Instructions of as use the runvectors2dim.py program.

In the Windows operating system:

After the download of 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 of the repository access the runvectors2dim.py program using two options of run.

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.

[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 = <3,1> and b=<-2,4>, find the Scalar Product a * b of this vectors.

Solution: Use the option: [1] and enter the [components]: a1 = 3, a2 = 1, b1 = -2, and b2 = 4 when requested by runvectors2dim.py program.

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

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

        [º>º] 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 [1º vectorA]!

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

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

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

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

- Introduce the 2º [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 folowing:

(xA,yA) = (xP, yP) ==> xP = xA and yP = yA replace the coordinates: xA and yA into the coordinates: xP and yP of the point: P when the runvectors2dim.py programs request to enter the coordinates: xP and yP. Of the same manner to the vertices 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 programs 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 programs request to enter the coordinates: xR and yR.

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.

Example2 – Find the dimensions of the triangleABC with vertices points: A(-1,0), B(2,1), and C(1,-2)

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

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

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

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

[⁰>⁰] 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 1⁰ [Coordinate(x)].
-_- What is the new value? -1
    **[The typed number]: -1.0 is a [valid float number!]
]

* Enter with the 2⁰ [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 1⁰ [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? 1
    **[The typed number]: 1.0 is a [valid float number!]
]

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

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

* Enter with the 2º [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(PQºQR)] is: [-3.0, -3.0]
-- The [terms] of the [Scalar Product(QRºRP)] is: [2.0, -6.0]
-- The [terms] of the [Scalar Product(RPºPQ)] is: [-6.0, 2.0]

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

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

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

To calculate all the threes Inner angles of the triangle type the option [7] and provide again the [coodinates]: xP = -1, yP = 0, xQ = 2, yQ = 1, xR = 1, and yR = -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 [Subraction] between [Two Vectors] A and B multiplyed by scalars[coeffic1 and coeffic2] key [12]

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

[⁰>⁰] 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 1º [Coordinate(x)].
-_- What is the new value? -1
    **[The typed number]: -1.0 is a [valid float number!]
]

* Enter with the 2º [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 1º [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? 1
    **[The typed number]: 1.0 is a [valid float number!]
]
-- Provide the [coordinates]: (xR, yR) of the (point R)?

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

* Enter with the 2º [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)

Example3 – 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(|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!

[⁰>⁰] 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 1º [Coordinate(x)].
-_- What is the new value? -6
     **[The typed number]: -6.0 is a [valid float number!]
]

* Enter with the 2º [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 1º [Coordinate(x)].
-_- What is the new value? 10
     **[The typed number]: 10.0 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!]
]

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

* Introduce the 1º [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? 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

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 [Subraction] between [Two Vectors] A and B multiplyed by scalars[coeffic1 and coeffic2] key [12]

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

[º>º] 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 1º [Coordinate(x)].
-_- What is the new value? -6
    **[The typed number]: -6.0 is a [valid float number!]
]

* Enter with the 2º [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 1º [Coordinate(x)].
-_- What is the new value? 10
   **[The typed number]: 10.0 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!]
]

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

* Introduce the 1º [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? 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!]--

Example4 – Find the cosine of the angle between the vectors a = i – 3j and b = -4i + j.

Solution: Use the option: [5] and enter the [components]: a1 = 1, a2 = -3, b1 = -4, and b2 = 1 when requested by runvectors2dim.py program.

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

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

        [º>º] 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 [1º vectorA]!

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

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

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

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

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

Example5 – 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.

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

* Introduce the 1º [Coordinate(x)].
-_- What is the new value? 3
   **[The typed number]: 3.0 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!]
]

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

* Introduce the 1º [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? 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! . . .

Example6 – 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 [Subraction] between [Two Vectors] A and B multiplyed by scalars[coeffic1 and coeffic2] key [12]

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

[⁰>⁰] 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 1⁰ [Coordinate(x)].
-_- What is the new value? -1
      **[The typed number]: -1.0 is a [valid float number!]
]

* Enter with the 2⁰ [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 1⁰ [Coordinate(x)].
-_- What is the new value? 2
      **[The typed number]: 2.0 is a [valid float number!]
]

* Enter with the 2⁰ [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 1⁰ [Coordinate(x)].
-_- What is the new value? 7
      **[The typed number]: 7.0 is a [valid float number!]
]

* Enter with the 2⁰ [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 1⁰ [Coordinate(x)].
-_- What is the new value? 4
      **[The typed number]: 4.0 is a [valid float number!]
]

* Enter with the 2⁰ [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)

Example7 – Find the addition and subtraction of the vectors a = -11i + 4j and b = 3i - j.

Solution: Use the option: [9] and enter the [components]: a1 = -11, a2 = 4, b1 = 3, and b2 = -1 when requested by runvectors2dim.py program.

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

      - Enter the 1º [Component(x)]!
-_- What is the new value? -11
    **[The typed number]: -11.0 is a [valid float number!]
]

      - Introduce the 2º [Component(y)]!
-_- What is the new value? 4
    **[The typed number]: 4.0 is a [valid float number!]
]

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

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

      - Introduce the 2º [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! . . .

Example8 – Find the angle between the vectors a = -3i + 5j and b = 7i - 2j.

Solution: Use the option: [4] and enter the [components]: a1 = -3, a2 = 5, b1 = 7, and b2 = -2 when requested by runvectors2dim.py program.

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

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

[º>º] 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 [1º vectorA]!

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

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

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

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

- Introduce the 2º [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] ís: [-21.0, -10.0]
- The [length] of a |vectorA|: 5.83
- The [length] of a |vectorB|: 7.28
- The [Scalar Product] is: -31.00

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

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

Example9 – The three displacement vectors A, B, and C are specified by their magnitudes A = 10, B = 7, and C = 8, respectively, and by their respective direction angles with the horizontal direction θ = 35º, β = 110º, and φ = 30º. The physical units of the magnitudes are centimeters. Find the Resultant(|R) Vector.

Solution: Use the option: [10] and enter the datas problem when requested by runvectors2dim.py program.

[INSTRUCTIONS OF USE]
- To find the [Scalar Product: a * b] between [two vectors] key [1]
- To calculate the [Perimeter(P)], [Height(h), and [Area(A)] of the TrianglePQR givens the [points: P, Q, and R] key[2]
- To get the [Area(S) and Height(h) of the [Parallelogram(PQRS)] given the [points: P, Q, R, and S] key[3]
- To find the [angle] between [two vectors] in plane key[4]
- To calculate the [value] of the [CossineTheta] between [two vectors] a and b key [5]
- To get the [Distance] between [two points] given P and Q key [6]
- To find the three [Inner Angles] of the [Triangle] of three points given: P, Q, R key [7]
- To calculate the [midPoint M(xM,yM)] between the points: P and Q key [8]
- To get the [Addition and Subtraction] of [Two Vectors: a and b] key [9]
- To calculate the [Resultant(|R) Vector] key [10]
- To find the[VectorA] and [lenght] of givens Points: P, AND Q key [11]
- To find the [Addition] and [Subraction] between [Two Vectors] A and B multiplyed by scalars[coeffic1 and coeffic2] key [12]

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

[º>º] What is the new value? 10
    **[The typed number]: 10 is a [valid integer number!]
]

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

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

+ 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: Vx(1) = 8.19
- The component of the 1 vector: Vy(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: Vx(2) = -2.39
- The component of the 2 vector: Vy(2) = 6.58

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

- Enter with the [new value] of the [angle] in degree?
-_- 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: Vx(3) = 6.93
- The component of the 3 vector: Vy(3) = 4.00

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

Example10 – Givens the vectors: a = 2i + 3j and b = 5i -j find the [vectors and modules]: a + b, a – b, |a + b|, |a – b|, and 2a – 3b.

Solution – Begin the runtoolsvectors.py program and key the option[12] and wait the display present instructions to select the options: [1] or [2]. Follow type the option[1] and provide the [components]; a1 = 2,

a2 = 3, b1 =5, and b2 = -1. Following the program will wait the user enter the [coefficients]. Do (1º)[coefficient] = 1 and (2º)[coefficient] = 1 and key ENTER to process.

[INSTRUCTIONS OF USE]
- To find the [Scalar Product: a * b] between [two vectors] key [1]
- To calculate the [Perimeter(P)], [Height(h), and [Area(A)] of the TrianglePQR givens the [points: P, Q, and R] key[2]
- To get the [Area(S) and Height(h) of the [Parallelogram(PQRS)] given the [points: P, Q, R, and S] key[3]
- To find the [angle] between [two vectors] in plane key[4]
- To calculate the [value] of the [CossineTheta] between [two vectors] a and b key [5]
- To get the [Distance] between [two points] given P and Q key [6]
- To find the three [Inner Angles] of the [Triangle] of three points given: P, Q, R key [7]
- To calculate the [midPoint M(xM,yM)] between the points: P and Q key [8]
- To get the [Addition and Subtraction] of [Two Vectors: a and b] key [9]
- To calculate the [Resultant(|R) Vector] key [10]
- To find the[VectorA] and [lenght] of givens Points: P, AND Q key [11]
- To find the [Addition] and [Subraction] between [Two Vectors] A and B multiplyed by scalars[coeffic1 and coeffic2] key [12]

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

[º>º] 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].
[º>º] 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 [1º vectorA]!

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

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

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

- Enter the 1º [Component(x)]!
-_- What is the new value? 5

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

            - Introduce the 2º [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 (1º)[coefficient]? 1
            - Give the new [value] to the (2º)[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]; a1 = 2, a2 = 3, b1 =5, and b2 = -1. Following the program will wait the user enter the [coefficients]. Do (1º)[coefficient] = 2 and (2º)[coefficient] = -3 and key ENTER to process.

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

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

[º>º] 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].
[º>º] 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 [1º vectorA]!

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

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

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

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

- Introduce the 2º [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 (1º)[coefficient]? 2
- Give the new [value] to the (2º)[coefficient]? -3

[ANSWER]

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

Example11 – Givens the points: P(2, 0), Q(0, 3), and R(3, 4) find the [vectors and modules]: a + b, a – b, |a + b|, and |a – b|.

Solution – Begin the runtoolsvectors.py program and key the option[12] and wait the display present instructions to select the options: [1] or [2]. Follow type the option[2] and provide the [coordinates]; xP = 2, yP = 0, xQ = 0, yQ = 3, xR = 3 and yR = 4. Following the program will wait the user enter the [coefficients]. Do (1º)[coefficient] = 1 and (2º)[coefficient] = 1 and key ENTER to process.

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

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

[º>º] 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].
[º>º] 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 1º [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? 0
    **[The typed number]: 0.0 is a [valid float number!]
]

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

* Introduce the 1º [Coordinate(x)].
-_- What is the new value? 0
    **[The typed number]: 0.0 is a [valid float number!]
]

* Enter with the 2º [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 [lenght] of the vectorA=|vectorA|: 3.61

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

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

* Introduce the 1º [Coordinate(x)].
-_- 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? 0
    **[The typed number]: 0.0 is a [valid float number!]
]

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

* Introduce the 1º [Coordinate(x)].
-_- What is the new value? 3
    **[The typed number]: 3.0 is a [valid float number!]
]

* Enter with the 2º [Coordinate(y)].
-_- What is the new value? 4
    **[The typed number]: 4.0 is a [valid float number!]
]

Example12 – Givens 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.

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

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

* Enter with the 2º [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 1º [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*