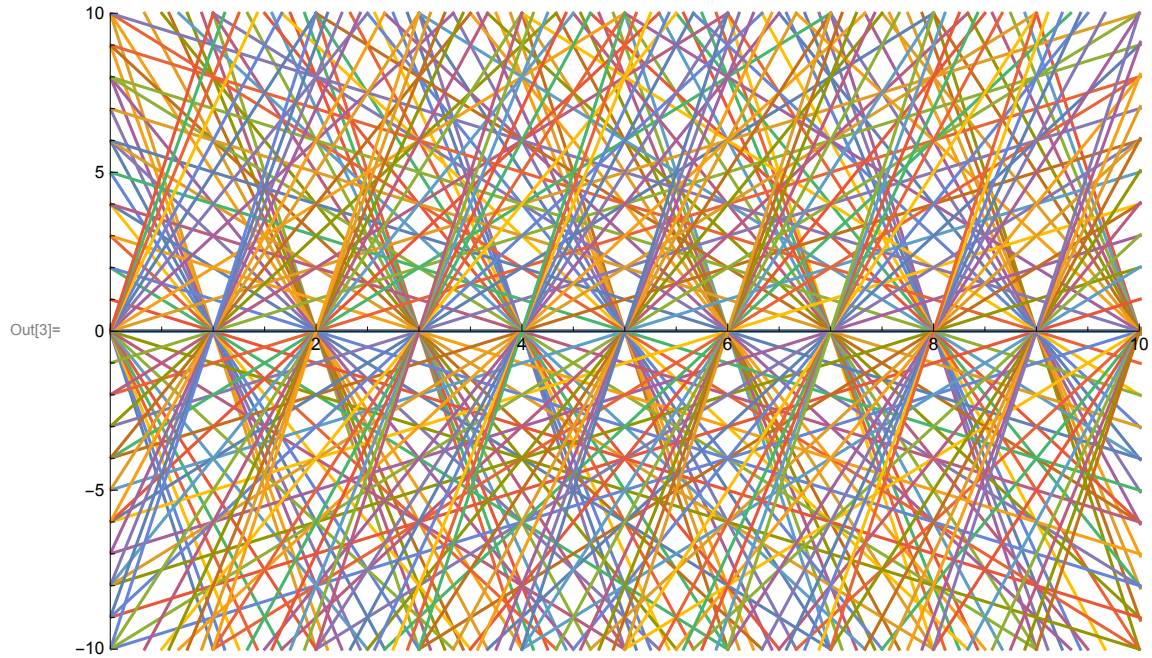```
In[1]:= Clear["Global`*"];
       flin[t_, a_, c_] := Module[{x = 0}, x = a * (t - c); x];
       (* plot the space of linear functions *)
       Plot[Evaluate@Table[flin[t, a, c], {a, -10, 10, 1}, {c, 0, 10, 1}],
        {t, 0.01, 10.01}, PlotRange → {{0, 10}, {-10, 10}}]
```
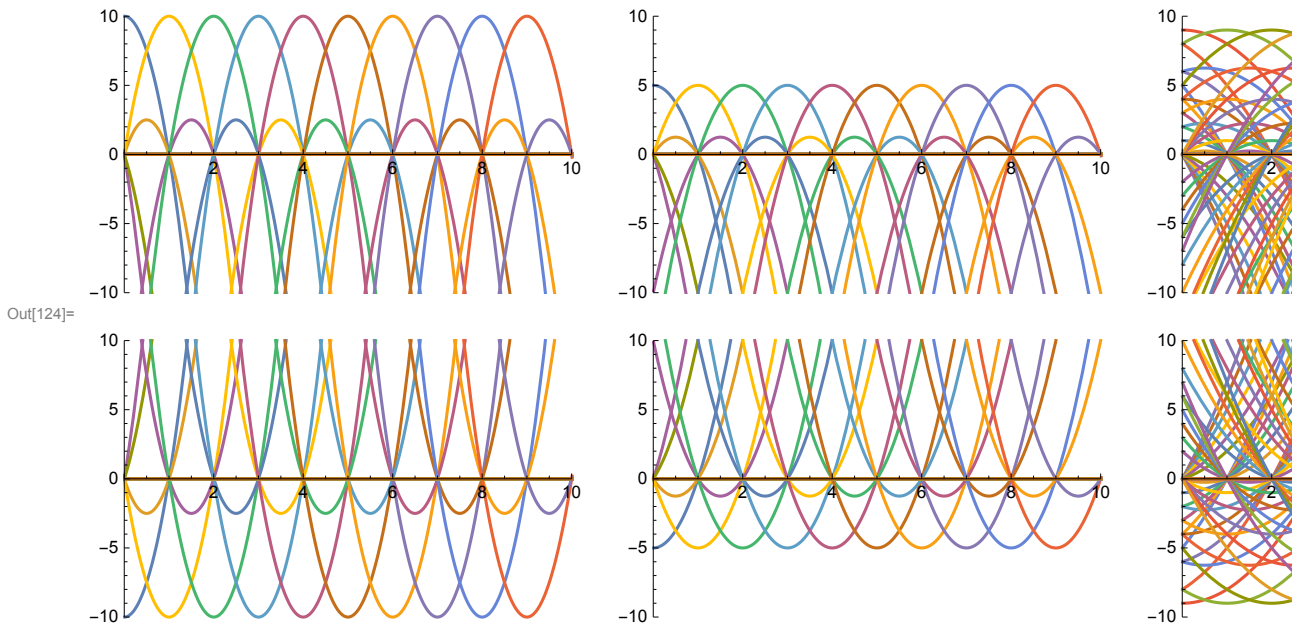
Out[3]=

```
In[117]:= fquad[t_, a_, b_, c_] := Module[{x = 0, r = 0},
          x = c * (t - a) * (t - b);
          If[b > a - 1, x = 0];
          If[b ≠ a, r = Abs[(b - a) * (a - b) / 4], r = 1];
          If[Abs[c] > 10 / r, x = 0];
          x];
     (* plot the space of quadratic functions *)
     (*Plot[fquad[t,8,6,-10],{t,0.01,10.01}, PlotRange→{{0,10},{-10,10}}] *)
     p1 = Plot[Evaluate@Table[fquad[t, a, b, -10], {a, 0, 10, 1}, {b, -10, 10, 1}],
          {t, 0.01, 10.01}, PlotRange → {{0, 10}, {-10, 10}}];
     p2 = Plot[Evaluate@Table[fquad[t, a, b, -5], {a, 0, 10, 1}, {b, -10, 10, 1}],
          {t, 0.01, 10.01}, PlotRange → {{0, 10}, {-10, 10}}];
     p3 = Plot[Evaluate@Table[fquad[t, a, b, -1], {a, 0, 10, 1}, {b, -10, 10, 1}],
          {t, 0.01, 10.01}, PlotRange → {{0, 10}, {-10, 10}}];
     p4 = Plot[Evaluate@Table[fquad[t, a, b, +10], {a, 0, 10, 1}, {b, -10, 10, 1}],
          {t, 0.01, 10.01}, PlotRange → {{0, 10}, {-10, 10}}];
     p5 = Plot[Evaluate@Table[fquad[t, a, b, +5], {a, 0, 10, 1}, {b, -10, 10, 1}],
          {t, 0.01, 10.01}, PlotRange → {{0, 10}, {-10, 10}}];
     p6 = Plot[Evaluate@Table[fquad[t, a, b, +1], {a, 0, 10, 1}, {b, -10, 10, 1}],
          {t, 0.01, 10.01}, PlotRange → {{0, 10}, {-10, 10}}];
     GraphicsGrid[{{p1, p2, p3}, {p4, p5, p6}}]
```

Out[124]=


```
In[204]:= Roots[(t - b) * (t - c) + (t - a) * (t - c) + (t - a) * (t - b) == 0, t]
```

Out[204]= $t == \frac{1}{3} \left(a + b + c - \sqrt{a^2 - a b + b^2 - a c - b c + c^2} \right) \; || \; t == \frac{1}{3} \left(a + b + c + \sqrt{a^2 - a b + b^2 - a c - b c + c^2} \right)$

```
fcubic[t_, a_, b_, c_, d_] := Module[{x = 0, r1 = 0, r2 = 0, v1 = 0, v2 = 0},
    x = d * (t - a) * (t - b) * (t - c);
    If[b > a - 1, x = 0];
    If[c > b - 1 || c > a - 1, x = 0];
    r1 = (a + b + c - Sqrt[a * a - a * b + b * b - a * c - b * c + c * c]) / 3;
    r2 = (a + b + c + Sqrt[a * a - a * b + b * b - a * c - b * c + c * c]) / 3;
    v1 = d * (r1 - a) * (r1 - b) * (r1 - c);
    v2 = d * (r2 - a) * (r2 - b) * (r2 - c);
    If[Abs[v1] > 10 || Abs[v2] > 10, x = 0];
    x];
(* plot the space of cubic functions *)
(* Plot[fcubic[t,8,5,-2,0.08],{t,0.01,10.01}, PlotRange→{{0,10},{-10,10}}] *)
p1 = Plot[Evaluate@Table[fcubic[t, a, b, -5, 0.01], {a, 0, 10, 1}, {b, -10, 10, 2}],
    {t, 0.01, 10.01}, PlotRange → {{0, 10}, {-10, 10}}];
p2 = Plot[Evaluate@Table[fcubic[t, a, b, -5, 0.05], {a, 0, 10, 1}, {b, -10, 10, 2}],
    {t, 0.01, 10.01}, PlotRange → {{0, 10}, {-10, 10}}];
p3 = Plot[Evaluate@Table[fcubic[t, a, b, -5, 0.10], {a, 0, 10, 1}, {b, -10, 10, 2}],
    {t, 0.01, 10.01}, PlotRange → {{0, 10}, {-10, 10}}];

p4 = Plot[Evaluate@Table[fcubic[t, a, b, -1, 0.05], {a, 0, 10, 1}, {b, -10, 10, 2}],
    {t, 0.01, 10.01}, PlotRange → {{0, 10}, {-10, 10}}];
p5 = Plot[Evaluate@Table[fcubic[t, a, b, -1, 0.08], {a, 0, 10, 1}, {b, -10, 10, 2}],
    {t, 0.01, 10.01}, PlotRange → {{0, 10}, {-10, 10}}];
p6 = Plot[Evaluate@Table[fcubic[t, a, b, -1, 0.10], {a, 0, 10, 1}, {b, -10, 10, 2}],
    {t, 0.01, 10.01}, PlotRange → {{0, 10}, {-10, 10}}];

p7 = Plot[Evaluate@Table[fcubic[t, a, b, +3, 0.1], {a, 0, 10, 1}, {b, -10, 10, 2}],
    {t, 0.01, 10.01}, PlotRange → {{0, 10}, {-10, 10}}];
p8 = Plot[Evaluate@Table[fcubic[t, a, b, +3, 0.2], {a, 0, 10, 1}, {b, -10, 10, 2}],
    {t, 0.01, 10.01}, PlotRange → {{0, 10}, {-10, 10}}];
p9 = Plot[Evaluate@Table[fcubic[t, a, b, +3, 0.3], {a, 0, 10, 1}, {b, -10, 10, 2}],
    {t, 0.01, 10.01}, PlotRange → {{0, 10}, {-10, 10}}];

GraphicsGrid[{{p1, p2, p3}, {p4, p5, p6}, {p7, p8, p9}}]
```
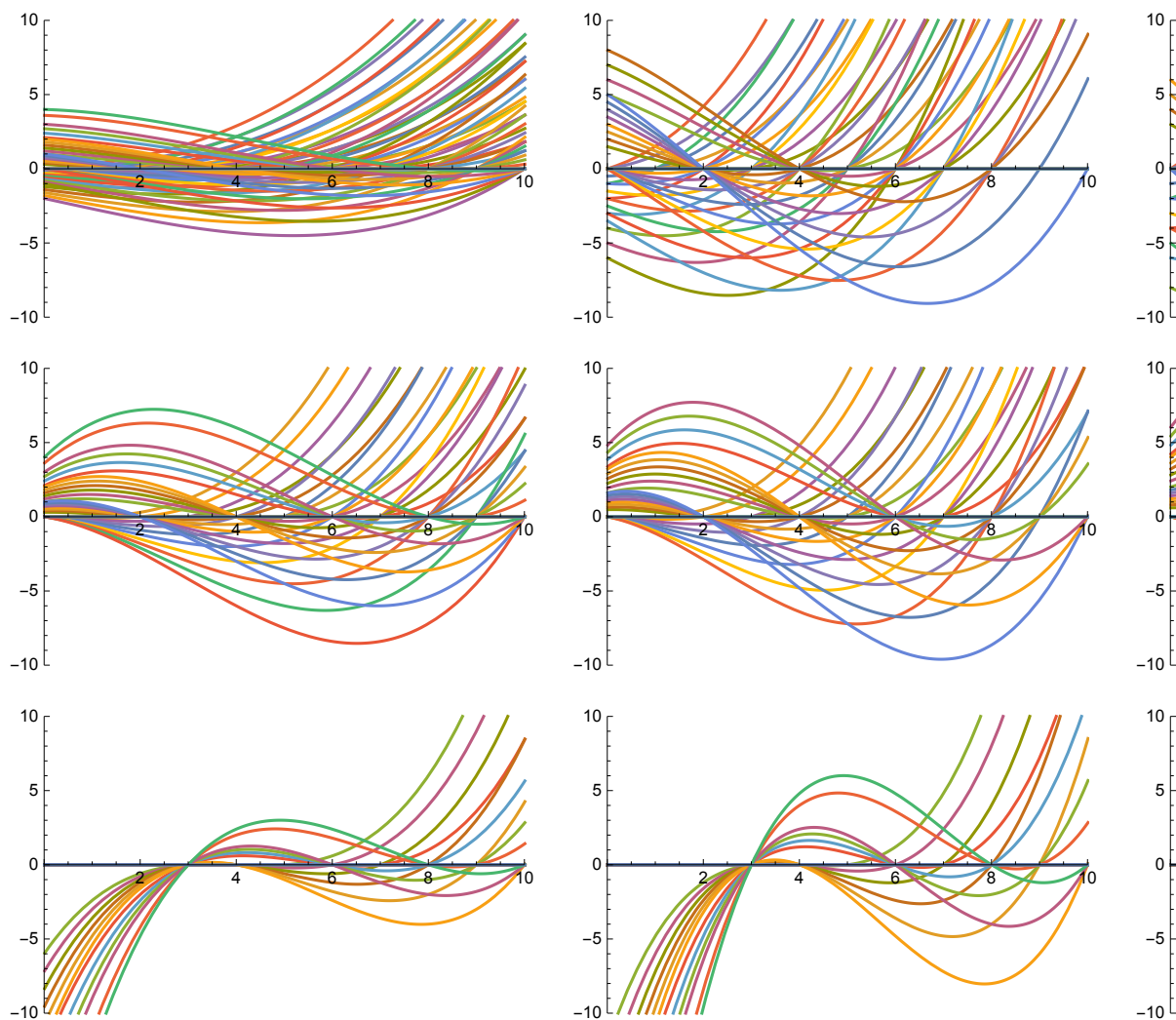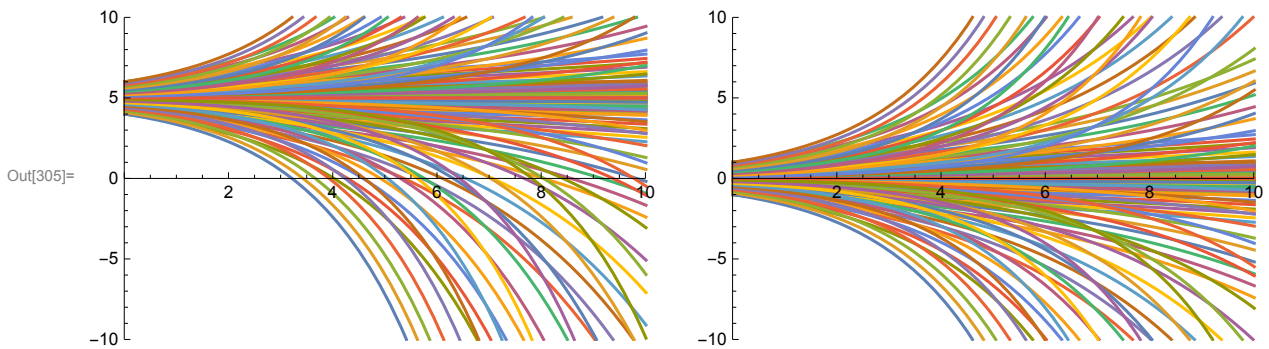
```
In[301]:= fexp[t_, a_, b_, c_] := Module[{x = 0, r = 0},
          x = b * Exp[a * t] + c;
          x];
       p1 = Plot[Evaluate@Table[fexp[t, a, b, 5], {a, -0.5, 0.5, 0.1}, {b, -1, 1, 0.1}],
          {t, 0.01, 10.01}, PlotRange → {{0, 10}, {-10, 10}}];
       p2 = Plot[Evaluate@Table[fexp[t, a, b, 0], {a, -0.5, 0.5, 0.1}, {b, -1, 1, 0.1}],
          {t, 0.01, 10.01}, PlotRange → {{0, 10}, {-10, 10}}];
       p3 = Plot[Evaluate@Table[fexp[t, a, b, -5], {a, -0.5, 0.5, 0.1}, {b, -1, 1, 0.1}],
          {t, 0.01, 10.01}, PlotRange → {{0, 10}, {-10, 10}}];

       GraphicsGrid[{{p1, p2, p3}}]
```



```
In[320]:= flog[t_, a_, b_] := Module[{x = 0, r = 0},
          x = a * Log[t] + b;
          x];
       p1 = Plot[Evaluate@Table[flog[t, a, 0], {a, -5.0, 5.0, 0.1}],
          {t, 0.01, 10.01}, PlotRange → {{0, 10}, {-10, 10}}];
       p2 = Plot[Evaluate@Table[flog[t, a, 5], {a, -5.0, 5.0, 0.1}],
          {t, 0.01, 10.01}, PlotRange → {{0, 10}, {-10, 10}}];
       p3 = Plot[Evaluate@Table[flog[t, a, -5], {a, -5.0, 5.0, 0.1}],
          {t, 0.01, 10.01}, PlotRange → {{0, 10}, {-10, 10}}];
       GraphicsGrid[{{p1, p2, p3}}]
```