Instructions of as use the runtoolsvectors.py program.

In the Windows operating system:

After the download the **repositorio** access the runtoolsvectors.py program given two clicks and follow the news instructions in display.

In the Linux operating system:

After the download the **repositorio** access the runtoolsvectors.py program. Exist two options to run the runtoolsvectors.py program.

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

python3 runtoolsvectors.py after key ENTER

2.) Open the runtoolsvectors.py file using the IDLE3 and use the Run ==> Run Module options. After follow the news instructions.

[Warning]: When the **runtoolsvectors.py program** request type the [components] or [coordinates], always key ENTER after to continue, Ok!

Now will use of the runtoolsvectors.py program in the 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 runtoolsvectors.py program and select the option[13]. After follow the instructions requested in accordance with showed in the display.

```
        **[ WELCOME IN USING THE [RUNTOOLSVECTORS.PY] PROGRAM ]**
        **[ TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] in the [SPACE] ]**
                                --[Version: 1.2 -- Stable]--


      **[INSTRUCTIONS OF USE]**

- To find the [value] of the [Dot Product] of two vectors key [1]
- To get the [Cross Product] of two [vectors: A and B] and the [Area(A)] of the
  Triangle(PQR) key [2]

- To calculate the [value] of the [SineTheta] between [two vectors] A and B
  key [3]

- To find the [value] of the [Scalar Triple Product] of three  vectors A, B,
  and C key [4]

- To calculate the [angle] between [two vectors] in space key[5]
- To get the [value] of the [CossineTheta] between two vectors A and B key [6]
- To find the [Distance] between two points P and Q key [7]
- To calculate the [Dimensions] of the [Triangle(PQR)] givens the points: P, Q,
  and R key [8]

- To find the [Area] and [Height] of the [Parallelogram] givens [two vectors]:
  A and B key [9]

- To get the [Volume(V)],[Height(h)] of the [Parallelepiped and Tetrahedron]
  given four points: P, Q, R, S key [10]

- To calculate the three [Inner Angles] of the [Triangle] given three points:
  P,Q,and R key [11]

- To find the [MID-POINT M] OF THE LINE SEGMENT BETWEEN [THE POINTS: P AND Q]
```

key [12]

- To get the [Addition] and [Subraction] between [Two Vectors] A and B key [13]
- To calculate the[VectorA] and [lenght] of givens Points: P, AND Q key [14]
- To determine the [Direction Cosines] and [Direction Angles] givens an Vector A or [two points]: P and Q key [15]

- To find the [Addition] and [Subraction] between [Two Vectors]: A and B multiplyed by scalars: [coeffic1 and coeffic2] key [16]

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

(º>º) Provide the [new] value? 13
[The typed number]: 13 is a [valid integer number!]]

[CALCULATE THE [ADDITION] AND [SUBTRACTION] OF THE [VECTORS]: A AND B]

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

- Enter the 1º [Component(x)]!
(ª<ª) Enter the [new] value? 7
[[The typed number]: 7.0 is a [valid integer or float number!]]

- Introduce the 2º [Component(y)]!
(ª<ª) Enter the [new] value? -2
[[The typed number]: -2.0 is a [valid integer or float number!]]

- Give the 3º [Component(z)]!
(ª<ª) Enter the [new] value? -11
[[The typed number]: -11.0 is a [valid integer or float number!]]

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

- Enter the 1º [Component(x)]!
(ª<ª) Enter the [new] value? -18
[[The typed number]: -18.0 is a [valid integer or float number!]]

- Introduce the 2º [Component(y)]!
(ª<ª) Enter the [new] value? 3
[[The typed number]: 3.0 is a [valid integer or float number!]]

- Give the 3º [Component(z)]!
(ª<ª) Enter the [new] value? 17
[[The typed number]: 17.0 is a [valid integer or float number!]]

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

[ANSWER]

-- The [Addition]: vectorA+B [-11.0, 1.0, 6.0]
-- The [Subtraction]: vectorA-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 the parallelepiped as too the volume V = (1/6)* a*(bxc)| of the Tetrahedron.
Solution: Before of begin the runtoolsvectors.py program do know the components of this vectors so: a1 = 2, a2 = 0, a3 = -3, b1 = 1, b2 = 1, b3 = 1, c1 = 0, c2 = 4, and c3 = -1 and select the option[4]. After follow the instructions requested in accordance with showed in the display.

[WELCOME IN USING THE [RUNTOOLSVECTORS.PY] PROGRAM]
[TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] in the [SPACE]]
--[Version: 1.2 -- Stable]--

[INSTRUCTIONS OF USE]

- To find the [value] of the [Dot Product] of two vectors key [1]
- To get the [Cross Product] of two [vectors: A and B] and the [Area(A)] of the Triangle(PQR) key [2]

- To calculate the [value] of the [SineTheta] between [two vectors] A and B key [3]

- To find the [value] of the [Scalar Triple Product] of three vectors A, B, and C key [4]

- To calculate the [angle] between [two vectors] in space key[5]
- To get the [value] of the [CossineTheta] between two vectors A and B key [6]
- To find the [Distance] between two points P and Q key [7]
- To calculate the [Dimensions] of the [Triangle(PQR)] givens the points: P, Q, and R key [8]

- To find the [Area] and [Height] of the [Parallelogram] givens [two vectors]: A and B key [9]

- To get the [Volume(V)],[Height(h)] of the [Parallelepiped and Tetrahedron] given four points: P, Q, R, S key [10]

- To calculate the three [Inner Angles] of the [Triangle] given three points: P,Q,and R key [11]

- To find the [MID-POINT M] OF THE LINE SEGMENT BETWEEN [THE POINTS: P AND Q] key [12]

- To get the [Addition] and [Subraction] between [Two Vectors] A and B key [13]
- To calculate the[VectorA] and [lenght] of givens Points: P, AND Q key [14]
- To determine the [Direction Cosines] and [Direction Angles] givens an Vector A or [two points]: P and Q key [15]

- To find the [Addition] and [Subraction] between [Two Vectors]: A and B multiplyed by scalars: [coeffic1 and coeffic2] key [16]

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

(º>º) Provide the [new] value? 4
[The typed number]: 4 is a [valid integer number!]]

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

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

- Enter the 1º [Component(x)]!
(ª<ª) Enter the [new] value? 2
[[The typed number]: 2.0 is a [valid integer or float number!]]

- Introduce the 2º [Component(y)]!
(ª<ª) Enter the [new] value? 0
[[The typed number]: 0.0 is a [valid integer or float number!]]

- Give the 3º [Component(z)]!
(ª<ª) Enter the [new] value? -3
[[The typed number]: -3.0 is a [valid integer or float number!]]

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

- Enter the 1º [Component(x)]!
(ª<ª) Enter the [new] value? 1
[[The typed number]: 1.0 is a [valid integer or float number!]]

- Introduce the 2º [Component(y)]!
(ª<ª) Enter the [new] value? 1
[[The typed number]: 1.0 is a [valid integer or float number!]]

- Give the 3º [Component(z)]!
(ª<ª) Enter the [new] value? 1
[[The typed number]: 1.0 is a [valid integer or float number!]]

- Provide the [Components] of the [3º vectorC]!

- Enter the 1º [Component(x)]!
(ª<ª) Enter the [new] value? 0
[[The typed number]: 0.0 is a [valid integer or float number!]]

- Introduce the 2º [Component(y)]!
(ª<ª) Enter the [new] value? 4
[[The typed number]: 4.0 is a [valid integer or float number!]]

- Give the 3º [Component(z)]!
(ª<ª) Enter the [new] value? -1
[[The typed number]: -1.0 is a [valid integer or float number!]]

[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 [SCALAR TRIPLE PRODUCT]: a * (b x c) is: -22.0
-- The [VOLUME(V) PARALLELEPIPED]: 22.00
-- The [HEIGHT(H) PARALLELEPIPED]: 3.57
-- The [Tetrahedron volume]: 3.67

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

Example3 – A triangle 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 runtoolsvectors.py program and key the option[8] and enter the coordinates of the vertices: P, Q, and R.

```
**[ WELCOME IN USING THE [RUNTOOLSVECTORS.PY] PROGRAM ]**
**[ TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] in the [SPACE] ]**
                    --[Version: 1.2 -- Stable]--


     **[INSTRUCTIONS OF USE]**

- To find the [value] of the [Dot Product] of two vectors key [1]
- To get the [Cross Product] of two [vectors: A and B] and the [Area(A)] of the
  Triangle(PQR) key [2]

- To calculate the [value] of the [SineTheta] between [two vectors] A and B
  key [3]

- To find the [value] of the [Scalar Triple Product] of three  vectors A, B,
  and C key [4]

- To calculate the [angle] between [two vectors] in space key[5]
- To get the [value] of the [CossineTheta] between two vectors A and B key [6]
- To find the [Distance] between two points P and Q key [7]
- To calculate the [Dimensions] of the [Triangle(PQR)] givens the points: P, Q,
  and R key [8]

- To find the [Area] and [Height] of the [Parallelogram] givens [two vectors]:
  A and B key [9]

- To get the [Volume(V)],[Height(h)] of the [Parallelepiped and Tetrahedron]
  given four points: P, Q, R, S key [10]

- To calculate the three [Inner Angles] of the [Triangle] given three points:
  P,Q,and R key [11]

- To find the [MID-POINT M] OF THE LINE SEGMENT BETWEEN [THE POINTS: P AND Q]
  key [12]

- To get the [Addition] and [Subraction] between [Two Vectors] A and B key [13]
- To calculate the[VectorA] and [lenght] of givens Points: P, AND Q key [14]
- To determine the [Direction Cosines] and [Direction Angles] givens an
  Vector A or [two points]: P and Q key [15]

- To find the [Addition] and [Subraction] between [Two Vectors]: A and B
  multiplyed by scalars: [coeffic1 and coeffic2] key [16]


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

     (º>º) Provide the [new] value? 8
     **[The typed number]: 8 is a [valid integer number!] ]**

     **[ GIVENS THE COORDINATES OF THE POINTS P, Q AND R FIND THE DIMENSIONS:
        SIDE(A), SIDE(B),SIDE(C), PERIMETER(P), HEIGHTS(H1,H2,H3), AND THE ]**
     **[ AREA(A) 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
[[The typed number]: 0.0 is a [valid integer or float number!]]

* Enter with the 2º [Coordinate(y)].
(ª<ª) Enter the [new] value? 2
[[The typed number]: 2.0 is a [valid integer or float number!]]

* Give the 3º [Coordinate(z)].
(ª<ª) Enter the [new] value? -1
[[The typed number]: -1.0 is a [valid integer or float number!]]

-- Introduce the (coordinates: xQ, yQ, zQ) of the (Point Q)?

* Introduce the 1º [Coordinate(x)].
(ª<ª) Enter the [new] value? 1
[[The typed number]: 1.0 is a [valid integer or float number!]]

* Enter with the 2º [Coordinate(y)].
(ª<ª) Enter the [new] value? 1
[[The typed number]: 1.0 is a [valid integer or float number!]]

* Give the 3º [Coordinate(z)].
(ª<ª) Enter the [new] value? 3
[[The typed number]: 3.0 is a [valid integer or float number!]]

-- Provide the (coordinates: xR, yR, zR) of the (Point R)?

* Introduce the 1º [Coordinate(x)].
(ª<ª) Enter the [new] value? 1
[[The typed number]: 1.0 is a [valid integer or float number!]]

* Enter with the 2º [Coordinate(y)].
(ª<ª) Enter the [new] value? 0
[[The typed number]: 0.0 is a [valid integer or float number!]]

* Give the 3º [Coordinate(z)].
(ª<ª) Enter the [new] value? -4
[[The typed number]: -4.0 is a [valid integer or float number!]]

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

-- The [sideA] of the triangle(PQR)] is: 4.24
-- The [sideB] of the triangle(PQR)] is: 3.74

```
-- The [sideC] of the triangle(PQR)] is: 7.07
-- The [Perimeter] of the [triangle(PQR)] is 15.06

-- The [terms] of the [Scalar Product(PQºQR)] is: [0.0, 1.0, -28.0]
-- The [terms] of the [Scalar Product(QRºPR)] is: [0.0, 2.0, 21.0]
-- The [terms] of the [Scalar Product(PRºPQ)] is: [1.0, 2.0, -12.0]

-- The [Scalar Product(PQºQR)] is: -27.00
-- The [Scalar Product(QRºPR)] is: 23.00
-- The [Scalar Product(PRºPQ)] is: -9.00

-- The [Height(h1) relative as sideQR] is 1.85
-- The [Height(h2) relative as sidePR] is 3.49
-- The [Height(h3) relative as sidePQ] is 3.08

-- The [Cross Product]: vectorAxB [11.0, 7.0, -1.0]
-- The [Area(A) of a Triangle(PQR)] is: 6.54



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

Now run the runtoolsvectors.py program again and key the option[11] and enter again the coordinates of the vertices: P, Q, and R.

```
**[ WELCOME IN USING THE [RUNTOOLSVECTORS.PY] PROGRAM ]**
**[ TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] in the [SPACE] ]**
                --[Version: 1.2 -- Stable]--


**[INSTRUCTIONS OF USE]**

- To find the [value] of the [Dot Product] of two vectors key [1]
- To get the [Cross Product] of two [vectors: A and B] and the [Area(A)] of the
  Triangle(PQR) key [2]

- To calculate the [value] of the [SineTheta] between [two vectors] A and B
  key [3]

- To find the [value] of the [Scalar Triple Product] of three  vectors A, B,
  and C key [4]

- To calculate the [angle] between [two vectors] in space key[5]
- To get the [value] of the [CossineTheta] between two vectors A and B key [6]
- To find the [Distance] between two points P and Q key [7]
- To calculate the [Dimensions] of the [Triangle(PQR)] givens the points: P, Q,
  and R key [8]

- To find the [Area] and [Height] of the [Parallelogram] givens [two vectors]:
  A and B key [9]

- To get the [Volume(V)],[Height(h)] of the [Parallelepiped and Tetrahedron]
  given four points: P, Q, R, S key [10]

- To calculate the three [Inner Angles] of the [Triangle] given three points:
  P,Q,and R key [11]

- To find the [MID-POINT M] OF THE LINE SEGMENT BETWEEN [THE POINTS: P AND Q]
  key [12]

- To get the [Addition] and [Subraction] between [Two Vectors] A and B key [13]
- To calculate the[VectorA] and [lenght] of givens Points: P, AND Q key [14]
```

- To determine the [Direction Cosines] and [Direction Angles] givens an Vector A or [two points]: P and Q key [15]

- To find the [Addition] and [Subraction] between [Two Vectors]: A and B multiplyed by scalars: [coeffic1 and coeffic2] key [16]

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

(º>º) Provide the [new] value? 11
[The typed number]: 11 is a [valid integer number!]]

[GIVENS 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
[[The typed number]: 0.0 is a [valid integer or float number!]]

* Enter with the 2º [Coordinate(y)].
(ª<ª) Enter the [new] value? 2
[[The typed number]: 2.0 is a [valid integer or float number!]]

* Give the 3º [Coordinate(z)].
(ª<ª) Enter the [new] value? -1
[[The typed number]: -1.0 is a [valid integer or float number!]]

-- Introduce the (coordinates: xQ, yQ, zQ) of the (Point Q)?

* Introduce the 1º [Coordinate(x)].
(ª<ª) Enter the [new] value? 1
[[The typed number]: 1.0 is a [valid integer or float number!]]

* Enter with the 2º [Coordinate(y)].
(ª<ª) Enter the [new] value? 1
[[The typed number]: 1.0 is a [valid integer or float number!]]

* Give the 3º [Coordinate(z)].
(ª<ª) Enter the [new] value? 3
[[The typed number]: 3.0 is a [valid integer or float number!]]

-- Provide the (coordinates: xR, yR, zR) of the (Point R)?

* Introduce the 1º [Coordinate(x)].
(ª<ª) Enter the [new] value? 1
[[The typed number]: 1.0 is a [valid integer or float number!]]

* Enter with the 2º [Coordinate(y)].
(ª<ª) Enter the [new] value? 0
[[The typed number]: 0.0 is a [valid integer or float number!]]

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

[[The typed number]: -4.0 is a [valid integer or float number!]]

- 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 Dot Product: [b * c] is: -9.00
- The value of the [ANGLE THETA] was calculate is: 124.54

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

- The Dot Product: [a * c] is: 27.00
- The value of the [ANGLE BETA] was calculate is: 25.84

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

- The Dot Product: [a * b] is: 23.00
- The value of the [ANGLE GAMA] was calculate is: 29.62

-- The triangle is [Scalene]!

- THE [ADD] OF THE INNER ANGLE OF THE TRIANGLE] is: 180.00

--[END CALCULUS-OK!]--

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

[Warning]:

When any user run the **runtoolsvectors.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 runtoolsvectors.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 runtoolsvectors.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 runtoolsvectors.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 runtoolsvectors.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 vertexes 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[8] 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 **runtoolsvectors.py program** request.

```
**[ WELCOME IN USING THE [RUNTOOLSVECTORS.PY] PROGRAM ]**
**[ TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] in the [SPACE] ]**
                    --[Version: 1.2 -- Stable]--


     **[INSTRUCTIONS OF USE]**

- To find the [value] of the [Dot Product] of two vectors key [1]
- To get the [Cross Product] of two [vectors: A and B] and the [Area(A)] of the
  Triangle(PQR) key [2]

- To calculate the [value] of the [SineTheta] between [two vectors] A and B
  key [3]

- To find the [value] of the [Scalar Triple Product] of three  vectors A, B,
  and C key [4]

- To calculate the [angle] between [two vectors] in space key[5]
- To get the [value] of the [CossineTheta] between two vectors A and B key [6]
- To find the [Distance] between two points P and Q key [7]
- To calculate the [Dimensions] of the [Triangle(PQR)] givens the points: P, Q,
  and R key [8]

- To find the [Area] and [Height] of the [Parallelogram] givens [two vectors]:
  A and B key [9]

- To get the [Volume(V)],[Height(h)] of the [Parallelepiped and Tetrahedron]
  given four points: P, Q, R, S key [10]

- To calculate the three [Inner Angles] of the [Triangle] given three points:
  P,Q,and R key [11]

- To find the [MID-POINT M] OF THE LINE SEGMENT BETWEEN [THE POINTS: P AND Q]
  key [12]

- To get the [Addition] and [Subraction] between [Two Vectors] A and B key [13]
- To calculate the[VectorA] and [lenght] of givens Points: P, AND Q key [14]
- To determine the [Direction Cosines] and [Direction Angles] givens an
  Vector A or [two points]: P and Q key [15]

- To find the [Addition] and [Subraction] between [Two Vectors]: A and B
  multiplyed by scalars: [coeffic1 and coeffic2] key [16]


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

(º>º) Provide the [new] value? 8
[The typed number]: 8 is a [valid integer number!]]

**[GIVENS THE COORDINATES OF THE POINTS P, Q AND R FIND THE DIMENSIONS:
SIDE(A), SIDE(B),SIDE(C), PERIMETER(P), HEIGHTS(H1,H2,H3), AND THE]**
[AREA(A) 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
[[The typed number]: 0.0 is a [valid integer or float number!]]

* Enter with the 2º [Coordinate(y)].
(ª<ª) Enter the [new] value? -1
[[The typed number]: -1.0 is a [valid integer or float number!]]

* Give the 3º [Coordinate(z)].
(ª<ª) Enter the [new] value? 2
[[The typed number]: 2.0 is a [valid integer or float number!]]

-- Introduce the (coordinates: xQ, yQ, zQ) of the (Point Q)?

* Introduce the 1º [Coordinate(x)].
(ª<ª) Enter the [new] value? 1
[[The typed number]: 1.0 is a [valid integer or float number!]]

* Enter with the 2º [Coordinate(y)].
(ª<ª) Enter the [new] value? 2
[[The typed number]: 2.0 is a [valid integer or float number!]]

* Give the 3º [Coordinate(z)].
(ª<ª) Enter the [new] value? -1
[[The typed number]: -1.0 is a [valid integer or float number!]]

-- Provide the (coordinates: xR, yR, zR) of the (Point R)?

* Introduce the 1º [Coordinate(x)].
(ª<ª) Enter the [new] value? 3
[[The typed number]: 3.0 is a [valid integer or float number!]]

* Enter with the 2º [Coordinate(y)].
(ª<ª) Enter the [new] value? -1
[[The typed number]: -1.0 is a [valid integer or float number!]]

* Give the 3º [Coordinate(z)].
(ª<ª) Enter the [new] value? 2
[[The typed number]: 2.0 is a [valid integer or float number!]]

- 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]

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

-- The [sideA] of the triangle(PQR)] is: 4.36
-- The [sideB] of the triangle(PQR)] is: 3.00
-- The [sideC] of the triangle(PQR)] is: 4.69
-- The [Perimeter] of the [triangle(PQR)] is 12.05

-- The [terms] of the [Scalar Product(PQºQR)] is: [2.0, -9.0, -9.0]
-- The [terms] of the [Scalar Product(QRºPR)] is: [6.0, -0.0, 0.0]
-- The [terms] of the [Scalar Product(PRºPQ)] is: [3.0, 0.0, -0.0]

-- The [Scalar Product(PQºQR)] is: -16.00
-- The [Scalar Product(QRºPR)] is: 6.00
-- The [Scalar Product(PRºPQ)] is: 3.00

-- The [Height(h1) relative as sideQR] is 2.71
-- The [Height(h2) relative as sidePR] is 4.24
-- The [Height(h3) relative as sidePQ] is 2.92

-- The [Cross Product]: vectorAxB [0.0, -9.0, -9.0]
-- The [Area(A) of a 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: Before of begin the runtoolsvectors.py program do know the components of this vectors so: a1 = 1, a2 = 2, a3 = 3, b1 = 4, b2 = 5, and b3 = 6. After begin the runtoolsvectors.py program using the option [3].

[WELCOME IN USING THE [RUNTOOLSVECTORS.PY] PROGRAM]
[TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] in the [SPACE]]
--[Version: 1.2 -- Stable]--

[INSTRUCTIONS OF USE]

- To find the [value] of the [Dot Product] of two vectors key [1]
- To get the [Cross Product] of two [vectors: A and B] and the [Area(A)] of the Triangle(PQR) key [2]

- To calculate the [value] of the [SineTheta] between [two vectors] A and B key [3]

- To find the [value] of the [Scalar Triple Product] of three vectors A, B, and C key [4]

- To calculate the [angle] between [two vectors] in space key[5]
- To get the [value] of the [CossineTheta] between two vectors A and B key [6]
- To find the [Distance] between two points P and Q key [7]
- To calculate the [Dimensions] of the [Triangle(PQR)] givens the points: P, Q, and R key [8]

- To find the [Area] and [Height] of the [Parallelogram] givens [two vectors]: A and B key [9]

- To get the [Volume(V)],[Height(h)] of the [Parallelepiped and Tetrahedron]
  given four points: P, Q, R, S key [10]

- To calculate the three [Inner Angles] of the [Triangle] given three points:
  P,Q,and R key [11]

- To find the [MID-POINT M] OF THE LINE SEGMENT BETWEEN [THE POINTS: P AND Q]
  key [12]

- To get the [Addition] and [Subraction] between [Two Vectors] A and B key [13]
- To calculate the[VectorA] and [lenght] of givens Points: P, AND Q key [14]
- To determine the [Direction Cosines] and [Direction Angles] givens an
  Vector A or [two points]: P and Q key [15]

- To find the [Addition] and [Subraction] between [Two Vectors]: A and B
  multiplyed by scalars: [coeffic1 and coeffic2] key [16]

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

(º>º) Provide the [new] value? 3
[The typed number]: 3 is a [valid integer number!]]

[FIND THE VALUE OF THE SINETHETA]

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

- Enter the 1º [Component(x)]!
(ª<ª) Enter the [new] value? 1
[[The typed number]: 1.0 is a [valid integer or float number!]]

- Introduce the 2º [Component(y)]!
(ª<ª) Enter the [new] value? 2
[[The typed number]: 2.0 is a [valid integer or float number!]]

- Give the 3º [Component(z)]!
(ª<ª) Enter the [new] value? 3
[[The typed number]: 3.0 is a [valid integer or float number!]]

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

- Enter the 1º [Component(x)]!
(ª<ª) Enter the [new] value? 4
[[The typed number]: 4.0 is a [valid integer or float number!]]

- Introduce the 2º [Component(y)]!
(ª<ª) Enter the [new] value? 5
[[The typed number]: 5.0 is a [valid integer or float number!]]

- Give the 3º [Component(z)]!
(ª<ª) Enter the [new] value? 6
[[The typed number]: 6.0 is a [valid integer or float number!]]

-- The [vectorA]: vectorA [1.0, 2.0, 3.0]
-- The [vectorB]: vectorB [4.0, 5.0, 6.0]

[ANSWER]

-- The [length] of the [vectorA]=|vectorA|: 3.74
-- The [length] of the [vectorB]=|vectorB| 8.77
-- The [length] of the [vectorAxB]=|vectorAxB| 7.35
-- The value of the [SINETheta] is: 0.22

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

Example6 – Find the area(A) and height(h) of the parellelogram determined by the vectors: a = 4i – j +k and b = 2i + 3j – k.
Solution – Begin the runtoolsvectors.py program using the option[9] and follow the instructions in to display.

[WELCOME IN USING THE [RUNTOOLSVECTORS.PY] PROGRAM]
[TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] in the [SPACE]]
--[Version: 1.2 -- Stable]--

[INSTRUCTIONS OF USE]

- To find the [value] of the [Dot Product] of two vectors key [1]
- To get the [Cross Product] of two [vectors: A and B] and the [Area(A)] of the Triangle(PQR) key [2]

- To calculate the [value] of the [SineTheta] between [two vectors] A and B key [3]

- To find the [value] of the [Scalar Triple Product] of three vectors A, B, and C key [4]

- To calculate the [angle] between [two vectors] in space key[5]
- To get the [value] of the [CossineTheta] between two vectors A and B key [6]
- To find the [Distance] between two points P and Q key [7]
- To calculate the [Dimensions] of the [Triangle(PQR)] givens the points: P, Q, and R key [8]

- To find the [Area] and [Height] of the [Parallelogram] givens [two vectors]: A and B key [9]

- To get the [Volume(V)],[Height(h)] of the [Parallelepiped and Tetrahedron] given four points: P, Q, R, S key [10]

- To calculate the three [Inner Angles] of the [Triangle] given three points: P,Q,and R key [11]

- To find the [MID-POINT M] OF THE LINE SEGMENT BETWEEN [THE POINTS: P AND Q] key [12]

- To get the [Addition] and [Subraction] between [Two Vectors] A and B key [13]
- To calculate the[VectorA] and [lenght] of givens Points: P, AND Q key [14]
- To determine the [Direction Cosines] and [Direction Angles] givens an Vector A or [two points]: P and Q key [15]

- To find the [Addition] and [Subraction] between [Two Vectors]: A and B multiplyed by scalars: [coeffic1 and coeffic2] key [16]

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

(º>º) Provide the [new] value? 9
[The typed number]: 9 is a [valid integer number!]]

**[FIND THE AREA(A) AND HEIGHT(H) PARALLELOGRAM GIVEN THE VECTORS:
A AND B]**

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

- Enter the 1º [Component(x)]!
(ª<ª) Enter the [new] value? 4
[[The typed number]: 4.0 is a [valid integer or float number!]]

- Introduce the 2º [Component(y)]!
(ª<ª) Enter the [new] value? -1
[[The typed number]: -1.0 is a [valid integer or float number!]]

- Give the 3º [Component(z)]!
(ª<ª) Enter the [new] value? 1
[[The typed number]: 1.0 is a [valid integer or float number!]]

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

- Enter the 1º [Component(x)]!
(ª<ª) Enter the [new] value? 2
[[The typed number]: 2.0 is a [valid integer or float number!]]

- Introduce the 2º [Component(y)]!
(ª<ª) Enter the [new] value? 3
[[The typed number]: 3.0 is a [valid integer or float number!]]

- Give the 3º [Component(z)]!
(ª<ª) Enter the [new] value? -1
[[The typed number]: -1.0 is a [valid integer or float number!]]

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

[ANSWER]

-- The [Height(h) Parallelogram] is: 3.62
-- The [Area(A) Parallelogram] is: 15.36

. . . 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 runtoolsvectors.py program using the option[6] and follow the instructions in to display.

[WELCOME IN USING THE [RUNTOOLSVECTORS.PY] PROGRAM]
[TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] in the [SPACE]]
--[Version: 1.2 -- Stable]--

[INSTRUCTIONS OF USE]

- To find the [value] of the [Dot Product] of two vectors key [1]
- To get the [Cross Product] of two [vectors: A and B] and the [Area(A)] of the Triangle(PQR) key [2]

- To calculate the [value] of the [SineTheta] between [two vectors] A and B key [3]

- To find the [value] of the [Scalar Triple Product] of three vectors A, B, and C key [4]

- To calculate the [angle] between [two vectors] in space key[5]
- To get the [value] of the [CossineTheta] between two vectors A and B key [6]
- To find the [Distance] between two points P and Q key [7]
- To calculate the [Dimensions] of the [Triangle(PQR)] givens the points: P, Q, and R key [8]

- To find the [Area] and [Height] of the [Parallelogram] givens [two vectors]: A and B key [9]

- To get the [Volume(V)],[Height(h)] of the [Parallelepiped and Tetrahedron] given four points: P, Q, R, S key [10]

- To calculate the three [Inner Angles] of the [Triangle] given three points: P,Q,and R key [11]

- To find the [MID-POINT M] OF THE LINE SEGMENT BETWEEN [THE POINTS: P AND Q] key [12]

- To get the [Addition] and [Subraction] between [Two Vectors] A and B key [13]
- To calculate the[VectorA] and [lenght] of givens Points: P, AND Q key [14]
- To determine the [Direction Cosines] and [Direction Angles] givens an Vector A or [two points]: P and Q key [15]

- To find the [Addition] and [Subraction] between [Two Vectors]: A and B multiplyed by scalars: [coeffic1 and coeffic2] key [16]

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

(º>º) Provide the [new] value? 6
[The typed number]: 6 is a [valid integer number!]]

[FIND THE [VALUE] OF THE [COSSINETHETA] BETWEEN VECTORS: A AND B]

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

- Enter the 1º [Component(x)]!
(ª<ª) Enter the [new] value? 1
[[The typed number]: 1.0 is a [valid integer or float number!]]

- Introduce the 2º [Component(y)]!
(ª<ª) Enter the [new] value? -3
[[The typed number]: -3.0 is a [valid integer or float number!]]

- Give the 3º [Component(z)]!

(ª<ª) Enter the [new] value? 2
[[The typed number]: 2.0 is a [valid integer or float number!]]

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

- Enter the 1º [Component(x)]!
(ª<ª) Enter the [new] value? 3
[[The typed number]: 3.0 is a [valid integer or float number!]]

- Introduce the 2º [Component(y)]!
(ª<ª) Enter the [new] value? 3
[[The typed number]: 3.0 is a [valid integer or float number!]]

- Give the 3º [Component(z)]!
(ª<ª) Enter the [new] value? 2
[[The typed number]: 2.0 is a [valid integer or float number!]]

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

[ANSWER]

-- The length [|vectorA|] is: 3.74
-- The length [|vectorB|] is: 4.69
-- The value [ScalarVectorA*B] is: -2.00
-- The value of the [CossineTheta] 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 runtoolsvectors.py program using the option[15] and after key the option[2] to enter the coordinates: xP = 2, yP = -3, zP = 5, xQ = 1, yQ = 0, and zQ = -1.

[WELCOME IN USING THE [RUNTOOLSVECTORS.PY] PROGRAM]
[TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] in the [SPACE]]
--[Version: 1.2 -- Stable]--

[INSTRUCTIONS OF USE]

- To find the [value] of the [Dot Product] of two vectors key [1]
- To get the [Cross Product] of two [vectors: A and B] and the [Area(A)] of the Triangle(PQR) key [2]

- To calculate the [value] of the [SineTheta] between [two vectors] A and B key [3]

- To find the [value] of the [Scalar Triple Product] of three vectors A, B, and C key [4]

- To calculate the [angle] between [two vectors] in space key[5]
- To get the [value] of the [CossineTheta] between two vectors A and B key [6]
- To find the [Distance] between two points P and Q key [7]
- To calculate the [Dimensions] of the [Triangle(PQR)] givens the points: P, Q,

and R key [8]

- To find the [Area] and [Height] of the [Parallelogram] givens [two vectors]:
A and B key [9]

- To get the [Volume(V)],[Height(h)] of the [Parallelepiped and Tetrahedron]
given four points: P, Q, R, S key [10]

- To calculate the three [Inner Angles] of the [Triangle] given three points:
P,Q,and R key [11]

- To find the [MID-POINT M] OF THE LINE SEGMENT BETWEEN [THE POINTS: P AND Q]
key [12]

- To get the [Addition] and [Subraction] between [Two Vectors] A and B key [13]
- To calculate the[VectorA] and [lenght] of givens Points: P, AND Q key [14]
- To determine the [Direction Cosines] and [Direction Angles] givens an
Vector A or [two points]: P and Q key [15]

- To find the [Addition] and [Subraction] between [Two Vectors]: A and B
multiplyed by scalars: [coeffic1 and coeffic2] key [16]

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

(º>º) Provide the [new] value? 15
[The typed number]: 15 is a [valid integer number!]]

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

- Type [1] to enter the [components] of vectorA.
- Type [2] to enter the [coordinates] of two givens points: P and Q.
(º>º) Provide the [new] value? 2
[The typed number]: 2 is a [valid integer number!]]

-- Enter the (coordinates: xP, yP, zP) of the (Point P)?

* Introduce the 1º [Coordinate(x)].
(ª<ª) Enter the [new] value? 2
[[The typed number]: 2.0 is a [valid integer or float number!]]

* Enter with the 2º [Coordinate(y)].
(ª<ª) Enter the [new] value? -3
[[The typed number]: -3.0 is a [valid integer or float number!]]

* Give the 3º [Coordinate(z)].
(ª<ª) Enter the [new] value? 5
[[The typed number]: 5.0 is a [valid integer or float number!]]

-- Introduce the (coordinates: xQ, yQ, zQ) of the (Point Q)?

* Introduce the 1º [Coordinate(x)].
(ª<ª) Enter the [new] value? 1
[[The typed number]: 1.0 is a [valid integer or float number!]]

* Enter with the 2º [Coordinate(y)].
(ª<ª) Enter the [new] value? 0
[[The typed number]: 0.0 is a [valid integer or float number!]]

* Give the 3º [Coordinate(z)].
(ª<ª) Enter the [new] value? -1
[[The typed number]: -1.0 is a [valid integer or float number!]]

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

[ANSWER]

-- The [vectorA]: vectorA=vectorPQ [-1.0, 3.0, -6.0]
-- The [lenght] of the vectorA=|vectorA|: 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! . . .

Example9 – Calculate the direction cosines and direction angles of the given vector a = i – 2j - 3k.
Solution – After was begin the runtoolsvectors.py program key the option[15] and wait the display present instructions to select the options: [1] or [2]. Follow type the option[1] and provide the [components]; a1 = 1, a2 = -2, and a3 = -3.

[WELCOME IN USING THE [RUNTOOLSVECTORS.PY] PROGRAM]
[TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] in the [SPACE]]
--[Version: 1.2 -- Stable]--

[INSTRUCTIONS OF USE]

- To find the [value] of the [Dot Product] of two vectors key [1]
- To get the [Cross Product] of two [vectors: A and B] and the [Area(A)] of the Triangle(PQR) key [2]

- To calculate the [value] of the [SineTheta] between [two vectors] A and B key [3]

- To find the [value] of the [Scalar Triple Product] of three vectors A, B, and C key [4]

- To calculate the [angle] between [two vectors] in space key[5]
- To get the [value] of the [CossineTheta] between two vectors A and B key [6]
- To find the [Distance] between two points P and Q key [7]
- To calculate the [Dimensions] of the [Triangle(PQR)] givens the points: P, Q, and R key [8]

- To find the [Area] and [Height] of the [Parallelogram] givens [two vectors]: A and B key [9]

- To get the [Volume(V)],[Height(h)] of the [Parallelepiped and Tetrahedron]
  given four points: P, Q, R, S key [10]

- To calculate the three [Inner Angles] of the [Triangle] given three points:
  P,Q,and R key [11]

- To find the [MID-POINT M] OF THE LINE SEGMENT BETWEEN [THE POINTS: P AND Q]
  key [12]

- To get the [Addition] and [Subraction] between [Two Vectors] A and B key [13]
- To calculate the[VectorA] and [lenght] of givens Points: P, AND Q key [14]
- To determine the [Direction Cosines] and [Direction Angles] givens an
  Vector A or [two points]: P and Q key [15]

- To find the [Addition] and [Subraction] between [Two Vectors]: A and B
  multiplyed by scalars: [coeffic1 and coeffic2] key [16]

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

(º>º) Provide the [new] value? 15
[The typed number]: 15 is a [valid integer number!]]

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

- Type [1] to enter the [components] of vectorA.
- Type [2] to enter the [coordinates] of two givens points: P and Q.
(º>º) Provide the [new] value? 1
[The typed number]: 1 is a [valid integer number!]]

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

- Enter the 1º [Component(x)]!
(ª<ª) Enter the [new] value? 1
[[The typed number]: 1.0 is a [valid integer or float number!]]

- Introduce the 2º [Component(y)]!
(ª<ª) Enter the [new] value? -2
[[The typed number]: -2.0 is a [valid integer or float number!]]

- Give the 3º [Component(z)]!
(ª<ª) Enter the [new] value? -3
[[The typed number]: -3.0 is a [valid integer or float number!]]

[ANSWER]

-- The [vectorA]: vectorA [1.0, -2.0, -3.0]
-- The [lenght] of the vectorA=|vectorA|: 3.74

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

-- The [value] of the [CosineAlpha] is: 0.27
-- The [value] of the [CosineBeta] is: -0.53
-- The [value] of the [CosineGama] is: -0.80

-- The [value] of the [AlphaAngle] is: 74.50
-- The [value] of the [BetaAngle] is: 122.31
-- The [value] of the [GamaAngle] is: 143.30

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

Example10 – Givens the vectors: a = i + 2j -3k and b = -2i -j + 5k find the [vectors and modules]: a + b, a – b, |a + b|, |a – b|, and 2a – 3b.
Solution – Begin the runtoolsvectors.py program and key the option[16] and wait the display present instructions to select the options: [1] or [2]. Follow type the option[1] and provide the [components]; a1 = 1, a2 = 2, a3 = -3, b1 = -2, b2 = -1, and b3 = 5. Following 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 [RUNTOOLSVECTORS.PY] PROGRAM]
[TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] in the [SPACE]]
--[Version: 1.2 -- Stable]--

[INSTRUCTIONS OF USE]

- To find the [value] of the [Dot Product] of two vectors key [1]
- To get the [Cross Product] of two [vectors: A and B] and the [Area(A)] of the Triangle(PQR) key [2]

- To calculate the [value] of the [SineTheta] between [two vectors] A and B key [3]

- To find the [value] of the [Scalar Triple Product] of three vectors A, B, and C key [4]

- To calculate the [angle] between [two vectors] in space key[5]
- To get the [value] of the [CossineTheta] between two vectors A and B key [6]
- To find the [Distance] between two points P and Q key [7]
- To calculate the [Dimensions] of the [Triangle(PQR)] givens the points: P, Q, and R key [8]

- To find the [Area] and [Height] of the [Parallelogram] givens [two vectors]: A and B key [9]

- To get the [Volume(V)],[Height(h)] of the [Parallelepiped and Tetrahedron] given four points: P, Q, R, S key [10]

- To calculate the three [Inner Angles] of the [Triangle] given three points: P,Q,and R key [11]

- To find the [MID-POINT M] OF THE LINE SEGMENT BETWEEN [THE POINTS: P AND Q] key [12]

- To get the [Addition] and [Subraction] between [Two Vectors] A and B key [13]
- To calculate the[VectorA] and [lenght] of givens Points: P, AND Q key [14]
- To determine the [Direction Cosines] and [Direction Angles] givens an Vector A or [two points]: P and Q key [15]

- To find the [Addition] and [Subraction] between [Two Vectors]: A and B multiplyed by scalars: [coeffic1 and coeffic2] key [16]

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

(º>º) Provide the [new] value? 15
[The typed number]: 15 is a [valid integer number!]]

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

- Type [1] to enter the [components] of vectorA.
- Type [2] to enter the [coordinates] of two givens points: P and Q.

(º>º) Provide the [new] value? 1
[The typed number]: 1 is a [valid integer number!]]

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

- Enter the 1º [Component(x)]!
(ª<ª) Enter the [new] value? 1
[[The typed number]: 1.0 is a [valid integer or float number!]]

- Introduce the 2º [Component(y)]!
(ª<ª) Enter the [new] value? -2
[[The typed number]: -2.0 is a [valid integer or float number!]]

- Give the 3º [Component(z)]!
(ª<ª) Enter the [new] value? -3
[[The typed number]: -3.0 is a [valid integer or float number!]]

[ANSWER]

-- The [vectorA]: vectorA [1.0, -2.0, -3.0]
-- The [lenght] of the vectorA=|vectorA|: 3.74

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

-- The [value] of the [CosineAlpha] is: 0.27
-- The [value] of the [CosineBeta] is: -0.53
-- The [value] of the [CosineGama] is: -0.80

-- The [value] of the [AlphaAngle] is: 74.50
-- The [value] of the [BetaAngle] is: 122.31
-- The [value] of the [GamaAngle] is: 143.30

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

Example10 – Givens the vectors: a = i + 2j -3k and b = -2i -j + 5k find the [vectors and modules]: a + b, a – b, |a + b|, |a – b|, and 2a – 3b.
Solution – Begin the runtoolsvectors.py program and key the option[16] and wait the display present instructions to select the options: [1] or [2]. Follow type the option[1] and provide the [components]; a1 = 1, a2 = 2, a3 = -3, b1 = -2, b2 = -1, and b3 = 5. Following 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 [RUNTOOLSVECTORS.PY] PROGRAM]
[TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] in the [SPACE]]
--[Version: 1.2 -- Stable]--

[INSTRUCTIONS OF USE]

- To find the [value] of the [Dot Product] of two vectors key [1]
- To get the [Cross Product] of two [vectors: A and B] and the [Area(A)] of the Triangle(PQR) key [2]

- To calculate the [value] of the [SineTheta] between [two vectors] A and B key [3]

- To find the [value] of the [Scalar Triple Product] of three vectors A, B, and C key [4]

- To calculate the [angle] between [two vectors] in space key[5]
- To get the [value] of the [CossineTheta] between two vectors A and B key [6]
- To find the [Distance] between two points P and Q key [7]
- To calculate the [Dimensions] of the [Triangle(PQR)] givens the points: P, Q, and R key [8]

- To find the [Area] and [Height] of the [Parallelogram] givens [two vectors]: A and B key [9]

- To get the [Volume(V)],[Height(h)] of the [Parallelepiped and Tetrahedron] given four points: P, Q, R, S key [10]

- To calculate the three [Inner Angles] of the [Triangle] given three points: P,Q,and R key [11]

- To find the [MID-POINT M] OF THE LINE SEGMENT BETWEEN [THE POINTS: P AND Q] key [12]

- To get the [Addition] and [Subraction] between [Two Vectors] A and B key [13]
- To calculate the[VectorA] and [lenght] of givens Points: P, AND Q key [14]
- To determine the [Direction Cosines] and [Direction Angles] givens an Vector A or [two points]: P and Q key [15]

- To find the [Addition] and [Subraction] between [Two Vectors]: A and B multiplyed by scalars: [coeffic1 and coeffic2] key [16]

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

(º>º) Provide the [new] value? 16
[The typed number]: 16 is a [valid integer number!]]

[GIVENS [TWO VECTORS: A AND B] MULTIPLYED BY THE [SCALARS]: [COEFFIC1] AND [COEFFIC2] OR]

[GIVENS [THE POINTS: P, Q, AND R] FIND [TWO VECTORS]: VECTOR(A)=VECTOR(PQ) AND VECTOR(B)=VECTOR(PR)]

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

- To enter the [Components] of the [vectors: A and B] type [1].
- To introduce the [Coordinates] of the [points: P, Q, and R] type [2].
(º>º) Provide the [new] value? 1
[The typed number]: 1 is a [valid integer number!]]

- Provide the [Components] of the [vectors]: vectorA and vectorB.

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

- Enter the 1º [Component(x)]!

(ª<ª) Enter the [new] value? 1
[[The typed number]: 1.0 is a [valid integer or float number!]]

- Introduce the 2º [Component(y)]!
(ª<ª) Enter the [new] value? 2
[[The typed number]: 2.0 is a [valid integer or float number!]]

- Give the 3º [Component(z)]!
(ª<ª) Enter the [new] value? -3
[[The typed number]: -3.0 is a [valid integer or float number!]]

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

- Enter the 1º [Component(x)]!
(ª<ª) Enter the [new] value? -2
[[The typed number]: -2.0 is a [valid integer or float number!]]

- Introduce the 2º [Component(y)]!
(ª<ª) Enter the [new] value? -1
[[The typed number]: -1.0 is a [valid integer or float number!]]

- Give the 3º [Component(z)]!
(ª<ª) Enter the [new] value? 5
[[The typed number]: 5.0 is a [valid integer or float number!]]

-- 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
[[The typed number]: 1.0 is a [valid integer or float number!]]

- Give the new [value] to the (2º)[coefficient]?
(ª<ª) Enter the [new] value? 1
[[The typed number]: 1.0 is a [valid integer or float number!]]

[ANSWER]

+ The vectorAcoeffic1 [1.0, 2.0, -3.0]
+ The vectorBcoeffic2 [-2.0, -1.0, 5.0]

-- The vectorAddition [-1.0, 1.0, 2.0]
-- The vectorSubtraction [3.0, 3.0, -8.0]

-- The [length] of the |vectorAddition| is: 2.45
-- The [length] of the |vectorSubtraction| is: 9.06

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

Now to get the vector: 2a − 3b, run the runtoolsvectors.py program again and key the option[16] and wait the display present instructions to select the options: [1] or [2]. Follow type the option[1] and provide again the [components]; a1 = 1, a2 = 2, a3 = -3, b1 = -2, b2 = -1, and b3 = 5. Following 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 [RUNTOOLSVECTORS.PY] PROGRAM]
[TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] in the [SPACE]]
--[Version: 1.2 -- Stable]--

[INSTRUCTIONS OF USE]

- To find the [value] of the [Dot Product] of two vectors key [1]
- To get the [Cross Product] of two [vectors: A and B] and the [Area(A)] of the Triangle(PQR) key [2]

- To calculate the [value] of the [SineTheta] between [two vectors] A and B key [3]

- To find the [value] of the [Scalar Triple Product] of three vectors A, B, and C key [4]

- To calculate the [angle] between [two vectors] in space key[5]
- To get the [value] of the [CossineTheta] between two vectors A and B key [6]
- To find the [Distance] between two points P and Q key [7]
- To calculate the [Dimensions] of the [Triangle(PQR)] givens the points: P, Q, and R key [8]

- To find the [Area] and [Height] of the [Parallelogram] givens [two vectors]: A and B key [9]

- To get the [Volume(V)],[Height(h)] of the [Parallelepiped and Tetrahedron] given four points: P, Q, R, S key [10]

- To calculate the three [Inner Angles] of the [Triangle] given three points: P,Q,and R key [11]

- To find the [MID-POINT M] OF THE LINE SEGMENT BETWEEN [THE POINTS: P AND Q] key [12]

- To get the [Addition] and [Subraction] between [Two Vectors] A and B key [13]
- To calculate the[VectorA] and [lenght] of givens Points: P, AND Q key [14]
- To determine the [Direction Cosines] and [Direction Angles] givens an Vector A or [two points]: P and Q key [15]

- To find the [Addition] and [Subraction] between [Two Vectors]: A and B multiplyed by scalars: [coeffic1 and coeffic2] key [16]

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

(º>º) Provide the [new] value? 16
[The typed number]: 16 is a [valid integer number!]]

[GIVENS [TWO VECTORS: A AND B] MULTIPLYED BY THE [SCALARS]: [COEFFIC1] AND [COEFFIC2] OR]

[GIVENS [THE POINTS: P, Q, AND R] FIND [TWO VECTORS]: VECTOR(A)=VECTOR(PQ) AND VECTOR(B)=VECTOR(PR)]

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

- To enter the [Components] of the [vectors: A and B] type [1].

- To introduce the [Coordinates] of the [points: P, Q, and R] type [2].

(º>º) Provide the [new] value? 1
[The typed number]: 1 is a [valid integer number!]]

- Provide the [Components] of the [vectors]: vectorA and vectorB.

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

- Enter the 1º [Component(x)]!
(ª<ª) Enter the [new] value? 1
[[The typed number]: 1.0 is a [valid integer or float number!]]

- Introduce the 2º [Component(y)]!
(ª<ª) Enter the [new] value? 2
[[The typed number]: 2.0 is a [valid integer or float number!]]

- Give the 3º [Component(z)]!
(ª<ª) Enter the [new] value? -3
[[The typed number]: -3.0 is a [valid integer or float number!]]

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

- Enter the 1º [Component(x)]!
(ª<ª) Enter the [new] value? -2
[[The typed number]: -2.0 is a [valid integer or float number!]]

- Introduce the 2º [Component(y)]!
(ª<ª) Enter the [new] value? -1
[[The typed number]: -1.0 is a [valid integer or float number!]]

- Give the 3º [Component(z)]!
(ª<ª) Enter the [new] value? 5
[[The typed number]: 5.0 is a [valid integer or float number!]]

-- 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
[[The typed number]: 2.0 is a [valid integer or float number!]]

- Give the new [value] to the (2º)[coefficient]?
(ª<ª) Enter the [new] value? -3
[[The typed number]: -3.0 is a [valid integer or float number!]]

[ANSWER]

+ The vectorAcoeffic1 [2.0, 4.0, -6.0]
+ The vectorBcoeffic2 [6.0, 3.0, -15.0]

-- The vectorAddition [8.0, 7.0, -21.0]
-- The vectorSubtraction [-4.0, 1.0, 9.0]

-- The [length] of the |vectorAddition| is: 23.54
-- The [length] of the |vectorSubtraction| is: 9.90

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

Example11 – Givens the points: P(2, 2, 3) and Q(4, -5, 6), find the [distance] between the points.
Solution – Begin the runtoolsvectors.py program and key the option[7] and provide the [coordinates]: xP = 2, yP = 2, zP = 3, xQ = 4, yQ = -5, and zQ = 6 when request by program.

[WELCOME IN USING THE [RUNTOOLSVECTORS.PY] PROGRAM]
[TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] in the [SPACE]]
--[Version: 1.2 -- Stable]--

[INSTRUCTIONS OF USE]

- To find the [value] of the [Dot Product] of two vectors key [1]
- To get the [Cross Product] of two [vectors: A and B] and the [Area(A)] of the Triangle(PQR) key [2]

- To calculate the [value] of the [SineTheta] between [two vectors] A and B key [3]

- To find the [value] of the [Scalar Triple Product] of three vectors A, B, and C key [4]

- To calculate the [angle] between [two vectors] in space key[5]
- To get the [value] of the [CossineTheta] between two vectors A and B key [6]
- To find the [Distance] between two points P and Q key [7]
- To calculate the [Dimensions] of the [Triangle(PQR)] givens the points: P, Q, and R key [8]

- To find the [Area] and [Height] of the [Parallelogram] givens [two vectors]: A and B key [9]

- To get the [Volume(V)],[Height(h)] of the [Parallelepiped and Tetrahedron] given four points: P, Q, R, S key [10]

- To calculate the three [Inner Angles] of the [Triangle] given three points: P,Q,and R key [11]

- To find the [MID-POINT M] OF THE LINE SEGMENT BETWEEN [THE POINTS: P AND Q] key [12]

- To get the [Addition] and [Subraction] between [Two Vectors] A and B key [13]
- To calculate the[VectorA] and [lenght] of givens Points: P, AND Q key [14]
- To determine the [Direction Cosines] and [Direction Angles] givens an Vector A or [two points]: P and Q key [15]

- To find the [Addition] and [Subraction] between [Two Vectors]: A and B multiplyed by scalars: [coeffic1 and coeffic2] key [16]

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

(º>º) Provide the [new] value? 7
[The typed number]: 7 is a [valid integer number!]]

[DETERMINE THE DISTANCE(d) BETWEEN TWO GIVENS POINTS P and Q]

-- Enter the (coordinates: xP, yP, zP) of the (Point P)?

* Introduce the 1º [Coordinate(x)].
(ª<ª) Enter the [new] value? 2
[[The typed number]: 2.0 is a [valid integer or float number!]]

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

[[The typed number]: 2.0 is a [valid integer or float number!]]

* Give the 3º [Coordinate(z)].
(ª<ª) Enter the [new] value? 3
[[The typed number]: 3.0 is a [valid integer or float number!]]

-- Introduce the (coordinates: xQ, yQ, zQ) of the (Point Q)?

* Introduce the 1º [Coordinate(x)].
(ª<ª) Enter the [new] value? 4
[[The typed number]: 4.0 is a [valid integer or float number!]]

* Enter with the 2º [Coordinate(y)].
(ª<ª) Enter the [new] value? -5
[[The typed number]: -5.0 is a [valid integer or float number!]]

* Give the 3º [Coordinate(z)].
(ª<ª) Enter the [new] value? 6
[[The typed number]: 6.0 is a [valid integer or float number!]]

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

[ANSWER]

-- The [vectorPQ]: vectorPQ [2.0, -7.0, 3.0]
-- The [Quadratic Components] of the [vectorCQD]:vectorCQD [4.0, 49.0, 9.0]
-- The [Distance(d)] geted between (Two Points) P and Q is: 7.87

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

Example12 – Givens the points: P(5, -9, 7) and Q(-2, 3, 3), find the [MidPoint] between the points.
Solution – Begin the runtoolsvectors.py program and key the option[12] and provide the [coordinates]: xP = 5, yP = -9, zP = 7, xQ = -2, yQ = 3, and zQ = 3 when the program request.

[WELCOME IN USING THE [RUNTOOLSVECTORS.PY] PROGRAM]
[TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] in the [SPACE]]
--[Version: 1.2 -- Stable]--

[INSTRUCTIONS OF USE]

- To find the [value] of the [Dot Product] of two vectors key [1]
- To get the [Cross Product] of two [vectors: A and B] and the [Area(A)] of the Triangle(PQR) key [2]

- To calculate the [value] of the [SineTheta] between [two vectors] A and B key [3]

- To find the [value] of the [Scalar Triple Product] of three vectors A, B, and C key [4]

- To calculate the [angle] between [two vectors] in space key[5]
- To get the [value] of the [CossineTheta] between two vectors A and B key [6]
- To find the [Distance] between two points P and Q key [7]
- To calculate the [Dimensions] of the [Triangle(PQR)] givens the points: P, Q, and R key [8]

- To find the [Area] and [Height] of the [Parallelogram] givens [two vectors]: A and B key [9]

- To get the [Volume(V)],[Height(h)] of the [Parallelepiped and Tetrahedron] given four points: P, Q, R, S key [10]

- To calculate the three [Inner Angles] of the [Triangle] given three points: P,Q,and R key [11]

- To find the [MID-POINT M] OF THE LINE SEGMENT BETWEEN [THE POINTS: P AND Q] key [12]

- To get the [Addition] and [Subraction] between [Two Vectors] A and B key [13]
- To calculate the[VectorA] and [lenght] of givens Points: P, AND Q key [14]
- To determine the [Direction Cosines] and [Direction Angles] givens an Vector A or [two points]: P and Q key [15]

- To find the [Addition] and [Subraction] between [Two Vectors]: A and B multiplyed by scalars: [coeffic1 and coeffic2] key [16]

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

(º>º) Provide the [new] value? 12
[The typed number]: 12 is a [valid integer number!]]

[WILL FIND THE [MIDPOINT(M)] OF THE [LINE SEGMENT] BETWEEN THE GIVEN POINTS : P AND Q]

-- Enter the (coordinates: xP, yP, zP) of the (Point P)?

* Introduce the 1º [Coordinate(x)].
(ª<ª) Enter the [new] value? 5
[[The typed number]: 5.0 is a [valid integer or float number!]]

* Enter with the 2º [Coordinate(y)].
(ª<ª) Enter the [new] value? -9
[[The typed number]: -9.0 is a [valid integer or float number!]]

* Give the 3º [Coordinate(z)].
(ª<ª) Enter the [new] value? 7
[[The typed number]: 7.0 is a [valid integer or float number!]]

-- Introduce the (coordinates: xQ, yQ, zQ) of the (Point Q)?

* Introduce the 1º [Coordinate(x)].
(ª<ª) Enter the [new] value? -2
[[The typed number]: -2.0 is a [valid integer or float number!]]

* Enter with the 2º [Coordinate(y)].
(ª<ª) Enter the [new] value? 3
[[The typed number]: 3.0 is a [valid integer or float number!]]

* Give the 3º [Coordinate(z)].
(ª<ª) Enter the [new] value? 3
[[The typed number]: 3.0 is a [valid integer or float number!]]

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

[ANSWER]

-- The (MidPoint M): M (1.5, -3.0, 5.0)

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

Example13 – Givens the points: P(-1, 2, 0), Q(2, 1, -3), R(1, 0, 1), and S(3, -2, 3), find the Volume(V) and Height(h) of the parallelepiped as too the volume of the Tetrahedron.
Solution – Run the runtoolsvectors.py program and key the option[10] 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 [RUNTOOLSVECTORS.PY] PROGRAM]
[TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] in the [SPACE]]
--[Version: 1.2 -- Stable]--

[INSTRUCTIONS OF USE]

- To find the [value] of the [Dot Product] of two vectors key [1]
- To get the [Cross Product] of two [vectors: A and B] and the [Area(A)] of the Triangle(PQR) key [2]

- To calculate the [value] of the [SineTheta] between [two vectors] A and B key [3]

- To find the [value] of the [Scalar Triple Product] of three vectors A, B, and C key [4]

- To calculate the [angle] between [two vectors] in space key[5]
- To get the [value] of the [CossineTheta] between two vectors A and B key [6]
- To find the [Distance] between two points P and Q key [7]
- To calculate the [Dimensions] of the [Triangle(PQR)] givens the points: P, Q, and R key [8]

- To find the [Area] and [Height] of the [Parallelogram] givens [two vectors]:

A and B key [9]

- To get the [Volume(V)],[Height(h)] of the [Parallelepiped and Tetrahedron]
given four points: P, Q, R, S key [10]

- To calculate the three [Inner Angles] of the [Triangle] given three points:
P,Q,and R key [11]

- To find the [MID-POINT M] OF THE LINE SEGMENT BETWEEN [THE POINTS: P AND Q]
key [12]

- To get the [Addition] and [Subraction] between [Two Vectors] A and B key [13]
- To calculate the[VectorA] and [lenght] of givens Points: P, AND Q key [14]
- To determine the [Direction Cosines] and [Direction Angles] givens an
Vector A or [two points]: P and Q key [15]

- To find the [Addition] and [Subraction] between [Two Vectors]: A and B
multiplyed by scalars: [coeffic1 and coeffic2] key [16]

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

(º>º) Provide the [new] value? 10
[The typed number]: 10 is a [valid integer number!]]

[GIVENS THE COORDINATES OF THE POINTS P, Q, R AND S FIND THE]
[VOLUME(V) AND HEIGHT(H) OF THE PARALLELEPIPED AND TETRAHEDRON]

-- Enter the (coordinates: xP, yP, zP) of the (Point P)?

* Introduce the 1º [Coordinate(x)].
(ª<ª) Enter the [new] value? -1
[[The typed number]: -1.0 is a [valid integer or float number!]]

* Enter with the 2º [Coordinate(y)].
(ª<ª) Enter the [new] value? 2
[[The typed number]: 2.0 is a [valid integer or float number!]]

* Give the 3º [Coordinate(z)].
(ª<ª) Enter the [new] value? 0
[[The typed number]: 0.0 is a [valid integer or float number!]]

-- Introduce the (coordinates: xQ, yQ, zQ) of the (Point Q)?

* Introduce the 1º [Coordinate(x)].
(ª<ª) Enter the [new] value? 2
[[The typed number]: 2.0 is a [valid integer or float number!]]

* Enter with the 2º [Coordinate(y)].
(ª<ª) Enter the [new] value? 1
[[The typed number]: 1.0 is a [valid integer or float number!]]

* Give the 3º [Coordinate(z)].
(ª<ª) Enter the [new] value? -3
[[The typed number]: -3.0 is a [valid integer or float number!]]

-- Provide the (coordinates: xR, yR, zR) of the (Point R)?

* Introduce the 1º [Coordinate(x)].
(ª<ª) Enter the [new] value? 1
[[The typed number]: 1.0 is a [valid integer or float number!]]

* Enter with the 2º [Coordinate(y)].
(ª<ª) Enter the [new] value? 0
[[The typed number]: 0.0 is a [valid integer or float number!]]

* Give the 3º [Coordinate(z)].
(ª<ª) Enter the [new] value? 1
[[The typed number]: 1.0 is a [valid integer or float number!]]

-- Give the [Coordinates: xS, yS, zS] of the [point S]?

* Introduce the 1º [Coordinate(x)].
(ª<ª) Enter the [new] value? 3
[[The typed number]: 3.0 is a [valid integer or float number!]]

* Enter with the 2º [Coordinate(y)].
(ª<ª) Enter the [new] value? -2
[[The typed number]: -2.0 is a [valid integer or float number!]]

* Give the 3º [Coordinate(z)].
(ª<ª) Enter the [new] value? 3
[[The typed number]: 3.0 is a [valid integer or float number!]]

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

-- [THE SCALAR TRIPLE PRODUCT]: a * (b x c) is: -4.0
-- The [VOLUME(V) PARALLELEPIPED]: 4.00
-- The [HEIGHT(H) PARALLELEPIPED]: 0.33
-- The [tetrahedron volume]: 0.67

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

[Warning]: In the new version: 1.2 of the runtoolsvectors.py program was improve the security of datas enter to the user type only *positive integer number* in the menu options. View below using the runtoolsvectors.py program when any user type: -2 or p or @ or J or 0(zero) or key ENTER.

[WELCOME IN USING THE [RUNTOOLSVECTORS.PY] PROGRAM]
[TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] in the [SPACE]]
--[Version: 1.2 -- Stable]--

[INSTRUCTIONS OF USE]

- To find the [value] of the [Dot Product] of two vectors key [1]
- To get the [Cross Product] of two [vectors: A and B] and the [Area(A)] of the Triangle(PQR) key [2]

- To calculate the [value] of the [SineTheta] between [two vectors] A and B key [3]

- To find the [value] of the [Scalar Triple Product] of three vectors A, B, and C key [4]

- To calculate the [angle] between [two vectors] in space key[5]
- To get the [value] of the [CossineTheta] between two vectors A and B key [6]
- To find the [Distance] between two points P and Q key [7]
- To calculate the [Dimensions] of the [Triangle(PQR)] givens the points: P, Q, and R key [8]

- To find the [Area] and [Height] of the [Parallelogram] givens [two vectors]: A and B key [9]

- To get the [Volume(V)],[Height(h)] of the [Parallelepiped and Tetrahedron] given four points: P, Q, R, S key [10]

- To calculate the three [Inner Angles] of the [Triangle] given three points: P,Q,and R key [11]

- To find the [MID-POINT M] OF THE LINE SEGMENT BETWEEN [THE POINTS: P AND Q] key [12]

- To get the [Addition] and [Subraction] between [Two Vectors] A and B key [13]
- To calculate the[VectorA] and [lenght] of givens Points: P, AND Q key [14]
- To determine the [Direction Cosines] and [Direction Angles] givens an Vector A or [two points]: P and Q key [15]

- To find the [Addition] and [Subraction] between [Two Vectors]: A and B multiplyed by scalars: [coeffic1 and coeffic2] key [16]

[§] Select an previous [option] that will used--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
```
  _/§\_
 @>@   [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? @
```
  _/§\_
 @>@   [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
  _/§_
 @>@   [Warning!]: invalid literal for int() with base 10: 'J'
   \~/   [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!]

(º>º) Provide the [new] value? Typed ENTER
  _/§_
 @>@ [Warning!]: invalid literal for int() with base 10: ''
   \~/   [TYPE AN [NEW POSITIVE INTEGER NUMBER]
         [IN NEXT INSTRUCTION -- OK!]

(º>º) Provide the [new] value? 23
[The typed number]: 23 is a [valid integer number!]]

          [NEITHER OF THE PREVIOUS OPTIONS WAS SELECTED]
          [RUN THE RUNTOOLSVECTORS.PY PROGRAM AGAIN -- OK!]

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

[Warning]: The runtoolsvectors.py program will follow only when the user typer any *positive integer number* between 1 to 16 – Ok! If type any positive integer number bigger than 16 the user will have that run the runtoolsvectors.py program again. View the last previous test.

Note: The Components of Vectors and Coordinates of Points will can be: Negative or Zero or Positive; but the options of menu of the runtoolsvectors.py program only can be typed *positive integer number*.

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