ||vectorRP|| of the triangle(PQR) is: 3.74
-- The [sideC] = ||vectorPQ|| of the triangle(PQR) is: 4.24

-- The [terms] of the [Scalar Product(QRºPQ)] is: [0.0, 1.0, -28.0]
-- The [terms] of the [Scalar Product(QRºRP)] is: [-0.0, -2.0, -21.0]
-- The [terms] of the [Scalar Product(RPºPQ)] is: [-1.0, -2.0, 12.0]

-- The [Scalar Product(QRºPQ)] is: -27.00
-- The [Scalar Product(QRºRP)] is: -23.00
-- The [Scalar Product(RPºPQ)] is: 9.00

-- The [vectorAxB]: vectorAxB [11.0, 7.0, -1.0]
-- The ||normVectorAxB|| is 13.08

-- The [Perimeter] of the [triangle(PQR)] is 15.06

-- The [Height(h1) relative as sideQR] is 1.85
-- The [Height(h2) relative as sideRP] is 3.49
-- The [Height(h3) relative as sidePQ] is 3.08
-- The [Area(A)] of the [triangle(PQR)] is 6.54

. . . Key [ENTER] to exit -- Ok! . . .

Now run the runVector3d.py program again and key in option[12] and after follow key in option[2] and type the given [coordinates] of the [vertices]: P, Q, and R. to find the [Inner Angles: α, β, and γ] of the TrianglePQR.

[WELCOME IN USING THE [RUNVECTOR3D.PY] PROGRAM]
[TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] IN THE [SPACE]]
--[Version: 2.0 -- Stable]--

[INSTRUCTIONS OF USE]

- To find the [value] of the [Dot Product] of [two vectors]: vectorA and vectorB using the [Definition]: a * b = a1*b1 + a2*b2 + a3*b3 key [1]
- To Determine the [value] of the [Dot Product] of [two vectors]: vectorA and vectorB using the [Theorem]: a * b = ||a||*||b||*cos(theta) key [2]
- To get the [Cross Product] with the given [Components] of [two vectors]: vectorA and vectorB or using the given [Coordinates] of the [points]: P, Q, and R key [3]
- To calculate the [value] of the [Theta Sine] between [two vectors]: vectorA and vectorB key [4]
- To find the [value] of the [Scalar Triple Product] of [three vectors]: vectorA, vectorB, and vectorC key [5]
- To determine the [value] of the [Theta angle in degrees] between the [two vectors]: vectorA and vectorB key [6]
- To get the [value] of the [Theta Cosine] between [two vectors]: vectorA and vectorB key [7]
- To find the [Vectors: vectorA, vectorB, vectorC, and vectorD] and [Modules] using the [Theorem] of the [Distance] between any [two points]: P and Q or P and R or Q and R or R and S key [8]
- To calculate the [Area(S)] of the [Triangle(PQR)] with the given [Coordinates] of the [points]: P, Q, and R or the given [Components] of [two vectors]: vectorA and vectorB key [9]
- To find the [height(h)] and [Area(P)] of the [Parallelogram(PQRS)] determined to [two adjacent vectors]: vectorA and vectorB or with given [Coordinates] of the [vertice points: P, Q, and R] key [10]
- To get the [Volume_V(P)], and [Height(h)] of a [Parallelepiped] and too the [Volume_V(T)] of a [Tetrahedron] with the given [Coordinates] of the [four points]: P, Q, R, and S or with the given [Components] of the [three vectors]: vector_A, vector_B, and vector_C key [11]

- To calculate the [three Inner Angles: Alpha, Beta, and Gama] of the [TrianglePQR] with the given [Coordinates] of the given [points]: P, Q, and R key [12]
- To Determine the following [Middle Points]: K(xK,yK,zK), L(xL,yL,zL), M(xM,yM,zM), and N(xN,yN,zN) between [points]: P(xP,yP,zP), Q(xQ,yQ,zQ), R(xR,yR,zR), and S(xS,yS,zS) or in [sides]: PQ, PR, and QR of a Triangle(PQR).key [13]
- To find the [Centroid: G(xG, yG, zG)] of the Triangle(PQR) key [14]
- To determine the [Medians: PM, QL, and RK] of a Triangle(PQR) key [15]
- To get the [Addition] and [Subraction] between [Two Vectors]: vectorA and vectorB key [16]
- Provide the given [Components] of a [vectorA] or find a [new vectorA] that represent a [oriented segmentPQ] with the given [Coordinates] of [two points]: P and Q and calculate the [Direction Cosines] and [Direction Angles] key [17]
- To find the [Addition] and [Subraction] between [two vectors]: vectorA and vectorB multiplyed by [two scalars]: [coeffic1 and coeffic2] key [18]
- To calculate the [dimensions]: [Perimeter(P)], [Heights(h1,h2,h3)], and [Area(A)] of a [TrianglePQR] with the given [Coordinates] of the [three points]: P, Q, and R key [19]
- To get the [dimensions]: [Perimeter(P)], [heights(h1,h2)], and [Area(S)] of a [Parallelogram(PQRS)] key [20]
- Given the [Coordinates] of the [Middle Points]: K(xK,yK,zK), L(xL,yL,zL), and M(xM,yM,zM) will calculate the [Coordinates] of the [vertice points]: P, Q, and R of a Triangle(PQR). key [21]

[§] Select an previous [option] that will used--Ok!

[º>º] Provide the [new] value? 12

[GIVEN THE COORDINATES OF THE POINTS P, Q AND R]
[FIND THE [INNER ANGLES] OF THE TRIANGLE(PQR)]

-- Enter the [coordinates]: (xP, yP, zP) of the (point P)?

* Introduce the 1º[Coordinate(x)].
(ª<ª) Enter the [new] value? 0

* Enter with the 2º[Coordinate(y)].
(ª<ª) Enter the [new] value? 2

* Provide the 3º[Coordinate(z)].
(ª<ª) Enter the [new] value? -1

-- Introduce the [coordinates]: (xQ, yQ, zQ) of the (point Q)?

* Introduce the 1º[Coordinate(x)].
(ª<ª) Enter the [new] value? 1

* Enter with the 2º[Coordinate(y)].
(ª<ª) Enter the [new] value? 1

* Provide the 3º[Coordinate(z)].
(ª<ª) Enter the [new] value? 3

-- Provide the [coordinates]: (xR, yR, zR) of the (point R)?

* Introduce the 1º[Coordinate(x)].
(ª<ª) Enter the [new] value? 1

* Enter with the 2º[Coordinate(y)].
(ª<ª) Enter the [new] value? 0

* Provide the 3º[Coordinate(z)].
(ª<ª) Enter the [new] value? -4

- The (Point P): P (0.0, 2.0, -1.0)
- The (Point Q): Q (1.0, 1.0, 3.0)
- The (Point R): R (1.0, 0.0, -4.0)

[Answer]

- The [vectorB]=vectorPR [1.0, -2.0, -3.0]
- The [vectorC]=vectorPQ [1.0, -1.0, 4.0]

- The [vectorA]=vectorQR [0.0, -1.0, -7.0]
- The [vectorC]=vectorQP [-1.0, 1.0, -4.0]

- The [vectorA]=vectorRQ [0.0, 1.0, 7.0]
- The [vectorB]=vectorRP [-1.0, 2.0, 3.0]

==========
[EXIST THE TRIANGLE(PQR) WITH THE GIVEN POINTS: P, Q, AND R -- OK!]
==========

-- The [sideA]=|vectorA| of the triangle(PQR)] is: 7.07

-- The [terms] of the [Scalar Profuct(AC°AB)] is the vector[AC°AB]: [1.0, 2.0, -12.0]
-- The [value] of the [Scalar Profuct(AC°AB)] is: -9.00
- The value of the [ALPHA ANGLE] was calculate is: 124.54

-- The [sideB]=|vectorB| of the triangle(PQR)] is: 3.74

-- The [terms] of the [Scalar Profuct(BC°BA)] is the vector[BC°BA]: [-0.0, -1.0, 28.0]
-- The [value] of the [Scalar Profuct(BC°BA)] is: 27.00
- The value of the [BETA ANGLE] was calculate is: 25.84

-- The [sideC]=|vectorC| of the triangle(PQR)] is: 4.24

-- The [terms] of the [Scalar Profuct(CB°CA)] is the vector[CB°CA]: [-0.0, 2.0, 21.0]
-- The [value] of the [Scalar Profuct(CB°CA)] is: 23.00
- The value of the [GAMA ANGLE] was calculate is: 29.62

-- The triangle(PQR) is [Scalene]!

-- The [Add] of the [Inner Angles: ALPHA, BETA, GAMA] is 180.0

- THE [ADD] OF THE [INNER ANGLES] OF THE [TRIANGLE-PQR] is 180.00

--[END CALCULUS-OK!]--

[Warning]:

When any user run the runVector3d.py program to solve exercises that provide vertexes A, B, and C to triangles do the folowing:
(xA,yA,zA) = (xP, yP,zP) ==> xP = xA, yP = yA, and zP = zA replace the coordinates: xA, yA, and zA into the coordinates: xP, yP, and zP of the point: P when the runVector3d.py program request to enter the coordinates: xP, yP and zP. Of the same manner to the vertexes B and C so:
(xB,yB,zB) = (xQ, yQ,zQ) ==> xQ = xB, yQ = yB, and zQ = zB replace the coordinates: xB, yB, and zB into the coordinates: xQ, yQ and zQ of the point: Q when the runVector3d.py program request to enter the coordinates: xQ, yQ and zQ.

(xC,yC,zC) = (xR, yR,zR) ==> xR = xC, yR = yC, and zR = zC replace the coordinates: xC, yC, and zC into the coordinates: xR, yR and zR of the point: R when the runVector3d.py program request to enter the coordinates: xR, yR and Zr. Of the same manner do to the vertexes: A, B, C, and D of the parallelogram as too to the parallelepiped. Replace your coordinates when the runVector3d.py program request enter the coordinates of the points: P, Q, R, and S.

Will be confused standardize the letters: A, B, and C to the vectors and too to the vertexes points: A, B, and C of the triangle into the code of functions developed.

Example4 – Find the dimensions of the triangleABC with [vertexe points]: A(0, -1,2), B(1,2,-1), and C(3, -1,2).

Solution**:** Do: A(0,-1,2) = P(xP,yP,zP) ==> xP = 0, yP = -1, and zP = 2
B(1,2,-1) = Q(xQ,yQ,zQ) ==> xQ = 1, yQ = 2, and zQ = -1
C(3, -1,2) = R(xR,yR,zR) ==> xR = 3, yR = -1, and zR = 2

Begin using the option[19] and provide the [coordinates]: xP = 0, yP = -1, zP = 2, xQ = 1, yQ = 2, zQ = -1, xR = 3, yR = -1, and zR = 2 when the runVector3d.py program request.

[WELCOME IN USING THE [RUNVECTOR3D.PY] PROGRAM]
[TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] IN THE [SPACE]]
--[Version: 2.0 -- Stable]--

[INSTRUCTIONS OF USE]

- To find the [value] of the [Dot Product] of [two vectors]: vectorA and vectorB using the [Definition]: a * b = a1*b1 + a2*b2 + a3*b3 key [1]
- To Determine the [value] of the [Dot Product] of [two vectors]: vectorA and vectorB using the [Theorem]: a * b = ||a||*||b||*cos(theta) key [2]
- To get the [Cross Product] with the given [Components] of [two vectors]: vectorA and vectorB or using the given [Coordinates] of the [points]: P, Q, and R key [3]
- To calculate the [value] of the [Theta Sine] between [two vectors]: vectorA and vectorB key [4]
- To find the [value] of the [Scalar Triple Product] of [three vectors]: vectorA, vectorB, and vectorC key [5]
- To determine the [value] of the [Theta angle in degrees] between the [two vectors]: vectorA and vectorB key [6]
- To get the [value] of the [Theta Cosine] between [two vectors]: vectorA and vectorB key [7]
- To find the [Vectors: vectorA, vectorB, vectorC, and vectorD] and [Modules] using the [Theorem] of the [Distance] between any [two points]: P and Q or P and R or Q and R or R and S key [8]
- To calculate the [Area(S)] of the [Triangle(PQR)] with the given [Coordinates] of the [points]: P, Q, and R or the given [Components] of [two vectors]: vectorA and vectorB key [9]
- To find the [height(h)] and [Area(P)] of the [Parallelogram(PQRS)] determined to [two adjacent vectors]: vectorA and vectorB or with given [Coordinates] of the [vertice points: P, Q, and R] key [10]
- To get the [Volume_V(P)], and [Height(h)] of a [Parallelepiped] and too the [Volume_V(T)] of a [Tetrahedron] with the given [Coordinates] of the [four points]: P, Q, R, and S or with the given [Components] of the [three vectors]: vector_A, vector_B, and vector_C key [11]
- To calculate the [three Inner Angles: Alpha, Beta, and Gama] of the [TrianglePQR] with the given [Coordinates] of the given [points]: P, Q, and R key [12]
- To Determine the following [Middle Points]: K(xK,yK,zK), L(xL,yL,zL), M(xM,yM,zM), and N(xN,yN,zN) between [points]: P(xP,yP,zP), Q(xQ,yQ,zQ), R(xR,yR,zR), and S(xS,yS,zS) or in [sides]: PQ, PR, and QR of a Triangle(PQR).key [13]
- To find the [Centroid: G(xG, yG, zG)] of the Triangle(PQR) key [14]
- To determine the [Medians: PM, QL, and RK] of a Triangle(PQR) key [15]
- To get the [Addition] and [Subraction] between [Two Vectors]: vectorA and vectorB key [16]
- Provide the given [Components] of a [vectorA] or find a [new vectorA] that represent a [oriented segmentPQ] with the given [Coordinates] of [two points]: P and Q and calculate the [Direction Cosines] and [Direction Angles] key [17]
- To find the [Addition] and [Subraction] between [two vectors]: vectorA and vectorB multiplyed by [two scalars]: [coeffic1 and coeffic2] key [18]
- To calculate the [dimensions]: [Perimeter(P)], [Heights(h1,h2,h3)], and [Area(A)] of a [TrianglePQR] with

the given [Coordinates] of the [three points]: P, Q, and R key [19]
- To get the [dimensions]: [Perimeter(P)], [heights(h1,h2)], and [Area(S)] of a [Parallelogram(PQRS)] key [20]
- Given the [Coordinates] of the [Middle Points]: K(xK,yK,zK), L(xL,yL,zL), and M(xM,yM,zM) will calculate the [Coordinates] of the [vertice points]: P, Q, and R of a Triangle(PQR). key [21]

[§] Select an previous [option] that will used--Ok!

[º>º] Provide the [new] value? 19

[DETERMINE THE DIMENSIONS:[PERIMETER(P), [HEIGTHS(H1,H2,H3)], AND [AREA(A)] OF A]
[TRIANGLE(PQR) WITH THE GIVEN [COORDINATES] OF THE [POINTS]: P, Q, AND, R USING THE]
[SCALAR PRODUCT OF VECTORS.]

-- Enter the [coordinates]: (xP, yP, zP) of the (point P)?

* Introduce the 1º[Coordinate(x)].
(ª<ª) Enter the [new] value? 0

* Enter with the 2º[Coordinate(y)].
(ª<ª) Enter the [new] value? -1

* Provide the 3º[Coordinate(z)].
(ª<ª) Enter the [new] value? 2

-- Introduce the [coordinates]: (xQ, yQ, zQ) of the (point Q)?

* Introduce the 1º[Coordinate(x)].
(ª<ª) Enter the [new] value? 1

* Enter with the 2º[Coordinate(y)].
(ª<ª) Enter the [new] value? 2

* Provide the 3º[Coordinate(z)].
(ª<ª) Enter the [new] value? -1

-- Provide the [coordinates]: (xR, yR, zR) of the (point R)?

* Introduce the 1º[Coordinate(x)].
(ª<ª) Enter the [new] value? 3

* Enter with the 2º[Coordinate(y)].
(ª<ª) Enter the [new] value? -1

* Provide the 3º[Coordinate(z)].
(ª<ª) Enter the [new] value? 2

- The (Point P): P (0.0, -1.0, 2.0)
- The (Point Q): Q (1.0, 2.0, -1.0)
- The (Point R): R (3.0, -1.0, 2.0)

[Answer]

==========
[EXIST THE TRIANGLE(PQR) WITH THE GIVEN POINTS: P, Q, AND R -- OK!]
==========

-- The [vectorA] = vectorQR [2.0, -3.0, 3.0]
-- The [vectorB] = vectorRP [-3.0, 0.0, 0.0]
-- The [vectorC] = vectorPQ [1.0, 3.0, -3.0]

-- The [sideA] = ||vectorQR|| of the triangle(PQR) is: 4.69
-- The [sideB] = ||vectorRP|| of the triangle(PQR) is: 3.00
-- The [sideC] = ||vectorPQ|| of the triangle(PQR) is: 4.36

-- The [terms] of the [Scalar Product(QRºPQ)] is: [2.0, -9.0, -9.0]
-- The [terms] of the [Scalar Product(QRºRP)] is: [-6.0, -0.0, 0.0]
-- The [terms] of the [Scalar Product(RPºPQ)] is: [-3.0, 0.0, -0.0]

-- The [Scalar Product(QRºPQ)] is: -16.00
-- The [Scalar Product(QRºRP)] is: -6.00
-- The [Scalar Product(RPºPQ)] is: -3.00

-- The [vectorAxB]: vectorAxB [-0.0, -9.0, -9.0]
-- The ||normVectorAxB|| is 12.73

-- The [Perimeter] of the [triangle(PQR)] is 12.05

-- The [Height(h1) relative as sideQR] is 2.71
-- The [Height(h2) relative as sideRP] is 4.24
-- The [Height(h3) relative as sidePQ] is 2.92
-- The [Area(A)] of the [triangle(PQR)] is 6.36

. . . Key [ENTER] to exit -- Ok! . . .

Example5 – Find sinθ where θ is the angle between the [vectors]: a = i + 2j +3k and b = 4i + 5j + 6K.
Solution: Begin the runVector3d.py program again and key in option[4] and after follow key in option[2] and type the given [components] of the [Vectors]: a1 = 1, a2 = 2, a3 = 3, b1 = 4, b2 = 5, and b3 = 6.

[WELCOME IN USING THE [RUNVECTOR3D.PY] PROGRAM]
[TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] IN THE [SPACE]]
--[Version: 2.0 -- Stable]--

[INSTRUCTIONS OF USE]

- To find the [value] of the [Dot Product] of [two vectors]: vectorA and vectorB using the [Definition]: a * b = a1*b1 + a2*b2 + a3*b3 key [1]
- To Determine the [value] of the [Dot Product] of [two vectors]: vectorA and vectorB using the [Theorem]: a * b = ||a||*||b||*cos(theta) key [2]
- To get the [Cross Product] with the given [Components] of [two vectors]: vectorA and vectorB or using the given [Coordinates] of the [points]: P, Q, and R key [3]
- To calculate the [value] of the [Theta Sine] between [two vectors]: vectorA and vectorB key [4]
- To find the [value] of the [Scalar Triple Product] of [three vectors]: vectorA, vectorB, and vectorC key [5]
- To determine the [value] of the [Theta angle in degrees] between the [two vectors]: vectorA and vectorB key [6]
- To get the [value] of the [Theta Cosine] between [two vectors]: vectorA and vectorB key [7]
- To find the [Vectors: vectorA, vectorB, vectorC, and vectorD] and [Modules] using the [Theorem] of the [Distance] between any [two points]: P and Q or P and R or Q and R or R and S key [8]
- To calculate the [Area(S)] of the [Triangle(PQR)] with the given [Coordinates] of the [points]: P, Q, and R or the given [Components] of [two vectors]: vectorA and vectorB key [9]
- To find the [height(h)] and [Area(P)] of the [Parallelogram(PQRS)] determined to [two adjacent vectors]: vectorA and vectorB or with given [Coordinates] of the [vertice points: P, Q, and R] key [10]
- To get the [Volume_V(P)], and [Height(h)] of a [Parallelepiped] and too the [Volume_V(T)] of a [Tetrahedron] with the given [Coordinates] of the [four points]: P, Q, R, and S or with the given [Components] of the [three vectors]: vector_A, vector_B, and vector_C key [11]
- To calculate the [three Inner Angles: Alpha, Beta, and Gama] of the [TrianglePQR] with the given [Coordinates] of the given [points]: P, Q, and R key [12]
- To Determine the following [Middle Points]: K(xK,yK,zK), L(xL,yL,zL), M(xM,yM,zM), and N(xN,yN,zN) between [points]: P(xP,yP,zP), Q(xQ,yQ,zQ), R(xR,yR,zR), and S(xS,yS,zS) or in [sides]: PQ, PR, and QR of a Triangle(PQR).key [13]
- To find the [Centroid: G(xG, yG, zG)] of the Triangle(PQR) key [14]

- To determine the [Medians: PM, QL, and RK] of a Triangle(PQR) key [15]
- To get the [Addition] and [Subraction] between [Two Vectors]: vectorA and vectorB key [16]
- Provide the given [Components] of a [vectorA] or find a [new vectorA] that represent a [oriented segmentPQ] with the given [Coordinates] of [two points]: P and Q and calculate the [Direction Cosines] and [Direction Angles] key [17]
- To find the [Addition] and [Subraction] between [two vectors]: vectorA and vectorB multiplyed by [two scalars]: [coeffic1 and coeffic2] key [18]
- To calculate the [dimensions]: [Perimeter(P)], [Heights(h1,h2,h3)], and [Area(A)] of a [TrianglePQR] with the given [Coordinates] of the [three points]: P, Q, and R key [19]
- To get the [dimensions]: [Perimeter(P)], [heights(h1,h2)], and [Area(S)] of a [Parallelogram(PQRS)] key [20]
- Given the [Coordinates] of the [Middle Points]: K(xK,yK,zK), L(xL,yL,zL), and M(xM,yM,zM) will calculate the [Coordinates] of the [vertice points]: P, Q, and R of a Triangle(PQR). key [21]

[§] Select an previous [option] that will used--Ok!

[º>º] Provide the [new] value? 4

[FIND THE VALUE OF THE [THETA SINE IN RADIAN] IN RADIAN]

[NEW INSTRUCTIONS]

* Type [1] to enter new given [Coordinate] points: P, Q, and R or
* Type [2] and provide the given [Components] of [two vectors]: vectorA and vectorB.

(º_º) Give the [new] value? 2

- Attribute the [Components] of the [1º vectorA].

- Enter the [coefficient] of the [Component: (i) or (a1)]?
(ª<ª) Enter the [new] value? 1

- Introduce the [coefficient] of the [Component: (j) or (a2)]?
(ª<ª) Enter the [new] value? 2

- Give the [coefficient] of the [Component: (k) or (a3)]?
(ª<ª) Enter the [new] value? 3

- Provide the [Components] of the [2º vectorB].

- Enter the [coefficient] of the [Component: (i) or (b1)]?
(ª<ª) Enter the [new] value? 4

- Introduce the [coefficient] of the [Component: (j) or (b2)]?
(ª<ª) Enter the [new] value? 5

- Give the [coefficient] of the [Component: (k) or (b3)]?
(ª<ª) Enter the [new] value? 6

[Answer]

-- The [vectorA]: vectorA [1.0, 2.0, 3.0]
-- The [vectorB]: vectorB [4.0, 5.0, 6.0]
-- The [Cross Product]: vectorAxB [-3.0, 6.0, -3.0]
-- The ||normVectorAxB|| is 7.35
-- The [THETA SINE IN RADIAN] is 0.22

. . . Key [ENTER] to exit -- Ok! . . .

Example6 – Find the [height(h)], and [area(P)] of a parellelogram with the [components] of the following [vectors]: a = 4i – j +k and b = 2i + 3j – k.
Solution – Begin the runVector3d.py program and key the option[10] and follow the instructions in to display. After key in option[2] and enter with the given [components] of the previous vectors an key: [ENTER].

[Warning]: If the problem request to determine others [dimensions]: sides: sideA, sideB, Inner angles(Θ and α), Perimeter(P), heights(h1 and h2) and Area(S) use the [new] option[20].

[WELCOME IN USING THE [RUNVECTOR3D.PY] PROGRAM]
[TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] IN THE [SPACE]]
--[Version: 2.0 -- Stable]--

[INSTRUCTIONS OF USE]

- To find the [value] of the [Dot Product] of [two vectors]: vectorA and vectorB using the [Definition]: a * b = a1*b1 + a2*b2 + a3*b3 key [1]
- To Determine the [value] of the [Dot Product] of [two vectors]: vectorA and vectorB using the [Theorem]: a * b = ||a||*||b||*cos(theta) key [2]
- To get the [Cross Product] with the given [Components] of [two vectors]: vectorA and vectorB or using the given [Coordinates] of the [points]: P, Q, and R key [3]
- To calculate the [value] of the [Theta Sine] between [two vectors]: vectorA and vectorB key [4]
- To find the [value] of the [Scalar Triple Product] of [three vectors]: vectorA, vectorB, and vectorC key [5]
- To determine the [value] of the [Theta angle in degrees] between the [two vectors]: vectorA and vectorB key [6]
- To get the [value] of the [Theta Cosine] between [two vectors]: vectorA and vectorB key [7]
- To find the [Vectors: vectorA, vectorB, vectorC, and vectorD] and [Modules] using the [Theorem] of the [Distance] between any [two points]: P and Q or P and R or Q and R or R and S key [8]
- To calculate the [Area(S)] of the [Triangle(PQR)] with the given [Coordinates] of the [points]: P, Q, and R or the given [Components] of [two vectors]: vectorA and vectorB key [9]
- To find the [height(h)] and [Area(P)] of the [Parallelogram(PQRS)] determined to [two adjacent vectors]: vectorA and vectorB or with given [Coordinates] of the [vertice points: P, Q, and R] key [10]
- To get the [Volume_V(P)], and [Height(h)] of a [Parallelepiped] and too the [Volume_V(T)] of a [Tetrahedron] with the given [Coordinates] of the [four points]: P, Q, R, and S or with the given [Components] of the [three vectors]: vector_A, vector_B, and vector_C key [11]
- To calculate the [three Inner Angles: Alpha, Beta, and Gama] of the [TrianglePQR] with the given [Coordinates] of the given [points]: P, Q, and R key [12]
- To Determine the following [Middle Points]: K(xK,yK,zK), L(xL,yL,zL), M(xM,yM,zM), and N(xN,yN,zN) between [points]: P(xP,yP,zP), Q(xQ,yQ,zQ), R(xR,yR,zR), and S(xS,yS,zS) or in [sides]: PQ, PR, and QR of a Triangle(PQR).key [13]
- To find the [Centroid: G(xG, yG, zG)] of the Triangle(PQR) key [14]
- To determine the [Medians: PM, QL, and RK] of a Triangle(PQR) key [15]
- To get the [Addition] and [Subraction] between [Two Vectors]: vectorA and vectorB key [16]
- Provide the given [Components] of a [vectorA] or find a [new vectorA] that represent a [oriented segmentPQ] with the given [Coordinates] of [two points]: P and Q and calculate the [Direction Cosines] and [Direction Angles] key [17]
- To find the [Addition] and [Subraction] between [two vectors]: vectorA and vectorB multiplyed by [two scalars]: [coeffic1 and coeffic2] key [18]
- To calculate the [dimensions]: [Perimeter(P)], [Heights(h1,h2,h3)], and [Area(A)] of a [TrianglePQR] with the given [Coordinates] of the [three points]: P, Q, and R key [19]
- To get the [dimensions]: [Perimeter(P)], [heights(h1,h2)], and [Area(S)] of a [Parallelogram(PQRS)] key [20]
- Given the [Coordinates] of the [Middle Points]: K(xK,yK,zK), L(xL,yL,zL), and M(xM,yM,zM) will calculate the [Coordinates] of the [vertice points]: P, Q, and R of a Triangle(PQR). key [21]

[§] Select an previous [option] that will used--Ok!

[º>º] Provide the [new] value? 10

[FIND THE [HEIGHT(H), AND AREA(P) OF THE PARALLELOGRAM(PQRS) DETERMINED BY]
[[TWO ADJACENT VECTORS]: VECTOR_A AND VECTOR_B OR WITH THE GIVEN [COORDINATES]]
[OF THE [VERTICES]: P, Q, AND R]

[NEW INSTRUCTIONS]

* Type [1] to enter new given [Coordinate] points: P, Q, and R or
* Type [2] and provide the given [Components] of [two vectors]: vectorA and vectorB.

(º_º) Give the [new] value? 2

- Attribute the [Components] of the [1º vectorA].

- Enter the [coefficient] of the [Component: (i) or (a1)]?
(ª<ª) Enter the [new] value? 4

- Introduce the [coefficient] of the [Component: (j) or (a2)]?
(ª<ª) Enter the [new] value? -1

- Give the [coefficient] of the [Component: (k) or (a3)]?
(ª<ª) Enter the [new] value? 1

- Provide the [Components] of the [2º vectorB].

- Enter the [coefficient] of the [Component: (i) or (b1)]?
(ª<ª) Enter the [new] value? 2

- Introduce the [coefficient] of the [Component: (j) or (b2)]?
(ª<ª) Enter the [new] value? 3

- Give the [coefficient] of the [Component: (k) or (b3)]?
(ª<ª) Enter the [new] value? -1

[Answer]

-- The [vectorA]: vectorA [4.0, -1.0, 1.0]
-- The [vectorB]: vectorB [2.0, 3.0, -1.0]
-- The [Cross Product]: vectorAxB [-2.0, 6.0, 14.0]
-- The ||normVectorAxB|| is 15.36

-- The [height(h)] of the [Parallelogram(PQRS)] is 3.62
-- The [Area(P)] of a [Parallelogram(PQRS)] is 15.36

. . . Key [ENTER] to exit -- Ok! . . .

(new) Example6.1 – Given the [Coordinates] of the [points]: P(1, -2, -2), Q(2, 1, 5), and R(3, -1, 2). Find the [height(h)], and [area(P)] of a parellelogramPQRS.

Solution – Begin the runVector3d.py program and key the option[10] and follow the instructions in to display. After key in option[1] and enter with the given [Coordinates] of the [previous points] an key: [ENTER].

[WELCOME IN USING THE [RUNVECTOR3D.PY] PROGRAM]
[TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] IN THE [SPACE]]
--[Version: 2.0 -- Stable]--

[INSTRUCTIONS OF USE]

- To find the [value] of the [Dot Product] of [two vectors]: vectorA and vectorB using the [Definition]: a * b = a1*b1 + a2*b2 + a3*b3 key [1]
- To Determine the [value] of the [Dot Product] of [two vectors]: vectorA and vectorB using the [Theorem]: a * b = ||a||*||b||*cos(theta) key [2]
- To get the [Cross Product] with the given [Components] of [two vectors]: vectorA and vectorB or using the given [Coordinates] of the [points]: P, Q, and R key [3]
- To calculate the [value] of the [Theta Sine] between [two vectors]: vectorA and vectorB key [4]
- To find the [value] of the [Scalar Triple Product] of [three vectors]: vectorA, vectorB, and vectorC key [5]
- To determine the [value] of the [Theta angle in degrees] between the [two vectors]: vectorA and vectorB

key [6]
- To get the [value] of the [Theta Cosine] between [two vectors]: vectorA and vectorB key [7]
- To find the [Vectors: vectorA, vectorB, vectorC, and vectorD] and [Modules] using the [Theorem] of the [Distance] between any [two points]: P and Q or P and R or Q and R or R and S key [8]
- To calculate the [Area(S)] of the [Triangle(PQR)] with the given [Coordinates] of the [points]: P, Q, and R or the given [Components] of [two vectors]: vectorA and vectorB key [9]
- To find the [height(h)] and [Area(P)] of the [Parallelogram(PQRS)] determined to [two adjacent vectors]: vectorA and vectorB or with given [Coordinates] of the [vertice points: P, Q, and R] key [10]
- To get the [Volume_V(P)], and [Height(h)] of a [Parallelepiped] and too the [Volume_V(T)] of a [Tetrahedron] with the given [Coordinates] of the [four points]: P, Q, R, and S or with the given [Components] of the [three vectors]: vector_A, vector_B, and vector_C key [11]
- To calculate the [three Inner Angles: Alpha, Beta, and Gama] of the [TrianglePQR] with the given [Coordinates] of the given [points]: P, Q, and R key [12]
- To Determine the following [Middle Points]: K(xK,yK,zK), L(xL,yL,zL), M(xM,yM,zM), and N(xN,yN,zN) between [points]: P(xP,yP,zP), Q(xQ,yQ,zQ), R(xR,yR,zR), and S(xS,yS,zS) or in [sides]: PQ, PR, and QR of a Triangle(PQR).key [13]
- To find the [Centroid: G(xG, yG, zG)] of the Triangle(PQR) key [14]
- To determine the [Medians: PM, QL, and RK] of a Triangle(PQR) key [15]
- To get the [Addition] and [Subraction] between [Two Vectors]: vectorA and vectorB key [16]
- Provide the given [Components] of a [vectorA] or find a [new vectorA] that represent a [oriented segmentPQ] with the given [Coordinates] of [two points]: P and Q and calculate the [Direction Cosines] and [Direction Angles] key [17]
- To find the [Addition] and [Subraction] between [two vectors]: vectorA and vectorB multiplyed by [two scalars]: [coeffic1 and coeffic2] key [18]
- To calculate the [dimensions]: [Perimeter(P)], [Heights(h1,h2,h3)], and [Area(A)] of a [TrianglePQR] with the given [Coordinates] of the [three points]: P, Q, and R key [19]
- To get the [dimensions]: [Perimeter(P)], [heights(h1,h2)], and [Area(S)] of a [Parallelogram(PQRS)] key [20]
- Given the [Coordinates] of the [Middle Points]: K(xK,yK,zK), L(xL,yL,zL), and M(xM,yM,zM) will calculate the [Coordinates] of the [vertice points]: P, Q, and R of a Triangle(PQR). key [21]

[§] Select an previous [option] that will used--Ok!

[º>º] Provide the [new] value? 10

[FIND THE [HEIGHT(H), AND AREA(P) OF THE PARALLELOGRAM(PQRS) DETERMINED BY]
[TWO ADJACENT VECTORS]: VECTOR_A AND VECTOR_B OR WITH THE GIVEN [COORDINATES]]
[OR WITH THE GIVEN [COORDINATES] OF THE [VERTICES]: P, Q, AND R]

[NEW INSTRUCTIONS]

* Type [1] to enter new given [Coordinate] points: P, Q, and R or
* Type [2] and provide the given [Components] of [two vectors]: vectorA and vectorB.

(º_º) Give the [new] value? 1

-- Enter the [coordinates]: (xP, yP, zP) of the (point P)?

* Introduce the 1º[Coordinate(x)].
(ª<ª) Enter the [new] value? 1

* Enter with the 2º[Coordinate(y)].
(ª<ª) Enter the [new] value? -2

* Provide the 3º[Coordinate(z)].
(ª<ª) Enter the [new] value? -2

-- Introduce the [coordinates]: (xQ, yQ, zQ) of the (point Q)?

* Introduce the 1º[Coordinate(x)].
(ª<ª) Enter the [new] value? 2

* Enter with the 2º[Coordinate(y)].
(ª<ª) Enter the [new] value? 1

* Provide the 3º[Coordinate(z)].
(ª<ª) Enter the [new] value? 5

-- Provide the [coordinates]: (xR, yR, zR) of the (point R)?

* Introduce the 1º[Coordinate(x)].
(ª<ª) Enter the [new] value? 3

* Enter with the 2º[Coordinate(y)].
(ª<ª) Enter the [new] value? -1

* Provide the 3º[Coordinate(z)].
(ª<ª) Enter the [new] value? 2

- The (Point P): P (1.0, -2.0, -2.0)
- The (Point Q): Q (2.0, 1.0, 5.0)
- The (Point R): R (3.0, -1.0, 2.0)

[Answer]

-- The [vectorA]: vectorA [1.0, -2.0, -3.0]
-- The [vectorB]: vectorB [-1.0, -3.0, -7.0]
-- The [Cross Product]: vectorAxB [5.0, 10.0, -5.0]
-- The ||normVectorAxB|| is 12.25

-- The [height(h)] of the [Parallelogram(PQRS)] is 3.27
-- The [Area(P)] of a [Parallelogram(PQRS)] is 12.25

. . . Key [ENTER] to exit -- Ok! . . .

(new) Example6.2 – Given the [Coordinates] of the [points]: P(1, 2, -1), Q(3, -1, 4), and R(2, 6, 2) of a parellelogramPQRS. Find the following [dimensions]:

[1.] All possible [Coordinates: xS, yS, zS] which will can be the four vértice S.
[2.] The sides: sideA and sideB.
[3.] Inner angles(Θ and α).
[4.] Perimeter(P).
[5.] heights(h1 and h2).
[6.] Area(S).

[Note]: the option[20] will calculate the six previous items.

1ª Solution – Begin the runVector3d.py program and key the [new] option[20] and follow the instructions in to display. After key in option[1] and enter with the given [Coordinates] of the [points: P and R] an key: [ENTER]. Follow key in option[2] and enter with the given [Coordinates] of the [point: Q] an key: [ENTER].

[WELCOME IN USING THE [RUNVECTOR3D.PY] PROGRAM]
[TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] IN THE [SPACE]]
--[Version: 2.0 -- Stable]--

[INSTRUCTIONS OF USE]

- To find the [value] of the [Dot Product] of [two vectors]: vectorA and vectorB using the [Definition]: a * b = a1*b1 + a2*b2 + a3*b3 key [1]
- To Determine the [value] of the [Dot Product] of [two vectors]: vectorA and vectorB using the

[Theorem]: a * b = ||a||*||b||*cos(theta) key [2]
- To get the [Cross Product] with the given [Components] of [two vectors]: vectorA and vectorB or using the given [Coordinates] of the [points]: P, Q, and R key [3]
- To calculate the [value] of the [Theta Sine] between [two vectors]: vectorA and vectorB key [4]
- To find the [value] of the [Scalar Triple Product] of [three vectors]: vectorA, vectorB, and vectorC key [5]
- To determine the [value] of the [Theta angle in degrees] between the [two vectors]: vectorA and vectorB key [6]
- To get the [value] of the [Theta Cosine] between [two vectors]: vectorA and vectorB key [7]
- To find the [Vectors: vectorA, vectorB, vectorC, and vectorD] and [Modules] using the [Theorem] of the [Distance] between any [two points]: P and Q or P and R or Q and R or R and S key [8]
- To calculate the [Area(S)] of the [Triangle(PQR)] with the given [Coordinates] of the [points]: P, Q, and R or the given [Components] of [two vectors]: vectorA and vectorB key [9]
- To find the [height(h)] and [Area(P)] of the [Parallelogram(PQRS)] determined to [two adjacent vectors]: vectorA and vectorB or with given [Coordinates] of the [vertice points: P, Q, and R] key [10]
- To get the [Volume_V(P)], and [Height(h)] of a [Parallelepiped] and too the [Volume_V(T)] of a [Tetrahedron] with the given [Coordinates] of the [four points]: P, Q, R, and S or with the given [Components] of the [three vectors]: vector_A, vector_B, and vector_C key [11]
- To calculate the [three Inner Angles: Alpha, Beta, and Gama] of the [TrianglePQR] with the given [Coordinates] of the given [points]: P, Q, and R key [12]
- To Determine the following [Middle Points]: K(xK,yK,zK), L(xL,yL,zL), M(xM,yM,zM), and N(xN,yN,zN) between [points]: P(xP,yP,zP), Q(xQ,yQ,zQ), R(xR,yR,zR), and S(xS,yS,zS) or in [sides]: PQ, PR, and QR of a Triangle(PQR).key [13]
- To find the [Centroid: G(xG, yG, zG)] of the Triangle(PQR) key [14]
- To determine the [Medians: PM, QL, and RK] of a Triangle(PQR) key [15]
- To get the [Addition] and [Subraction] between [Two Vectors]: vectorA and vectorB key [16]
- Provide the given [Components] of a [vectorA] or find a [new vectorA] that represent a [oriented segmentPQ] with the given [Coordinates] of [two points]: P and Q and calculate the [Direction Cosines] and [Direction Angles] key [17]
- To find the [Addition] and [Subraction] between [two vectors]: vectorA and vectorB multiplyed by [two scalars]: [coeffic1 and coeffic2] key [18]
- To calculate the [dimensions]: [Perimeter(P)], [Heights(h1,h2,h3)], and [Area(A)] of a [TrianglePQR] with the given [Coordinates] of the [three points]: P, Q, and R key [19]
- To get the [dimensions]: [Perimeter(P)], [heights(h1,h2)], and [Area(S)] of a [Parallelogram(PQRS)] key [20]
- Given the [Coordinates] of the [Middle Points]: K(xK,yK,zK), L(xL,yL,zL), and M(xM,yM,zM) will calculate the [Coordinates] of the [vertice points]: P, Q, and R of a Triangle(PQR). key [21]

[§] Select an previous [option] that will used--Ok!

[º>º] Provide the [new] value? 20

[FIND THE [DIMENSIONS]: [PERIMETER(P), [HEIGTHS(H1,H2)], AND [AREA(S)] OF A]
[[PARALLELOGRAM(PQRS)] WITH THE GIVEN [COORDINATES] OF THE [POINTS]: P, Q, AND R]
[OR WITH ALL GIVEN [COORDINATES] OF THE [POINTS]: P, Q, R, AND S]

[NEW INSTRUCTIONS]

- Key [1] if in problem is given the [coordinates] of the three vertices: P, Q, and R. After follow the new [instructions] in [Display] to find the [coordinates: xS, yS, and zS] relative as point: S below - Ok!

- Key [2] if in problem is given the [coordinates] of the four vertices: P, Q, R, and S.

[º>º] Provide the [new] value? 1

==========
[NEW INSTRUCTIONS]
==========

-- Type [1] to find the [coordinates: xM, yM and zM] of the middle point: M in [diagonal: SP] Use the [coordinates: xQ, yQ, zQ, xR, yR and zR] of the points: Q and R.

-- Type [2] to find the [coordinates: xL, yL and zL] of the middle point: L in [diagonal: SQ]
Use the [coordinates: xP, yP, zP, xR, yR, and zR] of the points: P and R.

-- Type [3] to find the [coordinates: xK, yK, and zK] of the middle point: K in [diagonal: SR]
Use the [coordinates: xP, yP, zP, xQ, yQ, and zQ] of the points: P and Q.

[º>º] Provide the [new] value? 2

-- Enter the [coordinates]: (xP, yP, zP) of the (point P)?

* Introduce the 1º[Coordinate(x)].
(ª<ª) Enter the [new] value? 1

* Enter with the 2º[Coordinate(y)].
(ª<ª) Enter the [new] value? 2

* Provide the 3º[Coordinate(z)].
(ª<ª) Enter the [new] value? -1

-- Provide the [coordinates]: (xR, yR, zR) of the (point R)?

* Introduce the 1º[Coordinate(x)].
(ª<ª) Enter the [new] value? 2

* Enter with the 2º[Coordinate(y)].
(ª<ª) Enter the [new] value? 6

* Provide the 3º[Coordinate(z)].
(ª<ª) Enter the [new] value? 2

- The (Point P): P (1.0, 2.0, -1.0)
- The (Point R): R (2.0, 6.0, 2.0)

[Answer]

-- The MidPoint_L(xL,yL,zL): (1.5, 4.0, 0.5)

-- Introduce the [coordinates]: (xQ, yQ, zQ) of the (point Q)?

* Introduce the 1º[Coordinate(x)].
(ª<ª) Enter the [new] value? 3

* Enter with the 2º[Coordinate(y)].
(ª<ª) Enter the [new] value? -1

* Provide the 3º[Coordinate(z)].
(ª<ª) Enter the [new] value? 4

- The (Point Q): Q (3.0, -1.0, 4.0)

[Answer]

- The [Coordinates] of the point S:

-- The [Coordinate]: xS is 0.00
-- The [Coordinate]: yS is 9.00
-- The [Coordinate]: zS is -3.00

-- The [vectorAxB]: vectorAxB [29.0, 1.0, -11.0]
-- The ||normVectorAxB|| is 31.03

-- The [vectorQP]: vectorQP [-2.0, 3.0, -5.0]

-- The [vectorQR]: vectorQR [-1.0, 7.0, -2.0]

-- The [sideA] relative as |vectorQP|: 6.16
-- The [sideB] relative as |vectorQR|: 7.35
-- The [Perimeter(P)] is: 27.03

-- The [terms] of the Scalar Product(vectorQPºQR) is: [2.0, 21.0, 10.0]
-- The [Scalar Product(QPºQR)] is: 33.0
-- The Cossine of theta: 0.73
-- The [Theta angle] between vectors: vectorQP and vectorQR is: 43.24
-- The Sine of alpha: 0.69
-- The [Alpha angle] between vectors: vectorQP and vectorPS is: 136.76

-_- The [Height(h1)] relative as [sideB] is: 4.22
---------- or ----------
º<º The [Height(h2)] relative as [sideA] is: 5.03

-- The [Area(S)] of the [Parallelogram(PQRS)] is 31.03

. . . Key [ENTER] to exit -- Ok! . . .

2ª Solution – Begin the runVector3d.py program again and key the [new] option[20] and follow the instructions in to display. After key in option[1] and enter with the given [Coordinates] of the [points: P and Q] an key: [ENTER]. Follow keying in option[3] and enter with the given [Coordinates] of the [point: R] an key: [ENTER]. Now [use] the following given [Coordinates] of the [points]: P(3, -1, 4), Q(2, 6, 2) and R(1, 2, -1).

[WELCOME IN USING THE [RUNVECTOR3D.PY] PROGRAM]
[TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] IN THE [SPACE]]
--[Version: 2.0 -- Stable]--

[INSTRUCTIONS OF USE]

- To find the [value] of the [Dot Product] of [two vectors]: vectorA and vectorB using the [Definition]: a * b = a1*b1 + a2*b2 + a3*b3 key [1]
- To Determine the [value] of the [Dot Product] of [two vectors]: vectorA and vectorB using the [Theorem]: a * b = ||a||*||b||*cos(theta) key [2]
- To get the [Cross Product] with the given [Components] of [two vectors]: vectorA and vectorB or using the given [Coordinates] of the [points]: P, Q, and R key [3]
- To calculate the [value] of the [Theta Sine] between [two vectors]: vectorA and vectorB key [4]
- To find the [value] of the [Scalar Triple Product] of [three vectors]: vectorA, vectorB, and vectorC key [5]
- To determine the [value] of the [Theta angle in degrees] between the [two vectors]: vectorA and vectorB key [6]
- To get the [value] of the [Theta Cosine] between [two vectors]: vectorA and vectorB key [7]
- To find the [Vectors: vectorA, vectorB, vectorC, and vectorD] and [Modules] using the [Theorem] of the [Distance] between any [two points]: P and Q or P and R or Q and R or R and S key [8]
- To calculate the [Area(S)] of the [Triangle(PQR)] with the given [Coordinates] of the [points]: P, Q, and R or the given [Components] of [two vectors]: vectorA and vectorB key [9]
- To find the [height(h)] and [Area(P)] of the [Parallelogram(PQRS)] determined to [two adjacent vectors]: vectorA and vectorB or with given [Coordinates] of the [vertice points: P, Q, and R] key [10]
- To get the [Volume_V(P)], and [Height(h)] of a [Parallelepiped] and too the [Volume_V(T)] of a [Tetrahedron] with the given [Coordinates] of the [four points]: P, Q, R, and S or with the given [Components] of the [three vectors]: vector_A, vector_B, and vector_C key [11]
- To calculate the [three Inner Angles: Alpha, Beta, and Gama] of the [TrianglePQR] with the given [Coordinates] of the given [points]: P, Q, and R key [12]
- To Determine the following [Middle Points]: K(xK,yK,zK), L(xL,yL,zL), M(xM,yM,zM), and N(xN,yN,zN) between [points]: P(xP,yP,zP), Q(xQ,yQ,zQ), R(xR,yR,zR), and S(xS,yS,zS) or in [sides]: PQ, PR, and QR

of a Triangle(PQR).key [13]
- To find the [Centroid: G(xG, yG, zG)] of the Triangle(PQR) key [14]
- To determine the [Medians: PM, QL, and RK] of a Triangle(PQR) key [15]
- To get the [Addition] and [Subraction] between [Two Vectors]: vectorA and vectorB key [16]
- Provide the given [Components] of a [vectorA] or find a [new vectorA] that represent a [oriented segmentPQ] with the given [Coordinates] of [two points]: P and Q and calculate the [Direction Cosines] and [Direction Angles] key [17]
- To find the [Addition] and [Subraction] between [two vectors]: vectorA and vectorB multiplyed by [two scalars]: [coeffic1 and coeffic2] key [18]
- To calculate the [dimensions]: [Perimeter(P)], [Heights(h1,h2,h3)], and [Area(A)] of a [TrianglePQR] with the given [Coordinates] of the [three points]: P, Q, and R key [19]
- To get the [dimensions]: [Perimeter(P)], [heights(h1,h2)], and [Area(S)] of a [Parallelogram(PQRS)] key [20]
- Given the [Coordinates] of the [Middle Points]: K(xK,yK,zK), L(xL,yL,zL), and M(xM,yM,zM) will calculate the [Coordinates] of the [vertice points]: P, Q, and R of a Triangle(PQR). key [21]

[§] Select an previous [option] that will used--Ok!

[º>º] Provide the [new] value? 20

[FIND THE [DIMENSIONS]: [PERIMETER(P), [HEIGTHS(H1,H2)], AND [AREA(S)] OF A]
[[PARALLELOGRAM(PQRS)] WITH THE GIVEN [COORDINATES] OF THE [POINTS]: P, Q, AND R]
[OR WITH ALL GIVEN [COORDINATES] OF THE [POINTS]: P, Q, R, AND S]

[NEW INSTRUCTIONS]

- Key [1] if in problem is given the [coordinates] of the three vertices: P, Q, and R. After follow the new [instructions] in [Display] to find the [coordinates: xS, yS, and zS] relative as point: S below - Ok!

- Key [2] if in problem is given the [coordinates] of the four vertices: P, Q, R, and S.

[º>º] Provide the [new] value? 1

==========
[NEW INSTRUCTIONS]
==========

-- Type [1] to find the [coordinates: xM, yM and zM] of the middle point: M in [diagonal: SP]
Use the [coordinates: xQ, yQ, zQ, xR, yR and zR] of the points: Q and R.

-- Type [2] to find the [coordinates: xL, yL and zL] of the middle point: L in [diagonal: SQ]
Use the [coordinates: xP, yP, zP, xR, yR, and zR] of the points: P and R.

-- Type [3] to find the [coordinates: xK, yK, and zK] of the middle point: K in [diagonal: SR]
Use the [coordinates: xP, yP, zP, xQ, yQ, and zQ] of the points: P and Q.

[º>º] Provide the [new] value? 3

-- Enter the [coordinates]: (xP, yP, zP) of the (point P)?

* Introduce the 1º[Coordinate(x)].
(ª<ª) Enter the [new] value? 3

* Enter with the 2º[Coordinate(y)].
(ª<ª) Enter the [new] value? -1

* Provide the 3º[Coordinate(z)].
(ª<ª) Enter the [new] value? 4

-- Introduce the [coordinates]: (xQ, yQ, zQ) of the (point Q)?

* Introduce the 1º[Coordinate(x)].
(ª<ª) Enter the [new] value? 2

* Enter with the 2º[Coordinate(y)].
(ª<ª) Enter the [new] value? 6

* Provide the 3º[Coordinate(z)].
(ª<ª) Enter the [new] value? 2

- The (Point P): P (3.0, -1.0, 4.0)
- The (Point Q): Q (2.0, 6.0, 2.0)

[Answer]

-- The MidPoint_K(xK,yK,zK): (2.5, 2.5, 3.0)

-- Provide the [coordinates]: (xR, yR, zR) of the (point R)?

* Introduce the 1º[Coordinate(x)].
(ª<ª) Enter the [new] value? 1

* Enter with the 2º[Coordinate(y)].
(ª<ª) Enter the [new] value? 2

* Provide the 3º[Coordinate(z)].
(ª<ª) Enter the [new] value? -1

- The (Point R): R (1.0, 2.0, -1.0)

[Answer]

- The [Coordenates] of the point S:

-- The [Coordinate]: xS is 4.00
-- The [Coordinate]: yS is 3.00
-- The [Coordinate]: zS is 7.00

-- The [vectorAxB]: vectorAxB [-29.0, -1.0, 11.0]
-- The ||normVectorAxB|| is 31.03

-- The [vectorRP]: vectorRP [2.0, -3.0, 5.0]
-- The [vectorRQ]: vectorRQ [1.0, 4.0, 3.0]

-- The [sideA] relative as |vectorRP|: 6.16
-- The [sideB] relative as |vectorRQ|: 5.10
-- The [Perimeter(P)] is: 22.53

-- The [terms] of the Scalar Product(vectorRPºRQ) is: [2.0, -12.0, 15.0]
-- The [Scalar Product(QPºQR)] is: 5.0
-- The Cossine of theta: 0.16
-- The [Theta angle] between vectors: vectorRP and vectorRQ is: 80.85
-- The Sine of alpha: 0.99
-- The [Alpha angle] between vectors: vectorRP and vectorPS is: 99.15

-_- The [Height(h1)] relative as [sideB] is: 6.09
---------- or ----------
º<º The [Height(h2)] relative as [sideA] is: 5.03

-- The [Area(S)] of the [Parallelogram(PQRS)] is 31.03

. . . Key [ENTER] to exit -- Ok! . . .

3ª Solution – Begin the runVector3d.py program again and key the [new] option[20] and follow the instructions in to display. After key in option[1] and enter with the given [Coordinates] of the [points: Q and R] an key: [ENTER]. Follow keying in option[3] and enter with the given [Coordinates] of the [point: P] an key: [ENTER]. Now [use] the following given [Coordinates] of the [points]: P(2, 6, 2), Q(1, 2, -1) and R(3,-1,4).

[WELCOME IN USING THE [RUNVECTOR3D.PY] PROGRAM]
[TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] IN THE [SPACE]]
--[Version: 2.0 -- Stable]--

[INSTRUCTIONS OF USE]

- To find the [value] of the [Dot Product] of [two vectors]: vectorA and vectorB using the [Definition]: a * b = a1*b1 + a2*b2 + a3*b3 key [1]
- To Determine the [value] of the [Dot Product] of [two vectors]: vectorA and vectorB using the [Theorem]: a * b = ||a||*||b||*cos(theta) key [2]
- To get the [Cross Product] with the given [Components] of [two vectors]: vectorA and vectorB or using the given [Coordinates] of the [points]: P, Q, and R key [3]
- To calculate the [value] of the [Theta Sine] between [two vectors]: vectorA and vectorB key [4]
- To find the [value] of the [Scalar Triple Product] of [three vectors]: vectorA, vectorB, and vectorC key [5]
- To determine the [value] of the [Theta angle in degrees] between the [two vectors]: vectorA and vectorB key [6]
- To get the [value] of the [Theta Cosine] between [two vectors]: vectorA and vectorB key [7]
- To find the [Vectors: vectorA, vectorB, vectorC, and vectorD] and [Modules] using the [Theorem] of the [Distance] between any [two points]: P and Q or P and R or Q and R or R and S key [8]
- To calculate the [Area(S)] of the [Triangle(PQR)] with the given [Coordinates] of the [points]: P, Q, and R or the given [Components] of [two vectors]: vectorA and vectorB key [9]
- To find the [height(h)] and [Area(P)] of the [Parallelogram(PQRS)] determined to [two adjacent vectors]: vectorA and vectorB or with given [Coordinates] of the [vertice points: P, Q, and R] key [10]
- To get the [Volume_V(P)], and [Height(h)] of a [Parallelepiped] and too the [Volume_V(T)] of a [Tetrahedron] with the given [Coordinates] of the [four points]: P, Q, R, and S or with the given [Components] of the [three vectors]: vector_A, vector_B, and vector_C key [11]
- To calculate the [three Inner Angles: Alpha, Beta, and Gama] of the [TrianglePQR] with the given [Coordinates] of the given [points]: P, Q, and R key [12]
- To Determine the following [Middle Points]: K(xK,yK,zK), L(xL,yL,zL), M(xM,yM,zM), and N(xN,yN,zN) between [points]: P(xP,yP,zP), Q(xQ,yQ,zQ), R(xR,yR,zR), and S(xS,yS,zS) or in [sides]: PQ, PR, and QR of a Triangle(PQR).key [13]
- To find the [Centroid: G(xG, yG, zG)] of the Triangle(PQR) key [14]
- To determine the [Medians: PM, QL, and RK] of a Triangle(PQR) key [15]
- To get the [Addition] and [Subraction] between [Two Vectors]: vectorA and vectorB key [16]
- Provide the given [Components] of a [vectorA] or find a [new vectorA] that represent a [oriented segmentPQ] with the given [Coordinates] of [two points]: P and Q and calculate the [Direction Cosines] and [Direction Angles] key [17]
- To find the [Addition] and [Subraction] between [two vectors]: vectorA and vectorB multiplyed by [two scalars]: [coeffic1 and coeffic2] key [18]
- To calculate the [dimensions]: [Perimeter(P)], [Heights(h1,h2,h3)], and [Area(A)] of a [TrianglePQR] with the given [Coordinates] of the [three points]: P, Q, and R key [19]
- To get the [dimensions]: [Perimeter(P)], [heights(h1,h2)], and [Area(S)] of a [Parallelogram(PQRS)] key [20]
- Given the [Coordinates] of the [Middle Points]: K(xK,yK,zK), L(xL,yL,zL), and M(xM,yM,zM) will calculate the [Coordinates] of the [vertice points]: P, Q, and R of a Triangle(PQR). key [21]

[§] Select an previous [option] that will used--Ok!

[º>º] Provide the [new] value? 20

[FIND THE [DIMENSIONS]: [PERIMETER(P), [HEIGTHS(H1,H2)], AND [AREA(S)] OF A]
[[PARALLELOGRAM(PQRS)] WITH THE GIVEN [COORDINATES] OF THE [POINTS]: P, Q, AND R]
[OR WITH ALL GIVEN [COORDINATES] OF THE [POINTS]: P, Q, R, AND S]

[NEW INSTRUCTIONS]

- Key [1] if in problem is given the [coordinates] of the three vertices: P, Q, and R. After follow the new [instructions] in [Display] to find the [coordinates: xS, yS, and zS] relative as point: S below - Ok!

- Key [2] if in problem is given the [coordinates] of the four vertices: P, Q, R, and S.

[º>º] Provide the [new] value? 1

==========
[NEW INSTRUCTIONS]
==========

-- Type [1] to find the [coordinates: xM, yM and zM] of the middle point: M in [diagonal: SP]
Use the [coordinates: xQ, yQ, zQ, xR, yR and zR] of the points: Q and R.

-- Type [2] to find the [coordinates: xL, yL and zL] of the middle point: L in [diagonal: SQ]
Use the [coordinates: xP, yP, zP, xR, yR, and zR] of the points: P and R.

-- Type [3] to find the [coordinates: xK, yK, and zK] of the middle point: K in [diagonal: SR]
Use the [coordinates: xP, yP, zP, xQ, yQ, and zQ] of the points: P and Q.

[º>º] Provide the [new] value? 1

-- Introduce the [coordinates]: (xQ, yQ, zQ) of the (point Q)?

* Introduce the 1º[Coordinate(x)].
(ª<ª) Enter the [new] value? 1

* Enter with the 2º[Coordinate(y)].
(ª<ª) Enter the [new] value? 2

* Provide the 3º[Coordinate(z)].
(ª<ª) Enter the [new] value? -1

-- Provide the [coordinates]: (xR, yR, zR) of the (point R)?

* Introduce the 1º[Coordinate(x)].
(ª<ª) Enter the [new] value? 3

* Enter with the 2º[Coordinate(y)].
(ª<ª) Enter the [new] value? -1

* Provide the 3º[Coordinate(z)].
(ª<ª) Enter the [new] value? 4

- The (Point Q): Q (1.0, 2.0, -1.0)
- The (Point R): R (3.0, -1.0, 4.0)

[Answer]

-- The MidPoint_M(xM,yM,zM): (2.0, 0.5, 1.5)

-- Enter the [coordinates]: (xP, yP, zP) of the (point P)?

```
* Introduce the 1º[Coordinate(x)].
(ª<ª) Enter the [new] value? 2

* Enter with the 2º[Coordinate(y)].
(ª<ª) Enter the [new] value? 6

* Provide the 3º[Coordinate(z)].
(ª<ª) Enter the [new] value? 2

- The (Point P): P (2.0, 6.0, 2.0)

 *[Answer]*

- The [Coordinates] of the point S:

  -- The [Coordinate]: xS is 2.00
  -- The [Coordinate]: yS is -5.00
  -- The [Coordinate]: zS is 1.00

-- The [vectorAxB]: vectorAxB [-29.0, -1.0, 11.0]
-- The ||normVectorAxB|| is 31.03

-- The [vectorPQ]: vectorPQ [-1.0, -4.0, -3.0]
-- The [vectorPR]: vectorPR [1.0, -7.0, 2.0]

-- The [sideA] relative as |vectorPQ|: 5.10
-- The [sideB] relative as |vectorPR|: 7.35
-- The [Perimeter(P)] is: 24.89

-- The [terms] of the Scalar Product(vectorPQºPR) is: [-1.0, 28.0, -6.0]
-- The [Scalar Product(PQºPR)] is: 21.0
-- The Cossine of theta: 0.56
-- The [Theta angle] between vectors: vectorPQ and vectorPR is: 55.91
-- The Sine of alpha: 0.83
-- The [Alpha angle] between vectors: vectorPQ and vectorQS is: 124.09

        ------------------------------------------------------------
        -_- The [Height(h1)] relative as [sideB] is: 4.22
        ------------------------------ or -------------------------
        º<º The [Height(h2)] relative as [sideA] is: 6.09
        ------------------------------------------------------------

-- The [Area(S)] of the [Parallelogram(PQRS)] is 31.03


        . . . Key [ENTER] to exit -- Ok! . . .
```

(new) Example6.3 – Given all the [Coordinates] of the following [points]: P(0, 1, -1), Q(1, 0, 2), R(2, 3, 0), and S(1, 4, -3) of a parallelogramPQRS. Get the following [dimensions]:

[1.] The sides: sideA and sideB.
[2.] Inner angles(Θ and α).
[3.] Perimeter(P).
[4.] heights(h1 and h2).
[5.] Area(S).

[Note]: the option[20] will calculate the five previous items.

Solution: Begin the runVector3d.py program and key the [new] option[20] and follow the instructions in to display. After key in option[2] and enter with the given [Coordinates] of the [points: P, Q, R, and S] an key: [ENTER].

Follow keying in option[2] and enter with the given [Coordinates] of the [point: Q] an key: [ENTER].

[WELCOME IN USING THE [RUNVECTOR3D.PY] PROGRAM]
[TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] IN THE [SPACE]]
--[Version: 2.0 -- Stable]--

[INSTRUCTIONS OF USE]

- To find the [value] of the [Dot Product] of [two vectors]: vectorA and vectorB using the [Definition]: a * b = a1*b1 + a2*b2 + a3*b3 key [1]
- To Determine the [value] of the [Dot Product] of [two vectors]: vectorA and vectorB using the [Theorem]: a * b = ||a||*||b||*cos(theta) key [2]
- To get the [Cross Product] with the given [Components] of [two vectors]: vectorA and vectorB or using the given [Coordinates] of the [points]: P, Q, and R key [3]
- To calculate the [value] of the [Theta Sine] between [two vectors]: vectorA and vectorB key [4]
- To find the [value] of the [Scalar Triple Product] of [three vectors]: vectorA, vectorB, and vectorC key [5]
- To determine the [value] of the [Theta angle in degrees] between the [two vectors]: vectorA and vectorB key [6]
- To get the [value] of the [Theta Cosine] between [two vectors]: vectorA and vectorB key [7]
- To find the [Vectors: vectorA, vectorB, vectorC, and vectorD] and [Modules] using the [Theorem] of the [Distance] between any [two points]: P and Q or P and R or Q and R or R and S key [8]
- To calculate the [Area(S)] of the [Triangle(PQR)] with the given [Coordinates] of the [points]: P, Q, and R or the given [Components] of [two vectors]: vectorA and vectorB key [9]
- To find the [height(h)] and [Area(P)] of the [Parallelogram(PQRS)] determined to [two adjacent vectors]: vectorA and vectorB or with given [Coordinates] of the [vertice points: P, Q, and R] key [10]
- To get the [Volume_V(P)], and [Height(h)] of a [Parallelepiped] and too the [Volume_V(T)] of a [Tetrahedron] with the given [Coordinates] of the [four points]: P, Q, R, and S or with the given [Components] of the [three vectors]: vector_A, vector_B, and vector_C key [11]
- To calculate the [three Inner Angles: Alpha, Beta, and Gama] of the [TrianglePQR] with the given [Coordinates] of the given [points]: P, Q, and R key [12]
- To Determine the following [Middle Points]: K(xK,yK,zK), L(xL,yL,zL), M(xM,yM,zM), and N(xN,yN,zN) between [points]: P(xP,yP,zP), Q(xQ,yQ,zQ), R(xR,yR,zR), and S(xS,yS,zS) or in [sides]: PQ, PR, and QR of a Triangle(PQR).key [13]
- To find the [Centroid: G(xG, yG, zG)] of the Triangle(PQR) key [14]
- To determine the [Medians: PM, QL, and RK] of a Triangle(PQR) key [15]
- To get the [Addition] and [Subraction] between [Two Vectors]: vectorA and vectorB key [16]
- Provide the given [Components] of a [vectorA] or find a [new vectorA] that represent a [oriented segmentPQ] with the given [Coordinates] of [two points]: P and Q and calculate the [Direction Cosines] and [Direction Angles] key [17]
- To find the [Addition] and [Subraction] between [two vectors]: vectorA and vectorB multiplyed by [two scalars]: [coeffic1 and coeffic2] key [18]
- To calculate the [dimensions]: [Perimeter(P)], [Heights(h1,h2,h3)], and [Area(A)] of a [TrianglePQR] with the given [Coordinates] of the [three points]: P, Q, and R key [19]
- To get the [dimensions]: [Perimeter(P)], [heights(h1,h2)], and [Area(S)] of a [Parallelogram(PQRS)] key [20]
- Given the [Coordinates] of the [Middle Points]: K(xK,yK,zK), L(xL,yL,zL), and M(xM,yM,zM) will calculate the [Coordinates] of the [vertice points]: P, Q, and R of a Triangle(PQR). key [21]

[§] Select an previous [option] that will used--Ok!

[º>º] Provide the [new] value? 20

[FIND THE [DIMENSIONS]: [PERIMETER(P), [HEIGTHS(H1,H2)], AND [AREA(S)] OF A]
[[PARALLELOGRAM(PQRS)] WITH THE GIVEN [COORDINATES] OF THE [POINTS]: P, Q, AND R]
[OR WITH ALL GIVEN [COORDINATES] OF THE [POINTS]: P, Q, R, AND S]

[NEW INSTRUCTIONS]

- Key [1] if in problem is given the [coordinates] of the three vertices: P, Q, and R. After follow the new [instructions] in [Display] to find the [coordinates: xS, yS, and zS] relative

as point: S below - Ok!

- Key [2] if in problem is given the [coordinates] of the four vertices: P, Q, R, and S.

[º>º] Provide the [new] value? 2

-- Enter the [coordinates]: (xP, yP, zP) of the (point P)?

* Introduce the 1º[Coordinate(x)].
(ª<ª) Enter the [new] value? 0

* Enter with the 2º[Coordinate(y)].
(ª<ª) Enter the [new] value? 1

* Provide the 3º[Coordinate(z)].
(ª<ª) Enter the [new] value? -1

-- Introduce the [coordinates]: (xQ, yQ, zQ) of the (point Q)?

* Introduce the 1º[Coordinate(x)].
(ª<ª) Enter the [new] value? 1

* Enter with the 2º[Coordinate(y)].
(ª<ª) Enter the [new] value? 0

* Provide the 3º[Coordinate(z)].
(ª<ª) Enter the [new] value? 2

-- Provide the [coordinates]: (xR, yR, zR) of the (point R)?

* Introduce the 1º[Coordinate(x)].
(ª<ª) Enter the [new] value? 2

* Enter with the 2º[Coordinate(y)].
(ª<ª) Enter the [new] value? 3

* Provide the 3º[Coordinate(z)].
(ª<ª) Enter the [new] value? 0

-- Give the [coordinates]: (xS, yS, zS) of the (point S)?

* Introduce the 1º[Coordinate(x)].
(ª<ª) Enter the [new] value? 1

* Enter with the 2º[Coordinate(y)].
(ª<ª) Enter the [new] value? 4

* Provide the 3º[Coordinate(z)].
(ª<ª) Enter the [new] value? -3

- The (Point P): P (0.0, 1.0, -1.0)
- The (Point Q): Q (1.0, 0.0, 2.0)
- The (Point R): R (2.0, 3.0, 0.0)
- The (Point S): S (1.0, 4.0, -3.0)

[Answer]

-- The [vectorAxB]: vectorAxB [-7.0, 5.0, 4.0]
-- The ||normVectorAxB|| is 9.49

-- The [vectorPQ]: vectorPQ [1.0, -1.0, 3.0]
-- The [vectorPS]: vectorPS [1.0, 3.0, -2.0]

```
-- The [sideA] relative as |vectorPQ|: 3.32
-- The [sideB] relative as |vectorPS|: 3.74
-- The [Perimeter(P)] is: 14.12

-- The [terms] of the Scalar Product(vectorPSºPQ) is: [1.0, -3.0, -6.0]
-- The [Scalar Product(PQºPS)] is: -8.0
-- The Cossine of theta: -0.64
-- The [Theta angle] between vectors: vectorPQ and vectorPS is: 130.14
-- The Sine of alpha: 0.76
-- The [Alpha angle] between vectors: vectorPQ and vectorQR is: 49.86

    ------------------------------------------------------------
    -_- The [Height(h1)] relative as [sideB] is: 2.54
    ---------------------------- or ----------------------------
    º<º The [Height(h2)] relative as [sideA] is: 2.86
    ------------------------------------------------------------

-- The [Area(S)] of the [Parallelogram(PQRS)] is 9.49


    . . . Key [ENTER] to exit -- Ok! . . .
```

Example7 – Find the cosine of the angle between the vectors: a = i – 3j +2k and b = 3i + 3j + 2k.
Solution – Begin the runVector3d.py program and key the option[7] and follow the instructions in display.

```
        **[ WELCOME IN USING THE [RUNVECTOR3D.PY] PROGRAM ]**
    **[ TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] IN THE [SPACE] ]**
                        --[Version: 2.0 -- Stable]--


    **[INSTRUCTIONS OF USE]**
```

- To find the [value] of the [Dot Product] of [two vectors]: vectorA and vectorB using the [Definition]: a * b = a1*b1 + a2*b2 + a3*b3 key [1]
- To Determine the [value] of the [Dot Product] of [two vectors]: vectorA and vectorB using the [Theorem]: a * b = ||a||*||b||*cos(theta) key [2]
- To get the [Cross Product] with the given [Components] of [two vectors]: vectorA and vectorB or using the given [Coordinates] of the [points]: P, Q, and R key [3]
- To calculate the [value] of the [Theta Sine] between [two vectors]: vectorA and vectorB key [4]
- To find the [value] of the [Scalar Triple Product] of [three vectors]: vectorA, vectorB, and vectorC key [5]
- To determine the [value] of the [Theta angle in degrees] between the [two vectors]: vectorA and vectorB key [6]
- To get the [value] of the [Theta Cosine] between [two vectors]: vectorA and vectorB key [7]
- To find the [Vectors: vectorA, vectorB, vectorC, and vectorD] and [Modules] using the [Theorem] of the [Distance] between any [two points]: P and Q or P and R or Q and R or R and S key [8]
- To calculate the [Area(S)] of the [Triangle(PQR)] with the given [Coordinates] of the [points]: P, Q, and R or the given [Components] of [two vectors]: vectorA and vectorB key [9]
- To find the [height(h)] and [Area(P)] of the [Parallelogram(PQRS)] determined to [two adjacent vectors]: vectorA and vectorB or with given [Coordinates] of the [vertice points: P, Q, and R] key [10]
- To get the [Volume_V(P)], and [Height(h)] of a [Parallelepiped] and too the [Volume_V(T)] of a [Tetrahedron] with the given [Coordinates] of the [four points]: P, Q, R, and S or with the given [Components] of the [three vectors]: vector_A, vector_B, and vector_C key [11]
- To calculate the [three Inner Angles: Alpha, Beta, and Gama] of the [TrianglePQR] with the given [Coordinates] of the given [points]: P, Q, and R key [12]
- To Determine the following [Middle Points]: K(xK,yK,zK), L(xL,yL,zL), M(xM,yM,zM), and N(xN,yN,zN) between [points]: P(xP,yP,zP), Q(xQ,yQ,zQ), R(xR,yR,zR), and S(xS,yS,zS) or in [sides]: PQ, PR, and QR of a Triangle(PQR).key [13]
- To find the [Centroid: G(xG, yG, zG)] of the Triangle(PQR) key [14]
- To determine the [Medians: PM, QL, and RK] of a Triangle(PQR) key [15]
- To get the [Addition] and [Subraction] between [Two Vectors]: vectorA and vectorB key [16]

- Provide the given [Components] of a [vectorA] or find a [new vectorA] that represent a [oriented segmentPQ] with the given [Coordinates] of [two points]: P and Q and calculate the [Direction Cosines] and [Direction Angles] key [17]
- To find the [Addition] and [Subraction] between [two vectors]: vectorA and vectorB multiplyed by [two scalars]: [coeffic1 and coeffic2] key [18]
- To calculate the [dimensions]: [Perimeter(P)], [Heights(h1,h2,h3)], and [Area(A)] of a [TrianglePQR] with the given [Coordinates] of the [three points]: P, Q, and R key [19]
- To get the [dimensions]: [Perimeter(P)], [heights(h1,h2)], and [Area(S)] of a [Parallelogram(PQRS)] key [20]
- Given the [Coordinates] of the [Middle Points]: K(xK,yK,zK), L(xL,yL,zL), and M(xM,yM,zM) will calculate the [Coordinates] of the [vertice points]: P, Q, and R of a Triangle(PQR). key [21]

[§] Select an previous [option] that will used--Ok!

[º>º] Provide the [new] value? 7

[FIND THE [VALUE] OF THE [THETA COSINE IN RADIAN] BETWEEN VECTORS: vectorA AND vectorB]

- Attribute the [Components] of the [1º vectorA].

- Enter the [coefficient] of the [Component: (i) or (a1)]?
(ª<ª) Enter the [new] value? 1

- Introduce the [coefficient] of the [Component: (j) or (a2)]?
(ª<ª) Enter the [new] value? -3

- Give the [coefficient] of the [Component: (k) or (a3)]?
(ª<ª) Enter the [new] value? 2

- Provide the [Components] of the [2º vectorB].

- Enter the [coefficient] of the [Component: (i) or (b1)]?
(ª<ª) Enter the [new] value? 3

- Introduce the [coefficient] of the [Component: (j) or (b2)]?
(ª<ª) Enter the [new] value? 3

- Give the [coefficient] of the [Component: (k) or (b3)]?
(ª<ª) Enter the [new] value? 2

[Answer]

-- The [vectorA]: vectorA [1.0, -3.0, 2.0]
-- The [vectorB]: vectorB [3.0, 3.0, 2.0]

-- The [length] of a ||vectorA||: 3.74
-- The [length] of a ||vectorB||: 4.69
-- The vectorA*B: vectorA*B [3.0, -9.0, 4.0]
-- The [value] finded of |vectorA*B| is: 17.55
-- The [Scalar Product] of the [vectorA*B] is: -2.00
-- The [value] determined of the [Theta Cosine in RADIAN] is: -0.11

. . . Key [ENTER] to exit -- Ok! . . .

Example8 – Find the [direction cosines] and [direction angles] of the vector represented by vectorPQ givens [two points]: P(2,-3, 5) and Q(1,0,-1).

Solution – Begin the runVector3d.py program using the option[17] and after follow keyed in option[2] to enter the given [Coordinates]: xP = 2, yP = -3, zP = 5, xQ = 1, yQ = 0, and zQ = -1.

[WELCOME IN USING THE [RUNVECTOR3D.PY] PROGRAM]
[TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] IN THE [SPACE]]
--[Version: 2.0 -- Stable]--

[INSTRUCTIONS OF USE]

- To find the [value] of the [Dot Product] of [two vectors]: vectorA and vectorB using the [Definition]: a * b = a1*b1 + a2*b2 + a3*b3 key [1]
- To Determine the [value] of the [Dot Product] of [two vectors]: vectorA and vectorB using the [Theorem]: a * b = ||a||*||b||*cos(theta) key [2]
- To get the [Cross Product] with the given [Components] of [two vectors]: vectorA and vectorB or using the given [Coordinates] of the [points]: P, Q, and R key [3]
- To calculate the [value] of the [Theta Sine] between [two vectors]: vectorA and vectorB key [4]
- To find the [value] of the [Scalar Triple Product] of [three vectors]: vectorA, vectorB, and vectorC key [5]
- To determine the [value] of the [Theta angle in degrees] between the [two vectors]: vectorA and vectorB key [6]
- To get the [value] of the [Theta Cosine] between [two vectors]: vectorA and vectorB key [7]
- To find the [Vectors: vectorA, vectorB, vectorC, and vectorD] and [Modules] using the [Theorem] of the [Distance] between any [two points]: P and Q or P and R or Q and R or R and S key [8]
- To calculate the [Area(S)] of the [Triangle(PQR)] with the given [Coordinates] of the [points]: P, Q, and R or the given [Components] of [two vectors]: vectorA and vectorB key [9]
- To find the [height(h)] and [Area(P)] of the [Parallelogram(PQRS)] determined to [two adjacent vectors]: vectorA and vectorB or with given [Coordinates] of the [vertice points: P, Q, and R] key [10]
- To get the [Volume_V(P)], and [Height(h)] of a [Parallelepiped] and too the [Volume_V(T)] of a [Tetrahedron] with the given [Coordinates] of the [four points]: P, Q, R, and S or with the given [Components] of the [three vectors]: vector_A, vector_B, and vector_C key [11]
- To calculate the [three Inner Angles: Alpha, Beta, and Gama] of the [TrianglePQR] with the given [Coordinates] of the given [points]: P, Q, and R key [12]
- To Determine the following [Middle Points]: K(xK,yK,zK), L(xL,yL,zL), M(xM,yM,zM), and N(xN,yN,zN) between [points]: P(xP,yP,zP), Q(xQ,yQ,zQ), R(xR,yR,zR), and S(xS,yS,zS) or in [sides]: PQ, PR, and QR of a Triangle(PQR).key [13]
- To find the [Centroid: G(xG, yG, zG)] of the Triangle(PQR) key [14]
- To determine the [Medians: PM, QL, and RK] of a Triangle(PQR) key [15]
- To get the [Addition] and [Subraction] between [Two Vectors]: vectorA and vectorB key [16]
- Provide the given [Components] of a [vectorA] or find a [new vectorA] that represent a [oriented segmentPQ] with the given [Coordinates] of [two points]: P and Q and calculate the [Direction Cosines] and [Direction Angles] key [17]
- To find the [Addition] and [Subraction] between [two vectors]: vectorA and vectorB multiplyed by [two scalars]: [coeffic1 and coeffic2] key [18]
- To calculate the [dimensions]: [Perimeter(P)], [Heights(h1,h2,h3)], and [Area(A)] of a [TrianglePQR] with the given [Coordinates] of the [three points]: P, Q, and R key [19]
- To get the [dimensions]: [Perimeter(P)], [heights(h1,h2)], and [Area(S)] of a [Parallelogram(PQRS)] key [20]
- Given the [Coordinates] of the [Middle Points]: K(xK,yK,zK), L(xL,yL,zL), and M(xM,yM,zM) will calculate the [Coordinates] of the [vertice points]: P, Q, and R of a Triangle(PQR). key [21]

[§] Select an previous [option] that will used--Ok!

[º>º] Provide the [new] value? 17

[GIVEN AN VECTOR(A) OR [TWO POINTS]: P AND Q DETERMINE THE]
[[DIRECTION COSINES] AND [DIRECTION ANGLES]]

[NEW INSTRUCTIONS]

- Type [1] to enter the [components] of vectorA.
- Type [2] to enter the [coordinats] of two givens points: P and Q.
(º_º) Give the [new] value? 2

-- Enter the [coordinates]: (xP, yP, zP) of the (point P)?

* Introduce the 1º[Coordinate(x)].

(ª<ª) Enter the [new] value? 2

* Enter with the 2º[Coordinate(y)].
(ª<ª) Enter the [new] value? -3

* Provide the 3º[Coordinate(z)].
(ª<ª) Enter the [new] value? 5

-- Introduce the [coordinates]: (xQ, yQ, zQ) of the (point Q)?

* Introduce the 1º[Coordinate(x)].
(ª<ª) Enter the [new] value? 1

* Enter with the 2º[Coordinate(y)].
(ª<ª) Enter the [new] value? 0

* Provide the 3º[Coordinate(z)].
(ª<ª) Enter the [new] value? -1

- The (Point P): P (2.0, -3.0, 5.0)
- The (Point Q): Q (1.0, 0.0, -1.0)

[Answer]

- The [vectorA] = vectorA [-1.0, 3.0, -6.0]
- The [value] of [lengthA] = ||vectorA|| is 6.78

[(COSINEALPHA)² + (COSINEBETA)² + (COSINEGAMA)² = 1]

-- The [value] of the [CosineAlpha] is -0.15
-- The [value] of the [CosineBeta] is 0.44
-- The [value] of the [CosineGama] is -0.88

-- The [value] of the [AlphaAngle] is 98.48
-- The [value] of the [BetaAngle] is 63.75
-- The [value] of the [GamaAngle] is 152.21

. . . Key [ENTER] to exit -- Ok! . . .

(New) Example8.1 – Get the [direction cosines] and [direction angles] with the given [Components] of the vectorA [-7, 4, -5].

Solution – Begin the runVector3d.py program using the option[17] and after follow keyed in option[1] to enter the given [Components]: a1 = -7, a2 = 4, a3 = -5.

[WELCOME IN USING THE [RUNVECTOR3D.PY] PROGRAM]
[TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] IN THE [SPACE]]
--[Version: 2.0 -- Stable]--

[INSTRUCTIONS OF USE]

- To find the [value] of the [Dot Product] of [two vectors]: vectorA and vectorB using the [Definition]: a * b = a1*b1 + a2*b2 + a3*b3 key [1]
- To Determine the [value] of the [Dot Product] of [two vectors]: vectorA and vectorB using the [Theorem]: a * b = ||a||*||b||*cos(theta) key [2]
- To get the [Cross Product] with the given [Components] of [two vectors]: vectorA and vectorB or using the given [Coordinates] of the [points]: P, Q, and R key [3]
- To calculate the [value] of the [Theta Sine] between [two vectors]: vectorA and vectorB key [4]
- To find the [value] of the [Scalar Triple Product] of [three vectors]: vectorA, vectorB, and vectorC key [5]

- To determine the [value] of the [Theta angle in degrees] between the [two vectors]: vectorA and vectorB key [6]
- To get the [value] of the [Theta Cosine] between [two vectors]: vectorA and vectorB key [7]
- To find the [Vectors: vectorA, vectorB, vectorC, and vectorD] and [Modules] using the [Theorem] of the [Distance] between any [two points]: P and Q or P and R or Q and R or R and S key [8]
- To calculate the [Area(S)] of the [Triangle(PQR)] with the given [Coordinates] of the [points]: P, Q, and R or the given [Components] of [two vectors]: vectorA and vectorB key [9]
- To find the [height(h)] and [Area(P)] of the [Parallelogram(PQRS)] determined to [two adjacent vectors]: vectorA and vectorB or with given [Coordinates] of the [vertice points: P, Q, and R] key [10]
- To get the [Volume_V(P)], and [Height(h)] of a [Parallelepiped] and too the [Volume_V(T)] of a [Tetrahedron] with the given [Coordinates] of the [four points]: P, Q, R, and S or with the given [Components] of the [three vectors]: vector_A, vector_B, and vector_C key [11]
- To calculate the [three Inner Angles: Alpha, Beta, and Gama] of the [TrianglePQR] with the given [Coordinates] of the given [points]: P, Q, and R key [12]
- To Determine the following [Middle Points]: K(xK,yK,zK), L(xL,yL,zL), M(xM,yM,zM), and N(xN,yN,zN) between [points]: P(xP,yP,zP), Q(xQ,yQ,zQ), R(xR,yR,zR), and S(xS,yS,zS) or in [sides]: PQ, PR, and QR of a Triangle(PQR).key [13]
- To find the [Centroid: G(xG, yG, zG)] of the Triangle(PQR) key [14]
- To determine the [Medians: PM, QL, and RK] of a Triangle(PQR) key [15]
- To get the [Addition] and [Subraction] between [Two Vectors]: vectorA and vectorB key [16]
- Provide the given [Components] of a [vectorA] or find a [new vectorA] that represent a [oriented segmentPQ] with the given [Coordinates] of [two points]: P and Q and calculate the [Direction Cosines] and [Direction Angles] key [17]
- To find the [Addition] and [Subraction] between [two vectors]: vectorA and vectorB multiplyed by [two scalars]: [coeffic1 and coeffic2] key [18]
- To calculate the [dimensions]: [Perimeter(P)], [Heights(h1,h2,h3)], and [Area(A)] of a [TrianglePQR] with the given [Coordinates] of the [three points]: P, Q, and R key [19]
- To get the [dimensions]: [Perimeter(P)], [heights(h1,h2)], and [Area(S)] of a [Parallelogram(PQRS)] key [20]
- Given the [Coordinates] of the [Middle Points]: K(xK,yK,zK), L(xL,yL,zL), and M(xM,yM,zM) will calculate the [Coordinates] of the [vertice points]: P, Q, and R of a Triangle(PQR). key [21]

[§] Select an previous [option] that will used--Ok!

[º>º] Provide the [new] value? 17

[PROVIDE THE GIVEN [COMPONENTS] OF A [VECTOR_A] OR FIND A [NEW VECTOR_A] THAT REPRESENT A [ORIENTED SEGMENT_PQ] WITH THE GIVEN [COORDINATES] OF [TWO POINTS]: P AND Q]
[AND CALCULATE THE [DIRECTION COSINES] AND [DIRECTION ANGLES]]

[NEW INSTRUCTIONS]

- Type [1] to enter the [components] of vectorA.
- Type [2] to enter the [coordinats] of two givens points: P and Q.
(º_º) Give the [new] value? 1

- Attribute the [Components] of the [1º vectorA].

- Enter the [coefficient] of the [Component: (i) or (a1)]?
(ª<ª) Enter the [new] value? -7

- Introduce the [coefficient] of the [Component: (j) or (a2)]?
(ª<ª) Enter the [new] value? 4

- Give the [coefficient] of the [Component: (k) or (a3)]?
(ª<ª) Enter the [new] value? -5

[Answer]

- The [vectorA] = vectorA [-7.0, 4.0, -5.0]
- The [value] of [lengthA] = ||vectorA|| is 9.49

[(COSINEALPHA)² + (COSINEBETA)² + (COSINEGAMA)² = 1]

-- The [value] of the [CosineAlpha] is -0.74
-- The [value] of the [CosineBeta] is 0.42
-- The [value] of the [CosineGama] is -0.53

-- The [value] of the [AlphaAngle] is 137.55
-- The [value] of the [BetaAngle] is 65.06
-- The [value] of the [GamaAngle] is 121.81

. . . Key [ENTER] to exit -- Ok! . . .

Example9 – Given the [Components] of [two vectors]: a = i + 2j -3k and b = -2i -j + 5k find the [vectors and modules]: vector(a + b), vector(a – b), |vector (a + b)|, |vector (a – b)|.

Solution – Begin the runVector3d.py program and key the option[16] and wait the display present instructions to select the options: [1] or [2]. Follow type the option[2] and provide the [components]; a1 = 1, a2 = 2, a3 = -3, b1 = -2, b2 = -1, and b3 = 5 and key ENTER.

[WELCOME IN USING THE [RUNVECTOR3D.PY] PROGRAM]
[TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] IN THE [SPACE]]
--[Version: 2.0 -- Stable]--

[INSTRUCTIONS OF USE]

- To find the [value] of the [Dot Product] of [two vectors]: vectorA and vectorB using the [Definition]: a * b = a1*b1 + a2*b2 + a3*b3 key [1]
- To Determine the [value] of the [Dot Product] of [two vectors]: vectorA and vectorB using the [Theorem]: a * b = ||a||*||b||*cos(theta) key [2]
- To get the [Cross Product] with the given [Components] of [two vectors]: vectorA and vectorB or using the given [Coordinates] of the [points]: P, Q, and R key [3]
- To calculate the [value] of the [Theta Sine] between [two vectors]: vectorA and vectorB key [4]
- To find the [value] of the [Scalar Triple Product] of [three vectors]: vectorA, vectorB, and vectorC key [5]
- To determine the [value] of the [Theta angle in degrees] between the [two vectors]: vectorA and vectorB key [6]
- To get the [value] of the [Theta Cosine] between [two vectors]: vectorA and vectorB key [7]
- To find the [Vectors: vectorA, vectorB, vectorC, and vectorD] and [Modules] using the [Theorem] of the [Distance] between any [two points]: P and Q or P and R or Q and R or R and S key [8]
- To calculate the [Area(S)] of the [Triangle(PQR)] with the given [Coordinates] of the [points]: P, Q, and R or the given [Components] of [two vectors]: vectorA and vectorB key [9]
- To find the [height(h)] and [Area(P)] of the [Parallelogram(PQRS)] determined to [two adjacent vectors]: vectorA and vectorB or with given [Coordinates] of the [vertice points: P, Q, and R] key [10]
- To get the [Volume_V(P)], and [Height(h)] of a [Parallelepiped] and too the [Volume_V(T)] of a [Tetrahedron] with the given [Coordinates] of the [four points]: P, Q, R, and S or with the given [Components] of the [three vectors]: vector_A, vector_B, and vector_C key [11]
- To calculate the [three Inner Angles: Alpha, Beta, and Gama] of the [TrianglePQR] with the given [Coordinates] of the given [points]: P, Q, and R key [12]
- To Determine the following [Middle Points]: K(xK,yK,zK), L(xL,yL,zL), M(xM,yM,zM), and N(xN,yN,zN) between [points]: P(xP,yP,zP), Q(xQ,yQ,zQ), R(xR,yR,zR), and S(xS,yS,zS) or in [sides]: PQ, PR, and QR of a Triangle(PQR).key [13]
- To find the [Centroid: G(xG, yG, zG)] of the Triangle(PQR) key [14]
- To determine the [Medians: PM, QL, and RK] of a Triangle(PQR) key [15]
- To get the [Addition] and [Subraction] between [Two Vectors]: vectorA and vectorB key [16]
- Provide the given [Components] of a [vectorA] or find a [new vectorA] that represent a [oriented segmentPQ] with the given [Coordinates] of [two points]: P and Q and calculate the [Direction Cosines] and [Direction Angles] key [17]
- To find the [Addition] and [Subraction] between [two vectors]: vectorA and vectorB multiplyed by [two scalars]: [coeffic1 and coeffic2] key [18]
- To calculate the [dimensions]: [Perimeter(P)], [Heights(h1,h2,h3)], and [Area(A)] of a [TrianglePQR] with the given [Coordinates] of the [three points]: P, Q, and R key [19]
- To get the [dimensions]: [Perimeter(P)], [heights(h1,h2)], and [Area(S)] of a [Parallelogram(PQRS)] key [20]
- Given the [Coordinates] of the [Middle Points]: K(xK,yK,zK), L(xL,yL,zL), and M(xM,yM,zM) will calculate

the [Coordinates] of the [vertice points]: P, Q, and R of a Triangle(PQR). key [21]

[§] Select an previous [option] that will used--Ok!

[º>º] Provide the [new] value? 16

[GIVE THE [COMPONENTS] OF [TWO VECTORS]: VECTOR_A AND VECTOR_B OR]
[PROVIDE THE [COORDINATES] OF [THREE POINTS]: P, Q, AND R IN [SPACE |R³]]
[AFTER FIND THE [TWO VECTORS]: VECTOR_A AND VECTOR_B AND FOLLOW]
[TO CALCULATE THE [ADDITION] AND [SUBTRACTION] OF THIS [VECTORS]]

[NEW INSTRUCTIONS]

- To introduce the given [Coordinates] of the [points: P, Q, and R] type [1].
- To enter the given [Components] of [two vectors]: vectorA and vectorB] type [2].
(º_º) Give the [new] value? 2

- Attribute the [Components] of the [1º vectorA].

- Enter the [coefficient] of the [Component: (i) or (a1)]?
(ª<ª) Enter the [new] value? 1

- Introduce the [coefficient] of the [Component: (j) or (a2)]?
(ª<ª) Enter the [new] value? 2

- Give the [coefficient] of the [Component: (k) or (a3)]?
(ª<ª) Enter the [new] value? -3

- Provide the [Components] of the [2º vectorB].

- Enter the [coefficient] of the [Component: (i) or (b1)]?
(ª<ª) Enter the [new] value? -2

- Introduce the [coefficient] of the [Component: (j) or (b2)]?
(ª<ª) Enter the [new] value? -1

- Give the [coefficient] of the [Component: (k) or (b3)]?
(ª<ª) Enter the [new] value? 5

[Answer]

-- The [vectorA]: vectorA [1.0, 2.0, -3.0]
-- The [vectorB]: vectorB [-2.0, -1.0, 5.0]

-- The [Addition]: vector(A+B) [-1.0, 1.0, 2.0]
-- The [Subtraction]: vector(A-B) [3.0, 3.0, -8.0]

. . . Key [ENTER] to exit -- Ok! . . .

[Note]: Now to get the [modules]: |vector(A+B)| and |vector(A-B)| begin the runVector3d.py program again and key the option[18] and wait the display present instructions to select the options: [1] or [2]. Follow type the option[2] and provide the given [components]: a1 = -1, a2 = 1, a3 = 2, b1 = 3, b2 = 3, and b3 = -8 and key ENTER. After the program will wait the user enter the [coefficients]. Do (1º)[coefficient] = 1 and (2º) [coefficient] = 1 and key ENTER to process.

[WELCOME IN USING THE [RUNVECTOR3D.PY] PROGRAM]
[TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] IN THE [SPACE]]
--[Version: 2.0 -- Stable]--

[INSTRUCTIONS OF USE]

- To find the [value] of the [Dot Product] of [two vectors]: vectorA and vectorB using the [Definition]: a * b = a1*b1 + a2*b2 + a3*b3 key [1]
- To Determine the [value] of the [Dot Product] of [two vectors]: vectorA and vectorB using the [Theorem]: a * b = ||a||*||b||*cos(theta) key [2]
- To get the [Cross Product] with the given [Components] of [two vectors]: vectorA and vectorB or using the given [Coordinates] of the [points]: P, Q, and R key [3]
- To calculate the [value] of the [Theta Sine] between [two vectors]: vectorA and vectorB key [4]
- To find the [value] of the [Scalar Triple Product] of [three vectors]: vectorA, vectorB, and vectorC key [5]
- To determine the [value] of the [Theta angle in degrees] between the [two vectors]: vectorA and vectorB key [6]
- To get the [value] of the [Theta Cosine] between [two vectors]: vectorA and vectorB key [7]
- To find the [Vectors: vectorA, vectorB, vectorC, and vectorD] and [Modules] using the [Theorem] of the [Distance] between any [two points]: P and Q or P and R or Q and R or R and S key [8]
- To calculate the [Area(S)] of the [Triangle(PQR)] with the given [Coordinates] of the [points]: P, Q, and R or the given [Components] of [two vectors]: vectorA and vectorB key [9]
- To find the [height(h)] and [Area(P)] of the [Parallelogram(PQRS)] determined to [two adjacent vectors]: vectorA and vectorB or with given [Coordinates] of the [vertice points: P, Q, and R] key [10]
- To get the [Volume_V(P)], and [Height(h)] of a [Parallelepiped] and too the [Volume_V(T)] of a [Tetrahedron] with the given [Coordinates] of the [four points]: P, Q, R, and S or with the given [Components] of the [three vectors]: vector_A, vector_B, and vector_C key [11]
- To calculate the [three Inner Angles: Alpha, Beta, and Gama] of the [TrianglePQR] with the given [Coordinates] of the given [points]: P, Q, and R key [12]
- To Determine the following [Middle Points]: K(xK,yK,zK), L(xL,yL,zL), M(xM,yM,zM), and N(xN,yN,zN) between [points]: P(xP,yP,zP), Q(xQ,yQ,zQ), R(xR,yR,zR), and S(xS,yS,zS) or in [sides]: PQ, PR, and QR of a Triangle(PQR).key [13]
- To find the [Centroid: G(xG, yG, zG)] of the Triangle(PQR) key [14]
- To determine the [Medians: PM, QL, and RK] of a Triangle(PQR) key [15]
- To get the [Addition] and [Subraction] between [Two Vectors]: vectorA and vectorB key [16]
- Provide the given [Components] of a [vectorA] or find a [new vectorA] that represent a [oriented segmentPQ] with the given [Coordinates] of [two points]: P and Q and calculate the [Direction Cosines] and [Direction Angles] key [17]
- To find the [Addition] and [Subraction] between [two vectors]: vectorA and vectorB multiplyed by [two scalars]: [coeffic1 and coeffic2] key [18]
- To calculate the [dimensions]: [Perimeter(P)], [Heights(h1,h2,h3)], and [Area(A)] of a [TrianglePQR] with the given [Coordinates] of the [three points]: P, Q, and R key [19]
- To get the [dimensions]: [Perimeter(P)], [heights(h1,h2)], and [Area(S)] of a [Parallelogram(PQRS)] key [20]
- Given the [Coordinates] of the [Middle Points]: K(xK,yK,zK), L(xL,yL,zL), and M(xM,yM,zM) will calculate the [Coordinates] of the [vertice points]: P, Q, and R of a Triangle(PQR). key [21]

[§] Select an previous [option] that will used--Ok!

[º>º] Provide the [new] value? 18

[GIVEN [TWO VECTORS]: VECTOR_A AND VECTOR_B MULTIPLYED BY THE [TWO SCALARS]: [COEFFIC1 AND COEFFIC2] OR]

[GIVEN [THE POINTS: P, Q, AND R] FIND [TWO VECTORS]: VECTOR_A=VECTOR(PQ) AND VECTOR_B=VECTOR(PR)]

[AND MULTIPLY BY [TWO SCALARS]: [COEFFIC1] AND [COEFFIC2] AND TOO GET THE [ADDITION] AND [SUBTRACTION]]

[NEW INSTRUCTIONS]

- To introduce the given [Coordinates] of the [points: P, Q, and R] type [1].
- To enter the given [Components] of [two vectors]: vectorA and vectorB] type [2].

(º_º) Give the [new] value? 2

- Attribute the [Components] of the [1º vectorA].

- Enter the [coefficient] of the [Component: (i) or (a1)]?
(ª<ª) Enter the [new] value? -1

- Introduce the [coefficient] of the [Component: (j) or (a2)]?
(ª<ª) Enter the [new] value? 1

- Give the [coefficient] of the [Component: (k) or (a3)]?
(ª<ª) Enter the [new] value? 2

- Provide the [Components] of the [2º vectorB].

- Enter the [coefficient] of the [Component: (i) or (b1)]?
(ª<ª) Enter the [new] value? 3

- Introduce the [coefficient] of the [Component: (j) or (b2)]?
(ª<ª) Enter the [new] value? 3

- Give the [coefficient] of the [Component: (k) or (b3)]?
(ª<ª) Enter the [new] value? -8

[Answer]

-- The [vectorA]: vectorA [1.0, 2.0, -3.0]
-- The [vectorB]: vectorB [-2.0, -1.0, 5.0]

- Enter with new [value] to the (1º)[coefficient]?
(ª<ª) Enter the [new] value? 1
- Give the new [value] to the (2º)[coefficient]?
(ª<ª) Enter the [new] value? 1

[Answer]

+ The (1.0) * vectorA [-1.0, 1.0, 2.0]
+ The (1.0) * vectorB [3.0, 3.0, -8.0]

-- The vector((1.0)A + (1.0)B) [2.0, 4.0, -6.0]
-- The vector((1.0)A - (1.0)B) [-4.0, -2.0, 10.0]

-- The [length] of the |vector((1.0)A + (1.0)B)| is 7.48
-- The [length] of the |vector((1.0)A - (1.0)B)| is 10.95

. . . Key [ENTER] to exit -- Ok! . . .

(New) Example9.1 – Given the [Components] of [two vectors]: a = i + 2j -3k and b = -2i -j + 5k find the [vectors and modules]: vector(2a – 3b) and |vector(2a – 3b)|.

Solution – Begin the runVector3d.py program and key the option[18] and wait the display present instructions to select the options: [1] or [2]. Follow type the option[2] and provide the given [components]: a1 = 1, a2 = 2, a3 = -3, b1 = -2, b2 = -1, and b3 = 5 and key ENTER.
After the program will wait the user enter the [coefficients]. Do (1º)[coefficient] = 2 and (2º)[coefficient] = -3 and key ENTER to process.

[WELCOME IN USING THE [RUNVECTOR3D.PY] PROGRAM]
[TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] IN THE [SPACE]]
--[Version: 2.0 -- Stable]--

[INSTRUCTIONS OF USE]

- To find the [value] of the [Dot Product] of [two vectors]: vectorA and vectorB using the [Definition]: a * b = a1*b1 + a2*b2 + a3*b3 key [1]
- To Determine the [value] of the [Dot Product] of [two vectors]: vectorA and vectorB using the [Theorem]: a * b = ||a||*||b||*cos(theta) key [2]
- To get the [Cross Product] with the given [Components] of [two vectors]: vectorA and vectorB or using the given [Coordinates] of the [points]: P, Q, and R key [3]
- To calculate the [value] of the [Theta Sine] between [two vectors]: vectorA and vectorB key [4]
- To find the [value] of the [Scalar Triple Product] of [three vectors]: vectorA, vectorB, and vectorC key [5]
- To determine the [value] of the [Theta angle in degrees] between the [two vectors]: vectorA and vectorB key [6]
- To get the [value] of the [Theta Cosine] between [two vectors]: vectorA and vectorB key [7]
- To find the [Vectors: vectorA, vectorB, vectorC, and vectorD] and [Modules] using the [Theorem] of the [Distance] between any [two points]: P and Q or P and R or Q and R or R and S key [8]
- To calculate the [Area(S)] of the [Triangle(PQR)] with the given [Coordinates] of the [points]: P, Q, and R or the given [Components] of [two vectors]: vectorA and vectorB key [9]
- To find the [height(h)] and [Area(P)] of the [Parallelogram(PQRS)] determined to [two adjacent vectors]: vectorA and vectorB or with given [Coordinates] of the [vertice points: P, Q, and R] key [10]
- To get the [Volume_V(P)], and [Height(h)] of a [Parallelepiped] and too the [Volume_V(T)] of a [Tetrahedron] with the given [Coordinates] of the [four points]: P, Q, R, and S or with the given [Components] of the [three vectors]: vector_A, vector_B, and vector_C key [11]
- To calculate the [three Inner Angles: Alpha, Beta, and Gama] of the [TrianglePQR] with the given [Coordinates] of the given [points]: P, Q, and R key [12]
- To Determine the following [Middle Points]: K(xK,yK,zK), L(xL,yL,zL), M(xM,yM,zM), and N(xN,yN,zN) between [points]: P(xP,yP,zP), Q(xQ,yQ,zQ), R(xR,yR,zR), and S(xS,yS,zS) or in [sides]: PQ, PR, and QR of a Triangle(PQR).key [13]
- To find the [Centroid: G(xG, yG, zG)] of the Triangle(PQR) key [14]
- To determine the [Medians: PM, QL, and RK] of a Triangle(PQR) key [15]
- To get the [Addition] and [Subraction] between [Two Vectors]: vectorA and vectorB key [16]
- Provide the given [Components] of a [vectorA] or find a [new vectorA] that represent a [oriented segmentPQ] with the given [Coordinates] of [two points]: P and Q and calculate the [Direction Cosines] and [Direction Angles] key [17]
- To find the [Addition] and [Subraction] between [two vectors]: vectorA and vectorB multiplyed by [two scalars]: [coeffic1 and coeffic2] key [18]
- To calculate the [dimensions]: [Perimeter(P)], [Heights(h1,h2,h3)], and [Area(A)] of a [TrianglePQR] with the given [Coordinates] of the [three points]: P, Q, and R key [19]
- To get the [dimensions]: [Perimeter(P)], [heights(h1,h2)], and [Area(S)] of a [Parallelogram(PQRS)] key [20]
- Given the [Coordinates] of the [Middle Points]: K(xK,yK,zK), L(xL,yL,zL), and M(xM,yM,zM) will calculate the [Coordinates] of the [vertice points]: P, Q, and R of a Triangle(PQR). key [21]

[§] Select an previous [option] that will used--Ok!

[º>º] Provide the [new] value? 18

[GIVEN [TWO VECTORS]: VECTOR_A AND VECTOR_B MULTIPLYED BY [TWO SCALARS]: [COEFFIC1 AND COEFFIC2] OR]

[GIVEN [THE POINTS: P, Q, AND R] FIND [TWO VECTORS]: VECTOR_A=VECTOR(PQ) AND VECTOR_B=VECTOR(PR)]

[AND MULTIPLY BY [TWO SCALARS]: [COEFFIC1] AND [COEFFIC2] AND TOO GET THE [ADDITION] AND [SUBTRACTION]]

[NEW INSTRUCTIONS]

- To introduce the given [Coordinates] of the [points: P, Q, and R] type [1].
- To enter the given [Components] of [two vectors]: vectorA and vectorB] type [2].

(º_º) Give the [new] value? 2

- Attribute the [Components] of the [1º vectorA].

- Enter the [coefficient] of the [Component: (i) or (a1)]?
(ª<ª) Enter the [new] value? 1

- Introduce the [coefficient] of the [Component: (j) or (a2)]?
(ª<ª) Enter the [new] value? 2

- Give the [coefficient] of the [Component: (k) or (a3)]?
(ª<ª) Enter the [new] value? -3

- Provide the [Components] of the [2º vectorB].

- Enter the [coefficient] of the [Component: (i) or (b1)]?
(ª<ª) Enter the [new] value? -2

- Introduce the [coefficient] of the [Component: (j) or (b2)]?
(ª<ª) Enter the [new] value? -1

- Give the [coefficient] of the [Component: (k) or (b3)]?
(ª<ª) Enter the [new] value? 5

[Answer]

-- The [vectorA]: vectorA [1.0, 2.0, -3.0]
-- The [vectorB]: vectorB [-2.0, -1.0, 5.0]

- Enter with new [value] to the (1º)[coefficient]?
(ª<ª) Enter the [new] value? 2
- Give the new [value] to the (2º)[coefficient]?
(ª<ª) Enter the [new] value? -3

[Answer]

+ The (2.0) * vectorA [2.0, 4.0, -6.0]
+ The (-3.0) * vectorB [6.0, 3.0, -15.0]

-- The vector((2.0)A + (-3.0)B) [8.0, 7.0, -21.0]
-- The vector((2.0)A - (-3.0)B) [-4.0, 1.0, 9.0]

-- The [length] of the |vector((2.0)A + (-3.0)B)| is 23.54
-- The [length] of the |vector((2.0)A - (-3.0)B)| is 9.90

. . . Key [ENTER] to exit -- Ok! . . .

(New) Example9.2 – With the given [Coordinates] of the [points]: P(3, -2, 7), Q(2, 5, -3), and R(-5, 2, 11) get the following [vectors]: vectorA = vectorPQ, vectorB = vectorPR, vector(A+B), and vector(A-B). The [modules]:

Solution – Begin the runVector3d.py program and key the option[18] and wait the display present instructions to select the options: [1] or [2]. Follow type the option[1] and provide the given [Coordinates] of the previous [points]: P, Q, and R. After key ENTER. After the program will wait the user enter the [coefficients]. Do (1º)[coefficient] = 5 and (2º)[coefficient] = -10 and key ENTER to process.

[WELCOME IN USING THE [RUNVECTOR3D.PY] PROGRAM]
[TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] IN THE [SPACE]]
--[Version: 2.0 -- Stable]--

[INSTRUCTIONS OF USE]

- To find the [value] of the [Dot Product] of [two vectors]: vectorA and vectorB using the [Definition]: a * b = a1*b1 + a2*b2 + a3*b3 key [1]
- To Determine the [value] of the [Dot Product] of [two vectors]: vectorA and vectorB using the [Theorem]: a * b = ||a||*||b||*cos(theta) key [2]
- To get the [Cross Product] with the given [Components] of [two vectors]: vectorA and vectorB or using the given [Coordinates] of the [points]: P, Q, and R key [3]
- To calculate the [value] of the [Theta Sine] between [two vectors]: vectorA and vectorB key [4]
- To find the [value] of the [Scalar Triple Product] of [three vectors]: vectorA, vectorB, and vectorC key [5]
- To determine the [value] of the [Theta angle in degrees] between the [two vectors]: vectorA and vectorB key [6]
- To get the [value] of the [Theta Cosine] between [two vectors]: vectorA and vectorB key [7]
- To find the [Vectors: vectorA, vectorB, vectorC, and vectorD] and [Modules] using the [Theorem] of the [Distance] between any [two points]: P and Q or P and R or Q and R or R and S key [8]
- To calculate the [Area(S)] of the [Triangle(PQR)] with the given [Coordinates] of the [points]: P, Q, and R or the given [Components] of [two vectors]: vectorA and vectorB key [9]
- To find the [height(h)] and [Area(P)] of the [Parallelogram(PQRS)] determined to [two adjacent vectors]: vectorA and vectorB or with given [Coordinates] of the [vertice points: P, Q, and R] key [10]
- To get the [Volume_V(P)], and [Height(h)] of a [Parallelepiped] and too the [Volume_V(T)] of a [Tetrahedron] with the given [Coordinates] of the [four points]: P, Q, R, and S or with the given [Components] of the [three vectors]: vector_A, vector_B, and vector_C key [11]
- To calculate the [three Inner Angles: Alpha, Beta, and Gama] of the [TrianglePQR] with the given [Coordinates] of the given [points]: P, Q, and R key [12]
- To Determine the following [Middle Points]: K(xK,yK,zK), L(xL,yL,zL), M(xM,yM,zM), and N(xN,yN,zN) between [points]: P(xP,yP,zP), Q(xQ,yQ,zQ), R(xR,yR,zR), and S(xS,yS,zS) or in [sides]: PQ, PR, and QR of a Triangle(PQR).key [13]
- To find the [Centroid: G(xG, yG, zG)] of the Triangle(PQR) key [14]
- To determine the [Medians: PM, QL, and RK] of a Triangle(PQR) key [15]
- To get the [Addition] and [Subraction] between [Two Vectors]: vectorA and vectorB key [16]
- Provide the given [Components] of a [vectorA] or find a [new vectorA] that represent a [oriented segmentPQ] with the given [Coordinates] of [two points]: P and Q and calculate the [Direction Cosines] and [Direction Angles] key [17]
- To find the [Addition] and [Subraction] between [two vectors]: vectorA and vectorB multiplyed by [two scalars]: [coeffic1 and coeffic2] key [18]
- To calculate the [dimensions]: [Perimeter(P)], [Heights(h1,h2,h3)], and [Area(A)] of a [TrianglePQR] with the given [Coordinates] of the [three points]: P, Q, and R key [19]
- To get the [dimensions]: [Perimeter(P)], [heights(h1,h2)], and [Area(S)] of a [Parallelogram(PQRS)] key [20]
- Given the [Coordinates] of the [Middle Points]: K(xK,yK,zK), L(xL,yL,zL), and M(xM,yM,zM) will calculate the [Coordinates] of the [vertice points]: P, Q, and R of a Triangle(PQR). key [21]

[§] Select an previous [option] that will used--Ok!

[º>º] Provide the [new] value? 18

[GIVEN [TWO VECTORS]: VECTOR_A AND VECTOR_B MULTIPLYED BY [TWO SCALARS]: [COEFFIC1 AND COEFFIC2] OR]

[GIVEN [THE POINTS: P, Q, AND R] FIND [TWO VECTORS]: VECTOR_A=VECTOR(PQ) AND VECTOR_B=VECTOR(PR)]

[AND MULTIPLY BY [TWO SCALARS]: [COEFFIC1] AND [COEFFIC2] AND TOO GET THE [ADDITION] AND [SUBTRACTION]]

[NEW INSTRUCTIONS]

- To introduce the given [Coordinates] of the [points: P, Q, and R] type [1].
- To enter the given [Components] of [two vectors]: vectorA and vectorB] type [2].
(º_º) Give the [new] value? 1

-- Enter the [coordinates]: (xP, yP, zP) of the (point P)?

* Introduce the 1º[Coordinate(x)].
(ª<ª) Enter the [new] value? 3

```
* Enter with the 2º[Coordinate(y)].
(ª<ª) Enter the [new] value? -2

* Provide the 3º[Coordinate(z)].
(ª<ª) Enter the [new] value? 7

-- Introduce the [coordinates]: (xQ, yQ, zQ) of the (point Q)?

* Introduce the 1º[Coordinate(x)].
(ª<ª) Enter the [new] value? 2

* Enter with the 2º[Coordinate(y)].
(ª<ª) Enter the [new] value? 5

* Provide the 3º[Coordinate(z)].
(ª<ª) Enter the [new] value? -3

-- Provide the [coordinates]: (xR, yR, zR) of the (point R)?

* Introduce the 1º[Coordinate(x)].
(ª<ª) Enter the [new] value? -5

* Enter with the 2º[Coordinate(y)].
(ª<ª) Enter the [new] value?  2

* Provide the 3º[Coordinate(z)].
(ª<ª) Enter the [new] value? 11

- The (Point P): P (3.0, -2.0, 7.0)
- The (Point Q): Q (2.0, 5.0, -3.0)
- The (Point R): R (-5.0, 2.0, 11.0)


 *[Answer]*

-- The [vectorA]: vectorA [-1.0, 7.0, -10.0]
-- The [vectorB]: vectorB [-8.0, 4.0, 4.0]

- Enter with new [value] to the (1º)[coefficient]?
(ª<ª) Enter the [new] value? 5
- Give the new [value] to the (2º)[coefficient]?
(ª<ª) Enter the [new] value? -10

 *[Answer]*

+ The (5.0) * vectorA [-5.0, 35.0, -50.0]
+ The (-10.0) * vectorB [80.0, -40.0, -40.0]

-- The vector( (5.0)A + (-10.0)B ) [75.0, -5.0, -90.0]
-- The vector( (5.0)A - (-10.0)B ) [-85.0, 75.0, -10.0]

-- The [length] of the |vector( (5.0)A + (-10.0)B )| is 117.26
-- The [length] of the |vector( (5.0)A - (-10.0)B )| is 113.80


        . . . Key [ENTER] to exit -- Ok! . . .
```

Example10 – Given the [coordinates] of the [points]: P(2, 2, 3) and Q(4, -5, 6), find the [distance] between the points.
Solution – Begin the runVector3d.py program and key the option[8] and wait the display present instructions to select the options: [1] or [2]. Follow type the option[1] and provide the [coordinates]: xP = 2, yP = 2, zP = 3, xQ = 4, yQ = -5, and zQ = 6 when request by program and key ENTER.

[WELCOME IN USING THE [RUNVECTOR3D.PY] PROGRAM]
[TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] IN THE [SPACE]]
--[Version: 2.0 -- Stable]--

[INSTRUCTIONS OF USE]

- To find the [value] of the [Dot Product] of [two vectors]: vectorA and vectorB using the [Definition]: a * b = a1*b1 + a2*b2 + a3*b3 key [1]
- To Determine the [value] of the [Dot Product] of [two vectors]: vectorA and vectorB using the [Theorem]: a * b = ||a||*||b||*cos(theta) key [2]
- To get the [Cross Product] with the given [Components] of [two vectors]: vectorA and vectorB or using the given [Coordinates] of the [points]: P, Q, and R key [3]
- To calculate the [value] of the [Theta Sine] between [two vectors]: vectorA and vectorB key [4]
- To find the [value] of the [Scalar Triple Product] of [three vectors]: vectorA, vectorB, and vectorC key [5]
- To determine the [value] of the [Theta angle in degrees] between the [two vectors]: vectorA and vectorB key [6]
- To get the [value] of the [Theta Cosine] between [two vectors]: vectorA and vectorB key [7]
- To find the [Vectors: vectorA, vectorB, vectorC, and vectorD] and [Modules] using the [Theorem] of the [Distance] between any [two points]: P and Q or P and R or Q and R or R and S key [8]
- To calculate the [Area(S)] of the [Triangle(PQR)] with the given [Coordinates] of the [points]: P, Q, and R or the given [Components] of [two vectors]: vectorA and vectorB key [9]
- To find the [height(h)] and [Area(P)] of the [Parallelogram(PQRS)] determined to [two adjacent vectors]: vectorA and vectorB or with given [Coordinates] of the [vertice points: P, Q, and R] key [10]
- To get the [Volume_V(P)], and [Height(h)] of a [Parallelepiped] and too the [Volume_V(T)] of a [Tetrahedron] with the given [Coordinates] of the [four points]: P, Q, R, and S or with the given [Components] of the [three vectors]: vector_A, vector_B, and vector_C key [11]
- To calculate the [three Inner Angles: Alpha, Beta, and Gama] of the [TrianglePQR] with the given [Coordinates] of the given [points]: P, Q, and R key [12]
- To Determine the following [Middle Points]: K(xK,yK,zK), L(xL,yL,zL), M(xM,yM,zM), and N(xN,yN,zN) between [points]: P(xP,yP,zP), Q(xQ,yQ,zQ), R(xR,yR,zR), and S(xS,yS,zS) or in [sides]: PQ, PR, and QR of a Triangle(PQR).key [13]
- To find the [Centroid: G(xG, yG, zG)] of the Triangle(PQR) key [14]
- To determine the [Medians: PM, QL, and RK] of a Triangle(PQR) key [15]
- To get the [Addition] and [Subraction] between [Two Vectors]: vectorA and vectorB key [16]
- Provide the given [Components] of a [vectorA] or find a [new vectorA] that represent a [oriented segmentPQ] with the given [Coordinates] of [two points]: P and Q and calculate the [Direction Cosines] and [Direction Angles] key [17]
- To find the [Addition] and [Subraction] between [two vectors]: vectorA and vectorB multiplyed by [two scalars]: [coeffic1 and coeffic2] key [18]
- To calculate the [dimensions]: [Perimeter(P)], [Heights(h1,h2,h3)], and [Area(A)] of a [TrianglePQR] with the given [Coordinates] of the [three points]: P, Q, and R key [19]
- To get the [dimensions]: [Perimeter(P)], [heights(h1,h2)], and [Area(S)] of a [Parallelogram(PQRS)] key [20]
- Given the [Coordinates] of the [Middle Points]: K(xK,yK,zK), L(xL,yL,zL), and M(xM,yM,zM) will calculate the [Coordinates] of the [vertice points]: P, Q, and R of a Triangle(PQR). key [21]

[§] Select an previous [option] that will used--Ok!

[º>º] Provide the [new] value? 8

[WILL DETERMINE THE [VECTOR] AND [MODULE] BETWEEN ANY TWO GIVEN POINTS:]
[P AND Q OR P AND R OR Q AND R OR R AND S]

[TO FIND THE [VECTOR(A)] THAT REPRESENT THE TWO GIVEN POINTS: P, AND Q]
[AND TOO THE [MODULE] OF THE VECTOR(A) = |VECTOR(PQ)|]

[TO GET THE [VECTOR(B)] THAT REPRESENT THE TWO GIVEN POINTS: P, AND R]
[AND TOO THE [MODULE] OF THE VECTOR(B) = |VECTOR(PR)|]

[TO FIND THE [VECTOR(C)] THAT REPRESENT THE TWO GIVEN POINTS: Q, AND R]
[AND TOO THE [MODULE] OF THE VECTOR(C) = |VECTOR(QR)|]

[TO GET THE [VECTOR(D)] THAT REPRESENT THE TWO GIVEN POINTS: R, AND S]
[AND TOO THE [MODULE] OF THE VECTOR(D) = |VECTOR(RS)|]

[NEW INSTRUCTIONS]

- Type [1] to find the [vectorA] and [module] usind the [distance]: d(P,Q)
- Type [2] to determine the [vectorB] and [module] usind the [distance]: d(P,R)
- Type [3] to get the [vectorC] and [module] usind the [distance]: d(Q,R)
- Type [4] to find the [vectorD] and [module] usind the [distance]: d(R,S)
- Type [5] to determine the [Vectors: vectorA, vectorB, vectorC, and vectorD] and [modules] usind the [distances]: d(P,Q), d(P,R), d(Q,R), d(R,S).

[º>º] Provide the [new] value? 1

- Will find only the distance: d(P,Q)

-- Enter the [coordinates]: (xP, yP, zP) of the (point P)?

* Introduce the 1º[Coordinate(x)].
(ª<ª) Enter the [new] value? 2

* Enter with the 2º[Coordinate(y)].
(ª<ª) Enter the [new] value? 2

* Provide the 3º[Coordinate(z)].
(ª<ª) Enter the [new] value? 3

-- Introduce the [coordinates]: (xQ, yQ, zQ) of the (point Q)?

* Introduce the 1º[Coordinate(x)].
(ª<ª) Enter the [new] value? 4

* Enter with the 2º[Coordinate(y)].
(ª<ª) Enter the [new] value? -5

* Provide the 3º[Coordinate(z)].
(ª<ª) Enter the [new] value? 6

- The (Point P): P (2.0, 2.0, 3.0)
- The (Point Q): Q (4.0, -5.0, 6.0)

[Answer]

-- The [vectorA]: vectorA=vectorPQ [2.0, -7.0, 3.0]
-- The [lenghtPQ = distPQ] is the ||vectorPQ||: 7.87

. . . Key [ENTER] to exit -- Ok! . . .

[Note]: In version: 1.3 the VectorModDev.pymodule file have a only distanceTwoPoints() function to calculate the [distance] between the [two points]: P and Q in previous Example 12 of the instructions-v1.3_User.pdf file. The [new] version: 2.0 will introduce the Vector3dClassModule.py module class file with more options of get the [distance] between other [points]: P and Q or P and R or Q and R or R and S. To check the lines: 2739 – 3146 of the code in Vector3dClassModule.py module class file.

Example11 – Given the [points]: P(5, -9, 7) and Q(-2, 3, 3), find the [MidPoint_K] between the points.
Solution – Begin the runVector3d.py program again and key the option[13] and follow key in option[2] and provide the [coordinates]: xP = 5, yP = -9, zP = 7, xQ = -2, yQ = 3, and zQ = 3 and key ENTER to get the [Coordinates] of the MidPoint_K.

[WELCOME IN USING THE [RUNVECTOR3D.PY] PROGRAM]
[TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] IN THE [SPACE]]
--[Version: 2.0 -- Stable]--

[INSTRUCTIONS OF USE]

- To find the [value] of the [Dot Product] of [two vectors]: vectorA and vectorB using the [Definition]: a * b = a1*b1 + a2*b2 + a3*b3 key [1]
- To Determine the [value] of the [Dot Product] of [two vectors]: vectorA and vectorB using the [Theorem]: a * b = ||a||*||b||*cos(theta) key [2]
- To get the [Cross Product] with the given [Components] of [two vectors]: vectorA and vectorB or using the given [Coordinates] of the [points]: P, Q, and R key [3]
- To calculate the [value] of the [Theta Sine] between [two vectors]: vectorA and vectorB key [4]
- To find the [value] of the [Scalar Triple Product] of [three vectors]: vectorA, vectorB, and vectorC key [5]
- To determine the [value] of the [Theta angle in degrees] between the [two vectors]: vectorA and vectorB key [6]
- To get the [value] of the [Theta Cosine] between [two vectors]: vectorA and vectorB key [7]
- To find the [Vectors: vectorA, vectorB, vectorC, and vectorD] and [Modules] using the [Theorem] of the [Distance] between any [two points]: P and Q or P and R or Q and R or R and S key [8]
- To calculate the [Area(S)] of the [Triangle(PQR)] with the given [Coordinates] of the [points]: P, Q, and R or the given [Components] of [two vectors]: vectorA and vectorB key [9]
- To find the [height(h)] and [Area(P)] of the [Parallelogram(PQRS)] determined to [two adjacent vectors]: vectorA and vectorB or with given [Coordinates] of the [vertice points: P, Q, and R] key [10]
- To get the [Volume_V(P)], and [Height(h)] of a [Parallelepiped] and too the [Volume_V(T)] of a [Tetrahedron] with the given [Coordinates] of the [four points]: P, Q, R, and S or with the given [Components] of the [three vectors]: vector_A, vector_B, and vector_C key [11]
- To calculate the [three Inner Angles: Alpha, Beta, and Gama] of the [TrianglePQR] with the given [Coordinates] of the given [points]: P, Q, and R key [12]
- To Determine the following [Middle Points]: K(xK,yK,zK), L(xL,yL,zL), M(xM,yM,zM), and N(xN,yN,zN) between [points]: P(xP,yP,zP), Q(xQ,yQ,zQ), R(xR,yR,zR), and S(xS,yS,zS) or in [sides]: PQ, PR, and QR of a Triangle(PQR).key [13]
- To find the [Centroid: G(xG, yG, zG)] of the Triangle(PQR) key [14]
- To determine the [Medians: PM, QL, and RK] of a Triangle(PQR) key [15]
- To get the [Addition] and [Subraction] between [Two Vectors]: vectorA and vectorB key [16]
- Provide the given [Components] of a [vectorA] or find a [new vectorA] that represent a [oriented segmentPQ] with the given [Coordinates] of [two points]: P and Q and calculate the [Direction Cosines] and [Direction Angles] key [17]
- To find the [Addition] and [Subraction] between [two vectors]: vectorA and vectorB multiplyed by [two scalars]: [coeffic1 and coeffic2] key [18]
- To calculate the [dimensions]: [Perimeter(P)], [Heights(h1,h2,h3)], and [Area(A)] of a [TrianglePQR] with the given [Coordinates] of the [three points]: P, Q, and R key [19]
- To get the [dimensions]: [Perimeter(P)], [heights(h1,h2)], and [Area(S)] of a [Parallelogram(PQRS)] key [20]
- Given the [Coordinates] of the [Middle Points]: K(xK,yK,zK), L(xL,yL,zL), and M(xM,yM,zM) will calculate the [Coordinates] of the [vertice points]: P, Q, and R of a Triangle(PQR). key [21]

[§] Select an previous [option] that will used--Ok!

[º>º] Provide the [new] value? 13

==========
[WILL DETERMINE THE [MIDPOINTS]:]
==========

[NEW INSTRUCTIONS]

- Type [1] to find the [Middle points] of the sides: PQ, PR, and QR of a Triangle(PQR).
- Type [2] to determine the [Middle Point: K(xK,yK,zK)] relative as points: P(xP,yP,zP) and Q(xQ,yQ,zQ).
- Type [3] to get the [Middle Point: L(xL,yL,zL)] relative as points: Q(xQ,yQ,zQ) and R(xR,yR,zR).
- Type [4] to find the [Middle Point: M(xM,yM,zM)] relative as points: R(xR,yR,zR) and S(xS,yS).

- Type [5] to calculate the [Middle Point: N(xN,yN,zN)] relative as points: S(xS,yS,zS) and P(xP,yP,zP).

[º>º] Provide the [new] value? 2

-- Enter the [coordinates]: (xP, yP, zP) of the (point P)?

* Introduce the 1º[Coordinate(x)].
(ª<ª) Enter the [new] value? 5

* Enter with the 2º[Coordinate(y)].
(ª<ª) Enter the [new] value? -9

* Provide the 3º[Coordinate(z)].
(ª<ª) Enter the [new] value? 7

-- Introduce the [coordinates]: (xQ, yQ, zQ) of the (point Q)?

* Introduce the 1º[Coordinate(x)].
(ª<ª) Enter the [new] value? -2

* Enter with the 2º[Coordinate(y)].
(ª<ª) Enter the [new] value? 3

* Provide the 3º[Coordinate(z)].
(ª<ª) Enter the [new] value? 3

- The (Point P): P (5.0, -9.0, 7.0)
- The (Point Q): Q (-2.0, 3.0, 3.0)

[Answer]

-- The MidPoint_K(xK,yK,zK): (1.5, -3.0, 5.0)

. . . Key [ENTER] to exit -- Ok! . . .

[Note]: In version: 1.3 the VectorModDev.pymodule file have a only midPoint() function to calculate the [MidPoint M] between the [points]: P and Q in Example 13 of the previous instructions-v1.3_User.pdf file. The [new] version: 2.0 will introduce the Vector3dClassModule.py module class file with more options of get the MidPoints between others points as in previous [options]: option[1] or option[3] or option[4] or option[5].

Example12 – Given the [points]: P(-1, 2, 0), Q(2, 1, -3), R(1, 0, 1), and S(3, -2, 3), find the Volume_V(P) and Height(h) of the parallelepiped as too the volume_V(T) of the Tetrahedron.

Solution – Run the runVector3d.py program again and key the option[11] and after follow key in option[1] and provide the [coordinates]: xP = -1, yP = 2, zP = 0, xQ = -2, yQ = 1, zQ = -3, xR = 1, yR = 0, zR = 1, xS = 3, yS = -2, and zS = 3 when the program request.

[WELCOME IN USING THE [RUNVECTOR3D.PY] PROGRAM]
[TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] IN THE [SPACE]]
--[Version: 2.0 -- Stable]--

[INSTRUCTIONS OF USE]

- To find the [value] of the [Dot Product] of [two vectors]: vectorA and vectorB using the [Definition]: a * b = a1*b1 + a2*b2 + a3*b3 key [1]
- To Determine the [value] of the [Dot Product] of [two vectors]: vectorA and vectorB using the [Theorem]: a * b = ||a||*||b||*cos(theta) key [2]
- To get the [Cross Product] with the given [Components] of [two vectors]: vectorA and vectorB or

using the given [Coordinates] of the [points]: P, Q, and R key [3]
- To calculate the [value] of the [Theta Sine] between [two vectors]: vectorA and vectorB key [4]
- To find the [value] of the [Scalar Triple Product] of [three vectors]: vectorA, vectorB, and vectorC key [5]
- To determine the [value] of the [Theta angle in degrees] between the [two vectors]: vectorA and vectorB key [6]
- To get the [value] of the [Theta Cosine] between [two vectors]: vectorA and vectorB key [7]
- To find the [Vectors: vectorA, vectorB, vectorC, and vectorD] and [Modules] using the [Theorem] of the [Distance] between any [two points]: P and Q or P and R or Q and R or R and S key [8]
- To calculate the [Area(S)] of the [Triangle(PQR)] with the given [Coordinates] of the [points]: P, Q, and R or the given [Components] of [two vectors]: vectorA and vectorB key [9]
- To find the [height(h)] and [Area(P)] of the [Parallelogram(PQRS)] determined to [two adjacent vectors]: vectorA and vectorB or with given [Coordinates] of the [vertice points: P, Q, and R] key [10]
- To get the [Volume_V(P)], and [Height(h)] of a [Parallelepiped] and too the [Volume_V(T)] of a [Tetrahedron] with the given [Coordinates] of the [four points]: P, Q, R, and S or with the given [Components] of the [three vectors]: vector_A, vector_B, and vector_C key [11]
- To calculate the [three Inner Angles: Alpha, Beta, and Gama] of the [TrianglePQR] with the given [Coordinates] of the given [points]: P, Q, and R key [12]
- To Determine the following [Middle Points]: K(xK,yK,zK), L(xL,yL,zL), M(xM,yM,zM), and N(xN,yN,zN) between [points]: P(xP,yP,zP), Q(xQ,yQ,zQ), R(xR,yR,zR), and S(xS,yS,zS) or in [sides]: PQ, PR, and QR of a Triangle(PQR).key [13]
- To find the [Centroid: G(xG, yG, zG)] of the Triangle(PQR) key [14]
- To determine the [Medians: PM, QL, and RK] of a Triangle(PQR) key [15]
- To get the [Addition] and [Subraction] between [Two Vectors]: vectorA and vectorB key [16]
- Provide the given [Components] of a [vectorA] or find a [new vectorA] that represent a [oriented segmentPQ] with the given [Coordinates] of [two points]: P and Q and calculate the [Direction Cosines] and [Direction Angles] key [17]
- To find the [Addition] and [Subraction] between [two vectors]: vectorA and vectorB multiplyed by [two scalars]: [coeffic1 and coeffic2] key [18]
- To calculate the [dimensions]: [Perimeter(P)], [Heights(h1,h2,h3)], and [Area(A)] of a [TrianglePQR] with the given [Coordinates] of the [three points]: P, Q, and R key [19]
- To get the [dimensions]: [Perimeter(P)], [heights(h1,h2)], and [Area(S)] of a [Parallelogram(PQRS)] key [20]
- Given the [Coordinates] of the [Middle Points]: K(xK,yK,zK), L(xL,yL,zL), and M(xM,yM,zM) will calculate the [Coordinates] of the [vertice points]: P, Q, and R of a Triangle(PQR). key [21]

[§] Select an previous [option] that will used--Ok!

[º>º] Provide the [new] value? 11

[GIVE THE [COMPONENTS] OF [THREE VECTORS]: VECTOR_A, VECTOR_B AND VECTOR_C OR]
[PROVIDE THE [COORDINATES] OF THE POINTS: P, Q, R AND S IN [SPACE |R³] AND FIND]
[THE [THREE VECTORS]: VECTOR_A, VECTOR_B AND VECTOR_C. AFTER FOLLOW TO DETERMINE]
[THE [DIMENSIONS]: [HEIGTH(H)] AND [VOLUME_V(P)] OF A PARALLELEPIPED AND TOO]
[THE [VOLUME_V(T)] OF A TETRAHEDRON]

[NEW INSTRUCTIONS]

* Type [1] to enter all the [Coordinate] points: P, Q, R and S or
* Type [2] and provide all the [Component] vectors: vectorA, vectorB and vectorC.

(º_º) Give the [new] value? 1

-- Enter the [coordinates]: (xP, yP, zP) of the (point P)?

* Introduce the 1º[Coordinate(x)].
(ª<ª) Enter the [new] value? -1

* Enter with the 2º[Coordinate(y)].
(ª<ª) Enter the [new] value? 2

* Provide the 3º[Coordinate(z)].
(ª<ª) Enter the [new] value? 0

-- Introduce the [coordinates]: (xQ, yQ, zQ) of the (point Q)?

* Introduce the 1º[Coordinate(x)].
(ª<ª) Enter the [new] value? 2

* Enter with the 2º[Coordinate(y)].
(ª<ª) Enter the [new] value? 1

* Provide the 3º[Coordinate(z)].
(ª<ª) Enter the [new] value? -3

-- Provide the [coordinates]: (xR, yR, zR) of the (point R)?

* Introduce the 1º[Coordinate(x)].
(ª<ª) Enter the [new] value? 1

* Enter with the 2º[Coordinate(y)].
(ª<ª) Enter the [new] value? 0

* Provide the 3º[Coordinate(z)].
(ª<ª) Enter the [new] value? 1

-- Give the [coordinates]: (xS, yS, zS) of the (point S)?

* Introduce the 1º[Coordinate(x)].
(ª<ª) Enter the [new] value? 3

* Enter with the 2º[Coordinate(y)].
(ª<ª) Enter the [new] value? -2

* Provide the 3º[Coordinate(z)].
(ª<ª) Enter the [new] value? 3

- The (Point P): P (-1.0, 2.0, 0.0)
- The (Point Q): Q (2.0, 1.0, -3.0)
- The (Point R): R (1.0, 0.0, 1.0)
- The (Point S): S (3.0, -2.0, 3.0)

[Answer]

-- The [vectorA]: vectorA [3.0, -1.0, -3.0]
-- The [vectorB]: vectorB [2.0, -2.0, 1.0]
-- The [vectorC]: vectorC [4.0, -4.0, 3.0]

-- The value of the [Mixed Product: a * (b x c)] finded: -4.0
-- The [vectorAxB]: vectorAxB [-7.0, -9.0, -4.0]
-- The ||normVectorAxB|| is 12.08

-- The [Height(h)] of a Parallelepiped is 0.33
-- The [Volume_V(P)] of a Parallelepiped is 4.00
-- The [Volume_V(T)] of a [Tetrahedron] is 0.67

. . . Key [ENTER] to exit -- Ok! . . .

[Warning]: After process all the **previous Examples** using the new runVector3d.py program get the same answer in accordance with the old *runtoolsvectors.py program file version: 1.3*.

Now will introduce [**(New) Examples**] that created to all users test and view the [new performance] of the runVector3d.py program in solve new problems.

(New) Example 13: Find the following [dimensions] of a TrianglePQR with the given [Coordinates] of the [MidPoints]: K(0, 2.5, 4), L(-0.5, 6, 2), and M(2.5, 1.5, 3) in following below items:

[1.] The [three] vertice points: P, Q, and R.

Solution: Run the runVector3d.py program again and key the option[21] and after follow key in option[4] and provide the given [coordinates]: of the [MidPoints]: xK = 0, yK = 2.5, zP = 4, xL = -0.5, yL = 6, zL = 2, xM = 2.5, yM = 1.5, zM = 3 when the program request.

```
**[ WELCOME IN USING THE [RUNVECTOR3D.PY] PROGRAM ]**
**[ TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] IN THE [SPACE] ]**
--[Version: 2.0 -- Stable]--


    **[INSTRUCTIONS OF USE]**

- To find the [value] of the [Dot Product] of [two vectors]: vectorA and vectorB using the
  [Definition]: a * b = a1*b1 + a2*b2 + a3*b3 key [1]
- To Determine the [value] of the [Dot Product] of [two vectors]: vectorA and vectorB using the
  [Theorem]: a * b = ||a||*||b||*cos(theta) key [2]
- To get the [Cross Product] with the given [Components] of [two vectors]: vectorA and vectorB or
  using the given [Coordinates] of the [points]: P, Q, and R key [3]
- To calculate the [value] of the [Theta Sine] between [two vectors]: vectorA and vectorB key [4]
- To find the [value] of the [Scalar Triple Product] of [three vectors]: vectorA, vectorB, and vectorC key [5]
- To determine the [value] of the [Theta angle in degrees] between the [two vectors]: vectorA and vectorB
   key [6]
- To get the [value] of the [Theta Cosine] between [two vectors]: vectorA and vectorB key [7]
- To find the [Vectors: vectorA, vectorB, vectorC, and vectorD] and [Modules] using the [Theorem] of the
   [Distance] between any [two points]: P and Q or P and R or Q and R or R and S key [8]
- To calculate the [Area(S)] of the [Triangle(PQR)] with the given [Coordinates] of the [points]: P, Q, and R
  or the given [Components] of [two vectors]: vectorA and vectorB key [9]
- To find the [height(h)] and [Area(P)] of the [Parallelogram(PQRS)] determined to [two adjacent vectors]:
vectorA and vectorB or with given [Coordinates] of the [vertice points: P, Q, and R] key [10]
- To get the [Volume_V(P)], and [Height(h)] of a [Parallelepiped] and too the [Volume_V(T)] of a [Tetrahedron]
   with the given [Coordinates] of the [four points]: P, Q, R, and S or with the given [Components] of the [three
   vectors]: vector_A, vector_B, and vector_C key [11]
- To calculate the [three Inner Angles: Alpha, Beta, and Gama] of the [TrianglePQR] with the given
  [Coordinates] of the given [points]: P, Q, and R key [12]
- To Determine the following [Middle Points]: K(xK,yK,zK), L(xL,yL,zL), M(xM,yM,zM), and N(xN,yN,zN)
  between [points]: P(xP,yP,zP), Q(xQ,yQ,zQ), R(xR,yR,zR), and S(xS,yS,zS) or in [sides]: PQ, PR, and QR
  of a Triangle(PQR).key [13]
- To find the [Centroid: G(xG, yG, zG)] of the Triangle(PQR) key [14]
- To determine the [Medians: PM, QL, and RK] of a Triangle(PQR) key [15]
- To get the [Addition] and [Subraction] between [Two Vectors]: vectorA and vectorB key [16]
- Provide the given [Components] of a [vectorA] or find a [new vectorA] that represent a [oriented
segmentPQ] with the given [Coordinates] of [two points]: P and Q and calculate the [Direction Cosines] and
[Direction Angles] key [17]
- To find the [Addition] and [Subraction] between [two vectors]: vectorA and vectorB multiplyed by
  [two scalars]: [coeffic1 and coeffic2] key [18]
- To calculate the [dimensions]: [Perimeter(P)], [Heights(h1,h2,h3)], and [Area(A)] of a [TrianglePQR]  with
  the given [Coordinates] of the [three points]: P, Q, and R key [19]
- To get the [dimensions]: [Perimeter(P)], [heights(h1,h2)], and [Area(S)] of a [Parallelogram(PQRS)] key [20]
- Given the [Coordinates] of the [Middle Points]: K(xK,yK,zK), L(xL,yL,zL), and M(xM,yM,zM) will calculate
  the [Coordinates] of the [vertice points]: P, Q, and R of a Triangle(PQR). key [21]

    [§] Select an previous [option] that will used--Ok!

    [º>º] Provide the [new] value? 21

**[ GIVEN THE [COORDINATES] OF THE [MIDDLE POINTS]: K(xK,yK,zK), L(xL,yL,zL), AND
```

M(xM,yM,zM)]**
[WILL FIND ALL THE [COORDENATES] OF THE [VERTICE POINTS: P, Q, AND R] OF A TRIANGLE(PQR)]

[NEW INSTRUCTIONS]

- Type [1] to find the only vertice: P(xP,yP,zP) of a triangle(PQR).
- Type [2] to get the only vertice: Q(xQ,yQ,zQ) of a triangle(PQR).
- Type [3] to find the only vertice: R(xR,yR,zR) of a triangle(PQR).
- Type [4] to determine the [three vertice points]: P(xP,yP,zP), Q(xQ,yQ,zQ), and R(xR,yR,zR) of a triangle(PQR).

[º>º] Provide the [new] value? 4

-- Give the [coordinates]: (xK, yK, zK) of the (Mid_point K)?

* Introduce the 1º[Coordinate(x)].
(ª<ª) Enter the [new] value? 0

* Enter with the 2º[Coordinate(y)].
(ª<ª) Enter the [new] value? 2.5

* Provide the 3º[Coordinate(z)].
(ª<ª) Enter the [new] value? 4

-- Give the [coordinates]: (xL, yL, zL) of the (Mid_point L)?

* Introduce the 1º[Coordinate(x)].
(ª<ª) Enter the [new] value? -0.5

* Enter with the 2º[Coordinate(y)].
(ª<ª) Enter the [new] value? 6

* Provide the 3º[Coordinate(z)].
(ª<ª) Enter the [new] value? 2

-- Give the [coordinates]: (xM, yM, zM) of the (Mid_point M)?

* Introduce the 1º[Coordinate(x)].
(ª<ª) Enter the [new] value? 2.5

* Enter with the 2º[Coordinate(y)].
(ª<ª) Enter the [new] value? 1.5

* Provide the 3º[Coordinate(z)].
(ª<ª) Enter the [new] value? 3

[Answer]

- The (Point P): P (-3.0, 7.0, 3.0)
- The (Point Q): Q (3.0, -2.0, 5.0)
- The (Point R): R (2.0, 5.0, 1.0)

. . . Key [ENTER] to exit -- Ok! . . .

[2.] The [sides]: sideA, sideB, and sideC.
[3.] The [Perimeter]
[4.] The [heights]: h1, h2, and h3
[5.] and [area(A)].

Solution: Will solve all the [previous items] using only the option[19]. Run the runVector3d.py program and key in option[19] and provide the previous [coordinates]: xP = -3, yP = 7, zP = 3, xQ = 3, yQ = -2, zQ = 5, xR = 2, yR = 5, and zR = 1. of the finded [vertices]: P, Q, and R.

[WELCOME IN USING THE [RUNVECTOR3D.PY] PROGRAM]
[TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] IN THE [SPACE]]
--[Version: 2.0 -- Stable]--

[INSTRUCTIONS OF USE]

- To find the [value] of the [Dot Product] of [two vectors]: vectorA and vectorB using the [Definition]: a * b = a1*b1 + a2*b2 + a3*b3 key [1]
- To Determine the [value] of the [Dot Product] of [two vectors]: vectorA and vectorB using the [Theorem]: a * b = ||a||*||b||*cos(theta) key [2]
- To get the [Cross Product] with the given [Components] of [two vectors]: vectorA and vectorB or using the given [Coordinates] of the [points]: P, Q, and R key [3]
- To calculate the [value] of the [Theta Sine] between [two vectors]: vectorA and vectorB key [4]
- To find the [value] of the [Scalar Triple Product] of [three vectors]: vectorA, vectorB, and vectorC key [5]
- To determine the [value] of the [Theta angle in degrees] between the [two vectors]: vectorA and vectorB key [6]
- To get the [value] of the [Theta Cosine] between [two vectors]: vectorA and vectorB key [7]
- To find the [Vectors: vectorA, vectorB, vectorC, and vectorD] and [Modules] using the [Theorem] of the [Distance] between any [two points]: P and Q or P and R or Q and R or R and S key [8]
- To calculate the [Area(S)] of the [Triangle(PQR)] with the given [Coordinates] of the [points]: P, Q, and R or the given [Components] of [two vectors]: vectorA and vectorB key [9]
- To find the [height(h)] and [Area(P)] of the [Parallelogram(PQRS)] determined to [two adjacent vectors]: vectorA and vectorB or with given [Coordinates] of the [vertice points: P, Q, and R] key [10]
- To get the [Volume_V(P)], and [Height(h)] of a [Parallelepiped] and too the [Volume_V(T)] of a [Tetrahedron] with the given [Coordinates] of the [four points]: P, Q, R, and S or with the given [Components] of the [three vectors]: vector_A, vector_B, and vector_C key [11]
- To calculate the [three Inner Angles: Alpha, Beta, and Gama] of the [TrianglePQR] with the given [Coordinates] of the given [points]: P, Q, and R key [12]
- To Determine the following [Middle Points]: K(xK,yK,zK), L(xL,yL,zL), M(xM,yM,zM), and N(xN,yN,zN) between [points]: P(xP,yP,zP), Q(xQ,yQ,zQ), R(xR,yR,zR), and S(xS,yS,zS) or in [sides]: PQ, PR, and QR of a Triangle(PQR).key [13]
- To find the [Centroid: G(xG, yG, zG)] of the Triangle(PQR) key [14]
- To determine the [Medians: PM, QL, and RK] of a Triangle(PQR) key [15]
- To get the [Addition] and [Subraction] between [Two Vectors]: vectorA and vectorB key [16]
- Provide the given [Components] of a [vectorA] or find a [new vectorA] that represent a [oriented segmentPQ] with the given [Coordinates] of [two points]: P and Q and calculate the [Direction Cosines] and [Direction Angles] key [17]
- To find the [Addition] and [Subraction] between [two vectors]: vectorA and vectorB multiplyed by [two scalars]: [coeffic1 and coeffic2] key [18]
- To calculate the [dimensions]: [Perimeter(P)], [Heights(h1,h2,h3)], and [Area(A)] of a [TrianglePQR] with the given [Coordinates] of the [three points]: P, Q, and R key [19]
- To get the [dimensions]: [Perimeter(P)], [heights(h1,h2)], and [Area(S)] of a [Parallelogram(PQRS)] key [20]
- Given the [Coordinates] of the [Middle Points]: K(xK,yK,zK), L(xL,yL,zL), and M(xM,yM,zM) will calculate the [Coordinates] of the [vertice points]: P, Q, and R of a Triangle(PQR). key [21]

[§] Select an previous [option] that will used--Ok!

[º>º] Provide the [new] value? 19

[DETERMINE THE DIMENSIONS:[PERIMETER(P), [HEIGHTS(H1,H2,H3)], AND [AREA(A)] OF A]
[TRIANGLE(PQR) WITH THE GIVEN [COORDINATES] OF THE [POINTS]: P, Q, AND, R USING THE]
[SCALAR PRODUCT OF VECTORS.]

-- Enter the [coordinates]: (xP, yP, zP) of the (point P)?

* Introduce the 1º[Coordinate(x)].

(ª<ª) Enter the [new] value? -3

* Enter with the 2º[Coordinate(y)].
(ª<ª) Enter the [new] value? 7

* Provide the 3º[Coordinate(z)].
(ª<ª) Enter the [new] value? 3

-- Introduce the [coordinates]: (xQ, yQ, zQ) of the (point Q)?

* Introduce the 1º[Coordinate(x)].
(ª<ª) Enter the [new] value? 3

* Enter with the 2º[Coordinate(y)].
(ª<ª) Enter the [new] value? -2

* Provide the 3º[Coordinate(z)].
(ª<ª) Enter the [new] value? 5

-- Provide the [coordinates]: (xR, yR, zR) of the (point R)?

* Introduce the 1º[Coordinate(x)].
(ª<ª) Enter the [new] value? 2

* Enter with the 2º[Coordinate(y)].
(ª<ª) Enter the [new] value? 5

* Provide the 3º[Coordinate(z)].
(ª<ª) Enter the [new] value? 1

- The (Point P): P (-3.0, 7.0, 3.0)
- The (Point Q): Q (3.0, -2.0, 5.0)
- The (Point R): R (2.0, 5.0, 1.0)

[Answer]

==========
[EXIST THE TRIANGLE(PQR) WITH THE GIVEN POINTS: P, Q, AND R -- OK!]
==========

-- The [vectorA] = vectorQR [-1.0, 7.0, -4.0]
-- The [vectorB] = vectorRP [-5.0, 2.0, 2.0]
-- The [vectorC] = vectorPQ [6.0, -9.0, 2.0]

-- The [sideA] = ||vectorQR|| of the triangle(PQR) is: 8.12
-- The [sideB] = ||vectorRP|| of the triangle(PQR) is: 5.74
-- The [sideC] = ||vectorPQ|| of the triangle(PQR) is: 11.00

-- The [terms] of the [Scalar Product(QRºPQ)] is: [-6.0, -63.0, -8.0]
-- The [terms] of the [Scalar Product(QRºRP)] is: [5.0, 14.0, -8.0]
-- The [terms] of the [Scalar Product(RPºPQ)] is: [-30.0, -18.0, 4.0]

-- The [Scalar Product(QRºPQ)] is: -77.00
-- The [Scalar Product(QRºRP)] is: 11.00
-- The [Scalar Product(RPºPQ)] is: -44.00

-- The [vectorAxB]: vectorAxB [22.0, 22.0, 33.0]
-- The ||normVectorAxB|| is 45.35

-- The [Perimeter] of the [triangle(PQR)] is 24.87

-- The [Height(h1) relative as sideQR] is 5.58
-- The [Height(h2) relative as sideRP] is 7.90

-- The [Height(h3) relative as sidePQ] is 4.12
-- The [Area(A)] of the [triangle(PQR)] is 22.68

. . . Key [ENTER] to exit -- Ok! . . .

[6.] The [Inner angles: α, β, and γ].

Solution: Will solve the [previous item] using only the option[12]. Run the runVector3d.py program again and key in option[12] and provide the previous [coordinates]: xP = -3, yP = 7, zP = 3, xQ = 3, yQ = -2, zQ = 5, xR = 2, yR = 5, and zR = 1. of the finded [vertices]: P, Q, and R.

[WELCOME IN USING THE [RUNVECTOR3D.PY] PROGRAM]
[TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] IN THE [SPACE]]
--[Version: 2.0 -- Stable]--

[INSTRUCTIONS OF USE]

- To find the [value] of the [Dot Product] of [two vectors]: vectorA and vectorB using the [Definition]: a * b = a1*b1 + a2*b2 + a3*b3 key [1]
- To Determine the [value] of the [Dot Product] of [two vectors]: vectorA and vectorB using the [Theorem]: a * b = ||a||*||b||*cos(theta) key [2]
- To get the [Cross Product] with the given [Components] of [two vectors]: vectorA and vectorB or using the given [Coordinates] of the [points]: P, Q, and R key [3]
- To calculate the [value] of the [Theta Sine] between [two vectors]: vectorA and vectorB key [4]
- To find the [value] of the [Scalar Triple Product] of [three vectors]: vectorA, vectorB, and vectorC key [5]
- To determine the [value] of the [Theta angle in degrees] between the [two vectors]: vectorA and vectorB key [6]
- To get the [value] of the [Theta Cosine] between [two vectors]: vectorA and vectorB key [7]
- To find the [Vectors: vectorA, vectorB, vectorC, and vectorD] and [Modules] using the [Theorem] of the [Distance] between any [two points]: P and Q or P and R or Q and R or R and S key [8]
- To calculate the [Area(S)] of the [Triangle(PQR)] with the given [Coordinates] of the [points]: P, Q, and R or the given [Components] of [two vectors]: vectorA and vectorB key [9]
- To find the [height(h)] and [Area(P)] of the [Parallelogram(PQRS)] determined to [two adjacent vectors]: vectorA and vectorB or with given [Coordinates] of the [vertice points: P, Q, and R] key [10]
- To get the [Volume_V(P)], and [Height(h)] of a [Parallelepiped] and too the [Volume_V(T)] of a [Tetrahedron] with the given [Coordinates] of the [four points]: P, Q, R, and S or with the given [Components] of the [three vectors]: vector_A, vector_B, and vector_C key [11]
- To calculate the [three Inner Angles: Alpha, Beta, and Gama] of the [TrianglePQR] with the given [Coordinates] of the given [points]: P, Q, and R key [12]
- To Determine the following [Middle Points]: K(xK,yK,zK), L(xL,yL,zL), M(xM,yM,zM), and N(xN,yN,zN) between [points]: P(xP,yP,zP), Q(xQ,yQ,zQ), R(xR,yR,zR), and S(xS,yS,zS) or in [sides]: PQ, PR, and QR of a Triangle(PQR).key [13]
- To find the [Centroid: G(xG, yG, zG)] of the Triangle(PQR) key [14]
- To determine the [Medians: PM, QL, and RK] of a Triangle(PQR) key [15]
- To get the [Addition] and [Subraction] between [Two Vectors]: vectorA and vectorB key [16]
- Provide the given [Components] of a [vectorA] or find a [new vectorA] that represent a [oriented segmentPQ] with the given [Coordinates] of [two points]: P and Q and calculate the [Direction Cosines] and [Direction Angles] key [17]
- To find the [Addition] and [Subraction] between [two vectors]: vectorA and vectorB multiplyed by [two scalars]: [coeffic1 and coeffic2] key [18]
- To calculate the [dimensions]: [Perimeter(P)], [Heights(h1,h2,h3)], and [Area(A)] of a [TrianglePQR] with the given [Coordinates] of the [three points]: P, Q, and R key [19]
- To get the [dimensions]: [Perimeter(P)], [heights(h1,h2)], and [Area(S)] of a [Parallelogram(PQRS)] key [20]
- Given the [Coordinates] of the [Middle Points]: K(xK,yK,zK), L(xL,yL,zL), and M(xM,yM,zM) will calculate the [Coordinates] of the [vertice points]: P, Q, and R of a Triangle(PQR). key [21]

[§] Select an previous [option] that will used--Ok!

[º>º] Provide the [new] value? 12

[GIVEN THE COORDINATES OF THE POINTS P, Q AND R]
[FIND THE [INNER ANGLES] OF THE TRIANGLE(PQR)]

-- Enter the [coordinates]: (xP, yP, zP) of the (point P)?

* Introduce the 1º[Coordinate(x)].
(ª<ª) Enter the [new] value? -3

* Enter with the 2º[Coordinate(y)].
(ª<ª) Enter the [new] value? 7

* Provide the 3º[Coordinate(z)].
(ª<ª) Enter the [new] value? 3

-- Introduce the [coordinates]: (xQ, yQ, zQ) of the (point Q)?

* Introduce the 1º[Coordinate(x)].
(ª<ª) Enter the [new] value? 3

* Enter with the 2º[Coordinate(y)].
(ª<ª) Enter the [new] value? -2

* Provide the 3º[Coordinate(z)].
(ª<ª) Enter the [new] value? 5

-- Provide the [coordinates]: (xR, yR, zR) of the (point R)?

* Introduce the 1º[Coordinate(x)].
(ª<ª) Enter the [new] value? 2

* Enter with the 2º[Coordinate(y)].
(ª<ª) Enter the [new] value? 5

* Provide the 3º[Coordinate(z)].
(ª<ª) Enter the [new] value? 1

- The (Point P): P (-3.0, 7.0, 3.0)
- The (Point Q): Q (3.0, -2.0, 5.0)
- The (Point R): R (2.0, 5.0, 1.0)

[Answer]

- The [vectorB]=vectorPR [5.0, -2.0, -2.0]
- The [vectorC]=vectorPQ [6.0, -9.0, 2.0]

- The [vectorA]=vectorQR [-1.0, 7.0, -4.0]
- The [vectorC]=vectorQP [-6.0, 9.0, -2.0]

- The [vectorA]=vectorRQ [1.0, -7.0, 4.0]
- The [vectorB]=vectorRP [-5.0, 2.0, 2.0]

==========
[EXIST THE TRIANGLE(PQR) WITH THE GIVEN POINTS: P, Q, AND R -- OK!]
==========

-- The [sideA]=|vectorA| of the triangle(PQR)] is: 8.12

-- The [terms] of the [Scalar Profuct(ACºAB)] is the vector[ACºAB]: [30.0, 18.0, -4.0]
-- The [value] of the [Scalar Profuct(ACºAB)] is: 44.00
- The value of the [ALPHA ANGLE] was calculate is: 45.87

-- The [sideB]=|vectorB| of the triangle(PQR)] is: 5.74

-- The [terms] of the [Scalar Profuct(BCºBA)] is the vector[BCºBA]: [6.0, 63.0, 8.0]
-- The [value] of the [Scalar Profuct(BCºBA)] is: 77.00
- The value of the [BETA ANGLE] was calculate is: 30.50

-- The [sideC]=|vectorC| of the triangle(PQR)] is: 11.00

-- The [terms] of the [Scalar Profuct(CBºCA)] is the vector[CBºCA]: [-5.0, -14.0, 8.0]
-- The [value] of the [Scalar Profuct(CBºCA)] is: -11.00
- The value of the [GAMA ANGLE] was calculate is: 103.63

-- The triangle(PQR) is [Scalene]!

-- The [Add] of the [Inner Angles: ALPHA, BETA, GAMA] is 180.0

- THE [ADD] OF THE [INNER ANGLES] OF THE [TRIANGLE-PQR] is 180.00

--[END CALCULUS-OK!]--

. . . Key [ENTER] to exit -- Ok! . . .

[6.] The medians: PM, QL, and RK

Solution: Will solve the [previous item [6]] using the option[15] and after key in option[4]. Run the runVector3d.py program again and provide the previous given [coordinates]: xP = -3, yP = 7, zP = 3, xQ = 3, yQ = -2, zQ = 5, xR = 2, yR = 5, and zR = 1 of the finded [vertices]: P, Q, and R.

[WELCOME IN USING THE [RUNVECTOR3D.PY] PROGRAM]
[TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] IN THE [SPACE]]
--[Version: 2.0 -- Stable]--

[INSTRUCTIONS OF USE]

- To find the [value] of the [Dot Product] of [two vectors]: vectorA and vectorB using the [Definition]: a * b = a1*b1 + a2*b2 + a3*b3 key [1]
- To Determine the [value] of the [Dot Product] of [two vectors]: vectorA and vectorB using the [Theorem]: a * b = ||a||*||b||*cos(theta) key [2]
- To get the [Cross Product] with the given [Components] of [two vectors]: vectorA and vectorB or using the given [Coordinates] of the [points]: P, Q, and R key [3]
- To calculate the [value] of the [Theta Sine] between [two vectors]: vectorA and vectorB key [4]
- To find the [value] of the [Scalar Triple Product] of [three vectors]: vectorA, vectorB, and vectorC key [5]
- To determine the [value] of the [Theta angle in degrees] between the [two vectors]: vectorA and vectorB key [6]
- To get the [value] of the [Theta Cosine] between [two vectors]: vectorA and vectorB key [7]
- To find the [Vectors: vectorA, vectorB, vectorC, and vectorD] and [Modules] using the [Theorem] of the [Distance] between any [two points]: P and Q or P and R or Q and R or R and S key [8]
- To calculate the [Area(S)] of the [Triangle(PQR)] with the given [Coordinates] of the [points]: P, Q, and R or the given [Components] of [two vectors]: vectorA and vectorB key [9]
- To find the [height(h)] and [Area(P)] of the [Parallelogram(PQRS)] determined to [two adjacent vectors]: vectorA and vectorB or with given [Coordinates] of the [vertice points: P, Q, and R] key [10]
- To get the [Volume_V(P)], and [Height(h)] of a [Parallelepiped] and too the [Volume_V(T)] of a [Tetrahedron] with the given [Coordinates] of the [four points]: P, Q, R, and S or with the given [Components] of the [three vectors]: vector_A, vector_B, and vector_C key [11]
- To calculate the [three Inner Angles: Alpha, Beta, and Gama] of the [TrianglePQR] with the given [Coordinates] of the given [points]: P, Q, and R key [12]
- To Determine the following [Middle Points]: K(xK,yK,zK), L(xL,yL,zL), M(xM,yM,zM), and N(xN,yN,zN) between [points]: P(xP,yP,zP), Q(xQ,yQ,zQ), R(xR,yR,zR), and S(xS,yS,zS) or in [sides]: PQ, PR, and QR

of a Triangle(PQR).key [13]
- To find the [Centroid: G(xG, yG, zG)] of the Triangle(PQR) key [14]
- To determine the [Medians: PM, QL, and RK] of a Triangle(PQR) key [15]
- To get the [Addition] and [Subraction] between [Two Vectors]: vectorA and vectorB key [16]
- Provide the given [Components] of a [vectorA] or find a [new vectorA] that represent a [oriented segmentPQ] with the given [Coordinates] of [two points]: P and Q and calculate the [Direction Cosines] and [Direction Angles] key [17]
- To find the [Addition] and [Subraction] between [two vectors]: vectorA and vectorB multiplyed by [two scalars]: [coeffic1 and coeffic2] key [18]
- To calculate the [dimensions]: [Perimeter(P)], [Heights(h1,h2,h3)], and [Area(A)] of a [TrianglePQR] with the given [Coordinates] of the [three points]: P, Q, and R key [19]
- To get the [dimensions]: [Perimeter(P)], [heights(h1,h2)], and [Area(S)] of a [Parallelogram(PQRS)] key [20]
- Given the [Coordinates] of the [Middle Points]: K(xK,yK,zK), L(xL,yL,zL), and M(xM,yM,zM) will calculate the [Coordinates] of the [vertice points]: P, Q, and R of a Triangle(PQR). key [21]

[§] Select an previous [option] that will used--Ok!

[º>º] Provide the [new] value? 15

==========
[TO DETERMINE THE MEDIANS OF THE TRIANGLE(PQR)]
==========

- Key [1] to find the new medianPM or
- Key [2] to find the new medianQL or
- Key [3] to find the new medianRK or
- Key [4] to find all the [three medians: PM, QP, and RK] of a TrianglePQR.

[º>º] Provide the [new] value? 4

-- Introduce the [coordinates]: (xQ, yQ, zQ) of the (point Q)?

* Introduce the 1º[Coordinate(x)].
(ª<ª) Enter the [new] value? 3

* Enter with the 2º[Coordinate(y)].
(ª<ª) Enter the [new] value? -2

* Provide the 3º[Coordinate(z)].
(ª<ª) Enter the [new] value? 5

-- Provide the [coordinates]: (xR, yR, zR) of the (point R)?

* Introduce the 1º[Coordinate(x)].
(ª<ª) Enter the [new] value? 2

* Enter with the 2º[Coordinate(y)].
(ª<ª) Enter the [new] value? 5

* Provide the 3º[Coordinate(z)].
(ª<ª) Enter the [new] value? 1

- The (Point Q): Q (3.0, -2.0, 5.0)
- The (Point R): R (2.0, 5.0, 1.0)

[Answer]

-- The MidPoint_M(xM,yM,zM): (2.5, 1.5, 3.0)

-- Enter the [coordinates]: (xP, yP, zP) of the (point P)?

* Introduce the 1º[Coordinate(x)].
(ª<ª) Enter the [new] value? -3

* Enter with the 2º[Coordinate(y)].
(ª<ª) Enter the [new] value? 7

* Provide the 3º[Coordinate(z)].
(ª<ª) Enter the [new] value? 3

[Answer]

-- The terms of the [vectorPM]: [5.5, -5.5, 0.0]
-- The [median: PM] finded is 7.78

-- Enter the [coordinates]: (xP, yP, zP) of the (point P)?

* Introduce the 1º[Coordinate(x)].
(ª<ª) Enter the [new] value? -3

* Enter with the 2º[Coordinate(y)].
(ª<ª) Enter the [new] value? 7

* Provide the 3º[Coordinate(z)].
(ª<ª) Enter the [new] value? 3

-- Provide the [coordinates]: (xR, yR, zR) of the (point R)?

* Introduce the 1º[Coordinate(x)].
(ª<ª) Enter the [new] value? 2

* Enter with the 2º[Coordinate(y)].
(ª<ª) Enter the [new] value? 5

* Provide the 3º[Coordinate(z)].
(ª<ª) Enter the [new] value? 1

- The (Point P): P (-3.0, 7.0, 3.0)
- The (Point R): R (2.0, 5.0, 1.0)

[Answer]

-- The MidPoint_L(xL,yL,zL): (-0.5, 6.0, 2.0)

-- Introduce the [coordinates]: (xQ, yQ, zQ) of the (point Q)?

* Introduce the 1º[Coordinate(x)].
(ª<ª) Enter the [new] value? 3

* Enter with the 2º[Coordinate(y)].
(ª<ª) Enter the [new] value? -2

* Provide the 3º[Coordinate(z)].
(ª<ª) Enter the [new] value? 5

[Answer]

-- The terms of the [vectorQL]: [-3.5, 8.0, -3.0]
-- The [median: QL] finded is 9.23

-- Enter the [coordinates]: (xP, yP, zP) of the (point P)?

* Introduce the 1º[Coordinate(x)].
(ª<ª) Enter the [new] value? -3

* Enter with the 2º[Coordinate(y)].
(ª<ª) Enter the [new] value? 7

* Provide the 3º[Coordinate(z)].
(ª<ª) Enter the [new] value? 3

-- Introduce the [coordinates]: (xQ, yQ, zQ) of the (point Q)?

* Introduce the 1º[Coordinate(x)].
(ª<ª) Enter the [new] value? 3

* Enter with the 2º[Coordinate(y)].
(ª<ª) Enter the [new] value? -2

* Provide the 3º[Coordinate(z)].
(ª<ª) Enter the [new] value? 5

- The (Point P): P (-3.0, 7.0, 3.0)
- The (Point Q): Q (3.0, -2.0, 5.0)

[Answer]

-- The MidPoint_K(xK,yK,zK): (0.0, 2.5, 4.0)

-- Provide the [coordinates]: (xR, yR, zR) of the (point R)?

* Introduce the 1º[Coordinate(x)].
(ª<ª) Enter the [new] value? 2

* Enter with the 2º[Coordinate(y)].
(ª<ª) Enter the [new] value? 5

* Provide the 3º[Coordinate(z)].
(ª<ª) Enter the [new] value? 1

[Answer]

-- The terms of the [vectorRK]: [-2.0, -2.5, 3.0]
-- The [median: RK] finded is 4.39

. . . Key [ENTER] to exit -- Ok! . . .

[7.] The Centroid_G(xG, yG, zG)

Solution: Will solve the [previous item] using only the option[14]. Run the runVector3d.py program again and key in option[14] and provide the previous [coordinates]: xP = -3, yP = 7, zP = 3, xQ = 3, yQ = -2, zQ = 5, xR = 2, yR = 5, and zR = 1 of the [vertices]: P, Q, and R.

[WELCOME IN USING THE [RUNVECTOR3D.PY] PROGRAM]
[TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] IN THE [SPACE]]
--[Version: 2.0 -- Stable]--

[INSTRUCTIONS OF USE]

- To find the [value] of the [Dot Product] of [two vectors]: vectorA and vectorB using the [Definition]: a * b = a1*b1 + a2*b2 + a3*b3 key [1]
- To Determine the [value] of the [Dot Product] of [two vectors]: vectorA and vectorB using the [Theorem]: a * b = ||a||*||b||*cos(theta) key [2]
- To get the [Cross Product] with the given [Components] of [two vectors]: vectorA and vectorB or using the given [Coordinates] of the [points]: P, Q, and R key [3]
- To calculate the [value] of the [Theta Sine] between [two vectors]: vectorA and vectorB key [4]
- To find the [value] of the [Scalar Triple Product] of [three vectors]: vectorA, vectorB, and vectorC key [5]
- To determine the [value] of the [Theta angle in degrees] between the [two vectors]: vectorA and vectorB key [6]
- To get the [value] of the [Theta Cosine] between [two vectors]: vectorA and vectorB key [7]
- To find the [Vectors: vectorA, vectorB, vectorC, and vectorD] and [Modules] using the [Theorem] of the [Distance] between any [two points]: P and Q or P and R or Q and R or R and S key [8]
- To calculate the [Area(S)] of the [Triangle(PQR)] with the given [Coordinates] of the [points]: P, Q, and R or the given [Components] of [two vectors]: vectorA and vectorB key [9]
- To find the [height(h)] and [Area(P)] of the [Parallelogram(PQRS)] determined to [two adjacent vectors]: vectorA and vectorB or with given [Coordinates] of the [vertice points: P, Q, and R] key [10]
- To get the [Volume_V(P)], and [Height(h)] of a [Parallelepiped] and too the [Volume_V(T)] of a [Tetrahedron] with the given [Coordinates] of the [four points]: P, Q, R, and S or with the given [Components] of the [three vectors]: vector_A, vector_B, and vector_C key [11]
- To calculate the [three Inner Angles: Alpha, Beta, and Gama] of the [TrianglePQR] with the given [Coordinates] of the given [points]: P, Q, and R key [12]
- To Determine the following [Middle Points]: K(xK,yK,zK), L(xL,yL,zL), M(xM,yM,zM), and N(xN,yN,zN) between [points]: P(xP,yP,zP), Q(xQ,yQ,zQ), R(xR,yR,zR), and S(xS,yS,zS) or in [sides]: PQ, PR, and QR of a Triangle(PQR).key [13]
- To find the [Centroid: G(xG, yG, zG)] of the Triangle(PQR) key [14]
- To determine the [Medians: PM, QL, and RK] of a Triangle(PQR) key [15]
- To get the [Addition] and [Subraction] between [Two Vectors]: vectorA and vectorB key [16]
- Provide the given [Components] of a [vectorA] or find a [new vectorA] that represent a [oriented segmentPQ] with the given [Coordinates] of [two points]: P and Q and calculate the [Direction Cosines] and [Direction Angles] key [17]
- To find the [Addition] and [Subraction] between [two vectors]: vectorA and vectorB multiplyed by [two scalars]: [coeffic1 and coeffic2] key [18]
- To calculate the [dimensions]: [Perimeter(P)], [Heights(h1,h2,h3)], and [Area(A)] of a [TrianglePQR] with the given [Coordinates] of the [three points]: P, Q, and R key [19]
- To get the [dimensions]: [Perimeter(P)], [heights(h1,h2)], and [Area(S)] of a [Parallelogram(PQRS)] key [20]
- Given the [Coordinates] of the [Middle Points]: K(xK,yK,zK), L(xL,yL,zL), and M(xM,yM,zM) will calculate the [Coordinates] of the [vertice points]: P, Q, and R of a Triangle(PQR). key [21]

[§] Select an previous [option] that will used--Ok!

[º>º] Provide the [new] value? 14

[TO DETERMINE THE [CENTROID: G(xG,yG,zG)] OF A TRIANGLE(PQR) WITH THE]
[GIVEN [COORDINATES] OF THE [POINTS]: P(xP,yP,zP), Q(xQ,yQ,zQ), AND R(xR,yR,zR)]

-- Enter the [coordinates]: (xP, yP, zP) of the (point P)?

* Introduce the 1º[Coordinate(x)].
(ª<ª) Enter the [new] value? -3

* Enter with the 2º[Coordinate(y)].
(ª<ª) Enter the [new] value? 7

* Provide the 3º[Coordinate(z)].
(ª<ª) Enter the [new] value? 3

-- Introduce the [coordinates]: (xQ, yQ, zQ) of the (point Q)?

* Introduce the 1º[Coordinate(x)].

(ª<ª) Enter the [new] value? 3

* Enter with the 2º[Coordinate(y)].
(ª<ª) Enter the [new] value? -2

* Provide the 3º[Coordinate(z)].
(ª<ª) Enter the [new] value? 5

-- Provide the [coordinates]: (xR, yR, zR) of the (point R)?

* Introduce the 1º[Coordinate(x)].
(ª<ª) Enter the [new] value? 2

* Enter with the 2º[Coordinate(y)].
(ª<ª) Enter the [new] value? 5

* Provide the 3º[Coordinate(z)].
(ª<ª) Enter the [new] value? 1

- The (Point P): P (-3.0, 7.0, 3.0)
- The (Point Q): Q (3.0, -2.0, 5.0)
- The (Point R): R (2.0, 5.0, 1.0)

[Answer]

-- The [Coordenates] of the [CentroidG_3d(xG,yG,zG)] in the Triangle(PQR):

-- The [Coordinate]: xG is 0.67
-- The [Coordinate]: yG is 3.33
-- The [Coordinate]: zG is 3.00

. . . Key [ENTER] to exit -- Ok! . . .

(New) Example 14: Given the [vector modules]: |a| = 85, |b| = 67, and too the [theta: Θ angle = 3π/4 = 135º degree]. Get the [dot product: a * b] using the Theorem.

Solution: Run the runVector3d.py program again and key only in option[2] and [enter] the previous problem data.

[WELCOME IN USING THE [RUNVECTOR3D.PY] PROGRAM]
[TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] IN THE [SPACE]]
--[Version: 2.0 -- Stable]--

[INSTRUCTIONS OF USE]

- To find the [value] of the [Dot Product] of [two vectors]: vectorA and vectorB using the [Definition]: a * b = a1*b1 + a2*b2 + a3*b3 key [1]
- To Determine the [value] of the [Dot Product] of [two vectors]: vectorA and vectorB using the [Theorem]: a * b = ||a||*||b||*cos(theta) key [2]
- To get the [Cross Product] with the given [Components] of [two vectors]: vectorA and vectorB or using the given [Coordinates] of the [points]: P, Q, and R key [3]
- To calculate the [value] of the [Theta Sine] between [two vectors]: vectorA and vectorB key [4]
- To find the [value] of the [Scalar Triple Product] of [three vectors]: vectorA, vectorB, and vectorC key [5]
- To determine the [value] of the [Theta angle in degrees] between the [two vectors]: vectorA and vectorB key [6]
- To get the [value] of the [Theta Cosine] between [two vectors]: vectorA and vectorB key [7]
- To find the [Vectors: vectorA, vectorB, vectorC, and vectorD] and [Modules] using the [Theorem] of the [Distance] between any [two points]: P and Q or P and R or Q and R or R and S key [8]
- To calculate the [Area(S)] of the [Triangle(PQR)] with the given [Coordinates] of the [points]: P, Q, and R or the given [Components] of [two vectors]: vectorA and vectorB key [9]

- To find the [height(h)] and [Area(P)] of the [Parallelogram(PQRS)] determined to [two adjacent vectors]: vectorA and vectorB or with given [Coordinates] of the [vertice points: P, Q, and R] key [10]
- To get the [Volume_V(P)], and [Height(h)] of a [Parallelepiped] and too the [Volume_V(T)] of a [Tetrahedron] with the given [Coordinates] of the [four points]: P, Q, R, and S or with the given [Components] of the [three vectors]: vector_A, vector_B, and vector_C key [11]
- To calculate the [three Inner Angles: Alpha, Beta, and Gama] of the [TrianglePQR] with the given [Coordinates] of the given [points]: P, Q, and R key [12]
- To Determine the following [Middle Points]: K(xK,yK,zK), L(xL,yL,zL), M(xM,yM,zM), and N(xN,yN,zN) between [points]: P(xP,yP,zP), Q(xQ,yQ,zQ), R(xR,yR,zR), and S(xS,yS,zS) or in [sides]: PQ, PR, and QR of a Triangle(PQR).key [13]
- To find the [Centroid: G(xG, yG, zG)] of the Triangle(PQR) key [14]
- To determine the [Medians: PM, QL, and RK] of a Triangle(PQR) key [15]
- To get the [Addition] and [Subraction] between [Two Vectors]: vectorA and vectorB key [16]
- Provide the given [Components] of a [vectorA] or find a [new vectorA] that represent a [oriented segmentPQ] with the given [Coordinates] of [two points]: P and Q and calculate the [Direction Cosines] and [Direction Angles] key [17]
- To find the [Addition] and [Subraction] between [two vectors]: vectorA and vectorB multiplyed by [two scalars]: [coeffic1 and coeffic2] key [18]
- To calculate the [dimensions]: [Perimeter(P)], [Heights(h1,h2,h3)], and [Area(A)] of a [TrianglePQR] with the given [Coordinates] of the [three points]: P, Q, and R key [19]
- To get the [dimensions]: [Perimeter(P)], [heights(h1,h2)], and [Area(S)] of a [Parallelogram(PQRS)] key [20]
- Given the [Coordinates] of the [Middle Points]: K(xK,yK,zK), L(xL,yL,zL), and M(xM,yM,zM) will calculate the [Coordinates] of the [vertice points]: P, Q, and R of a Triangle(PQR). key [21]

[§] Select an previous [option] that will used--Ok!

[º>º] Provide the [new] value? 2

[FIND THE [DOT PRODUCT] OF [TWO VECTORS: A AND B USING THE [THEOREM]:]
[A * B = ||A||*||B||*COS(THETA) IN |R³]

* Enter with the [new value] of the [vectorA] module?
(ª<ª) Enter the [new] value? 85
* Provide the [new value] of the [vectorB] module?
(ª<ª) Enter the [new] value? 67

-- The |vectorA|: 85.0
-- The |vectorB|: 67.0

[NEW INSTRUCTION]

- The [theta angle in degree] between [vectors]: [vectorA] and [vectorB]
- [Type a only integer or real number] without the [Character: º(degree)].
- The [conversion] of [degree] to [radian] will be done automatically by Method.
(ª<ª) Enter the [new] value? 135

[Answer]

-- The [A*B_Scalar Product] is -4026.97

. . . Key [ENTER] to exit -- Ok! . . .

(New) Example 15: Determine the [dot product: A * B] by definiton using the given [Components] of two [Vectors]: vectorA [3, 7, -1], and vectorB [11, -5, -8].

Solution: Run the runVector3d.py program again and key only in option[1] and [enter] the previous problem data.

[WELCOME IN USING THE [RUNVECTOR3D.PY] PROGRAM]
[TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] IN THE [SPACE]]
--[Version: 2.0 -- Stable]--

[INSTRUCTIONS OF USE]

- To find the [value] of the [Dot Product] of [two vectors]: vectorA and vectorB using the [Definition]: a * b = a1*b1 + a2*b2 + a3*b3 key [1]
- To Determine the [value] of the [Dot Product] of [two vectors]: vectorA and vectorB using the [Theorem]: a * b = ||a||*||b||*cos(theta) key [2]
- To get the [Cross Product] with the given [Components] of [two vectors]: vectorA and vectorB or using the given [Coordinates] of the [points]: P, Q, and R key [3]
- To calculate the [value] of the [Theta Sine] between [two vectors]: vectorA and vectorB key [4]
- To find the [value] of the [Scalar Triple Product] of [three vectors]: vectorA, vectorB, and vectorC key [5]
- To determine the [value] of the [Theta angle in degrees] between the [two vectors]: vectorA and vectorB key [6]
- To get the [value] of the [Theta Cosine] between [two vectors]: vectorA and vectorB key [7]
- To find the [Vectors: vectorA, vectorB, vectorC, and vectorD] and [Modules] using the [Theorem] of the [Distance] between any [two points]: P and Q or P and R or Q and R or R and S key [8]
- To calculate the [Area(S)] of the [Triangle(PQR)] with the given [Coordinates] of the [points]: P, Q, and R or the given [Components] of [two vectors]: vectorA and vectorB key [9]
- To find the [height(h)] and [Area(P)] of the [Parallelogram(PQRS)] determined to [two adjacent vectors]: vectorA and vectorB or with given [Coordinates] of the [vertice points: P, Q, and R] key [10]
- To get the [Volume_V(P)], and [Height(h)] of a [Parallelepiped] and too the [Volume_V(T)] of a [Tetrahedron] with the given [Coordinates] of the [four points]: P, Q, R, and S or with the given [Components] of the [three vectors]: vector_A, vector_B, and vector_C key [11]
- To calculate the [three Inner Angles: Alpha, Beta, and Gama] of the [TrianglePQR] with the given [Coordinates] of the given [points]: P, Q, and R key [12]
- To Determine the following [Middle Points]: K(xK,yK,zK), L(xL,yL,zL), M(xM,yM,zM), and N(xN,yN,zN) between [points]: P(xP,yP,zP), Q(xQ,yQ,zQ), R(xR,yR,zR), and S(xS,yS,zS) or in [sides]: PQ, PR, and QR of a Triangle(PQR).key [13]
- To find the [Centroid: G(xG, yG, zG)] of the Triangle(PQR) key [14]
- To determine the [Medians: PM, QL, and RK] of a Triangle(PQR) key [15]
- To get the [Addition] and [Subraction] between [Two Vectors]: vectorA and vectorB key [16]
- Provide the given [Components] of a [vectorA] or find a [new vectorA] that represent a [oriented segmentPQ] with the given [Coordinates] of [two points]: P and Q and calculate the [Direction Cosines] and [Direction Angles] key [17]
- To find the [Addition] and [Subraction] between [two vectors]: vectorA and vectorB multiplyed by [two scalars]: [coeffic1 and coeffic2] key [18]
- To calculate the [dimensions]: [Perimeter(P)], [Heights(h1,h2,h3)], and [Area(A)] of a [TrianglePQR] with the given [Coordinates] of the [three points]: P, Q, and R key [19]
- To get the [dimensions]: [Perimeter(P)], [heights(h1,h2)], and [Area(S)] of a [Parallelogram(PQRS)] key [20]
- Given the [Coordinates] of the [Middle Points]: K(xK,yK,zK), L(xL,yL,zL), and M(xM,yM,zM) will calculate the [Coordinates] of the [vertice points]: P, Q, and R of a Triangle(PQR). key [21]

[§] Select an previous [option] that will used--Ok!

[º>º] Provide the [new] value? 1

[FIND THE [DOT PRODUCT] OF [TWO VECTORS: A AND B USING THE [DEFINITION]:]
[A * B = A1*B1 + A2*B2 + A3*B3 IN THE TRI-DIMENSIONAL(XYZ) SPACE]

- Attribute the [Components] of the [1º vectorA].

- Enter the [coefficient] of the [Component: (i) or (a1)]?
(ª<ª) Enter the [new] value? 3

- Introduce the [coefficient] of the [Component: (j) or (a2)]?
(ª<ª) Enter the [new] value? 7

- Give the [coefficient] of the [Component: (k) or (a3)]?
(ª<ª) Enter the [new] value? -1

- Provide the [Components] of the [2º vectorB].

- Enter the [coefficient] of the [Component: (i) or (b1)]?
(ª<ª) Enter the [new] value? 11

- Introduce the [coefficient] of the [Component: (j) or (b2)]?
(ª<ª) Enter the [new] value? -5

- Give the [coefficient] of the [Component: (k) or (b3)]?
(ª<ª) Enter the [new] value? -8

[Answer]

-- The [vectorA]: vectorA [3.0, 7.0, -1.0]
-- The [vectorB]: vectorB [11.0, -5.0, -8.0]

-- The [Vector] of the [terms of the Scalar Product]: vectorA*B [33.0, -35.0, 8.0]
-- The [Scalar Product(vectorA*B)] of the vectors is: 6.00

. . . Key [ENTER] to exit -- Ok! . . .

(New) Example 16 – Type the given [Components] of the [Vectors]: a = <3, -5, 4>, b = <-1, -2, 2>, and c = <2, -3, 7> and calculate the [Scalar Triple Product] = a * (b xc). Begin the runVector3d.py program again and follow key in option[5] and after key in option[2].

[WELCOME IN USING THE [RUNVECTOR3D.PY] PROGRAM]
[TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] IN THE [SPACE]]
--[Version: 2.0 -- Stable]--

[INSTRUCTIONS OF USE]

- To find the [value] of the [Dot Product] of [two vectors]: vectorA and vectorB using the [Definition]: a * b = a1*b1 + a2*b2 + a3*b3 key [1]
- To Determine the [value] of the [Dot Product] of [two vectors]: vectorA and vectorB using the [Theorem]: a * b = ||a||*||b||*cos(theta) key [2]
- To get the [Cross Product] with the given [Components] of [two vectors]: vectorA and vectorB or using the given [Coordinates] of the [points]: P, Q, and R key [3]
- To calculate the [value] of the [Theta Sine] between [two vectors]: vectorA and vectorB key [4]
- To find the [value] of the [Scalar Triple Product] of [three vectors]: vectorA, vectorB, and vectorC key [5]
- To determine the [value] of the [Theta angle in degrees] between the [two vectors]: vectorA and vectorB key [6]
- To get the [value] of the [Theta Cosine] between [two vectors]: vectorA and vectorB key [7]
- To find the [Vectors: vectorA, vectorB, vectorC, and vectorD] and [Modules] using the [Theorem] of the [Distance] between any [two points]: P and Q or P and R or Q and R or R and S key [8]
- To calculate the [Area(S)] of the [Triangle(PQR)] with the given [Coordinates] of the [points]: P, Q, and R or the given [Components] of [two vectors]: vectorA and vectorB key [9]
- To find the [height(h)] and [Area(P)] of the [Parallelogram(PQRS)] determined to [two adjacent vectors]: vectorA and vectorB or with given [Coordinates] of the [vertice points: P, Q, and R] key [10]
- To get the [Volume_V(P)], and [Height(h)] of a [Parallelepiped] and too the [Volume_V(T)] of a [Tetrahedron] with the given [Coordinates] of the [four points]: P, Q, R, and S or with the given [Components] of the [three vectors]: vector_A, vector_B, and vector_C key [11]
- To calculate the [three Inner Angles: Alpha, Beta, and Gama] of the [TrianglePQR] with the given [Coordinates] of the given [points]: P, Q, and R key [12]
- To Determine the following [Middle Points]: K(xK,yK,zK), L(xL,yL,zL), M(xM,yM,zM), and N(xN,yN,zN) between [points]: P(xP,yP,zP), Q(xQ,yQ,zQ), R(xR,yR,zR), and S(xS,yS,zS) or in [sides]: PQ, PR, and QR of a Triangle(PQR).key [13]
- To find the [Centroid: G(xG, yG, zG)] of the Triangle(PQR) key [14]
- To determine the [Medians: PM, QL, and RK] of a Triangle(PQR) key [15]
- To get the [Addition] and [Subraction] between [Two Vectors]: vectorA and vectorB key [16]

- Provide the given [Components] of a [vectorA] or find a [new vectorA] that represent a [oriented segmentPQ] with the given [Coordinates] of [two points]: P and Q and calculate the [Direction Cosines] and [Direction Angles] key [17]
- To find the [Addition] and [Subraction] between [two vectors]: vectorA and vectorB multiplyed by [two scalars]: [coeffic1 and coeffic2] key [18]
- To calculate the [dimensions]: [Perimeter(P)], [Heights(h1,h2,h3)], and [Area(A)] of a [TrianglePQR] with the given [Coordinates] of the [three points]: P, Q, and R key [19]
- To get the [dimensions]: [Perimeter(P)], [heights(h1,h2)], and [Area(S)] of a [Parallelogram(PQRS)] key [20]
- Given the [Coordinates] of the [Middle Points]: K(xK,yK,zK), L(xL,yL,zL), and M(xM,yM,zM) will calculate the [Coordinates] of the [vertice points]: P, Q, and R of a Triangle(PQR). key [21]

[§] Select an previous [option] that will used--Ok!

[º>º] Provide the [new] value? 5

**[WILL CALCULATE THE [SCALAR TRIPLE PRODUCT] BETWEEN THE THREE
[VECTORS: A, B, AND C] IN TRI-DIMENSIONAL(XYZ) SPACE]

[NEW INSTRUCTIONS]

* Type [1] to enter all the [Coordinate] points: P, Q, R and S or
* Type [2] and provide all the [Component] vectors: vectorA, vectorB and vectorC.

(º_º) Give the [new] value? 2

- Attribute the [Components] of the [1º vectorA].

- Enter the [coefficient] of the [Component: (i) or (a1)]?
(ª<ª) Enter the [new] value? 3

- Introduce the [coefficient] of the [Component: (j) or (a2)]?
(ª<ª) Enter the [new] value? -5

- Give the [coefficient] of the [Component: (k) or (a3)]?
(ª<ª) Enter the [new] value? 4

- Provide the [Components] of the [2º vectorB].

- Enter the [coefficient] of the [Component: (i) or (b1)]?
(ª<ª) Enter the [new] value? -1

- Introduce the [coefficient] of the [Component: (j) or (b2)]?
(ª<ª) Enter the [new] value? -2

- Give the [coefficient] of the [Component: (k) or (b3)]?
(ª<ª) Enter the [new] value? 2

- Give the [Components] of the [3º vectorC].

- Enter the [coefficient] of the [Component: (i) or (c1)]?
(ª<ª) Enter the [new] value? 2

- Introduce the [coefficient] of the [Component: (j) or (c2)]?
(ª<ª) Enter the [new] value? -3

- Give the [coefficient] of the [Component: (k) or (c3)]?
(ª<ª) Enter the [new] value? 7

[Answer]

-- The [vectorA]: vectorA [3.0, -5.0, 4.0]
-- The [vectorB]: vectorB [-1.0, -2.0, 2.0]
-- The [vectorC]: vectorC [2.0, -3.0, 7.0]

-- The value of the [Mixed Product: a * (b x c)] finded: -51.0

. . . Key [ENTER] to exit -- Ok! . . .

[Warning]: All developers, users, and students that access this repository **will duty** follow all the [instructions] and **[Examples]** to the correct uso of the runVector3d.py program.

Will show below **the incorrect use** of the runVector3d.py program using the same **(new) Example6.1**. .

(new) Example6.1 – Given the [Coordinates] of the [points]: P(1, -2, -2), Q(2, 1, 5), and R(3, -1, 2). Find the [height(h)], and [area(P)] of a parellelogramPQRS.

Solution – Begin the runVector3d.py program and key the option[10] and follow the instructions in to display. After key in option[1] and enter with the given [Coordinates] of the [previous points] an key: [ENTER].

[WELCOME IN USING THE [RUNVECTOR3D.PY] PROGRAM]
[TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] IN THE [SPACE]]
--[Version: 2.0 -- Stable]--

[INSTRUCTIONS OF USE]

- To find the [value] of the [Dot Product] of [two vectors]: vectorA and vectorB using the [Definition]: a * b = a1*b1 + a2*b2 + a3*b3 key [1]
- To Determine the [value] of the [Dot Product] of [two vectors]: vectorA and vectorB using the [Theorem]: a * b = ||a||*||b||*cos(theta) key [2]
- To get the [Cross Product] with the given [Components] of [two vectors]: vectorA and vectorB or using the given [Coordinates] of the [points]: P, Q, and R key [3]
- To calculate the [value] of the [Theta Sine] between [two vectors]: vectorA and vectorB key [4]
- To find the [value] of the [Scalar Triple Product] of [three vectors]: vectorA, vectorB, and vectorC key [5]
- To determine the [value] of the [Theta angle in degrees] between the [two vectors]: vectorA and vectorB key [6]
- To get the [value] of the [Theta Cosine] between [two vectors]: vectorA and vectorB key [7]
- To find the [Vectors: vectorA, vectorB, vectorC, and vectorD] and [Modules] using the [Theorem] of the [Distance] between any [two points]: P and Q or P and R or Q and R or R and S key [8]
- To calculate the [Area(S)] of the [Triangle(PQR)] with the given [Coordinates] of the [points]: P, Q, and R or the given [Components] of [two vectors]: vectorA and vectorB key [9]
- To find the [height(h)] and [Area(P)] of the [Parallelogram(PQRS)] determined to [two adjacent vectors]: vectorA and vectorB or with given [Coordinates] of the [vertice points: P, Q, and R] key [10]
- To get the [Volume_V(P)], and [Height(h)] of a [Parallelepiped] and too the [Volume_V(T)] of a [Tetrahedron] with the given [Coordinates] of the [four points]: P, Q, R, and S or with the given [Components] of the [three vectors]: vector_A, vector_B, and vector_C key [11]
- To calculate the [three Inner Angles: Alpha, Beta, and Gama] of the [TrianglePQR] with the given [Coordinates] of the given [points]: P, Q, and R key [12]
- To Determine the following [Middle Points]: K(xK,yK,zK), L(xL,yL,zL), M(xM,yM,zM), and N(xN,yN,zN) between [points]: P(xP,yP,zP), Q(xQ,yQ,zQ), R(xR,yR,zR), and S(xS,yS,zS) or in [sides]: PQ, PR, and QR of a Triangle(PQR).key [13]
- To find the [Centroid: G(xG, yG, zG)] of the Triangle(PQR) key [14]
- To determine the [Medians: PM, QL, and RK] of a Triangle(PQR) key [15]
- To get the [Addition] and [Subraction] between [Two Vectors]: vectorA and vectorB key [16]
- Provide the given [Components] of a [vectorA] or find a [new vectorA] that represent a [oriented segmentPQ] with the given [Coordinates] of [two points]: P and Q and calculate the [Direction Cosines] and [Direction Angles] key [17]
- To find the [Addition] and [Subraction] between [two vectors]: vectorA and vectorB multiplyed by [two scalars]: [coeffic1 and coeffic2] key [18]
- To calculate the [dimensions]: [Perimeter(P)], [Heights(h1,h2,h3)], and [Area(A)] of a [TrianglePQR] with the given [Coordinates] of the [three points]: P, Q, and R key [19]
- To get the [dimensions]: [Perimeter(P)], [heights(h1,h2)], and [Area(S)] of a [Parallelogram(PQRS)] key [20]
- Given the [Coordinates] of the [Middle Points]: K(xK,yK,zK), L(xL,yL,zL), and M(xM,yM,zM) will calculate the [Coordinates] of the [vertice points]: P, Q, and R of a Triangle(PQR). key [21]

[§] Select an previous [option] that will used--Ok!

[Warning]: the [incorrect use: option] that any user never will not duty type:

[º>º] Provide the [new] value? ENTER

_=§=_
º<º [Warning!]: invalid literal for int() with base 10: 'ENTER'
[~] [TYPE AN [NEW POSITIVE INTEGER NUMBER]
[IN NEXT INSTRUCTION -- OK!]

[º>º] Provide the [new] value? -2

[NO TYPE AN [NEGATIVE INTEGER NUMBER] OR EQUAL [ZERO]--Ok!]

[º>º] Provide the [new] value? p

_=§=_
º<º [Warning!]: invalid literal for int() with base 10: 'p'
[~] [TYPE AN [NEW POSITIVE INTEGER NUMBER]
[IN NEXT INSTRUCTION -- OK!]

[º>º] Provide the [new] value? @

_=§=_
º<º [Warning!]: invalid literal for int() with base 10: '@'
[~] [TYPE AN [NEW POSITIVE INTEGER NUMBER]
[IN NEXT INSTRUCTION -- OK!]

[º>º] Provide the [new] value? J

_=§=_
º<º [Warning!]: invalid literal for int() with base 10: 'p'
[~] [TYPE AN [NEW POSITIVE INTEGER NUMBER]
[IN NEXT INSTRUCTION -- OK!]

[º>º] Provide the [new] value? 0

[NO TYPE AN [NEGATIVE INTEGER NUMBER] OR EQUAL [ZERO]--Ok!]

Follow type the correct [option10] below – OK!

[º>º] Provide the [new] value? 10

[FIND THE [HEIGHT(H), AND AREA(P) OF THE PARALLELOGRAM(PQRS) DETERMINED BY]
[TWO ADJACENT VECTORS]: VECTOR_A AND VECTOR_B OR WITH THE GIVEN [COORDINATES]]
[OR WITH THE GIVEN [COORDINATES] OF THE [VERTICES]: P, Q, AND R]

[NEW INSTRUCTIONS]

* Type [1] to enter new given [Coordinate] points: P, Q, and R or
* Type [2] and provide the given [Components] of [two vectors]: vectorA and vectorB.

[Warning]: the [incorrect option] that any user never will not duty type:

(º_º) Give the [new] value? ENTER

_===_
º>º [Warning!]: invalid literal for int() with base 10: 'ENTER'
[~] [TYPE AN [NEW POSITIVE INTEGER NUMBER]

```
          [ IN NEXT INSTRUCTION -- OK! ]


(º_º) Give the [new] value? -3

  *[ NO TYPE: ]*
 **[ ANY [NEGATIVE INTEGER NUMBER] OR EQUAL [ZERO] OR ]**
***[ ANY [POSITIVE INTEGER NUMBER] BIGGER THAN OR EQUAL [THREE]--Ok! ]***

(º_º) Give the [new] value? 0

  *[ NO TYPE: ]*
 **[ ANY [NEGATIVE INTEGER NUMBER] OR EQUAL [ZERO] OR ]**
***[ ANY [POSITIVE INTEGER NUMBER] BIGGER THAN OR EQUAL [THREE]--Ok! ]***

(º_º) Give the [new] value? h

 _===_
  º>º   [Warning!]: invalid literal for int() with base 10: 'h'
  [~]   [ TYPE AN [NEW POSITIVE INTEGER NUMBER ]
        [ IN NEXT INSTRUCTION -- OK! ]

(º_º) Give the [new] value? 3

  *[ NO TYPE: ]*
 **[ ANY [NEGATIVE INTEGER NUMBER] OR EQUAL [ZERO] OR ]**
***[ ANY [POSITIVE INTEGER NUMBER] BIGGER THAN OR EQUAL [THREE]--Ok! ]***

(º_º) Give the [new] value? 5

  *[ NO TYPE: ]*
 **[ ANY [NEGATIVE INTEGER NUMBER] OR EQUAL [ZERO] OR ]**
***[ ANY [POSITIVE INTEGER NUMBER] BIGGER THAN OR EQUAL [THREE]--Ok! ]***
```

[Warning]: When using the runVector3d.py program **and after *[new instruction]* request other two [options] to any user type follow key only in** [option 1] or [option 2]. If run **the** runVector3d.py program **again and after the **[new instruction]** request other three [options] to any user type follow key only in** [option 1] or [option 2] or [option 3].

Here follow type the correct [option1] below – OK!

```
(º_º) Give the [new] value? 1

-- Enter the [coordinates]: (xP, yP, zP) of the (point P)?

* Introduce the 1º[Coordinate(x)].
(ª<ª) Enter the [new] value? 1

* Enter with the 2º[Coordinate(y)].
(ª<ª) Enter the [new] value? -2

* Provide the 3º[Coordinate(z)].
(ª<ª) Enter the [new] value? -2

-- Introduce the [coordinates]: (xQ, yQ, zQ) of the (point Q)?

* Introduce the 1º[Coordinate(x)].
(ª<ª) Enter the [new] value? 2

* Enter with the 2º[Coordinate(y)].
(ª<ª) Enter the [new] value? 1
```

* Provide the 3º[Coordinate(z)].
(ª<ª) Enter the [new] value? 5

-- Provide the [coordinates]: (xR, yR, zR) of the (point R)?

* Introduce the 1º[Coordinate(x)].
(ª<ª) Enter the [new] value? 3

* Enter with the 2º[Coordinate(y)].
(ª<ª) Enter the [new] value? -1

* Provide the 3º[Coordinate(z)].
(ª<ª) Enter the [new] value? 2

- The (Point P): P (1.0, -2.0, -2.0)
- The (Point Q): Q (2.0, 1.0, 5.0)
- The (Point R): R (3.0, -1.0, 2.0)

[Answer]

-- The [vectorA]: vectorA [1.0, -2.0, -3.0]
-- The [vectorB]: vectorB [-1.0, -3.0, -7.0]
-- The [Cross Product]: vectorAxB [5.0, 10.0, -5.0]
-- The ||normVectorAxB|| is 12.25

-- The [height(h)] of the [Parallelogram(PQRS)] is 3.27
-- The [Area(P)] of a [Parallelogram(PQRS)] is 12.25

. . . Key [ENTER] to exit -- Ok! . . .

Any user that try solve all the Examples of the instructions2-v2.0_User.pdf without use the runVector3d.py program and Vector3dClassModule.py module files and use pencil and paper will duty use a Scientific Calculator as help to determine the values: roots of the Vectors: |A|, |B|, |C| and |D| modulus and any others functions: sin, cos, tan.

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