**Instructions of as use the runvectors2dim.py program.**

In the Windows operating system:

After the download the **repository** access the runvectors2dim.py program given two clicks and follow the news instructions in display.

In the Linux operating system:

After the download the **repository** access the runvectors2dim.py program. Exist two options to run the runvectors2dim.py program.

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

python3  runvectors2dim.py after key ENTER

2.) Open  the runvectors2dim.py file using the IDLE3 and use the Run ==> Run Module options. After follow the  news instructions in display.

***[Warning]***: When the **runvectors2dim.py program** request type the [components] or [coordinates], always key ENTER after to continue, Ok!

Now will use the runvectors2dim.py program in the examples below.

Example1 – Given the vectors: a = <3,1> and b=<-2,4>, find the Scalar Product a * b of this vectors.
Solution: Use the option: [1] and enter the [components]: a1 = 3, a2 = 1, b1 = -2, and b2 = 4 when requested by  runvectors2dim.py program.

```
 **[ WELCOME IN USING THE [RUNVECTORS2DIM.PY] PROGRAM ]**
**[ TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] in the [PLANE] ]**
                --[Version: 1.3 -- Stable]--


**[INSTRUCTIONS OF USE]**

- To find the [Scalar Product: a * b] between [two vectors] key [1]
- To calculate the [Perimeter(P)], [Height(h), and [Area(A)] of the
  TrianglePQR givens the [points: P, Q, and R] key[2]

- To get the [Area(S) and Height(h) of the [Parallelogram(PQRS)] given
  the [points: P, Q, R, and S] key[3]

- To find the [angle] between [two vectors] in plane key[4]
- To calculate the [value] of the [CossineTheta] between
  [two vectors] a and b key [5]

- To get the [Distance] between [two points] given P and Q key [6]
- To find the three [Inner Angles] of the [Triangle] of
  three points given: P, Q, R key [7]

- To calculate the [midPoint M(xM,yM)] between the points: P and Q key [8]
- To get the [Addition and Subtraction] of [Two Vectors: a and b] key [9]
- To calculate the [Resultant(|R) Vector] key [10]
- To find the[VectorA] and [lenght] of givens Points: P, AND Q key [11]
- To find the [Addition] and [Subraction] between [Two Vectors]
  A and B multiplyed by scalars[coeffic1 and coeffic2] key [12]

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

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

**[TO FIND THE [SCALAR PRODUCT] OF [TWO VECTORS: A and B] IN THE BI-DIMENSIONAL(XY) PLANE]**

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

- 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? 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? 4
**[ [The typed number]: 4.0 is a [valid integer or float number!] ]**

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

*[ANSWER]*

-- The [Vector] of the [terms of the Scalar Product]: vectorAB [-6.0, 4.0]
-- The [Scalar Product(vectorAB)] of the vectors is: -2.00

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

***[Warning]:***

When any user run the ***runvectors2dim.py program*** to solve exercises that provide vertexes A, B, and C to triangles do the folowing:

(xA,yA) = (xP, yP) ==> xP = xA and yP = yA replace the coordinates: xA and yA into the coordinates: xP and yP of the point: P when the runvectors2dim.py program request to enter the coordinates: xP and yP. Of the same manner to the vertexes B and C so:

(xB,yB) = (xQ, yQ) ==> xQ = xB and yQ = yB replace the coordinates: xB and yB into the coordinates: xQ and yQ of the point: Q when the runvectors2dim.py program request to enter the coordinates: xQ and yQ.

(xC,yC) = (xR, yR) ==> xR = xC and yR = yC replace the coordinates: xC and yC into the coordinates: xR and yR of the point: R when the runvectors2dim.py program request to enter the coordinates: xR and yR.

Of the same manner do to the vertexes: A, B, C, and D of the parallelogram. Replace your coordinates when the runvectors2dim.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.

**Example** – Find the dimensions of the triangleABC with vertexes points: A(-1,0), B(2,1), and C(1,-2)

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

Begin using the option[2] and provide the coordinates: xP = -1, yP = 0, xQ = 2, yQ = 1, xR = 1, and yR = -2, when the ***runvectors2dim.py program*** request.

```
 **[ WELCOME IN USING THE [RUNVECTORS2DIM.PY] PROGRAM ]**
**[ TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] in the [PLANE] ]**
                --[Version: 1.3 -- Stable]--


**[INSTRUCTIONS OF USE]**

- To find the [Scalar Product: a * b] between [two vectors] key [1]
- To calculate the [Perimeter(P)], [Height(h), and [Area(A)] of the
  TrianglePQR givens the [points: P, Q, and R] key[2]

- To get the [Area(S) and Height(h) of the [Parallelogram(PQRS)] given
  the [points: P, Q, R, and S] key[3]

- To find the [angle] between [two vectors] in plane key[4]
- To calculate the [value] of the [CossineTheta] between
  [two vectors] a and b key [5]

- To get the [Distance] between [two points] given P and Q key [6]
- To find the three [Inner Angles] of the [Triangle] of
  three points given: P, Q, R key [7]

- To calculate the [midPoint M(xM,yM)] between the points: P and Q key [8]
- To get the [Addition and Subtraction] of [Two Vectors: a and b] key [9]
- To calculate the [Resultant(|R) Vector] key [10]
- To find the[VectorA] and [lenght] of givens Points: P, AND Q key [11]
- To find the [Addition] and [Subraction] between [Two Vectors]
  A and B multiplyed by scalars[coeffic1 and coeffic2] key [12]

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

        (º>º) Provide the [new] value? 2
        **[The typed number]: 1 is a [valid integer number!] ]**

**[TO CALCULATE THE [PERIMETER(P), HEIGHTS(H1,H2,H3),AND AREA(A) OF THE]**
**[[TRIANGLE-PQR] GIVENS THE POINTS: P, Q, AND R IN THE BI-DIMENSIONAL(XY)
    PLANE]**


        -- Enter the [coordinates]: (xP, yP) 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? 0
**[ [The typed number]: 0.0 is a [valid integer or float number!] ]**

-- Introduce the [coordinates]: (xQ, yQ) 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!] ]**

-- Provide the [coordinates]: (xR, yR) 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? -2
**[ [The typed number]: -2.0 is a [valid integer or float number!] ]**

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

*[ANSWER]*

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

-- The [sideA of the triangle(PQR)] is: 3.16
-- The [sideB of the triangle(PQR)] is: 2.83
-- The [sideC of the triangle(PQR)] is: 3.16

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

-- The [Scalar Product(PQºQR)] is: -6.00
-- The [Scalar Product(QRºRP)] is: -4.00
-- The [Scalar Product(RPºPQ)] is: -4.00

-- The [Perimeter] of the [triangle(PQR)] is 9.15
-- The [Height(h1) relative as sideQR] is 2.53
-- The [Height(h2) relative as sideRP] is 2.83
-- The [Height(h3) relative as sidePQ] is 2.53
-- The [Area(A)] of the [triangle(PQR)] is 4.00

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

To calculate all the threes Inner angles of the triangle type the option [7] when requested by runvectors2dim.py program.

**[ WELCOME IN USING THE [RUNVECTORS2DIM.PY] PROGRAM ]**
**[ TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] in the [PLANE] ]**
--[Version: 1.3 -- Stable]--

**[INSTRUCTIONS OF USE]**

- To find the [Scalar Product: a * b] between [two vectors] key [1]
- To calculate the [Perimeter(P)], [Height(h), and [Area(A)] of the TrianglePQR givens the [points: P, Q, and R] key[2]

- To get the [Area(S) and Height(h) of the [Parallelogram(PQRS)] given the [points: P, Q, R, and S] key[3]

- To find the [angle] between [two vectors] in plane key[4]
- To calculate the [value] of the [CossineTheta] between [two vectors] a and b key [5]

- To get the [Distance] between [two points] given P and Q key [6]
- To find the three [Inner Angles] of the [Triangle] of three points given: P, Q, R key [7]

- To calculate the [midPoint M(xM,yM)] between the points: P and Q key [8]
- To get the [Addition and Subtraction] of [Two Vectors: a and b] key [9]
- To calculate the [Resultant(|R) Vector] key [10]
- To find the[VectorA] and [lenght] of givens Points: P, AND Q key [11]
- To find the [Addition] and [Subraction] between [Two Vectors] A and B multiplyed by scalars[coeffic1 and coeffic2] key [12]

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

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

**[ TO FIND THE THREES [INNER ANGLES] OF THE [TRIANGLE(PQR)] ]**

-- Enter the [coordinates]: (xP, yP) 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? 0
**[ [The typed number]: 0.0 is a [valid integer or float number!] ]**

-- Introduce the [coordinates]: (xQ, yQ) 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!] ]**

-- Provide the [coordinates]: (xR, yR) 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? -2
**[ [The typed number]: -2.0 is a [valid integer or float number!] ]**

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

*[ANSWER]*

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

- The Scalar Product: [b * c] is: 4.00
- The value of the [ANGLE ALPHA] was calculate is: 63.43

- The [vectorA]=vectorQR [-1.0, -3.0]
- The [vectorC]=vectorQP [-3.0, -1.0]

- The Scalar Product: [a * c] is: 6.00
- The value of the [ANGLE BETA] was calculate is: 53.13

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

- The Scalar Product: [a * b] is: 4.00
- The value of the [ANGLE GAMA] was calculate is: 63.43

-- The triangle is [Isosceles]!

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

--[END CALCULUS-OK!]--

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

Example2 – Find the measures of the sides: sideA, sideB, and sideC, perimeter(P), height(h1,h2.h3), area(A), Scalar Products: c*a, b*c, a*b, and the inner angles of the Triangle whose vertexes are P(-6,0), Q(10,-5), and R(-2, 4).
Solution: To find the sides: sideA, sideB, and sideC as too the perimeter(P), area(A) key in the option: [2] and after ENTER. Wait the runvectors2dim.py program request enter the coodinates of the points: P, Q, and R according viewed below.

**[ WELCOME IN USING THE [RUNVECTORS2DIM.PY] PROGRAM ]**
**[ TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] in the [PLANE] ]**
--[Version: 1.3 -- Stable]--

**[INSTRUCTIONS OF USE]**

- To find the [Scalar Product: a * b] between [two vectors] key [1]
- To calculate the [Perimeter(P)], [Height(h), and [Area(A)] of the TrianglePQR givens the [points: P, Q, and R] key[2]

- To get the [Area(S) and Height(h) of the [Parallelogram(PQRS)] given the [points: P, Q, R, and S] key[3]

- To find the [angle] between [two vectors] in plane key[4]
- To calculate the [value] of the [CossineTheta] between [two vectors] a and b key [5]

- To get the [Distance] between [two points] given P and Q key [6]
- To find the three [Inner Angles] of the [Triangle] of three points given: P, Q, R key [7]

- To calculate the [midPoint M(xM,yM)] between the points: P and Q key [8]
- To get the [Addition and Subtraction] of [Two Vectors: a and b] key [9]
- To calculate the [Resultant(|R) Vector] key [10]
- To find the[VectorA] and [lenght] of givens Points: P, AND Q key [11]
- To find the [Addition] and [Subraction] between [Two Vectors] A and B multiplyed by scalars[coeffic1 and coeffic2] key [12]

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

(º>º) Provide the [new] value? 2
**[The typed number]: 7 is a [valid integer number!] ]**

**[TO CALCULATE THE [PERIMETER(P), HEIGHTS(H1,H2,H3),AND AREA(A) OF THE]**
**[[TRIANGLE-PQR] GIVENS THE POINTS: P, Q, AND R IN THE BI-DIMENSIONAL(XY) PLANE]**

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

* Introduce the 1º [Coordinate(x)].
(ª<ª) Enter the [new] value? -6
**[ [The typed number]: -6.0 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!] ]**

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

* Introduce the 1º [Coordinate(x)].
(ª<ª) Enter the [new] value? 10
**[ [The typed number]: 10.0 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!] ]**

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

* 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? 4
**[ [The typed number]: 4.0 is a [valid integer or float number!] ]**

- The (Point P): P (-6.0, 0.0)
- The (Point Q): Q (10.0, -5.0)
- The (Point R): R (-2.0, 4.0)

*[ANSWER]*

-- The [vectorA] = vectorQR [-12.0, 9.0]
-- The [vectorB] = vectorRP [-4.0, -4.0]
-- The [vectorC] = vectorPQ [16.0, -5.0]

-- The [sideA of the triangle(PQR)] is: 15.00
-- The [sideB of the triangle(PQR)] is: 5.66
-- The [sideC of the triangle(PQR)] is: 16.76

-- The [terms] of the [Scalar Product(PQºQR)] is: [-192.0, -45.0]
-- The [terms] of the [Scalar Product(QRºRP)] is: [48.0, -36.0]
-- The [terms] of the [Scalar Product(RPºPQ)] is: [-64.0, 20.0]

-- The [Scalar Product(PQºQR)] is: -237.00
-- The [Scalar Product(QRºRP)] is: 12.00
-- The [Scalar Product(RPºPQ)] is: -44.00

-- The [Perimeter] of the [triangle(PQR)] is 37.42
-- The [Height(h1) relative as sideQR] is 5.60
-- The [Height(h2) relative as sideRP] is 14.85
-- The [Height(h3) relative as sidePQ] is 5.01
-- The [Area(A)] of the [triangle(PQR)] is 42.00

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

To calculate all the threes Inner angles of the triangle type the option [7] when requested by runvectors2dim.py program.

**[ WELCOME IN USING THE [RUNVECTORS2DIM.PY] PROGRAM ]**
**[ TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] in the [PLANE] ]**
--[Version: 1.3 -- Stable]--

**[INSTRUCTIONS OF USE]**

- To find the [Scalar Product: a * b] between [two vectors] key [1]
- To calculate the [Perimeter(P)], [Height(h), and [Area(A)] of the TrianglePQR givens the [points: P, Q, and R] key[2]

- To get the [Area(S) and Height(h) of the [Parallelogram(PQRS)] given the [points: P, Q, R, and S] key[3]

- To find the [angle] between [two vectors] in plane key[4]
- To calculate the [value] of the [CossineTheta] between [two vectors] a and b key [5]

- To get the [Distance] between [two points] given P and Q key [6]

- To find the three [Inner Angles] of the [Triangle] of
  three points given: P, Q, R key [7]

- To calculate the [midPoint M(xM,yM)] between the points: P and Q key [8]
- To get the [Addition and Subtraction] of [Two Vectors: a and b] key [9]
- To calculate the [Resultant(|R) Vector] key [10]
- To find the[VectorA] and [lenght] of givens Points: P, AND Q key [11]
- To find the [Addition] and [Subraction] between [Two Vectors]
  A and B multiplyed by scalars[coeffic1 and coeffic2] key [12]

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

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

**[ TO FIND THE THREES [INNER ANGLES] OF THE [TRIANGLE(PQR)] ]**

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

* Introduce the 1º [Coordinate(x)].
(ª<ª) Enter the [new] value? -6
**[ [The typed number]: -6.0 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!] ]**

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

* Introduce the 1º [Coordinate(x)].
(ª<ª) Enter the [new] value? 10
**[ [The typed number]: 10.0 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!] ]**

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

* 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? 4
**[ [The typed number]: 4.0 is a [valid integer or float number!] ]**

- The (Point P): P (-6.0, 0.0)
- The (Point Q): Q (10.0, -5.0)
- The (Point R): R (-2.0, 4.0)

*[ANSWER]*

- The [vectorB]=vectorPR [4.0, 4.0]
- The [vectorC]=vectorPQ [16.0, -5.0]

- The Scalar Product: [b * c] is: 44.00
- The value of the [ANGLE ALPHA] was calculate is: 62.35

- The [vectorA]=vectorQR [-12.0, 9.0]
- The [vectorC]=vectorQP [-16.0, 5.0]

- The Scalar Product: [a * c] is: 237.00
- The value of the [ANGLE BETA] was calculate is: 19.52

- The [vectorA]=vectorRQ [12.0, -9.0]
- The [vectorB]=vectorRP [-4.0, -4.0]

- The Scalar Product: [a * b] is: -12.00
- The value of the [ANGLE GAMA] was calculate is: 98.13

-- The triangle is [Scalene]!

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

--[END CALCULUS-OK!]--

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

Example3 – Find the cosine of the angle between the vectors a = i – 3j and b = -4i + j.
Solution: Use the option: [5] and enter the [components]: a1 = 1, a2 = -3, b1 = -4, and b2 = 1 when requested by runvectors2dim.py program.

**[ WELCOME IN USING THE [RUNVECTORS2DIM.PY] PROGRAM ]**
**[ TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] in the [PLANE] ]**
--[Version: 1.3 -- Stable]--

**[INSTRUCTIONS OF USE]**

- To find the [Scalar Product: a * b] between [two vectors] key [1]
- To calculate the [Perimeter(P)], [Height(h), and [Area(A)] of the TrianglePQR givens the [points: P, Q, and R] key[2]

- To get the [Area(S) and Height(h) of the [Parallelogram(PQRS)] given the [points: P, Q, R, and S] key[3]

- To find the [angle] between [two vectors] in plane key[4]
- To calculate the [value] of the [CossineTheta] between [two vectors] a and b key [5]

- To get the [Distance] between [two points] given P and Q key [6]
- To find the three [Inner Angles] of the [Triangle] of three points given: P, Q, R key [7]

- To calculate the [midPoint M(xM,yM)] between the points: P and Q key [8]
- To get the [Addition and Subtraction] of [Two Vectors: a and b] key [9]
- To calculate the [Resultant(|R) Vector] key [10]
- To find the[VectorA] and [lenght] of givens Points: P, AND Q key [11]
- To find the [Addition] and [Subraction] between [Two Vectors] A and B multiplyed by scalars[coeffic1 and coeffic2] key [12]

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

(º>º) Provide the [new] value? 5
**[The typed number]: 7 is a [valid integer number!] ]**

**[TO CALCULATE THE [VALUE] OF THE [COSSINE THETA] BETWEEN [TWO VECTORS] GIVEN: 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!] ]**

- 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? 1
**[ [The typed number]: 1.0 is a [valid integer or float number!] ]**

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

*[ANSWER]*

- The [VectorA*B]: [-4.0, -3.0]
- The [length] of a |vectorA|: 3.16
- The [length] of a |vectorB|: 4.12
- The [Scalar Product] of the [VectorA*B] is: -7.00

- The value of the [COSINE THETA IN RADIANS] calculated is: -0.54

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

Example4 – Find the [distance] between the points: P(3,-5), and Q(2,8).
Solution: Use the option: [6] and after provide the coordinates of the points when requested by runvectors2dim.py program.

**[ WELCOME IN USING THE [RUNVECTORS2DIM.PY] PROGRAM ]**
**[ TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] in the [PLANE] ]**
--[Version: 1.3 -- Stable]--

**[INSTRUCTIONS OF USE]**

- To find the [Scalar Product: a * b] between [two vectors] key [1]
- To calculate the [Perimeter(P)], [Height(h), and [Area(A)] of the
  TrianglePQR givens the [points: P, Q, and R] key[2]

- To get the [Area(S) and Height(h) of the [Parallelogram(PQRS)] given
  the [points: P, Q, R, and S] key[3]

- To find the [angle] between [two vectors] in plane key[4]
- To calculate the [value] of the [CossineTheta] between
  [two vectors] a and b key [5]

- To get the [Distance] between [two points] given P and Q key [6]
- To find the three [Inner Angles] of the [Triangle] of
  three points given: P, Q, R key [7]

- To calculate the [midPoint M(xM,yM)] between the points: P and Q key [8]
- To get the [Addition and Subtraction] of [Two Vectors: a and b] key [9]
- To calculate the [Resultant(|R) Vector] key [10]
- To find the[VectorA] and [lenght] of givens Points: P, AND Q key [11]
- To find the [Addition] and [Subraction] between [Two Vectors]
  A and B multiplyed by scalars[coeffic1 and coeffic2] key [12]

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

(º>º) Provide the [new] value? 6
**[The typed number]: 7 is a [valid integer number!] ]**

**[TO GET THE [DISTANCE(D)] BETWEEN ANY [TWO POINTS] GIVEN P AND Q]**

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

* 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? -5
**[ [The typed number]: -5.0 is a [valid integer or float number!] ]**

-- Introduce the [coordinates]: (xQ, yQ) 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? 8
**[ [The typed number]: 8.0 is a [valid integer or float number!] ]**

- The (Point P): P (3.0, -5.0)
- The (Point Q): Q (2.0, 8.0)

*[ANSWER]*

-- The [vectorPQ]: vectorPQ [-1.0, 13.0]
-- The [Quadratic Components] of the [vectorPQ]: VectorQUAD [1.0, 169.0]

-- The [Distance(D)] geted between Two (Points) P and Q] is: 13.04

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

Example5 – Find the Area(A) and Height(h) of the parallelogram whose vertexes are the points: P(-1,2), Q(2,0), R(7,1), and S(4,3).
Solution: Use the option: [3] and after provide the [coordinates] of the points when requested by runvectors2dim.py program.

**[ WELCOME IN USING THE [RUNVECTORS2DIM.PY] PROGRAM ]**
**[ TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] in the [PLANE] ]**
--[Version: 1.3 -- Stable]--

**[INSTRUCTIONS OF USE]**

- To find the [Scalar Product: a * b] between [two vectors] key [1]
- To calculate the [Perimeter(P)], [Height(h), and [Area(A)] of the TrianglePQR givens the [points: P, Q, and R] key[2]

- To get the [Area(S) and Height(h) of the [Parallelogram(PQRS)] given the [points: P, Q, R, and S] key[3]

- To find the [angle] between [two vectors] in plane key[4]
- To calculate the [value] of the [CossineTheta] between [two vectors] a and b key [5]

- To get the [Distance] between [two points] given P and Q key [6]
- To find the three [Inner Angles] of the [Triangle] of three points given: P, Q, R key [7]

- To calculate the [midPoint M(xM,yM)] between the points: P and Q key [8]
- To get the [Addition and Subtraction] of [Two Vectors: a and b] key [9]
- To calculate the [Resultant(|R) Vector] key [10]
- To find the[VectorA] and [lenght] of givens Points: P, AND Q key [11]
- To find the [Addition] and [Subraction] between [Two Vectors] A and B multiplyed by scalars[coeffic1 and coeffic2] key [12]

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

(º>º) Provide the [new] value? 3
**[The typed number]: 7 is a [valid integer number!] ]**

**[TO GET THE [AREA(S) AND HEIGHT(H) OF THE [PARALLELOGRAM(PQRS)] GIVEN ]**
**[THE POINTS: P, Q, R AND S IN THE BI-DIMENSIONAL(XY) PLANE]**

-- Enter the [coordinates]: (xP, yP) 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!] ]**

-- Introduce the [coordinates]: (xQ, yQ) 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? 0
**[ [The typed number]: 0.0 is a [valid integer or float number!] ]**

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

* Introduce the 1º [Coordinate(x)].
(ª<ª) Enter the [new] value? 7
**[ [The typed number]: 7.0 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!] ]**

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

* 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? 3
**[ [The typed number]: 3.0 is a [valid integer or float number!] ]**

- The (Point P): P (-1.0, 2.0)
- The (Point Q): Q (2.0, 0.0)
- The (Point R): R (7.0, 1.0)
- The (Point S): S (4.0, 3.0)

*[ANSWER]*

-- The [vectorPQ]:vectorPQ [3.0, -2.0]
-- The [vectorPS]:vectorPS [5.0, 1.0]

-- The [sideA] relative as |vectorPQ|: 3.61
-- The [sideB] relative as |vectorPS|: 5.10
-- The [Perimeter(P)] is: 17.41

-- The [terms] of the Scalar Product(vectorPSºPQ)] is: [15.0, -2.0]
-- The [Scalar Product(PQºPS)] is: 13.0
-- The Cossine of theta: 0.71
-- The Theta angle is: 45.00
-- The [Height(h)] relative as [sideA]=|vectorPQ| is: 2.55
-- The [Area(S)] of the [Parallelogram(PQRS)]: 13.00

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

Example6 – Find the addition and subtraction of the vectors a = -11i + 4j and b = 3i - j.
Solution: Use the option: [9] and enter the [components]: a1 = -11, a2 = 4, b1 = 3, and b2 = -1 when requested by runvectors2dim.py program.

```
  **[ WELCOME IN USING THE [RUNVECTORS2DIM.PY] PROGRAM ]**
**[ TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] in the [PLANE] ]**
                --[Version: 1.3 -- Stable]--

**[INSTRUCTIONS OF USE]**

- To find the [Scalar Product: a * b] between [two vectors] key [1]
- To calculate the [Perimeter(P)], [Height(h), and [Area(A)] of the
  TrianglePQR givens the [points: P, Q, and R] key[2]

- To get the [Area(S) and Height(h) of the [Parallelogram(PQRS)] given
  the [points: P, Q, R, and S] key[3]

- To find the [angle] between [two vectors] in plane key[4]
- To calculate the [value] of the [CossineTheta] between
  [two vectors] a and b key [5]

- To get the [Distance] between [two points] given P and Q key [6]
- To find the three [Inner Angles] of the [Triangle] of
  three points given: P, Q, R key [7]

- To calculate the [midPoint M(xM,yM)] between the points: P and Q key [8]
- To get the [Addition and Subtraction] of [Two Vectors: a and b] key [9]
- To calculate the [Resultant(|R) Vector] key [10]
- To find the[VectorA] and [lenght] of givens Points: P, AND Q key [11]
- To find the [Addition] and [Subraction] between [Two Vectors]
  A and B multiplyed by scalars[coeffic1 and coeffic2] key [12]

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

(º>º) Provide the [new] value? 9
**[The typed number]: 7 is a [valid integer number!] ]**


**[TO FIND THE [ADDITION AND SUBTRACTION] OF [TWO VECTORS: A and B] IN THE
BI-DIMENSIONAL(XY) PLANE]**


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

- Enter the 1º [Component(x)]!
(ª<ª) Enter the [new] value? -11
**[ [The typed number]: -11.0 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!] ]**


- 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? -1
**[ [The typed number]: -1.0 is a [valid integer or float number!] ]**

-- The [vectorA]: vectorA [-11.0, 4.0]
-- The [vectorB]: vectorB [3.0, -1.0]

*[ANSWER]*

- The [Addition]: vector[a+b]: [-8.0, 3.0]
- The [Subtraction]: vector[a-b]: [-14.0, 5.0]

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

Example7 – Find the angle between the vectors a = -3i + 5 and b = 7i - 2j.
Solution: Use the option: [4] and enter the [components]: a1 = -3, a2 = 5, b1 = 7, and b2 = -2 when requested by runvectors2dim.py program.

**[ WELCOME IN USING THE [RUNVECTORS2DIM.PY] PROGRAM ]**
**[ TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] in the [PLANE] ]**
--[Version: 1.3 -- Stable]--

**[INSTRUCTIONS OF USE]**

- To find the [Scalar Product: a * b] between [two vectors] key [1]
- To calculate the [Perimeter(P)], [Height(h), and [Area(A)] of the
TrianglePQR givens the [points: P, Q, and R] key[2]

- To get the [Area(S) and Height(h) of the [Parallelogram(PQRS)] given
the [points: P, Q, R, and S] key[3]

- To find the [angle] between [two vectors] in plane key[4]
- To calculate the [value] of the [CossineTheta] between
[two vectors] a and b key [5]

- To get the [Distance] between [two points] given P and Q key [6]
- To find the three [Inner Angles] of the [Triangle] of
three points given: P, Q, R key [7]

- To calculate the [midPoint M(xM,yM)] between the points: P and Q key [8]
- To get the [Addition and Subtraction] of [Two Vectors: a and b] key [9]
- To calculate the [Resultant(|R) Vector] key [10]
- To find the[VectorA] and [lenght] of givens Points: P, AND Q key [11]
- To find the [Addition] and [Subraction] between [Two Vectors]
A and B multiplyed by scalars[coeffic1 and coeffic2] key [12]

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

(º>º) Provide the [new] value? 4
**[The typed number]: 7 is a [valid integer number!] ]**

**[WILL FIND THE [VALUE] OF THE [THETA ANGLE] BETWEEN
[TWO VECTORS] GIVEN: A AND B]**

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

- 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? 5
**[ [The typed number]: 5.0 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? 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!] ]**

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

*[ANSWER]*

- The [terms] of the [VectorA*B] ís: [-21.0, -10.0]
- The [length] of a |vectorA|: 5.83
- The [length] of a |vectorB|: 7.28
- The [Scalar Product] is: -31.00

- The value of the [THETA ANGLE IN DEGREES] was calculate is: 136.91

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

Example8 – The three displacement vectors A, B, and C are specified by their magnitudes A = 10, B = 7, and C = 8, respectively, and by their respective direction angles with the horizontal direction θ = 35º, β = -110º, and φ = 30º. The physical units of the magnitudes are centimeters. Find the Resultant(|R) Vector.
Solution: Use the option: [10] and enter the datas problem when requested by runvectors2dim.py program.

**[ WELCOME IN USING THE [RUNVECTORS2DIM.PY] PROGRAM ]**
**[ TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] in the [PLANE] ]**
--[Version: 1.3 -- Stable]--

**[INSTRUCTIONS OF USE]**

- To find the [Scalar Product: a * b] between [two vectors] key [1]
- To calculate the [Perimeter(P)], [Height(h), and [Area(A)] of the TrianglePQR givens the [points: P, Q, and R] key[2]

- To get the [Area(S) and Height(h) of the [Parallelogram(PQRS)] given the [points: P, Q, R, and S] key[3]

- To find the [angle] between [two vectors] in plane key[4]
- To calculate the [value] of the [CossineTheta] between [two vectors] a and b key [5]

- To get the [Distance] between [two points] given P and Q key [6]
- To find the three [Inner Angles] of the [Triangle] of
  three points given: P, Q, R key [7]

- To calculate the [midPoint M(xM,yM)] between the points: P and Q key [8]
- To get the [Addition and Subtraction] of [Two Vectors: a and b] key [9]
- To calculate the [Resultant(|R) Vector] key [10]
- To find the[VectorA] and [lenght] of givens Points: P, AND Q key [11]
- To find the [Addition] and [Subraction] between [Two Vectors]
  A and B multiplyed by scalars[coeffic1 and coeffic2] key [12]

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

(º>º) Provide the [new] value? 10
**[The typed number]: 7 is a [valid integer number!] ]**

**[TO GET THE VALUE OF THE RESULTANT(|R) VECTOR]**

+ How much [Vectors] will necessary to get the [Resultant(R) Vector]?

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

**[Warning]**
- All the [Vectorials Components] will can be:
  [positive] or [negative] or Zero!

What are the arguments: [angle] and [radius] of the( 1 )[vector]?

- Enter with the [new value] of the [angle] in degree?
(ª<ª) Enter the [new] value? 35
**[ [The typed number]: 35.0 is a [valid float number!] ]**

- Provide the [new value] of the [radius] of vector?
/º<º\ Type a [new] value? 10
**[The typed number]: 10.0 is a [valid float number!] ]**

_-_ . . .[Running]. . . _-_

* [answer] *

- The component of the  1 vector: Vx( 1 ) =  8.19
- The component of the  1 vector: Vy( 1 ) =  5.74

--[Warning]:
**[ THE [PREVIOUS COMPONENTS]: Vx(1) AND Vy(1) BEEN CALCULED; BUT ]**
**[ [NO EXIST RESULTANT(R) VECTOR] TO A ONLY VECTOR!]**

+ What are the arguments: [angle] and [radius] of the( 2 )[vector]?

- Enter with the [new value] of the [angle] in degree?
(ª<ª) Enter the [new] value? -110
**[ [The typed number]: -110.0 is a [valid float number!] ]**

- Provide the [new value] of the [radius] of vector?
/º<º\ Type a [new] value? 7
**[The typed number]: 7.0 is a [valid float number!] ]**

_-_ . . .[Running]. . . _-_

* [answer] *

- The component of the  2 vector: Vx( 2 ) =  -2.39
- The component of the  2 vector: Vy( 2 ) =  -6.58

+ What are the arguments: [angle] and [radius] of the( 3 )[vector]?

- Enter with the [new value] of the [angle] in degree?
(ª<ª) Enter the [new] value? 30
**[ [The typed number]: 30.0 is a [valid float number!] ]**

- Provide the [new value] of the [radius] of vector?
/º<º\ Type a [new] value? 8
**[The typed number]: 8.0 is a [valid float number!] ]**

_-_ . . .[Running]. . . _-_

* [answer] *

- The component of the  3 vector: Vx( 3 ) =  6.93
- The component of the  3 vector: Vy( 3 ) =  4.00

+ The sum of all the components of x_axis: Rx =  12.73
+ The sum of all the components of y_axis: Ry =  3.16

+ The resultant vector: [Resultant(R)_Vector] =  13.11
+ The theta angle [theta_degrees] =  13.94

**[End Processing of the [ RESULTANTVECTOR.PY FUNCTION ]--Ok! ]**

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

Example9 – Givens the vectors: a = 2i + 3j  and b = 5i -j  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[12] and wait the display present instructions to select the options: [1] or [2]. Follow type the option[1] and provide the [components]; a1 = 2, a2 = 3, b1 =5, and b2 = -1. 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 [RUNVECTORS2DIM.PY] PROGRAM ]**
**[ TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] in the [PLANE] ]**
--[Version: 1.3 -- Stable]--

**[INSTRUCTIONS OF USE]**

- To find the [Scalar Product: a * b] between [two vectors] key [1]
- To calculate the [Perimeter(P)], [Height(h), and [Area(A)] of the
  TrianglePQR givens the [points: P, Q, and R] key[2]

- To get the [Area(S) and Height(h) of the [Parallelogram(PQRS)] given
  the [points: P, Q, R, and S] key[3]

- To find the [angle] between [two vectors] in plane key[4]
- To calculate the [value] of the [CossineTheta] between
  [two vectors] a and b key [5]

- To get the [Distance] between [two points] given P and Q key [6]
- To find the three [Inner Angles] of the [Triangle] of
  three points given: P, Q, R key [7]

- To calculate the [midPoint M(xM,yM)] between the points: P and Q key [8]
- To get the [Addition and Subtraction] of [Two Vectors: a and b] key [9]
- To calculate the [Resultant(|R) Vector] key [10]
- To find the[VectorA] and [lenght] of givens Points: P, AND Q key [11]
- To find the [Addition] and [Subraction] between [Two Vectors]
  A and B multiplyed by scalars[coeffic1 and coeffic2] key [12]

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

(º>º) Provide the [new] value? 12
**[The typed number]: 7 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] type [1].
- To introduce the [Coordinates] of the [points] 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? 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!] ]**

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

- Enter the 1º [Component(x)]!
(ª<ª) Enter the [new] value? 5
**[ [The typed number]: 5.0 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!] ]**

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

- 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 [product]: [vectorA]*[scalar(coeffic1)]=vectorAcoeffic1 [2.0, 3.0]
+ The [product]: [vectorB]*[scalar(coeffic2)]=vectorBcoeffic2 [5.0, -1.0]

-- The [Addition]=[vectorA(coeffic1)+vectorB(coeffic2)] [7.0, 2.0]
-- The [Subtraction]=[vectorA(coeffic1)-vectorB(coeffic2)] [-3.0, 4.0]

-- The [length] of the |vectorAddition| is: 7.28
-- The [length] of the |vectorSubtraction| is: 5.00

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

After the processing previous the [ vectors and modules ]: a + b, a – b, |a + b|, |a – b| was find.

Now to get the vector: 2a – 3b and module: |2a -3b| , run the runtoolsvectors.py program again and key the option[12] and wait the display present instructions to select the options: [1] or [2]. Follow type the option[1] and provide again the [components]; a1 = 2, a2 = 3, b1 = 5, and b2 = -1. 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 [RUNVECTORS2DIM.PY] PROGRAM ]**
**[ TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] in the [PLANE] ]**
--[Version: 1.3 -- Stable]--

**[INSTRUCTIONS OF USE]**

- To find the [Scalar Product: a * b] between [two vectors] key [1]
- To calculate the [Perimeter(P)], [Height(h), and [Area(A)] of the
  TrianglePQR givens the [points: P, Q, and R] key[2]

- To get the [Area(S) and Height(h) of the [Parallelogram(PQRS)] given
  the [points: P, Q, R, and S] key[3]

- To find the [angle] between [two vectors] in plane key[4]
- To calculate the [value] of the [CossineTheta] between
  [two vectors] a and b key [5]

- To get the [Distance] between [two points] given P and Q key [6]
- To find the three [Inner Angles] of the [Triangle] of
  three points given: P, Q, R key [7]

- To calculate the [midPoint M(xM,yM)] between the points: P and Q key [8]
- To get the [Addition and Subtraction] of [Two Vectors: a and b] key [9]

- To calculate the [Resultant(|R) Vector] key [10]
- To find the[VectorA] and [lenght] of givens Points: P, AND Q key [11]
- To find the [Addition] and [Subraction] between [Two Vectors]
  A and B multiplyed by scalars[coeffic1 and coeffic2] key [12]

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

(º>º) Provide the [new] value? 12
**[The typed number]: 7 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] type [1].
- To introduce the [Coordinates] of the [points] 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? 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!] ]**

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

- Enter the 1º [Component(x)]!
(ª<ª) Enter the [new] value? 5
**[ [The typed number]: 5.0 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!] ]**

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

- 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 [product]: [vectorA]*[scalar(coeffic1)]=vectorAcoeffic1 [4.0, 6.0]
+ The [product]: [vectorB]*[scalar(coeffic2)]=vectorBcoeffic2 [-15.0, 3.0]

-- The [Addition]=[vectorA(coeffic1)+vectorB(coeffic2)] [-11.0, 9.0]
-- The [Subtraction]=[vectorA(coeffic1)-vectorB(coeffic2)] [19.0, 3.0]

-- The [length] of the |vectorAddition| is: 14.21
-- The [length] of the |vectorSubtraction| is: 19.24

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

Example10 – Givens the points: P(2, 0), Q(0, 3), and R(3, 4) find the [vectors and modules]: a + b, a – b, |a + b|, and |a – b|.
Solution – Begin the runtoolsvectors.py program and key the option[12] and wait the display present instructions to select the options: [1] or [2]. Follow type the option[2] and provide the [coordinates]; xP = 2, yP = 0, xQ = 0, yQ = 3, xR = 3 and yR = 4. 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 [RUNVECTORS2DIM.PY] PROGRAM ]**
**[ TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] in the [PLANE] ]**
--[Version: 1.3 -- Stable]--

**[INSTRUCTIONS OF USE]**

- To find the [Scalar Product: a * b] between [two vectors] key [1]
- To calculate the [Perimeter(P)], [Height(h), and [Area(A)] of the
  TrianglePQR givens the [points: P, Q, and R] key[2]

- To get the [Area(S) and Height(h) of the [Parallelogram(PQRS)] given
  the [points: P, Q, R, and S] key[3]

- To find the [angle] between [two vectors] in plane key[4]
- To calculate the [value] of the [CossineTheta] between
  [two vectors] a and b key [5]

- To get the [Distance] between [two points] given P and Q key [6]
- To find the three [Inner Angles] of the [Triangle] of
  three points given: P, Q, R key [7]

- To calculate the [midPoint M(xM,yM)] between the points: P and Q key [8]
- To get the [Addition and Subtraction] of [Two Vectors: a and b] key [9]
- To calculate the [Resultant(|R) Vector] key [10]
- To find the[VectorA] and [lenght] of givens Points: P, AND Q key [11]
- To find the [Addition] and [Subraction] between [Two Vectors]
  A and B multiplyed by scalars[coeffic1 and coeffic2] key [12]

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

(º>º) Provide the [new] value? 12
**[The typed number]: 7 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] type [1].
- To introduce the [Coordinates] of the [points] type [2].
(º>º) Provide the [new] value? 2
**[The typed number]: 2 is a [valid integer number!] ]**

- Give the [Coordinates] of the [givens points: P and Q].

-- Enter the [coordinates]: (xP, yP) 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? 0
**[ [The typed number]: 0.0 is a [valid integer or float number!] ]**

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

* 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? 3
**[ [The typed number]: 3.0 is a [valid integer or float number!] ]**

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

*[ANSWER]*

-- The [vectorA]: vectorA=vectorPQ [-2.0, 3.0]
-- The [lenght] of the vectorA=|vectorA|:  3.61

- Enter the [Coordinates] of the [givens points: P and R].

-- Enter the [coordinates]: (xP, yP) 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? 0
**[ [The typed number]: 0.0 is a [valid integer or float number!] ]**

-- Provide the [coordinates]: (xR, yR) 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? 4
**[ [The typed number]: 4.0 is a [valid integer or float number!] ]**

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

*[ANSWER]*

-- The [vectorB]: vectorB=vectorPR [1.0, 4.0]
-- The [lenght] of the vectorB=|vectorB|:  4.12

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

- 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 [product]: [vectorA]*[scalar(coeffic1)]=vectorAcoeffic1 [-2.0, 3.0]
 + The [product]: [vectorB]*[scalar(coeffic2)]=vectorBcoeffic2 [1.0, 4.0]

-- The [Addition]=[vectorA(coeffic1)+vectorB(coeffic2)] [-1.0, 7.0]
-- The [Subtraction]=[vectorA(coeffic1)-vectorB(coeffic2)] [-3.0, -1.0]

-- The [length] of the |vectorAddition| is: 7.07
-- The [length] of the |vectorSubtraction| is: 3.16

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

**[Warning]:** In the new version: 1.3 of the runvectors2dim.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 runvectors2dim.py program when any user type: -2 or p or @ or J  or 0(zero) or key ENTER.

**[ WELCOME IN USING THE [RUNVECTORS2DIM.PY] PROGRAM ]**
**[ TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] in the [PLANE] ]**
--[Version: 1.3 -- Stable]--

**[INSTRUCTIONS OF USE]**

- To find the [Scalar Product: a * b] between [two vectors] key [1]
- To calculate the [Perimeter(P)], [Height(h), and [Area(A)] of the
  TrianglePQR givens the [points: P, Q, and R] key[2]

- To get the [Area(S) and Height(h) of the [Parallelogram(PQRS)] given
  the [points: P, Q, R, and S] key[3]

- To find the [angle] between [two vectors] in plane key[4]
- To calculate the [value] of the [CossineTheta] between
  [two vectors] a and b key [5]

- To get the [Distance] between [two points] given P and Q key [6]

- To find the three [Inner Angles] of the [Triangle] of
  three points given: P, Q, R key [7]

- To calculate the [midPoint M(xM,yM)] between the points: P and Q key [8]
- To get the [Addition and Subtraction] of [Two Vectors: a and b] key [9]
- To calculate the [Resultant(|R) Vector] key [10]
- To find the[VectorA] and [lenght] of givens Points: P, AND Q key [11]
- To find the [Addition] and [Subraction] between [Two Vectors]
  A and B multiplyed by scalars[coeffic1 and coeffic2] key [12]

[§] 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 RUNVECTORS2DIM.PY PROGRAM AGAIN -- OK! ]

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

**[Warning]:** The runvectors2dim.py program will follow only when the user typer any *positive integer number* between 1 to 12 – Ok! If type any positive integer number bigger than 12 the user will have that run the runvectors2dim.py program again. View the last previous test.

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

**[TO FIND THE [SCALAR PRODUCT] OF [TWO VECTORS: A and B] IN THE BI-DIMENSIONAL(XY) PLANE]**

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

- 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? 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? 4
**[ [The typed number]: 4.0 is a [valid integer or float number!] ]**

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

*[ANSWER]*

-- The [Vector] of the [terms of the Scalar Product]: vectorAB [-6.0, 4.0]
-- The [Scalar Product(vectorAB)] of the vectors is: -2.00

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

(New) Example11 – Find the components: Vx and Vy of a vector in polar form given the angle Θ = 57º and the radius r = 23.
Solution: Use the option: [10] and enter the datas problem when requested by runvectors2dim.py program. After follow keying 1 in the keyboard to a only vector.

**[ WELCOME IN USING THE [RUNVECTORS2DIM.PY] PROGRAM ]**
**[ TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] in the [PLANE] ]**
--[Version: 1.3 -- Stable]--

**[INSTRUCTIONS OF USE]**

- To find the [Scalar Product: a * b] between [two vectors] key [1]
- To calculate the [Perimeter(P)], [Height(h), and [Area(A)] of the
  TrianglePQR givens the [points: P, Q, and R] key[2]

- To get the [Area(S) and Height(h) of the [Parallelogram(PQRS)] given
  the [points: P, Q, R, and S] key[3]

- To find the [angle] between [two vectors] in plane key[4]
- To calculate the [value] of the [CossineTheta] between
  [two vectors] a and b key [5]

- To get the [Distance] between [two points] given P and Q key [6]
- To find the three [Inner Angles] of the [Triangle] of
  three points given: P, Q, R key [7]

- To calculate the [midPoint M(xM,yM)] between the points: P and Q key [8]
- To get the [Addition and Subtraction] of [Two Vectors: a and b] key [9]
- To calculate the [Resultant(|R) Vector] key [10]
- To find the[VectorA] and [lenght] of givens Points: P, AND Q key [11]
- To find the [Addition] and [Subraction] between [Two Vectors]
  A and B multiplyed by scalars[coeffic1 and coeffic2] key [12]

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

(º>º) Provide the [new] value? 10
**[The typed number]: 7 is a [valid integer number!] ]**

**[TO GET THE VALUE OF THE RESULTANT(|R) VECTOR]**

+ How much [Vectors] will necessary to get the [Resultant(R) Vector]?

(º>º) Provide the [new] value? 1
**[The typed number]: 3 is a [valid integer number!] ]**

**[Warning]**
- All the [Vectorials Components] will can be:
  [positive] or [negative] or Zero!

+ What are the arguments: [angle] and [radius] of the( 1 )[vector]?

- Enter with the [new value] of the [angle] in degree?
(ª<ª) Enter the [new] value? 57
**[ [The typed number]: 57.0 is a [valid float number!] ]**

- Provide the [new value] of the [radius] of vector?
/º<º\ Type a [new] value? 23
**[The typed number]: 23.0 is a [valid float number!] ]**

_-_ . . .[Running]. . . _-_

* [answer] *

- The component of the  1 vector: Vx( 1 ) =  12.53
- The component of the  1 vector: Vy( 1 ) =  19.29

--[Warning]:
**[ THE [PREVIOUS COMPONENTS]: Vx(1) AND Vy(1) BEEN CALCULED; BUT ]**
**[ [NO EXIST RESULTANT(R) VECTOR] TO A ONLY VECTOR!]**

**[End Processing of the [ RESULTANTVECTOR.PY FUNCTION ]--Ok! ]**

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

Now view the [new] exceptions when the user attribute values [Negative] or [Zero] to the radius of any vector. Below will resolve the same previous Example 11.

**[ WELCOME IN USING THE [RUNVECTORS2DIM.PY] PROGRAM ]**
**[ TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] in the [PLANE] ]**
--[Version: 1.3 -- Stable]--

**[INSTRUCTIONS OF USE]**

- To find the [Scalar Product: a * b] between [two vectors] key [1]
- To calculate the [Perimeter(P)], [Height(h), and [Area(A)] of the TrianglePQR givens the [points: P, Q, and R] key[2]

- To get the [Area(S) and Height(h) of the [Parallelogram(PQRS)] given the [points: P, Q, R, and S] key[3]

- To find the [angle] between [two vectors] in plane key[4]
- To calculate the [value] of the [CossineTheta] between [two vectors] a and b key [5]

- To get the [Distance] between [two points] given P and Q key [6]
- To find the three [Inner Angles] of the [Triangle] of three points given: P, Q, R key [7]

- To calculate the [midPoint M(xM,yM)] between the points: P and Q key [8]
- To get the [Addition and Subtraction] of [Two Vectors: a and b] key [9]
- To calculate the [Resultant(|R) Vector] key [10]
- To find the[VectorA] and [lenght] of givens Points: P, AND Q key [11]
- To find the [Addition] and [Subraction] between [Two Vectors] A and B multiplyed by scalars[coeffic1 and coeffic2] key [12]

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

(º>º) Provide the [new] value? 10
**[The typed number]: 7 is a [valid integer number!] ]**

**[TO GET THE VALUE OF THE RESULTANT(|R) VECTOR]**

+ How much [Vectors] will necessary to get the [Resultant(R) Vector]?

(º>º) Provide the [new] value? 1
**[The typed number]: 3 is a [valid integer number!] ]**

**[Warning]**
- All the [Vectorials Components] will can be:
  [positive] or [negative] or Zero!

+ What are the arguments: [angle] and [radius] of the( 1 )[vector]?

- Enter with the [new value] of the [angle] in degree?
(ª<ª) Enter the [new] value? 57
**[ [The typed number]: 57.0 is a [valid float number!] ]**
- Provide the [new value] of the [radius] of vector?
/º<º\ Type a [new] value? -23

```
 _===_
  º>º   [Warning!]:
  \~/   **[ No exist none [vector] when the [component]: radius is: ]
        **[ A Negative float number: radius < 0 ] or [ Zero: radius = 0 ] -- Ok! ]**

/º<º\ Type a [new] value? 0

 _===_
  º>º   [Warning!]:
  \~/   **[ No exist none [vector] when the [component]: radius is: ]
        **[ A Negative float number: radius < 0 ] or [ Zero: radius = 0 ] -- Ok! ]**
```

[Note]: If any user key ENTER or other character of the keyboard wil receive the following message below:

- Provide the [new value] of the [radius] of vector?

```
/º<º\ Type a [new] value? Key ENTER

 _===_
 @<@   [Warning!]: could not convert string to float:
  \=/   **[ NO KEY ANY OTHER CHARACTER OR [ENTER] IN THE KEYBOARD ]**
        ----------------------------------------------------------------------------------------------------
        [ TYPE ALWAYS A NEW [POSITIVE FLOAT NUMBER] TO THE [RADIUS] ]
        [ IN NEXT INSTRUCTION -- OK! ]

/º<º\ Type a [new] value? 23
**[The typed number]: 23.0 is a [valid float number!] ]**


                    _-_ . . .[Running]. . . _-_

* [answer] *

- The component of the  1 vector: Vx( 1 ) =  12.53
- The component of the  1 vector: Vy( 1 ) =  19.29


--[Warning]:
**[ THE [PREVIOUS COMPONENTS]: Vx(1) AND Vy(1) BEEN CALCULED; BUT ]**
**[ [NO EXIST RESULTANT(R) VECTOR] TO A ONLY VECTOR!]**


**[End Processing of the [ RESULTANTVECTOR.PY FUNCTION ]--Ok! ]**


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

**Note:** The Components of Vectors and Coordinates of Points will can be: Negative or Zero or Positive; but the options of menu of the runvectors2dim.py program only can be typed *positive integer number*.

Developer: ***Cristovom A. Girodo***