Betterplot

```
In[•]:= Betterplot::usage = "Betterplot[{eq__},{x,min,max},{y,min,max}]";

In[•]:= CircleForm[eq_] := Block[{cof = Echo[Coefficient[eq, #, 2] & /@ Variables[eq], "Coefficients"]},
     If[cof ≠ ConstantArray[cof[[1]], Length@cof], Print["coefficients not same"]];
     Echo[Transpose[{(x - h) ^2 + (y - k) ^2 == r^2, If[0 == Expand[cof[[1]] ((x - h) ^2 + (y - k) ^2 - r^2) - eq], "True"]} /.
        SolveAlways[eq / cof[[1]] == (x - h) ^2 + (y - k) ^2 - r^2, {x, y}]]]][[1]][[1]]

   DiscontinuityPoints[eq_, var1_, var2_, var_ : x] := Module[{ineq = FunctionDiscontinuities[eq, var], a},
     a = InequalitiesToIntervals[Check[SolveValues[ineq && var1 ≤ var ≤ var2, var, Reals], Reduce[ineq && var1 ≤ var ≤ var2, var, Reals]], var];
     Select[{#, eq /. var → #} & /@ Flatten[a[[#]] & /@ Range[Length[a]]], {True, True} === Internal`RealValuedNumericQ /@ # &]]

   InequalitiesToIntervals[ineq_, x_] := LogicalExpand[ineq] /.
      {Greater[x, foo_] → Interval[{foo, Infinity}], Greater[foo_, x] → Interval[{-Infinity, foo}], GreaterEqual[x, foo_] → Interval[{foo, Infinity}],
       GreaterEqual[foo_, x] → Interval[{-Infinity, foo}], Less[x, foo_] → Interval[{-Infinity, foo}], Less[foo_, x] → Interval[{foo, Infinity}],
       LessEqual[x, foo_] → Interval[{-Infinity, foo}], LessEqual[foo_, x] → Interval[{foo, Infinity}], Or → IntervalUnion, And → IntervalIntersection};

In[•]:= Options[Betterplot] =
     Join[Options[ContourPlot], {"Asymptote" → True, "N" → False, "TP" → True, "Time" → 7, "IP" → True, "Endpoints" → True, PlotPoints → 50}];

   Betterplot[{eqint__}, dom : {_, _?NumericQ, _?NumericQ} : {x, -10, 10}, ran : {_, _?NumericQ, _?NumericQ} : {y, -10, 10}, opts : OptionsPattern[]] :=
    TimeConstrained[Quiet@Module[{pairs, Tp, graphintercepts, xintercepts, hp, yintercepts, endpoints, midpoints, op, asymp,
        VAsymp, HAsymp, OAsymp, h, k, r, c1, C1Asymp, negx, posx, posy, negy, l, time = OptionValue["Time"], oip, ihp, IP, complex, eq},
       complex =
        Transpose@Table[Module[{a, eq1, trans, final},
           If[Length@Variables[First[ieq]] === 0, eq1 = Last[ieq] == First[ieq], eq1 = ieq];
           Which[Exponent[First[eq1], z] === 1, trans = {0, 0}, Length[First[eq1] // First] ≠ 2, trans = {0, 0}, True, trans = ReIm@First@First@First[eq1]];
           final = {(dom[[1]] + trans[[1]])^2 + (ran[[1]] + trans[[2]])^2 == ((Abs[Last[eq1]])^(1/Exponent[First[eq1],z]))^2, Button[Tooltip@#, Print[#]] & /@
              FromPolarCoordinates /@ AbsArg /@ SolveValues[ieq, z]}], {ieq, Select[{eqint}, Variables[First[Normal@#] - Last[Normal@#]][[1]] === z &]}];

       eq = Sequence[Sequence @@ Select[Normal[{eqint}], Variables[First[Normal@#] - Last[Normal@#]][[1]] =!= z &]];
       pairs = Subsets[{eq}, {2}];
       If[OptionValue["N"],
        graphintercepts = Select[Normal@Table[
            TimeConstrained[NSolveValues[Join[i, {dom[[2]] ≤ dom[[1]] ≤ dom[[3]]}], {dom[[1]], ran[[1]]}, Reals], 8],
            {i, pairs}], UnsameQ[#, {}] &];
        xintercepts = Select[Flatten[{#, 0}] & /@ # & /@ Select[Normal@Table[
              TimeConstrained[Check[NSolveValues[{i /. ran[[1]] → 0, dom[[2]] ≤ dom[[1]] ≤ dom[[3]]}, dom[[1]], Reals], {l}], 7],
              {i, {eq}}], UnsameQ[#, {}] &], Flatten[#][[1]] =!= l &];
        yintercepts = Select[Flatten[{0, #}] & /@ # & /@ Select[Normal@Table[
              TimeConstrained[Check[NSolveValues[{i /. dom[[1]] → 0, ran[[2]] ≤ ran[[1]] ≤ ran[[3]]}, ran[[1]], Reals], {l}], 7],
              {i, {eq}}], UnsameQ[#, {}] &], Flatten[#][[2]] =!= l &];
        negx = Select[Flatten[{dom[[2]], #} & /@ # & /@ Select[Normal@Table[
               TimeConstrained[Check[NSolveValues[{i /. dom[[1]] → dom[[2]], ran[[2]] ≤ ran[[1]] ≤ ran[[3]]}, ran[[1]], Reals], {l}], 7],
               {i, {eq}}], UnsameQ[#, {}] &], 1], #[[2]] =!= l &];
        posx = Select[Flatten[{dom[[3]], #} & /@ # & /@ Select[Normal@Table[
               TimeConstrained[Check[NSolveValues[{i /. dom[[1]] → dom[[3]], ran[[2]] ≤ ran[[1]] ≤ ran[[3]]}, ran[[1]], Reals], {l}], 7],
               {i, {eq}}], UnsameQ[#, {}] &], 1], #[[2]] =!= l &];
        negy = Select[Flatten[{#, ran[[2]]} & /@ # & /@ Select[Normal@Table[
               TimeConstrained[Check[SolveValues[{i /. ran[[1]] → ran[[2]], dom[[2]] ≤ dom[[1]] ≤ dom[[3]]}, dom[[1]], Reals], {l}], 7],
               {i, {eq}}], UnsameQ[#, {}] &], 1], #[[1]] =!= l &];
        posy = Select[Flatten[{#, ran[[3]]} & /@ # & /@ Select[Normal@Table[
               TimeConstrained[Check[SolveValues[{i /. ran[[1]] → ran[[3]], dom[[2]] ≤ dom[[1]] ≤ dom[[3]]}, dom[[1]], Reals], {l}], 7],
               {i, {eq}}], UnsameQ[#, {}] &], 1], #[[1]] =!= l &];


        ,
        graphintercepts = Select[Normal@Table[
            TimeConstrained[SolveValues[Join[i, {dom[[2]] ≤ dom[[1]] ≤ dom[[3]]}], {dom[[1]], ran[[1]]}, Reals],
             time, TimeConstrained[NSolveValues[Join[i, {dom[[2]] ≤ dom[[1]] ≤ dom[[3]]}], {dom[[1]], ran[[1]]}, Reals], 8]],
            {i, pairs}], UnsameQ[#, {}] &];
        xintercepts = Select[Flatten[{#, 0}] & /@ # & /@ Select[Normal@Table[
              TimeConstrained[Check[SolveValues[{i /. ran[[1]] → 0, dom[[2]] ≤ dom[[1]] ≤ dom[[3]]}, dom[[1]], Reals], {l}],
               time, TimeConstrained[Check[NSolveValues[{i /. ran[[1]] → 0, dom[[2]] ≤ dom[[1]] ≤ dom[[3]]}, dom[[1]], Reals], {l}], 7]],
              {i, {eq}}], UnsameQ[#, {}] &], Flatten[#][[1]] =!= l &];
        yintercepts = Select[Flatten[{0, #}] & /@ # & /@ Select[Normal@Table[
              TimeConstrained[Check[SolveValues[{i /. dom[[1]] → 0, ran[[2]] ≤ ran[[1]] ≤ ran[[3]]}, ran[[1]], Reals], {l}],
               time, TimeConstrained[Check[NSolveValues[{i /. dom[[1]] → 0, ran[[2]] ≤ ran[[1]] ≤ ran[[3]]}, ran[[1]], Reals], {l}], 7]],
              {i, {eq}}], UnsameQ[#, {}] &], Flatten[#][[2]] =!= l &];
        negx = Select[Flatten[{dom[[2]], #} & /@ # & /@ Select[Normal@Table[
               TimeConstrained[Check[SolveValues[{i /. dom[[1]] → dom[[2]], ran[[2]] ≤ ran[[1]] ≤ ran[[3]]}, ran[[1]], Reals], {l}],
                time, TimeConstrained[Check[NSolveValues[{i /. dom[[1]] → dom[[2]], ran[[2]] ≤ ran[[1]] ≤ ran[[3]]}, ran[[1]], Reals], {l}], 7]],
               {i, {eq}}], UnsameQ[#, {}] &], 1], #[[2]] =!= l &];
        posx = Select[Flatten[{dom[[3]], #} & /@ # & /@ Select[Normal@Table[
               TimeConstrained[Check[SolveValues[{i /. dom[[1]] → dom[[3]], ran[[2]] ≤ ran[[1]] ≤ ran[[3]]}, ran[[1]], Reals], {l}],
                time, TimeConstrained[Check[NSolveValues[{i /. dom[[1]] → dom[[3]], ran[[2]] ≤ ran[[1]] ≤ ran[[3]]}, ran[[1]], Reals], {l}], 7]],
               {i, {eq}}], UnsameQ[#, {}] &], 1], #[[2]] =!= l &];
        negy = Select[Flatten[{#, ran[[2]]} & /@ # & /@ Select[Normal@Table[
               TimeConstrained[Check[SolveValues[{i /. ran[[1]] → ran[[2]], dom[[2]] ≤ dom[[1]] ≤ dom[[3]]}, dom[[1]], Reals], {l}],
                time, TimeConstrained[Check[SolveValues[{i /. ran[[1]] → ran[[2]], dom[[2]] ≤ dom[[1]] ≤ dom[[3]]}, dom[[1]], Reals], {l}], 7]],
               {i, {eq}}], UnsameQ[#, {}] &], 1], #[[1]] =!= l &];
        posy = Select[Flatten[{#, ran[[3]]} & /@ # & /@ Select[Normal@Table[
               TimeConstrained[Check[SolveValues[{i /. ran[[1]] → ran[[3]], dom[[2]] ≤ dom[[1]] ≤ dom[[3]]}, dom[[1]], Reals], {l}],
                time, TimeConstrained[Check[SolveValues[{i /. ran[[1]] → ran[[3]], dom[[2]] ≤ dom[[1]] ≤ dom[[3]]}, dom[[1]], Reals], {l}], 7]],
               {i, {eq}}], UnsameQ[#, {}] &], 1], #[[1]] =!= l &];
       ];
       If[OptionValue["Endpoints"],
        endpoints = If[Not@ContainsAny[#, {∞, -∞}], #, ## &[]] & /@ DiscontinuityPoints[#, dom[[2]], dom[[3]], dom[[1]]] & /@
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          Flatten[SolveValues[#, ran[[1]]] & /@ Select[{eq},
             Exponent[First[Normal@#] - Last[Normal@#], dom[[1]]] ≠ 2 && Exponent[First[Normal@#] - Last[Normal@#], ran[[1]]] ≠ 2 &]], endpoints = {}];

       midpoints = Lookup[Association[SolveAlways[First[
               QuietEcho[CircleForm[Expand[First[#] - Last[#]]]]] == (x - h) ^2 + (y - k) ^2 - r^2, {x, y}]], {h, k}] & /@
         Select[{eq}, Exponent[First[Normal@#] - Last[Normal@#], dom[[1]]] == 2 && Exponent[First[Normal@#] - Last[Normal@#], ran[[1]]] == 2 &];

       If[OptionValue["Asymptote"],
        asymp = Lookup[Merge[
           OperatorApplied[ResourceFunctionHelpers`Asymptotes, {3, 1, 2}][dom[[1]]][ran[[1]]]
            /@ ReplaceAll[Rule → Equal][
             Flatten[Solve[#, ran[[1]]] & /@
               Select[{eq}, (Exponent[First[Normal@#] - Last[Normal@#], dom[[1]]] ≠ 2) || (Exponent[First[Normal@#] - Last[Normal@#], ran[[1]]] ≠ 2) &]]]
          , Identity], {"Vertical", "Horizontal", "Oblique"}];

        VAsymp = If[Not@MissingQ[asymp[[1]]],
          DeleteDuplicates[Merge[Evaluate[asymp[[1]] // Flatten] /. x___ ± y_ :> Sequence @@ {(x + y), (x - y)}, Identity][dom[[1]]]], {}];
   HAsymp = If[Not@MissingQ[asymp[[2]]],
          DeleteDuplicates[Merge[Evaluate[asymp[[2]] // Flatten] /. x___ ± y_ :> Sequence @@ {(x + y), (x - y)}, Identity][ran[[1]]]], {}];
   OAsymp = If[Not@MissingQ[asymp[[3]]],
          DeleteDuplicates[Merge[Evaluate[asymp[[3]] // Flatten] /. x___ ± y_ :> Sequence @@ {(x + y), (x - y)}, Identity][ran[[1]]]], {}];
        C1Asymp = If[Length@Select[VAsymp, Variables[{#}] == {c1} &] > 0, Flatten[Reap[
            Table[Sow[Table[Evaluate[c1 /. c1 :> x], {x, Ceiling[SolveValues[c1 == dom[[2]], c1]][[1]], Floor[SolveValues[c1 == dom[[3]], c1]][[1]]}]],
              {c1, Select[VAsymp, Variables[{#}] == {c1} &]}] // Last]], {}];
        VAsymp = Select[VAsymp, Variables[{#}] ≠ {c1} &],
        VAsymp = {}; HAsymp = {}; OAsymp = {}; C1Asymp = {}];
       If[OptionValue["TP"],

        If[OptionValue["N"],
         Tp = Flatten[Table[Module[{z = {dom[[1]], Sequence @@ NSolveValues[n, ran[[1]]]} /.
                NSolve[{SolveValues[Dt[n, dom[[1]]], Dt[ran[[1]], dom[[1]]]] == 0, dom[[2]] ≤ dom[[1]] ≤ dom[[3]]}, dom[[1]]]},
             If[ContainsAny[z, {dom[[1]]}] || Not@ContainsAny[Flatten[Length[#] ≠ 2 & /@ z], {False}], ## &[], z]], {n, {eq}}], 1],
         Tp = Flatten[Table[Module[{z = {dom[[1]], Sequence @@ SolveValues[n, ran[[1]]]} /.
                Solve[{SolveValues[Dt[n, dom[[1]]], Dt[ran[[1]], dom[[1]]]] == 0, dom[[2]] ≤ dom[[1]] ≤ dom[[3]]}, dom[[1]]]},
             If[ContainsAny[z, {dom[[1]]}] || Not@ContainsAny[Flatten[Length[#] ≠ 2 & /@ z], {False}], ## &[], z]], {n, {eq}}], 1]];
        op = Normal[Select[Tp, Variables[{Normal[#[[1]]]}] == {c1} &]];
        hp = Flatten[Table[Table[Evaluate[c1 /. c1 :> x],
             {x, Ceiling[SolveValues[c1[[1]] == dom[[2]], c1]][[1]], Floor[SolveValues[c1[[1]] == dom[[3]], c1]][[1]]}], {c1, op}], 1] // DeleteDuplicates;
        Tp = Normal[Select[Tp, Variables[{Normal[#[[1]]]}] ≠ {c1} &]], Tp = {}; hp = {}

       ];
       If[OptionValue["IP"], If[OptionValue["N"],
         IP = Flatten[Table[Module[{z = {dom[[1]], Sequence @@ NSolveValues[n, ran[[1]]]} /.
                NSolve[{SolveValues[Dt[n, {dom[[1]], 2}], Dt[ran[[1]], {dom[[1]], 2}]] == 0, dom[[2]] ≤ dom[[1]] ≤ dom[[3]]}, dom[[1]]]},
             If[ContainsAny[z, {dom[[1]]}] || Not@ContainsAny[Flatten[Length[#] ≠ 2 & /@ z], {False}], ## &[], z]], {n, {eq}}], 1],
         IP = Flatten[Table[Module[{z = {dom[[1]], Sequence @@ SolveValues[n, ran[[1]]]} /.
                Solve[{SolveValues[Dt[n, {dom[[1]], 2}], Dt[ran[[1]], {dom[[1]], 2}]] == 0, dom[[2]] ≤ dom[[1]] ≤ dom[[3]]}, dom[[1]]]},
             If[ContainsAny[z, {dom[[1]]}] || Not@ContainsAny[Flatten[Length[#] ≠ 2 & /@ z], {False}], ## &[], z]], {n, {eq}}], 1]
        ];
        oip = Normal[Select[IP, Variables[{Normal[#[[1]]]}] == {c1} &]];
        ihp = Flatten[Table[Table[Evaluate[c1 /. c1 :> x],
             {x, Ceiling[SolveValues[c1[[1]] == dom[[2]], c1]][[1]], Floor[SolveValues[c1[[1]] == dom[[3]], c1]][[1]]}], {c1, oip}], 1] // DeleteDuplicates;
        IP = Normal[Select[IP, Variables[{Normal[#[[1]]]}] ≠ {c1} &]
         ]];
       Show[{
         ContourPlot[{eqint}, dom, ran, Evaluate[FilterRules[{opts}, Options[ContourPlot]]],
          PlotRange → Full, Axes → True, AxesLabel → {Row[{"ℝ | ", dom[[1]]}], Row[{"Im | ", ran[[1]]}]}, PlotLegends → "Expressions",
          Frame → False, Ticks → Automatic, GridLines → Automatic, PlotPoints → OptionValue[PlotPoints]],

         If[Not[complex === {}],
          Sequence @@ {ContourPlot[Evaluate[complex[[1]]], dom, ran, ContourStyle → Dashed], ListPlot[complex[[2]], PlotMarkers → {Automatic, 7}]}, ## &[]]
         ,

         Sequence @@ If[OptionValue["N"],
           {
            ListPlot[Button[Tooltip@#, Print[#]] & /@
              N@DeleteDuplicates@Join[Sequence @@ xintercepts, Sequence @@ yintercepts], PlotStyle → {Black}, PlotMarkers → {Automatic, 5}],
            ListPlot[Button[Tooltip@#, Print[#]] & /@ N@Flatten[DeleteDuplicates@graphintercepts, 1], PlotStyle → {Blue}, PlotMarkers → {Automatic, 5}],
            ListPlot[Button[Tooltip@#, Print[#]] & /@ N@DeleteDuplicates@midpoints, PlotStyle → {Brown}, PlotMarkers → {Automatic, 5}],
            ListPlot[Button[Tooltip@#, Print[#]] & /@
              N@Part[DeleteDuplicates[{Flatten[{posx, negx, posy, negy}, 1]}], 1], PlotStyle → {Gray}, PlotMarkers → {Automatic, 5}],
            ListPlot[Button[Tooltip@#, Print[#]] & /@
              N@Flatten[DeleteDuplicates[Select[endpoints, UnsameQ[#, {}] &]], 1], PlotStyle → {Red}, PlotMarkers → {Automatic, 5}]


           },
           {
            ListPlot[Button[Tooltip@#, Print[#]] & /@
              DeleteDuplicates@Join[Sequence @@ xintercepts, Sequence @@ yintercepts], PlotStyle → {Black}, PlotMarkers → {Automatic, 5}],
            ListPlot[Button[Tooltip@#, Print[#]] & /@ Flatten[DeleteDuplicates@graphintercepts, 1], PlotStyle → {Blue}, PlotMarkers → {Automatic, 5}],
            ListPlot[Button[Tooltip@#, Print[#]] & /@ DeleteDuplicates@midpoints, PlotStyle → {Brown}, PlotMarkers → {Automatic, 5}],
            ListPlot[Button[Tooltip@#, Print[#]] & /@
              Part[DeleteDuplicates[{Flatten[{posx, negx, posy, negy}, 1]}], 1], PlotStyle → {Gray}, PlotMarkers → {Automatic, 5}],
            ListPlot[Button[Tooltip@#, Print[#]] & /@
              Flatten[DeleteDuplicates[Select[endpoints, UnsameQ[#, {}] &]], 1], PlotStyle → {Green}, PlotMarkers → {Automatic, 5}]
           }
          ]
         , If[OptionValue["IP"],
          ListPlot[Button[Tooltip@#, Print[#]] & /@ Complement[Join[IP, ihp], Join[Tp, hp]], PlotStyle → {Magenta}, PlotMarkers → {Automatic, 5}], ## &[],
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    If[OptionValue["TP"], ListPlot[Button[Tooltip@#, Print[#]] & /@ Join[Tp, hp], PlotStyle → {Red}, PlotMarkers → {Automatic, 5}], ## &[]],
    If[OptionValue["Asymptote"] && Length[Flatten@Join[HAsymp, OAsymp, C1Asymp, VAsymp]] ≠ 0,
     ContourPlot[
      Evaluate[
       Join[
        If[Length[VAsymp] ≠ 0 || Length[C1Asymp] ≠ 0,
         dom[[1]] == # & /@ DeleteDuplicates[Join[VAsymp, C1Asymp]],
         ## &[]]
        , If[Length[Join[HAsymp, OAsymp]] ≠ 0,
         ran[[1]] == # & /@ Join[HAsymp, OAsymp],
         ## &[]]
       ]
      ],
      dom, ran, ContourStyle → Directive[Orange, Thick, Dashed]], ## &[]]
   }]], 22]
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In[◦]:=
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SetAttributes[Betterplot, HoldFirst]
```
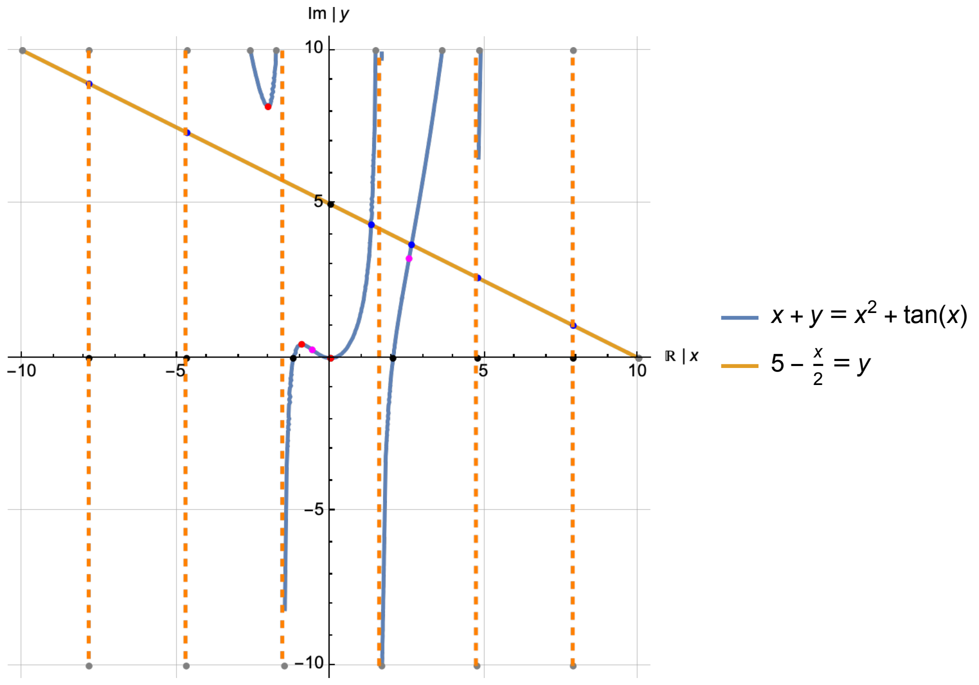

Examples

In[◦]:=
```
Betterplot[{y + x == x^2 + Tan[x], 5 - x / 2 == y}]
```

Out[◦]=



In[◦]:=
```
Betterplot[{(z - I + 1) ^ 4 == 3 + 2 I}, {x, -5, 5}, {y, -5, 5}]
```

Out[◦]=