

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: $a = \langle 3, 1 \rangle$ and $b = \langle -2, 4 \rangle$, find the Scalar Product $a \cdot b$ of this vectors.

Solution: Use the option: [1] and enter the [components]: $a_1 = 3$, $a_2 = 1$, $b_1 = -2$, and $b_2 = 4$ 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: $a \cdot b$] 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!
```

```
(^>^>) 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 [1° vectorA]!

- Enter the 1° [Component(x)]!

(^a<^a) Enter the [new] value? 3

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

- Introduce the 2° [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 [2° vectorB]!

- Enter the 1° [Component(x)]!

(^a<^a) Enter the [new] value? -2

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

- Introduce the 2° [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 following:

(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 triangle ABC with vertexes points: A(-1,0), B(2,1), and C(1,-2)

Solution: Do: $A(-1,0) = P(x_P, y_P) \Rightarrow x_P = -1$, and $y_P = 0$
 $B(2,1) = Q(x_Q, y_Q) \Rightarrow x_Q = 2$, and $y_Q = 1$
 $C(1,-2) = R(x_R, y_R) \Rightarrow x_R = 1$, and $y_R = -2$

Begin using the option[2] and provide the coordinates: $x_P = -1$, $y_P = 0$, $x_Q = 2$, $y_Q = 1$, $x_R = 1$, and $y_R = -2$, 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: $a \cdot b$] 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(x_M, y_M)] 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 multiplied by scalars[coeffic1 and coeffic2] key [12]

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

```
(°>°) 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 1° [Coordinate(x)].
```

```
(^<^ ) Enter the [new] value? -1
```

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

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

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

* Enter with the 2° [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(PQ°QR)] is: [-3.0, -3.0]
-- The [terms] of the [Scalar Product(QR°RP)] is: [2.0, -6.0]
-- The [terms] of the [Scalar Product(RP°PQ)] is: [-6.0, 2.0]

-- The [Scalar Product(PQ°QR)] is: -6.00
-- The [Scalar Product(QR°RP)] is: -4.00
-- The [Scalar Product(RP°PQ)] 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 three 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: $a \cdot b$] 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(x_M, y_M)] 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 [Subtraction] between [Two Vectors] A and B multiplied by scalars[coeffic1 and coeffic2] key [12]

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

(°>°) 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 1° [Coordinate(x)].

(^a<^a) Enter the [new] value? -1

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

* Enter with the 2° [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 1° [Coordinate(x)].

(^a<^a) Enter the [new] value? 2

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

* Enter with the 2° [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 1° [Coordinate(x)].

(^{a<a}) Enter the [new] value? 1

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

* Enter with the 2° [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: $a \cdot b$] between [two vectors] key [1]
- To calculate the [Perimeter(P)], [Height(h)], and [Area(A)] of the TrianglePQR given 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 [Subtraction] between [Two Vectors] A and B multiplied by scalars[coeffic1 and coeffic2] key [12]

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

(°>°) 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 1° [Coordinate(x)].

(^<^a) Enter the [new] value? -6

[[The typed number]: -6.0 is a [valid integer or float number!]]

* Enter with the 2° [Coordinate(y)].

(^<^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 1° [Coordinate(x)].

(^<^a) Enter the [new] value? 10

[[The typed number]: 10.0 is a [valid integer or float number!]]

* Enter with the 2° [Coordinate(y)].

(^<^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 1° [Coordinate(x)].

(^<^a) Enter the [new] value? -2

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

* Enter with the 2° [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(PQ°QR)] is: [-192.0, -45.0]
 -- The [terms] of the [Scalar Product(QR°RP)] is: [48.0, -36.0]
 -- The [terms] of the [Scalar Product(RP°PQ)] is: [-64.0, 20.0]

-- The [Scalar Product(PQ°QR)] is: -237.00
 -- The [Scalar Product(QR°RP)] is: 12.00
 -- The [Scalar Product(RP°PQ)] 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: $a \cdot b$] between [two vectors] key [1]
- To calculate the [Perimeter(P)], [Height(h)], and [Area(A)] of the TrianglePQR gives 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 multiplied by scalars[coeffic1 and coeffic2] key [12]

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

(°>°) 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 1° [Coordinate(x)].

(^<^) Enter the [new] value? -6

[[The typed number]: -6.0 is a [valid integer or float number!]]

* Enter with the 2° [Coordinate(y)].

(^<^) 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 1° [Coordinate(x)].

(^<^) Enter the [new] value? 10

[[The typed number]: 10.0 is a [valid integer or float number!]]

* Enter with the 2° [Coordinate(y)].

(^<^) 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 1° [Coordinate(x)].

(^<^) Enter the [new] value? -2

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

* Enter with the 2° [Coordinate(y)].

(^<^) 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 $[components]$: $a_1 = 1$, $a_2 = -3$, $b_1 = -4$, and $b_2 = 1$ 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 gives 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 $[Subtraction]$ between $[Two\ Vectors]$ A and B multiplied by scalars $[coeffic1\ and\ coeffic2]$ key $[12]$

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

(°>°) 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 [1° vectorA]!

- Enter the 1° [Component(x)]!

(^<^) Enter the [new] value? 1

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

- Introduce the 2° [Component(y)]!

(^<^) Enter the [new] value? -3

[[The typed number]: -3.0 is a [valid integer or float number!]]

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

- Enter the 1° [Component(x)]!

(^<^) Enter the [new] value? -4

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

- Introduce the 2° [Component(y)]!

(^<^) 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: $a \cdot b$] between [two vectors] key [1]
- To calculate the [Perimeter(P)], [Height(h)], and [Area(A)] of the TrianglePQR given 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(x_M, y_M)] 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 multiplied by scalars[coeffic1 and coeffic2] key [12]

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

(°>°) 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 1° [Coordinate(x)].

(^a<^a) Enter the [new] value? 3

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

* Enter with the 2° [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 1° [Coordinate(x)].

(^a<^a) Enter the [new] value? 2

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

* Enter with the 2° [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: $a \cdot b$] 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 [Subtraction] between [Two Vectors] A and B multiplied by scalars[coeffic1 and coeffic2] key [12]

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

(°>°) 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 1° [Coordinate(x)].

(^<^a) Enter the [new] value? -1

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

* Enter with the 2° [Coordinate(y)].

(^<^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 [vector|PQ|]: 3.61
-- The [sideB] relative as [vector|PS|]: 5.10
-- The [Perimeter(P)] is: 17.41

-- The [terms] of the Scalar Product(vectorPS°PQ) is: [15.0, -2.0]
-- The [Scalar Product(PQ°PS)] is: 13.0
-- The [Height(h)] relative as [sideA]=|vectorPQ| is: 3.61
-- 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]: $a_1 = -11$, $a_2 = 4$, $b_1 = 3$, and $b_2 = -1$ 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: $a \cdot b$] between [two vectors] key [1]
- To calculate the [Perimeter(P)], [Height(h), and [Area(A)] of the TrianglePQR gives 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!

(°>°) 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 [1° vectorA]!

- Enter the 1° [Component(x)]!

(^<^) Enter the [new] value? -11

[[The typed number]: -11.0 is a [valid integer or float number!]]

- Introduce the 2° [Component(y)]!

(^<^) Enter the [new] value? 4

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

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

- Enter the 1° [Component(x)]!

(^<^) Enter the [new] value? 3

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

- Introduce the 2° [Component(y)]!

(^<^) 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]: $a_1 = -3$, $a_2 = 5$, $b_1 = 7$, and $b_2 = -2$ 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: $a \cdot b$] between [two vectors] key [1]
- To calculate the [Perimeter(P)], [Height(h)], and [Area(A)] of the TrianglePQR gives 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(x_M, y_M)] 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 [Subtraction] between [Two Vectors] A and B multiplied by scalars[coeffic1 and coeffic2] key [12]

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

```
(°>°) 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 [1° vectorA]!
```

```
- Enter the 1° [Component(x)]!
```

```
(^<^a) Enter the [new] value? -3
```

```
**[ [The typed number]: -3.0 is a [valid integer or float number!] ]**
```


- Introduce the 2° [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 [2° vectorB]!

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

- Introduce the 2° [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] is: [-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 $\theta = 35^\circ$, $\beta = -110^\circ$, and $\phi = 30^\circ$. 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 given 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 [Subtraction] between [Two Vectors]
- A and B multiplied by scalars[coeffic1 and coeffic2] key [12]

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

(°>°) 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]?

(°>°) 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) Enter the [new] value? 35

[[The typed number]: 35.0 is a [valid float number!]]

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

/°<°\ Type a [new] value? 10

[The typed number]: 10.0 is a [valid float number!]]

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

* [answer] *

- The component of the 1 vector: $V_x(1) = 8.19$

- The component of the 1 vector: $V_y(1) = 5.74$

--[Warning]:

[THE [PREVIOUS COMPONENTS]: $V_x(1)$ AND $V_y(1)$ 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) Enter the [new] value? -110

[[The typed number]: -110.0 is a [valid float number!]]

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

/°<°\ Type a [new] value? 7

[The typed number]: 7.0 is a [valid float number!]]

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

* [answer] *

- The component of the 2 vector: $V_x(2) = -2.39$
- The component of the 2 vector: $V_y(2) = -6.58$

+ 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: $V_x(3) = 6.93$
- The component of the 3 vector: $V_y(3) = 4.00$

+ The sum of all the components of x_axis: $R_x = 12.73$

+ The sum of all the components of y_axis: $R_y = 3.16$

+ 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]; $a_1 = 2$, $a_2 = 3$, $b_1 = 5$, and $b_2 = -1$. Following the program will wait the user enter the [coefficients]. Do (1^o) [coefficient] = 1 and (2^o) [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: $a \cdot b$] 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 [Subtraction] between [Two Vectors] A and B multiplied by scalars[coeffic1 and coeffic2] key [12]

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

(°>°) 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].

(°>°) 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 [1° vectorA]!

- Enter the 1° [Component(x)]!

(^<^a) Enter the [new] value? 2

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

- Introduce the 2° [Component(y)]!

(^<^a) Enter the [new] value? 3

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

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

- Enter the 1° [Component(x)]!

(^<^a) Enter the [new] value? 5

[[The typed number]: 5.0 is a [valid integer or float number!]]

- Introduce the 2° [Component(y)]!

(^<^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 (1°)[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 (2°)[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]; $a_1 = 2$, $a_2 = 3$, $b_1 = 5$, and $b_2 = -1$. Following the program will wait the user enter the [coefficients]. Do (1°)[coefficient] = 2 and (2°)[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: $a \cdot b$] 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 [Subtraction] between [Two Vectors] A and B multiplied by scalars[coeffic1 and coeffic2] key [12]

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

(°>°) Provide the [new] value? 12

[The typed number]: 7 is a [valid integer number!]]

**[GIVENS [TWO VECTORS: A AND B] MULTIPLIED 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].

(°>°) 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 [1° vectorA]!

- Enter the 1° [Component(x)]!

(°<°) Enter the [new] value? 2

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

- Introduce the 2° [Component(y)]!

(°<°) Enter the [new] value? 3

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

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

- Enter the 1° [Component(x)]!

(°<°) Enter the [new] value? 5

[[The typed number]: 5.0 is a [valid integer or float number!]]

- Introduce the 2° [Component(y)]!

(°<°) 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 (1°)[coefficient]?

(°<°) Enter the [new] value? 2

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

- Give the new [value] to the (2°)[coefficient]?

(°<°) 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 – Given 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]: $x_P = 2$, $y_P = 0$, $x_Q = 0$, $y_Q = 3$, $x_R = 3$ and $y_R = 4$. Following the program will wait the user enter the [coefficients]. Do (1°)[coefficient] = 1 and (2°)[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]--
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**[INSTRUCTIONS OF USE]**
```

- To find the [Scalar Product: $a \cdot b$] 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(x_M, y_M)] 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 [Subtraction] between [Two Vectors] A and B multiplied by scalars[coeffic1 and coeffic2] key [12]

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

(°>°) 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].

(°>°) 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 1° [Coordinate(x)].

(^<^a) Enter the [new] value? 2

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

* Enter with the 2° [Coordinate(y)].

(^<^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 1° [Coordinate(x)].

(^<^a) Enter the [new] value? 0

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

* Enter with the 2° [Coordinate(y)].

(^<^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 [length] 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 1° [Coordinate(x)].

(^<^a) Enter the [new] value? 2

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

* Enter with the 2° [Coordinate(y)].

(^<^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 1° [Coordinate(x)].

(^<^a) Enter the [new] value? 3

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

* Enter with the 2° [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 [length] 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 (1°)[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 (2°)[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: $a \cdot b$] 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 [length] of givens Points: P, AND Q key [11]

- To find the [Addition] and [Subtraction] between [Two Vectors]

A and B multiplied by scalars[coeffic1 and coeffic2] key [12]

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

(^>^) Provide the [new] value? -2

[NO TYPE AN [NEGATIVE INTEGER NUMBER] or equal [ZERO]--Ok!]

(^>^) Provide the [new] value? p

```
./$\  
@>@ [Warning!]: invalid literal for int() with base 10: 'p'  
~/ [ TYPE AN [NEW POSITIVE INTEGER NUMBER ]  
[ IN NEXT INSTRUCTION -- OK! ]
```

(^>^) Provide the [new] value? @

```
./$\  
@>@ [Warning!]: invalid literal for int() with base 10: '@'  
~/ [ TYPE AN [NEW POSITIVE INTEGER NUMBER ]  
[ IN NEXT INSTRUCTION -- OK! ]
```

(^>^) Provide the [new] value? J

```
./$\  
@>@ [Warning!]: invalid literal for int() with base 10: 'J'  
~/ [ TYPE AN [NEW POSITIVE INTEGER NUMBER ]  
[ IN NEXT INSTRUCTION -- OK! ]
```

(^>^) Provide the [new] value? 0

[NO TYPE AN [NEGATIVE INTEGER NUMBER] or equal [ZERO]--Ok!]

(^>^) Provide the [new] value? Typed ENTER

```
./$\  
@>@ [Warning!]: invalid literal for int() with base 10: "  
~/ [ TYPE AN [NEW POSITIVE INTEGER NUMBER ]  
[ IN NEXT INSTRUCTION -- OK! ]
```

(^>^) 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.

(°>°) 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 [1° vectorA]!

- Enter the 1° [Component(x)]!

(^<^a) Enter the [new] value? 3

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

- Introduce the 2° [Component(y)]!

(^<^a) Enter the [new] value? 1

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

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

- Enter the 1° [Component(x)]!

(^<^a) Enter the [new] value? -2

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

- Introduce the 2° [Component(y)]!

(^<^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: V_x and V_y of a vector in polar form given the angle $\Theta = 57^\circ$ and the radius $r = 23$.

Solution: Use the option: [10] and enter the data 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 [Subtraction] between [Two Vectors] A and B multiplied by scalars[coeffic1 and coeffic2] key [12]

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

(°>°) 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]?

(°>°) 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) Enter the [new] value? 57

[[The typed number]: 57.0 is a [valid float number!]]

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

/°<°\ Type a [new] value? 23

[The typed number]: 23.0 is a [valid float number!]]

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

* [answer] *

- The component of the 1 vector: $V_x(1) = 12.53$

- The component of the 1 vector: $V_y(1) = 19.29$

--[Warning]:

[THE [PREVIOUS COMPONENTS]: $V_x(1)$ AND $V_y(1)$ 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 ]**
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--[Version: 1.3 -- Stable]--
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**[INSTRUCTIONS OF USE]**
```

- To find the [Scalar Product: $a \cdot b$] 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(x_M, y_M)] 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 [Subtraction] between [Two Vectors] A and B multiplied by scalars[coeffic1 and coeffic2] key [12]

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

```
(^>^ ) 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]?
```

```
(^>^ ) 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?
```

```
(^<^ ) Enter the [new] value? 57
```

```
**[ [The typed number]: 57.0 is a [valid float number!] ]**
```

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

```
/^<^ \ Type a [new] value? -23
```

```
===
```

```
^>^ [Warning!]:
```

```
\~/ **[ No exist none [vector] when the [component]: radius is: ]
```

```
**[ A Negative float number: radius < 0 ] or [ Zero: radius = 0 ] -- Ok! ]**
```

```
/°<°\ Type a [new] value? 0
```

```
===  
°>° [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 will receive the following message below:

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

```
/°<°\ 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! ]
```

```
/°<°\ 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**