

Instructions of as use the runvectors2dim.py program.

In the **Windows operating system**:

After the download the **repositorio** access the **Vectors2Dim directorie** and give two clicks in the runvectors2dim.py program and follow the news instructions in display.

In the **Linux operating system**:

After the download the repositorio access the Vectors2Dim directorie exist two options of run the runvectors2dim.py program.

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

python3 runvectors2dim.py after key ENTER

2.) In the Vectors2Dim directorie open runvectors2dim.py file using the IDLE3 and use the Run ==> Run Module options. After follow the news instructions.

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

Now will the use of 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: 1.0 -- 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 multiplyed by scalars[coeffic1 and coeffic2] key [12]
```

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

[$^{\circ}>^{\circ}$] What is 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)]!
- - What is the new value? 3
  **[The typed number]: 3.0 is a [valid float number!]
]

- Introduce the 2° [Component(y)]!
- - What is the new value? 1
  **[The typed number]: 1.0 is a [valid float number!]
]

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

- Enter the 1° [Component(x)]!
- - What is the new value? -2
  **[The typed number]: -2.0 is a [valid float number!]
]

- Introduce the 2° [Component(y)]!
- - What is the new value? 4
  **[The typed number]: 4.0 is a [valid 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 programs** to solve exercises that provide vertices A, B, and C to triangles do the following:

$(x_A, y_A) = (x_P, y_P) \implies x_P = x_A$ and $y_P = y_A$ replace the coordinates: x_A and y_A into the coordinates: x_P and y_P of the point: P when the runvectors2dim.py programs request to enter the coordinates: x_P and y_P . Of the same manner to the vertices B and C so:

$(x_B, y_B) = (x_Q, y_Q) \implies x_Q = x_B$ and $y_Q = y_B$ replace the coordinates: x_B and y_B into the coordinates: x_Q and y_Q of the point: Q when the runvectors2dim.py programs request to enter the coordinates: x_Q and y_Q .

$(x_C, y_C) = (x_R, y_R) \implies x_R = x_C$ and $y_R = y_C$ replace the coordinates: x_C and y_C into the coordinates: x_R and y_R of the point: R when the runvectors2dim.py programs request to enter the coordinates: x_R and y_R .

Of the same manner do to the vertices: A, B, C, and D of the parallelogram as too to the parallelepiped. 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 vertices points: **A, B, and C of the triangle** into the code of functions developed.

Example – Find the dimensions of the triangle ABC with vertices 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: 1.0 -- 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!

[°>°] What is the new value? 2

**[The typed number]: 2 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)].
```

```
-- What is the new value? -1
```

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

]

```
* Enter with the 2° [Coordinate(y)].
```

```
-- What is the new value? 0
```

```
**[The typed number]: 0.0 is a [valid float number!]
```

]

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

```
* Introduce the 1° [Coordinate(x)].
```

```
-- What is the new value? 2
```

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

```

]

* Enter with the 2° [Coordinate(y)].
- _ - What is the new value? 1
    **[The typed number]: 1.0 is a [valid float number!]

]

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

* Introduce the 1° [Coordinate(x)].
- _ - What is the new value? 1
    **[The typed number]: 1.0 is a [valid float number!]

]

* Enter with the 2° [Coordinate(y)].
- _ - What is the new value? -2
    **[The typed number]: -2.0 is a [valid 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] and provide again the [coordinates]:
 $x_P = -1$, $y_P = 0$, $x_Q = 2$, $y_Q = 1$, $x_R = 1$, and $y_R = -2$ when requested by runvectors2dim.py program.

```

**[ WELCOME IN USING THE [RUNVECTORS2DIM.PY] PROGRAM ]**
**[ TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] in the [PLANE] ]**
--[Version: 1.0 -- 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 multiplyed by scalars[coeffic1 and coeffic2] key [12]

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

[°>°] What is 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)].

-- What is the new value? -1

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

]

* Enter with the 2° [Coordinate(y)].

-- What is the new value? 0

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

]

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

* Introduce the 1° [Coordinate(x)].

-- What is the new value? 2

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

]

* Enter with the 2° [Coordinate(y)].

-- What is the new value? 1

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

]

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

* Introduce the 1° [Coordinate(x)].

-- What is the new value? 1

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

]

* Enter with the 2° [Coordinate(y)].

-- What is the new value? -2

**[The typed number]: -2.0 is a [valid 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 vertices 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 coodinate 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: 1.0 -- 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(IR) 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!

[°>°] What is the new value? 2

**[The typed number]: 2 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)].

-- What is the new value? -6

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

]

* Enter with the 2° [Coordinate(y)].

-- What is the new value? 0

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

]

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

* Introduce the 1° [Coordinate(x)].

-- What is the new value? 10

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

]

* Enter with the 2° [Coordinate(y)].

-- What is the new value? -5

**[The typed number]: -5.0 is a [valid float number!]

]

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

* Introduce the 1° [Coordinate(x)].

-- What is the new value? -2

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

]

* Enter with the 2° [Coordinate(y)].

-- What is the new value? 4

**[The typed number]: 4.0 is a [valid 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: 1.0 -- 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!
```

```
[°>°] What is 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)].
```

```
-- What is the new value? -6
```

```
**[The typed number]: -6.0 is a [valid float number!]
```

```
]
```

```
* Enter with the 2° [Coordinate(y)].
```



```

    ]
    - _ - What is the new value? 0
      **[The typed number]: 0.0 is a [valid float number!]

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

    * Introduce the 1° [Coordinate(x)].
    - _ - What is the new value? 10
      **[The typed number]: 10.0 is a [valid float number!]

    ]

    * Enter with the 2° [Coordinate(y)].
    - _ - What is the new value? -5
      **[The typed number]: -5.0 is a [valid float number!]

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

    * Introduce the 1° [Coordinate(x)].
    - _ - What is the new value? -2
      **[The typed number]: -2.0 is a [valid float number!]

    ]

    * Enter with the 2° [Coordinate(y)].
    - _ - What is the new value? 4
      **[The typed number]: 4.0 is a [valid 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: 1.0 -- 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 multiplyed by scalars[coeffic1
and coeffic2] key [12]

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

    [°>°] What is the new value? 5
        **[The typed number]: 5 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)]!
    - - What is the new value? 1
        **[The typed number]: 1.0 is a [valid float number!]

]

    - Introduce the 2° [Component(y)]!
    - - What is the new value? -3
        **[The typed number]: -3.0 is a [valid float number!]

]

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

    - Enter the 1° [Component(x)]!
    - - What is the new value? -4
        **[The typed number]: -4.0 is a [valid float number!]

]

    - Introduce the 2° [Component(y)]!
    - - What is the new value? 1
        **[The typed number]: 1.0 is a [valid 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: 1.0 -- 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 multiplied by scalars[coeffic1 and coeffic2] key [12]
```

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

```
[°>°] What is the new value? 6
**[The typed number]: 6 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)].
```

```
- - What is the new value? 3
**[The typed number]: 3.0 is a [valid float number!]
```

```
]
```

```

    * Enter with the 2° [Coordinate(y)].
    - - What is the new value? -5
      **[The typed number]: -5.0 is a [valid float number!]
  ]
  -- Introduce the [coordinates]: (xQ, yQ) of the (point Q)?

  * Introduce the 1° [Coordinate(x)].
  - - What is the new value? 2
    **[The typed number]: 2.0 is a [valid float number!]
  ]

  * Enter with the 2° [Coordinate(y)].
  - - What is the new value? 8
    **[The typed number]: 8.0 is a [valid float number!]
  ]

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

```

[ANSWER]

```

n    -- The [vectorPQ]: vectorPQ [-1.0, 13.0]
n    -- The [Quadratic Components] of the [vectorPQ]: VectorQUAD [1.0, 169.0]
n    -- 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 vertices 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: 1.0 -- 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 multiplyed by scalars[coeffic1 and coeffic2] key [12]

```

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

```

[°>°] What is the new value? 3
    **[The typed number]: 3 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)].
```

```
-- - What is the new value? -1
```

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

]

```
* Enter with the 2° [Coordinate(y)].
```

```
-- - What is the new value? 2
```

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

]

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

```
* Introduce the 1° [Coordinate(x)].
```

```
-- - What is the new value? 2
```

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

]

```
* Enter with the 2° [Coordinate(y)].
```

```
-- - What is the new value? 0
```

```
**[The typed number]: 0.0 is a [valid float number!]
```

]

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

```
* Introduce the 1° [Coordinate(x)].
```

```
-- - What is the new value? 7
```

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

]

```
* Enter with the 2° [Coordinate(y)].
```

```
-- - What is the new value? 1
```

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

]

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

```
* Introduce the 1° [Coordinate(x)].
```

```
-- - What is the new value? 4
```

```
**[The typed number]: 4.0 is a [valid float number!]
```

]

```
* Enter with the 2° [Coordinate(y)].
```

```
-- - What is the new value? 3
```

```
**[The typed number]: 3.0 is a [valid 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 [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: 1.0 -- 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 multiplyed by scalars[coeffic1
and coeffic2] key [12]
```

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

```
[°>°] What is the new value? 9
```

```
**[The typed number]: 9 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)]!
```

```
-- What is the new value? -11
```

```
**[The typed number]: -11.0 is a [valid float number!]
```

```
]
```

```
- Introduce the 2° [Component(y)]!
```

```
-- What is the new value? 4
```

```
**[The typed number]: 4.0 is a [valid float number!]
```

```
]
```

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

```

- Enter the 1° [Component(x)]!
- - What is the new value? 3
  **[The typed number]: 3.0 is a [valid float number!]
]

- Introduce the 2° [Component(y)]!
- - What is the new value? -1
  **[The typed number]: -1.0 is a [valid 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 $a = -3i + 5j$ 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: 1.0 -- 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 multiplyed by scalars[coeffic1
and coeffic2] key [12]

```

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

```

[°>°] What is the new value? 4
  **[The typed number]: 4 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)]!
- - What is the new value? -3
  **[The typed number]: -3.0 is a [valid float number!]
]

```

```

- Introduce the 2° [Component(y)]!
- - What is the new value? 5
  **[The typed number]: 5.0 is a [valid float number!]
]

```

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

```

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

```

```

- Introduce the 2° [Component(y)]!
- - What is the new value? -2
  **[The typed number]: -2.0 is a [valid 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: 1.0 -- 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 multiplyed by scalars[coeffic1 and coeffic2] key [12]

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

[°>°] What is the new value? 10

**[The typed number]: 10 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]?

[°>°] What is 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?

- - What is the new value? 35

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

]

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

- - What is the 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: $V_y(1) = 5.74$

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

- Enter with the [new value] of the [angle] in degree?

- - What is the new value? 110

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

]

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

- - What is the 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?
-- What is the new value? 30
  **[The typed number]: 30.0 is a [valid float number!]

]

- Provide the [new value] of the [radius] of vector?
-- What is the 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:  $R_y = 16.31$ 

+ The resultant vector:  $[Resultant(R)_Vector] = 20.69$ 
+ The theta angle  $[theta\_degrees] = 52.04$ 

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

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

```

Example9 – Given 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°) [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: 1.0 -- 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 multiplyed by scalars[coeffic1 and coeffic2] key [12]

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

[°>°] What is the new value? 12

**[The typed number]: 12 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].

[°>°] What is 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)]!

- _ - What is the new value? 2

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

]

- Introduce the 2° [Component(y)]!

- _ - What is the new value? 3

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

]

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

- Enter the 1° [Component(x)]!

- _ - What is the new value? 5

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

]

- Introduce the 2° [Component(y)]!

- _ - What is the new value? -1

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

]

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

-- The [vectorB]: vectorB [5.0, -1.0]

- Enter with new [value] to the (1°)[coefficient]? 1

- Give the new [value] to the (2°)[coefficient]? 1

[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]: $a + b$, $a - b$, $|a + b|$, $|a - b|$ already 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: 1.0 -- 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(IR) 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 multiplyed by scalars[coeffic1  
and coeffic2] key [12]
```

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

[°>°] What is the new value? 12

**[The typed number]: 12 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].

```

[>] What is 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)]!
- - What is the new value? 2
    **[The typed number]: 2.0 is a [valid float number!]
]

- Introduce the 2° [Component(y)]!
- - What is the new value? 3
    **[The typed number]: 3.0 is a [valid float number!]
]

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

- Enter the 1° [Component(x)]!
- - What is the new value? 5
    **[The typed number]: 5.0 is a [valid float number!]
]

- Introduce the 2° [Component(y)]!
- - What is the new value? -1
    **[The typed number]: -1.0 is a [valid float number!]
]

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

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

*[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: 1.0 -- 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!

[°>°] What is the new value? 12

**[The typed number]: 12 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].

[°>°] What is 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)].

-- What is the new value? 2

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

]

* Enter with the 2° [Coordinate(y)].

-- What is the new value? 0

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

]

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

* Introduce the 1° [Coordinate(x)].

-- What is the new value? 0

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

]

* Enter with the 2° [Coordinate(y)].

-- What is the new value? 3
**[The typed number]: 3.0 is a [valid 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)].

-- What is the new value? 2
**[The typed number]: 2.0 is a [valid float number!]

]

* Enter with the 2° [Coordinate(y)].

-- What is the new value? 0
**[The typed number]: 0.0 is a [valid float number!]

]

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

* Introduce the 1° [Coordinate(x)].

-- What is the new value? 3
**[The typed number]: 3.0 is a [valid float number!]

]

* Enter with the 2° [Coordinate(y)].

-- What is the new value? 4
**[The typed number]: 4.0 is a [valid 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]? 1
- Give the new [value] to the (2°)[coefficient]? 1

[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! ...
```

Example11 – Given the points: P(1, -1), Q(2, 5) find the [MidPoint]:

Solution – Begin the runtoolsvectors.py program and key the option[8] and provide the [coordinates]; xP = 1, yP = -1, xQ = 2, yQ = 5.

```
**[ WELCOME IN USING THE [RUNVECTORS2DIM.PY] PROGRAM ]**
**[ TO [SOLVE] VARIOUS PROBLEMS OF [VECTORS] in the [PLANE] ]**
--[Version: 1.0 -- 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 [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!
```

```
[>] What is the new value? 8
**[The typed number]: 8 is a [valid integer number!]
```

```
**[ WILL DETERMINE THE [MIDPOINT(M)] BETWEEN THE (POINTS): P AND Q GIVEN]**
```

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

```
* Introduce the 1° [Coordinate(x)].
- - What is the new value? 1
**[The typed number]: 1.0 is a [valid float number!]
```

```
* Enter with the 2° [Coordinate(y)].
- - What is the new value? -1
**[The typed number]: -1.0 is a [valid float number!]
```

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

```
* Introduce the 1° [Coordinate(x)].
- - What is the new value? 2
**[The typed number]: 2.0 is a [valid float number!]
```


* Enter with the 2º [Coordinate(y)].

-- What is the new value? 5

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

]

- The (Point P): P (1.0, -1.0)

- The (Point Q): Q (2.0, 5.0)

[ANSWER]

-- The [(MidPoint)]: M (1.5, 2.0)

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

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