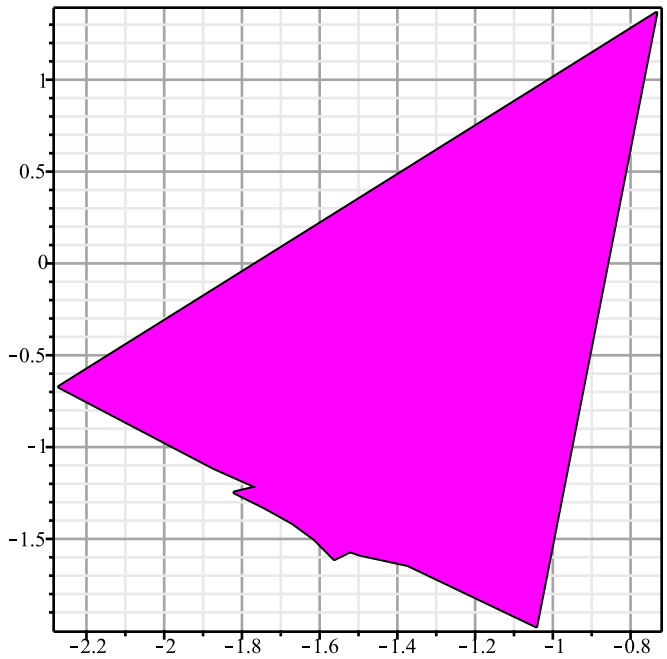
```
> with(plots)
```

[animate, animate3d, animatecurve, arrow, changecoords, complexplot, complexplot3d, conformal, conformal3d, contourplot, contourplot3d, coordplot, coordplot3d, densityplot, display, dualaxisplot, fieldplot, fieldplot3d, gradplot, gradplot3d, implicitplot, implicitplot3d, inequal, interactive, interactiveparams, intersectplot, listcontplot, listcontplot3d, listdensityplot, listplot, listplot3d, loglogplot, logplot, matrixplot, multiple, odeplot, pareto, plotcompare, pointplot, pointplot3d, polarplot, polygonplot, polygonplot3d, polyhedra_supported, polyhedraplot, rootlocus, semilogplot, setcolors, setoptions, setoptions3d, shadebetween, spacecurve, sparsematrixplot, surfdata, textplot, textplot3d, tubeplot] **(1)**

```
> with(geometry)
```

[Apollonius, AreCollinear, AreConcurrent, AreConcyclic, AreConjugate, AreHarmonic, AreOrthogonal, AreParallel, ArePerpendicular, AreSimilar, AreTangent, CircleOfSimilitude, CrossProduct, CrossRatio, DefinedAs, Equation, EulerCircle, EulerLine, ExteriorAngle, ExternalBisector, FindAngle, GergonnePoint, GlideReflection, HorizontalCoord, HorizontalName, InteriorAngle, IsEquilateral, IsOnCircle, IsOnLine, IsRightTriangle, MajorAxis, MakeSquare, MinorAxis, NagelPoint, OnSegment, ParallelLine, PedalTriangle, PerpenBisector, PerpendicularLine, Polar, Pole, RadicalAxis, RadicalCenter, RegularPolygon, RegularStarPolygon, SensedMagnitude, SimsonLine, SpiralRotation, StretchReflection, StretchRotation, TangentLine, VerticalCoord, VerticalName, altitude, apothem, area, asymptotes, bisector, center, centroid, circle, circumcircle, conic, convexhull, coordinates, detail, diagonal, diameter, dilatation, directrix, distance, draw, dsegment, ellipse, excircle, expansion, foci, focus, form, homology, homothety, hyperbola, incircle, inradius, intersection, inversion, line, medial, median, method, midpoint, orthocenter, parabola, perimeter, point, powerpc, projection, radius, randpoint, reciprocation, reflection, rotation, segment, sides, similitude, slope, square, stretch, tangentpc, translation, triangle, vertex, vertices] **(2)**

```
>
>
> no_intersection_1 := Matrix([[ -2.2707, -0.671873 ], [ -1.87269, -1.11342 ], [ -1.7617,
    -1.21776 ], [ -1.80882, -1.24153 ], [ -1.81922, -1.24714 ], [ -1.74258, -1.32806 ], [
    -1.67081, -1.41219 ], [ -1.6136, -1.50057 ], [ -1.56223, -1.60986 ], [ -1.52142,
    -1.56724 ], [ -1.49817, -1.58469 ], [ -1.37304, -1.64217 ], [ -1.04275, -1.97584 ], [
    -0.733766, 1.36335 ]], datatype = float) :
>
> polygonplot(no_intersection_1, axes = boxed, colour = "Magenta", transparency = 0.7, gridlines)
```




```
> no_intersection_1_point_list := [point(A, -2.2707, -0.671873), point(B, -1.87269,
      -1.11342), point(C, -1.7617, -1.21776), point(E, -1.80882, -1.24153), point(F,
      -1.81922, -1.24714), point(G, -1.74258, -1.32806), point(H, -1.67081, -1.41219),
      point(J, -1.6136, -1.50057), point(K, -1.56223, -1.60986), point(L, -1.52142,
      -1.56724), point(M, -1.49817, -1.58469), point(N, -1.37304, -1.64217), point(P,
      -1.04275, -1.97584), point(Q, -0.733766, 1.36335)]
```

$$one\_point\_list := [A, B, C, E, F, G, H, J, K, L, M, N, P, Q] \quad (3)$$

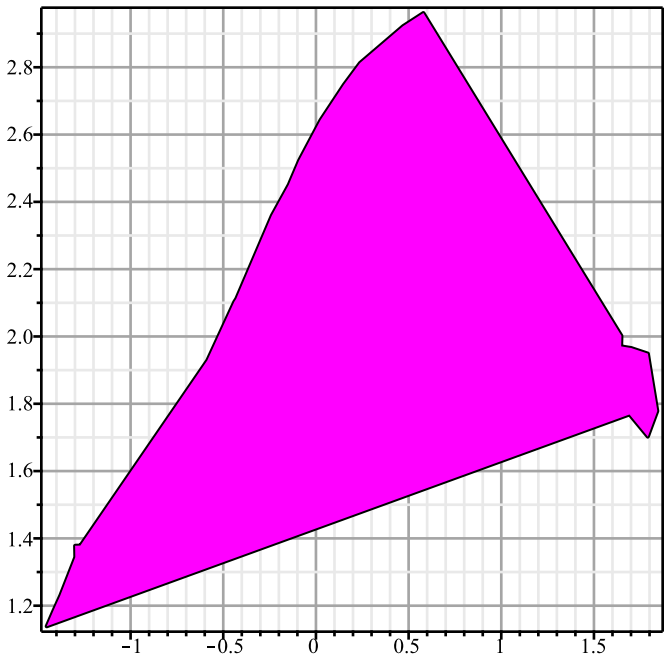
```
> centroid(R,no_intersection_1_point_list)
```

$$R \quad (4)$$

```
> coordinates(R)
```

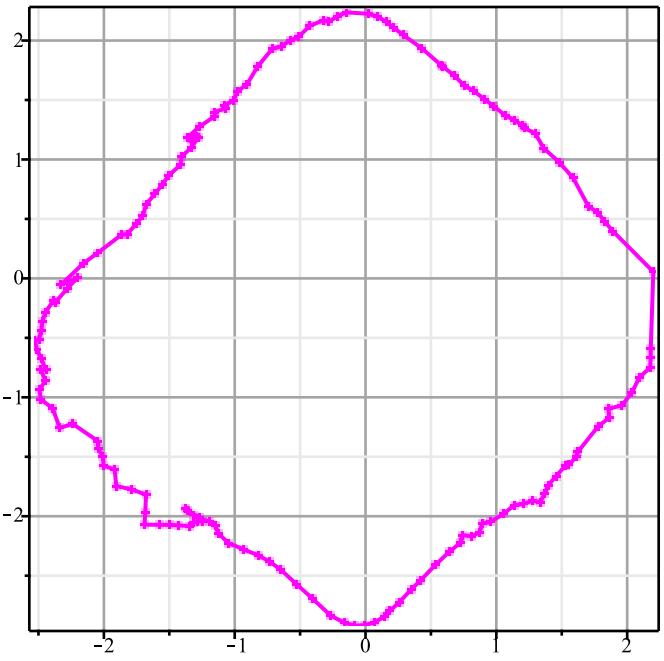
$$[-1.592249714, -1.196356643] \quad (5)$$

```
>
>
> no_intersection_2 := Matrix([[ 1.79065, 1.70226 ], [ 1.84189, 1.77841 ], [ 1.79108,
      1.94911 ], [ 1.70117, 1.96561 ], [ 1.64682, 1.97058 ], [ 1.64834, 2.00207 ], [ 0.579654,
      2.9612 ], [ 0.470181, 2.92217 ], [ 0.237726, 2.81262 ], [ 0.150733, 2.74811 ],
      [ 0.0247387, 2.64311 ], [ -0.0907662, 2.52311 ], [ -0.137273, 2.46312 ], [ -0.146275,
      2.45112 ], [ -0.237777, 2.35962 ], [ -0.429805, 2.11215 ], [ -0.440305, 2.10315 ], [
      -0.585821, 1.92917 ], [ -1.27128, 1.37863 ], [ -1.29933, 1.37814 ], [ -1.29829,
      1.34413 ], [ -1.3793, 1.23015 ], [ -1.41381, 1.18815 ], [ -1.45281, 1.13866 ],
      [ 1.69172, 1.76819 ] ], datatype = float) :
> polygonplot(no_intersection_2, axes = boxed, colour = "Magenta", transparency = 0.7, gridlines)
```




```
>
> intersection_3 := Matrix([[ 1.95935, -1.06816 ], [ 2.03657, -0.958725 ], [ 2.09231,
      -0.834391 ], [ 2.17588, -0.748562 ], [ 2.17956, -0.667772 ], [ 2.1802, -0.585333 ],
      [ 2.19978, 0.0551595 ], [ 1.88977, 0.397893 ], [ 1.82898, 0.477325 ], [ 1.77325,
      0.556991 ], [ 1.70475, 0.604511 ], [ 1.58619, 0.845729 ], [ 1.47955, 0.977455 ],
      [ 1.36262, 1.09416 ], [ 1.29639, 1.21897 ], [ 1.21279, 1.265 ], [ 1.19986, 1.28623 ],
      [ 1.14087, 1.33021 ], [ 1.06675, 1.37141 ], [ 0.979473, 1.4481 ], [ 0.909823, 1.50672 ],
      [ 0.821894, 1.57982 ], [ 0.753623, 1.62236 ], [ 0.677478, 1.70691 ], [ 0.585419,
      1.78576 ], [ 0.5809, 1.79024 ], [ 0.428965, 1.93578 ], [ 0.287446, 2.047 ], [ 0.216996,
      2.10734 ], [ 0.157291, 2.1578 ], [ 0.092434, 2.20018 ], [ 0.0232267, 2.22498 ], [
      -0.148401, 2.23719 ], [ -0.213918, 2.20521 ], [ -0.281968, 2.15697 ], [ -0.321865,
      2.1713 ], [ -0.425435, 2.12354 ], [ -0.512606, 2.03148 ], [ -0.573862, 2.00154 ], [
      -0.644653, 1.95093 ], [ -0.713868, 1.92983 ], [ -0.826894, 1.77832 ], [ -0.907591,
      1.62844 ], [ -0.97866, 1.57536 ], [ -1.00942, 1.49328 ], [ -1.08128, 1.45712 ], [
      -1.07079, 1.42897 ], [ -1.15402, 1.3989 ], [ -1.15289, 1.36314 ], [ -1.27268,
      1.27318 ], [ -1.3591, 1.18618 ], [ -1.33966, 1.17289 ], [ -1.32549, 1.17318 ], [
      -1.30867, 1.18356 ], [ -1.28892, 1.18917 ], [ -1.27916, 1.18345 ], [ -1.33165,
      1.10101 ], [ -1.4053, 1.02438 ], [ -1.4142, 0.954791 ], [ -1.50514, 0.865025 ], [
      -1.55162, 0.791523 ], [ -1.6106, 0.710221 ], [ -1.67635, 0.623157 ], [ -1.7024,
      0.528378 ], [ -1.75097, 0.46044 ], [ -1.82165, 0.37245 ], [ -1.86613, 0.366217 ], [
      -2.04861, 0.213455 ], [ -2.1548, 0.127433 ], [ -2.3279, -0.052161 ], [ -2.20184,
      0.00357705 ], [ -2.27727, -0.0809568 ], [ -2.36896, -0.200651 ], [ -2.38692,
      -0.189147 ], [ -2.44727, -0.285606 ], [ -2.46921, -0.358873 ], [ -2.47921,
      -0.439633 ], [ -2.49539, -0.511149 ], [ -2.52905, -0.519139 ], [ -2.51295,
      -0.594366 ], [ -2.47883, -0.677467 ], [ -2.44212, -0.768172 ], [ -2.48412,
      -0.77002 ], [ -2.44535, -0.858211 ], [ -2.49148, -0.933307 ], [ -2.48314,
      -1.01667 ], [ -2.39089, -1.09338 ], [ -2.33759, -1.25702 ], [ -2.23793, -1.22359 ], [
      -2.04524, -1.36844 ], [ -2.04418, -1.42932 ], [ -2.00761, -1.49809 ], [ -2.00204,
      -1.5744 ], [ -1.91743, -1.60818 ], [ -1.90511, -1.74621 ], [ -1.78665, -1.77436 ], [
      -1.67757, -1.81911 ], [ -1.68389, -1.97044 ], [ -1.68919, -2.07086 ], [ -1.57517,
      -2.07216 ], [ -1.50051, -2.07299 ], [ -1.42833, -2.07687 ], [ -1.34904, -2.0825 ], [
      -1.31679, -2.05344 ], [ -1.28312, -2.04236 ], [ -1.24901, -2.04033 ], [ -1.31482,
      -1.9895 ], [ -1.37622, -1.93265 ], [ -1.35974, -1.95166 ], [ -1.2683, -2.01416 ], [
```

```
    -1.19467, -2.04553 ], [ -1.14795, -2.08175 ], [ -1.12385, -2.14632 ], [ -1.04586,
    -2.22675 ], [ -0.936395, -2.27667 ], [ -0.820015, -2.32899 ], [ -0.730704,
    -2.38393 ], [ -0.652627, -2.44544 ], [ -0.525162, -2.57372 ], [ -0.406811,
    -2.69134 ], [ -0.26671, -2.83517 ], [ -0.159789, -2.89657 ], [ -0.08109, -2.9202 ], [
    -0.00602179, -2.91571 ], [ 0.066261, -2.89309 ], [ 0.142085, -2.84638 ], [ 0.18614,
    -2.79538 ], [ 0.257397, -2.72466 ], [ 0.349353, -2.61477 ], [ 0.419151, -2.54106 ],
    [ 0.53464, -2.40912 ], [ 0.640105, -2.29917 ], [ 0.726704, -2.22249 ], [ 0.743246,
    -2.15886 ], [ 0.809312, -2.16836 ], [ 0.870535, -2.13776 ], [ 0.892425, -2.06249 ],
    [ 0.958485, -2.04571 ], [ 1.05352, -1.98112 ], [ 1.13594, -1.90747 ], [ 1.20661,
    -1.8967 ], [ 1.2782, -1.86922 ], [ 1.33368, -1.88036 ], [ 1.37162, -1.80719 ],
    [ 1.39659, -1.73857 ], [ 1.45695, -1.6621 ], [ 1.5296, -1.57352 ], [ 1.5538,
    -1.56832 ], [ 1.61087, -1.50097 ], [ 1.62306, -1.45942 ], [ 1.77735, -1.24461 ],
    [ 1.86121, -1.17367 ], [ 1.85747, -1.09603 ] ], datatype = float) :
> polygonplot(intersection_3, axes = boxed, colour = "Magenta", transparency = 0.7, gridlines, style
    = pointline)
```




```
>
> intersection_2 := Matrix( [ [ 4.45327, 4.0822 ], [ 4.25486, 3.90112 ], [ 4.14446, 3.58195 ],
    [ 4.10713, 3.5055 ], [ 4.02483, 3.50932 ], [ 3.95703, 3.66378 ], [ 4.14724, 3.86212 ],
    [ 4.42137, 4.02941 ], [ 4.61051, 4.19243 ], [ 4.87458, 4.15157 ], [ 5.07155, 4.34398 ],
    [ 5.30994, 4.44361 ], [ 5.49269, 4.33694 ], [ 5.89203, 4.30996 ], [ 6.16475, 4.32853 ],
    [ 6.42676, 4.4449 ], [ 6.75477, 4.68576 ], [ 6.95534, 4.53065 ], [ 7.27227, 4.40478 ],
    [ 7.5418, 4.30457 ], [ 7.81271, 4.21289 ], [ 8.17287, 4.2469 ], [ 8.14899, 3.9465 ],
    [ 8.4078, 4.07965 ], [ 8.70196, 4.12787 ], [ 8.83405, 3.9786 ], [ 9.00349, 4.13456 ],
    [ 9.26543, 4.03087 ], [ 9.39334, 3.88889 ], [ 9.63696, 3.7445 ], [ 9.81179, 3.59153 ],
    [ 10.1371, 3.44291 ], [ 10.419, 3.22306 ], [ 10.3839, 2.97313 ], [ 10.3589, 2.74564 ],
    [ 10.3661, 2.53377 ], [ 10.6817, 2.48854 ], [ 11.0348, 2.53838 ], [ 11.1159, 2.36883 ],
    [ 11.1011, 2.0861 ], [ 11.3644, 1.93185 ], [ 11.2023, 1.66064 ], [ 10.9909, 1.39433 ],
    [ 10.8817, 1.13261 ], [ 10.7544, 1.0609 ], [ 10.7026, 1.06779 ], [ 10.73, 1.0171 ],
    [ 10.8125, 0.998518 ], [ 10.9128, 0.96359 ], [ 11.0119, 1.13152 ], [ 11.101, 1.48218 ],
    [ 11.0324, 1.70447 ], [ 11.0227, 2.00339 ], [ 10.8903, 2.25114 ], [ 10.786, 2.55914 ],
    [ 10.5466, 2.69772 ], [ 10.5249, 2.97604 ], [ 10.4788, 3.17118 ], [ 10.3136, 3.36128 ],
    [ 10.0416, 3.39964 ], [ 9.89797, 3.28802 ], [ 9.89152, 3.49719 ], [ 9.78851, 3.57638 ],
```

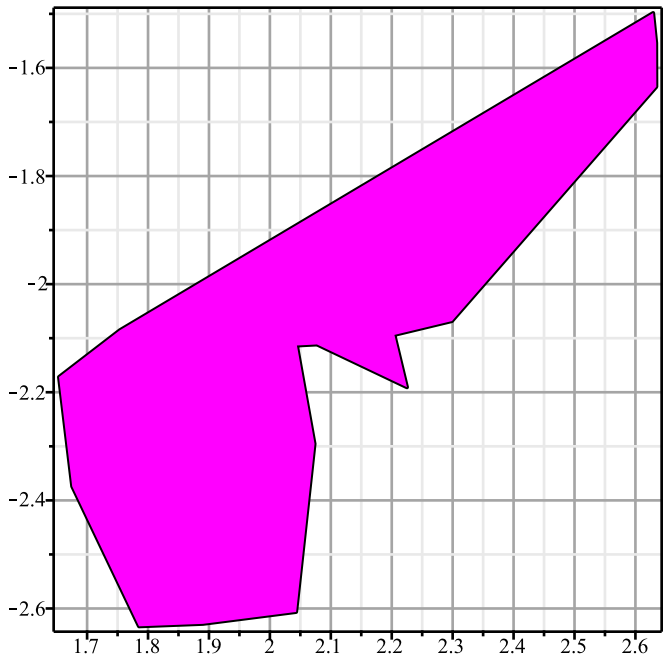
[9.63648, 3.58777], [9.48121, 3.77765], [9.26596, 3.82067], [9.29147, 4.02735], [8.97868, 4.15724], [8.74854, 3.99991], [8.51846, 4.09383], [8.27966, 4.06963], [8.14935, 3.88406], [8.06143, 4.01364], [7.89129, 4.06204], [7.83425, 4.29102], [7.53634, 4.4172], [7.24735, 4.52993], [6.96612, 4.5311], [6.62102, 4.45428], [6.28793, 4.43222], [6.05952, 4.58138], [5.80921, 4.6242], [5.61968, 4.4473], [5.37562, 4.30019], [5.50612, 3.9949], [5.32726, 4.07613], [5.06169, 4.22001], [4.74451, 4.16549]], *datatype* = *float*) :

> *polygonplot*(*intersection_2*, *axes* = *boxed*, *colour* = "Magenta", *transparency* = 0.7, *gridlines*)

>

> *no_intersection_2* := *Matrix*([[2.04311, -2.60638], [2.07328, -2.29542], [2.04436, -2.1135], [2.07723, -2.11157], [2.22505, -2.1908], [2.2044, -2.09395], [2.29885, -2.06831], [2.63428, -1.63493], [2.6341, -1.55385], [2.62903, -1.49845], [1.75374, -2.08527], [1.65385, -2.17183], [1.6755, -2.37402], [1.78514, -2.63299], [1.89026, -2.62838]], *datatype* = *float*) :

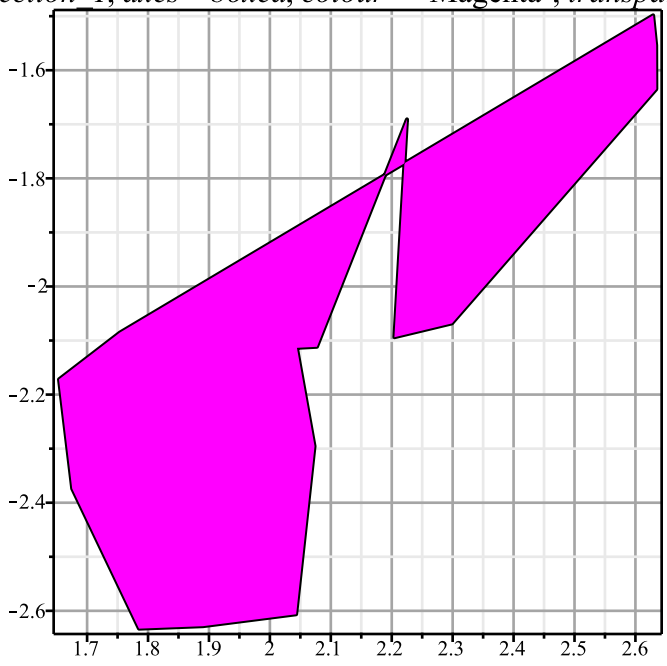
> *polygonplot*(*no_intersection_2*, *axes* = *boxed*, *colour* = "Magenta", *transparency* = 0.7, *gridlines*)




```
>
```

```
> intersection_1 := Matrix([[ 2.04311, -2.60638 ], [ 2.07328, -2.29542 ], [ 2.04436,
      -2.1135 ], [ 2.07723, -2.11157 ], [ 2.22505, -1.6908 ], [ 2.2044, -2.09395 ],
      [ 2.29885, -2.06831 ], [ 2.63428, -1.63493 ], [ 2.6341, -1.55385 ], [ 2.62903,
      -1.49845 ], [ 1.75374, -2.08527 ], [ 1.65385, -2.17183 ], [ 1.6755, -2.37402 ],
      [ 1.78514, -2.63299 ], [ 1.89026, -2.62838 ] ], datatype = float) :
```

```
> polygonplot(intersection_1, axes = boxed, colour = "Magenta", transparency = 0.7, gridlines)
```




```
>
```