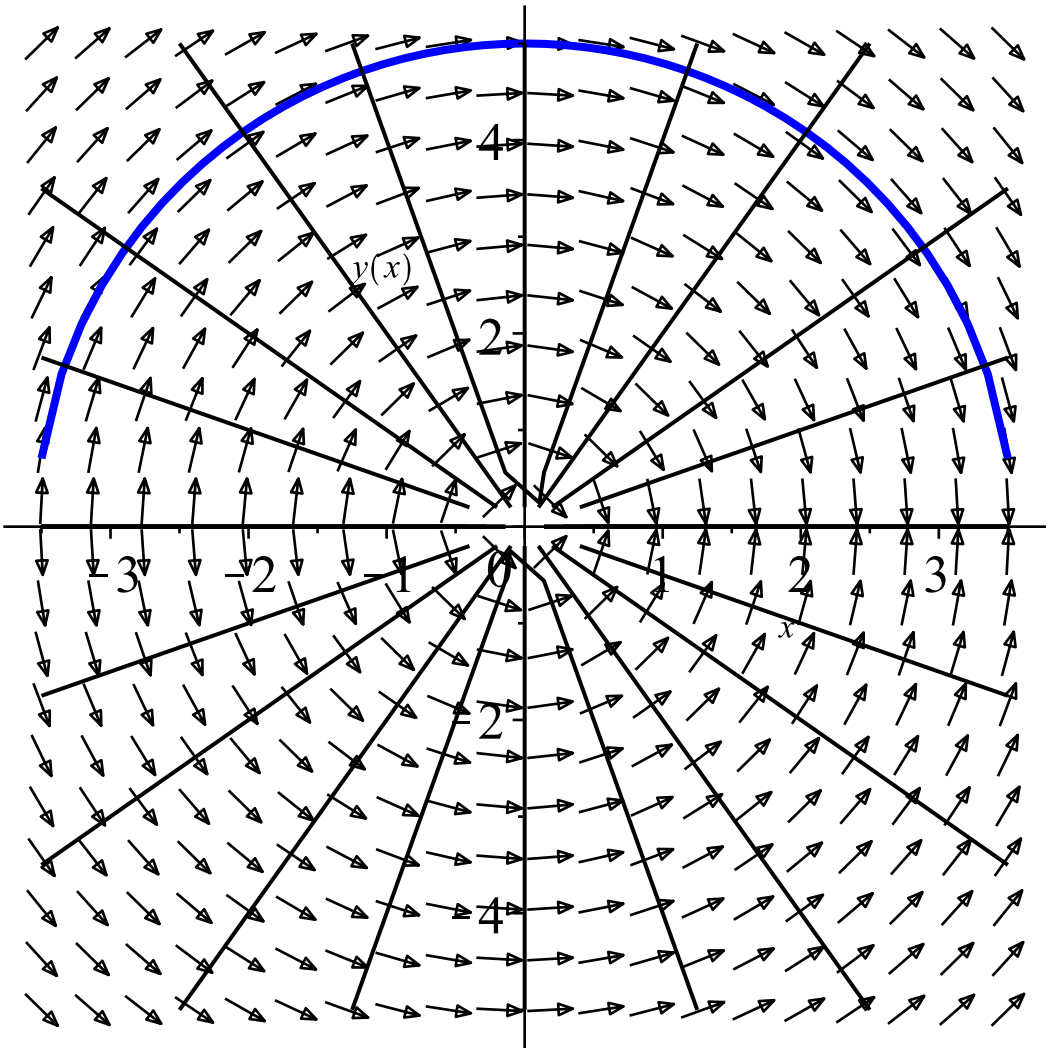
```
> #Лабораторная работа 1
> # Задание 1
> restart;
> with(DEtools) :
> p := DEplot(diff(y(x), x)·y(x) = -2·x, y(x), x = -3.5 ..3.5, y = -5 ..5, [y(0) = 5], color = black,
      arrows = medium, linecolor = blue) :
> for i from -5 to 5 do k[i] := plots[implicitplot]( -2·x/y = i, x = -3.5 ..3.5, y = -5 ..5, color
      = black, transparency = 0.25, rational ) end do:
> plots[display]( p, k[0], k[1], k[2], k[4], k[-1], k[-2], k[-4], plots[implicitplot]( |-2·x/y|
      = 1/2, x = -3.5 ..3.5, y = -5 ..5, color = black, transparency = 0.25, rational ) );
```




```
> # Задание 2
> #1)
> restart;
> with(DEtools) :
```

```
> dsolve(diff(y(x),x) = x/sqrt(15^2 - x^2), y(x));
```

$$y(x) = \frac{(x-15)\,(x+15)}{\sqrt{-x^2+225}} + \_C1 \tag{1}$$

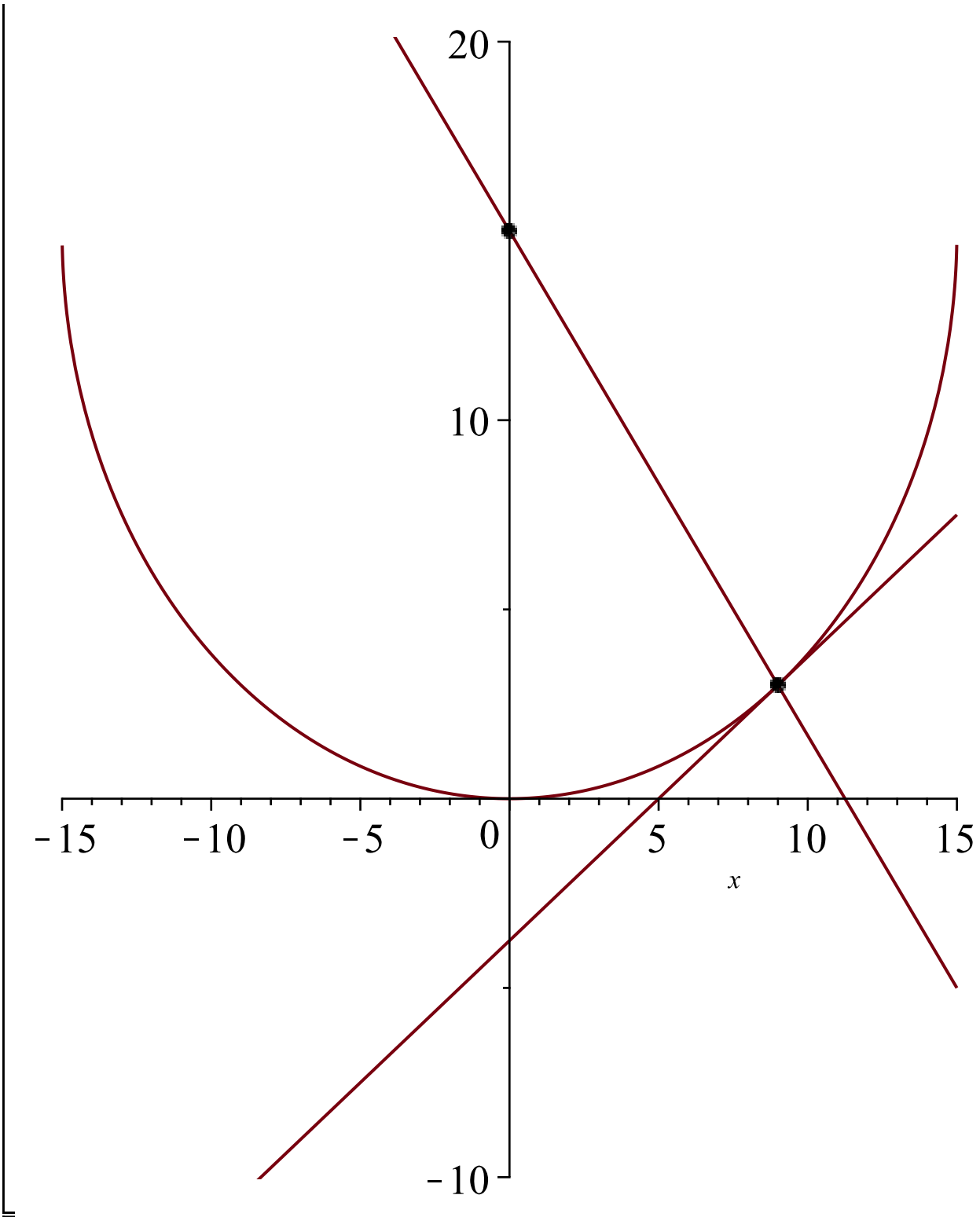
```
> Y := rhs(%) :
> C := simplify(solve(subs(x = 9, Y = 3))) :
> Y := subs(_C1 = C, Y);
```

$$Y := \frac{(x-15)\,(x+15)}{\sqrt{-x^2+225}} + 15 \tag{2}$$

```
> g := plot(Y, x = -15..15) :
> kas := plot(0.75*x - 3.75, x = -15..15, y = -10..20) :
> n := plot(-4/3*x + 15, x = -15..15, y = -10..20) :
> MN = sqrt((9 - 0)^2 + (3 - 15)^2);
```

$$MN = 15 \tag{3}$$

```
> plots[display](g, kas, n, plot([[9, 3], [0, 15]], style = point, color = black, symbol
      = solidcircle));
```



> #2)

> $dsolve\left(diff(y(x),x)=\frac{x\cdot y(x)}{2},y(x)\right);$

$$y(x)=\_C1\,e^{\frac{1}{4}x^2} \quad \textbf{(4)}$$

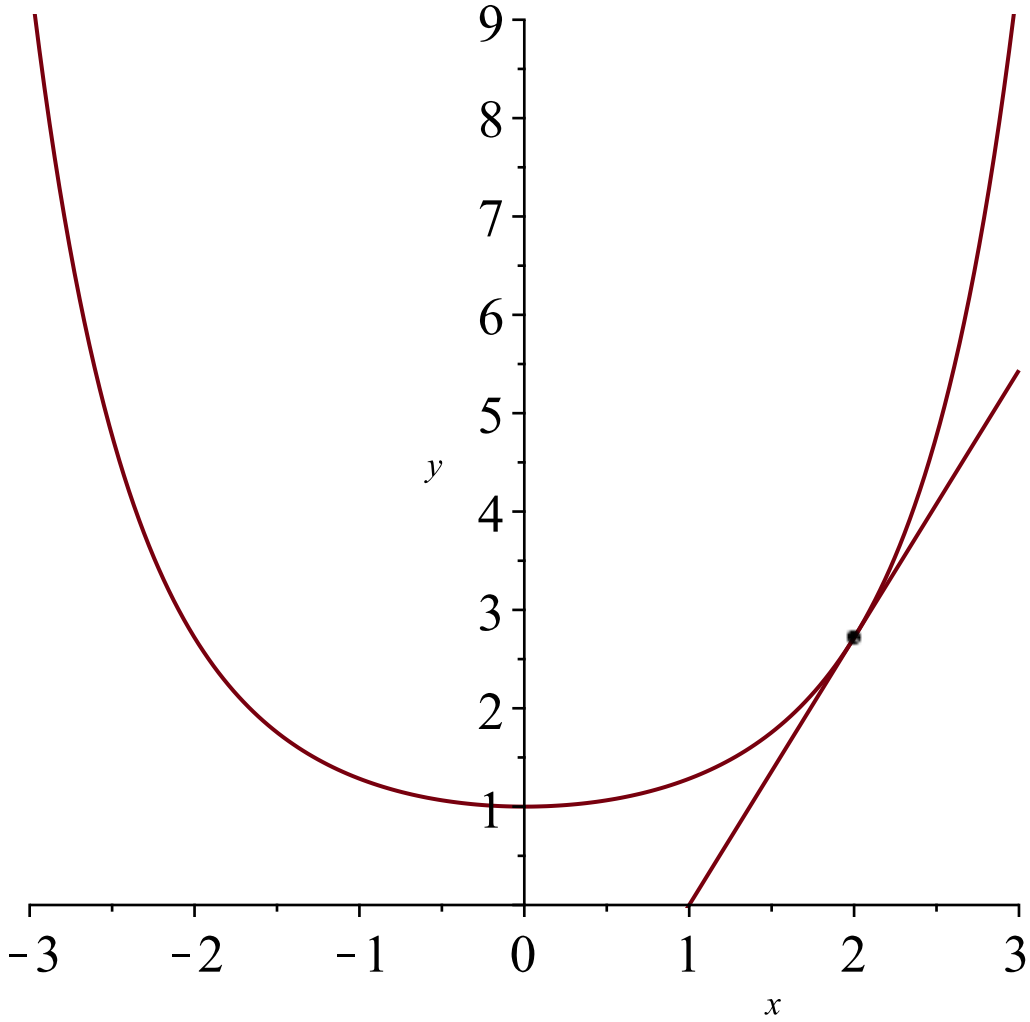
> $Y:=rhs(\%):$

> $C:=simplify(solve(subs(x=2,Y=e))):$

```
> Y := subs(_C1 = C, Y);
```

$$Y := e^{\frac{1}{4}x^2} \quad (5)$$

```
> g := plot(Y, x = -3..3, y = 0..9):
> kas := plot(e·x - e, x = -3..3, y = 0..9):
> plots[display](g, kas, plot([[2, e]], style = point, color = black, symbol = solidcircle));
```




```
> # Задание 3
> restart;
> with(DEtools):
> diffy := dsolve(diff(y(x), x) = (-15·x + y(x) + 13)/(9·x + y(x) - 11), y(x), implicit);
```

$$diffy := -3\ln\left(-\frac{y(x) - 5 + 3x}{x - 1}\right) + 2\ln\left(-\frac{y(x) - 7 + 5x}{x - 1}\right) - \ln(x - 1) - \_C1 = 0 \quad (6)$$

```
> diffy := subs(_C1 = -ln(_C1), y(x) = y, diffy):
> C := solve(diffy, _C1);
```

$$C := -\frac{(y - 5 + 3x)^3}{(y - 7 + 5x)^2} \quad (7)$$

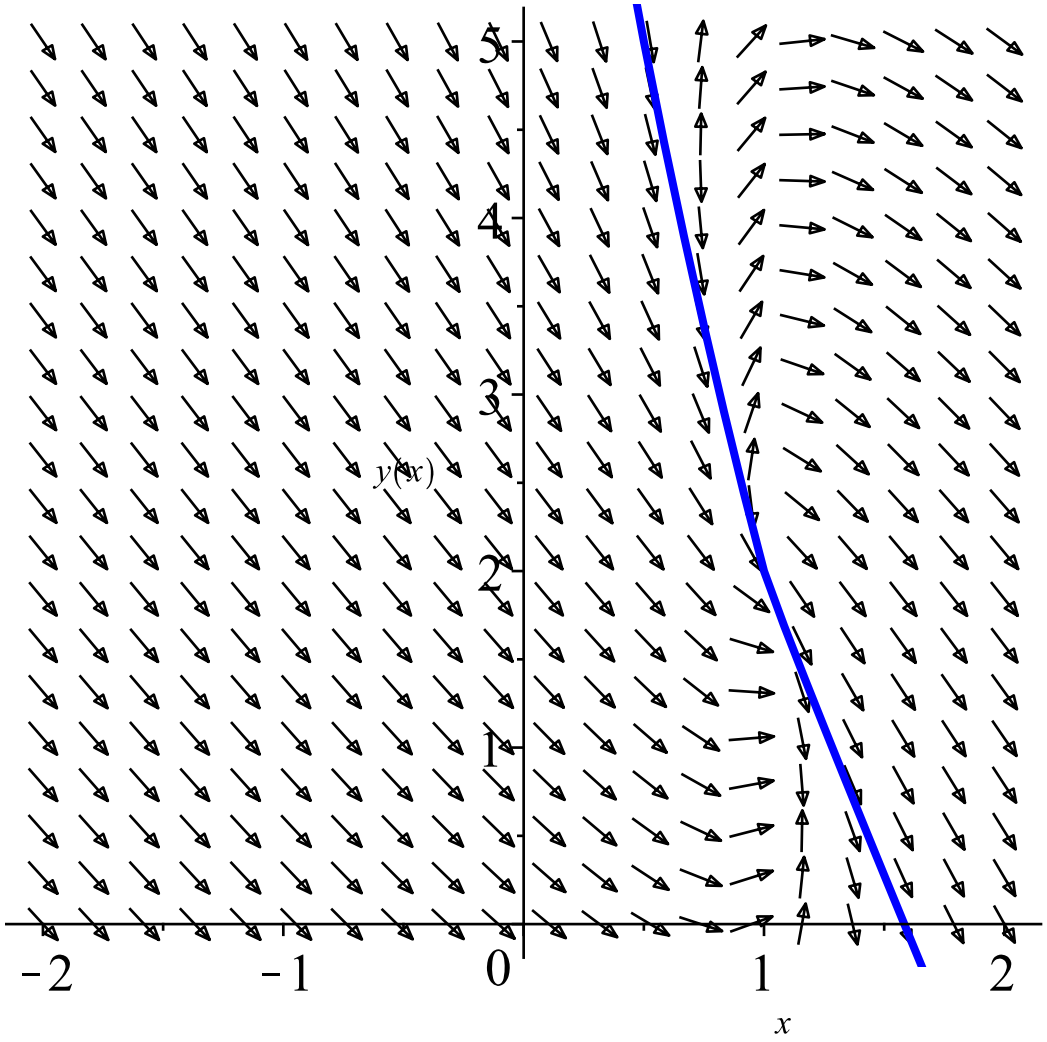
```
> solve({-15·x + y + 13 = 0, 9·x + y - 11 = 0});
```

$$\{x = 1, y = 2\} \quad (8)$$

```
> with(LinearAlgebra) :
> A := Matrix([[9, 1], [-15, 1]]) :
> Eigenvalues(A);
```

$$\begin{bmatrix} 6 \\ 4 \end{bmatrix} \tag{9}$$

```
> DEplot(diff(y(x), x) = (-15·x + y(x) + 13)/(9·x + y(x) - 11), y(x), x = -2..2, y = 0..5, [y(0.5) = 5, ], color
      = black, arrows = medium, linecolor = blue);
```



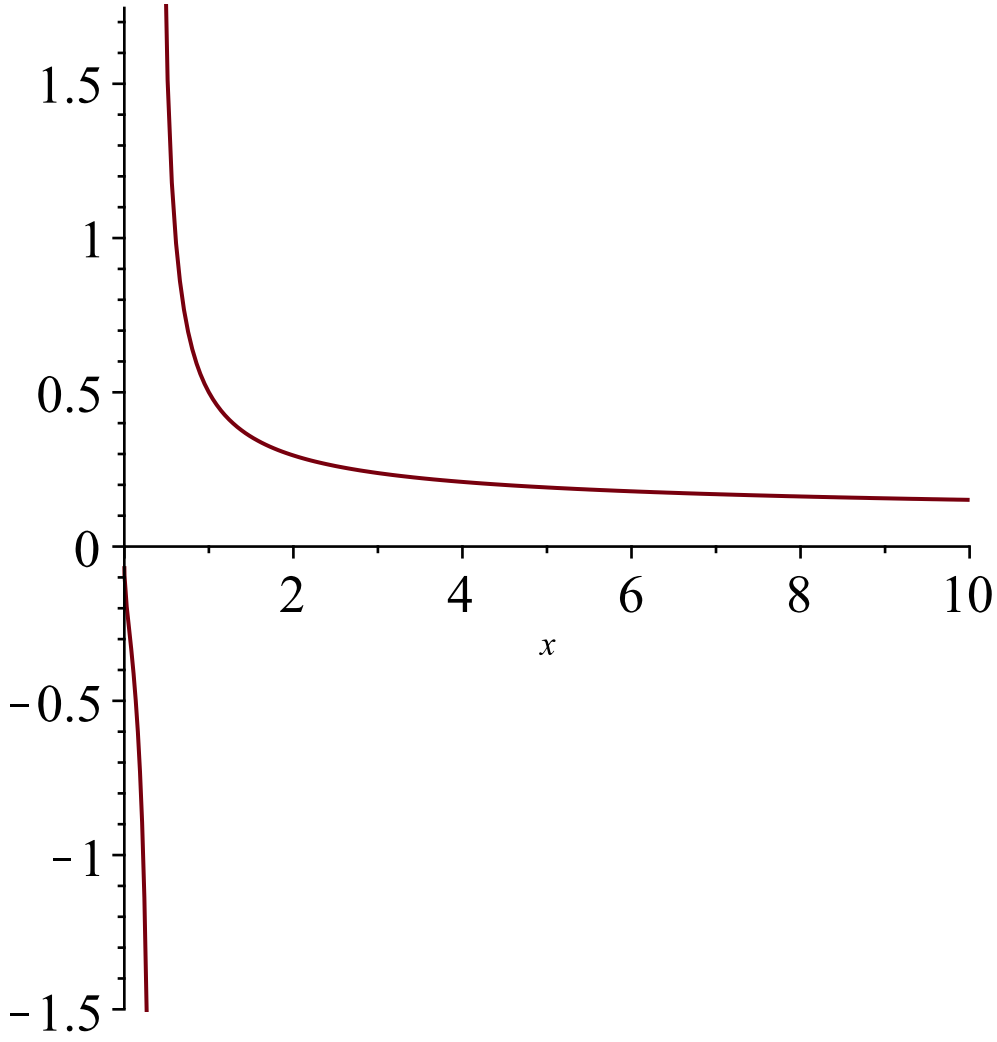

```
> # Задание 4
> restart;
> with(DEtools) :
> y := rhs(dsolve(x·diff(y(x), x) + y(x) = 2·y(x)^2·ln(x), y(x)));
```

$$y := \frac{1}{2 + \_C1\, x + 2\ln(x)} \tag{10}$$

```
> C := solve(subs(x = 1, y = 1/2)) :
> y := subs(_C1 = C, y);
```

$$y := \frac{1}{2 + 2\ln(x)} \quad \textbf{(11)}$$

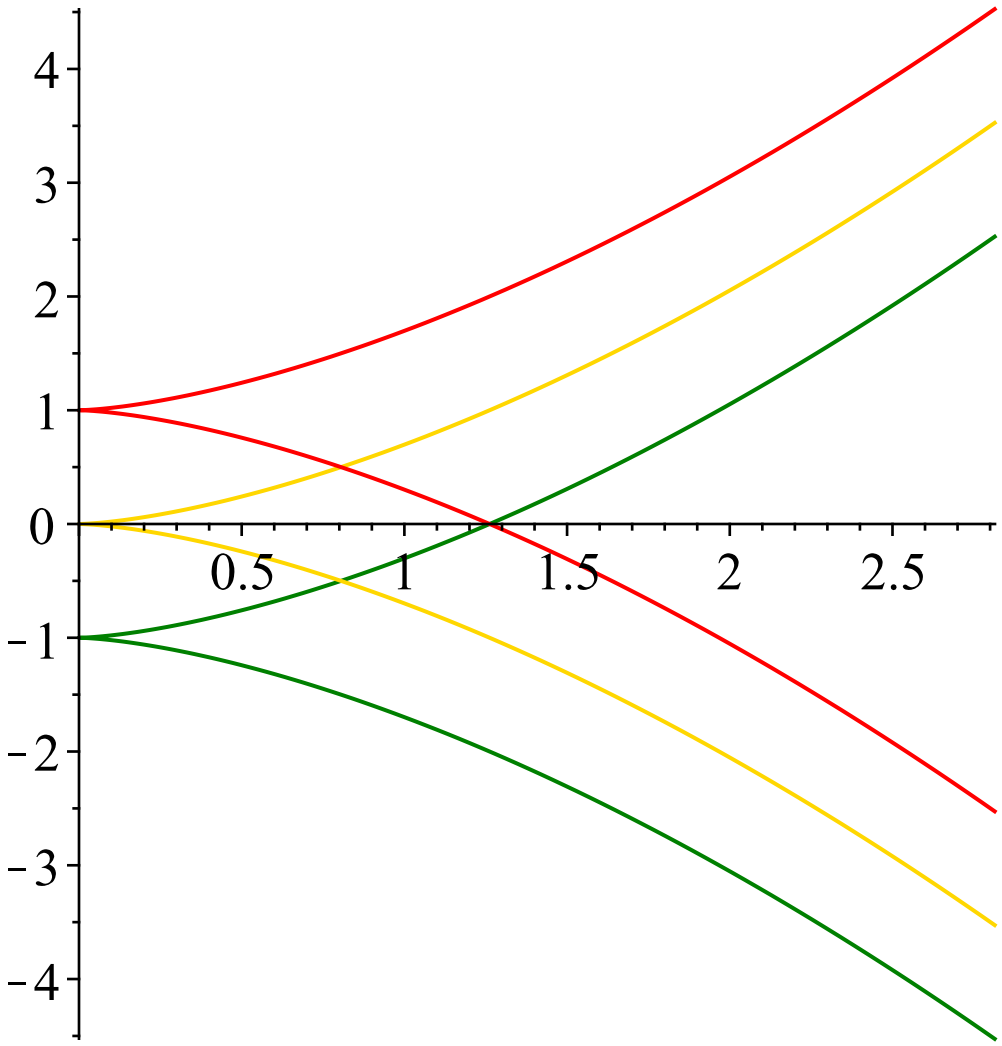
```
> plot(y, discont = true);
```




```
> #Задание 5
> #1)
> restart;
> with(DEtools) :
> x := t → (2·t·arctan(t) − ln(t^2 + 1)) :
> y := rhs(dsolve(diff(y(t), t) = t·diff(x(t), t), y(t)));
```

$$y := \arctan(t)\, t^2 - t + \arctan(t) + \_C1 \quad \textbf{(12)}$$

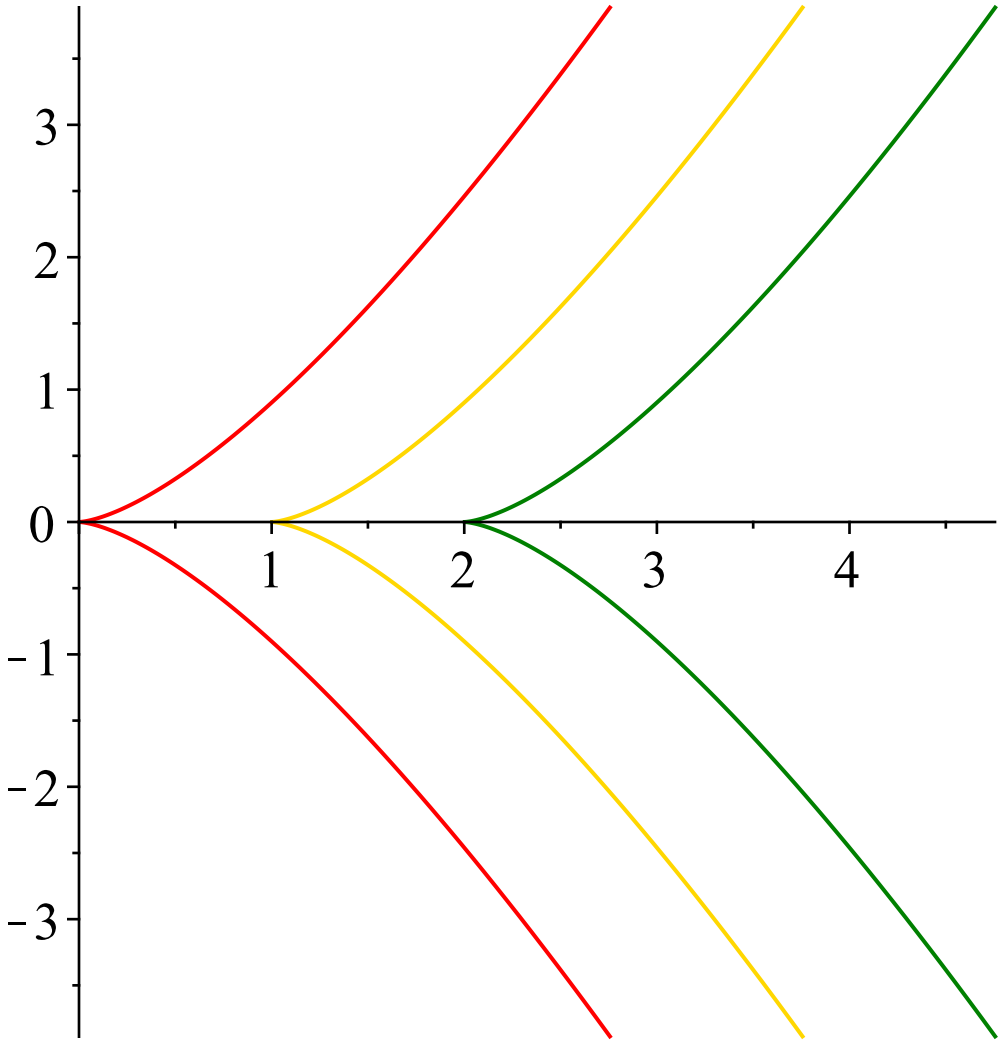
```
> g := C → plot([x(t), subs(_C1 = C, y), t = -2..2]) :
> plots[display]([g(-1), g(0), g(1)], color = [red, gold, green]);
```




```
> #2)
> restart;
> with(DEtools) :
> y := t→(t·cosh(t) − sinh(t)) :
> x := rhs(dsolve(diff(y(t), t) = t·diff(x(t), t), x(t)));
```

$$x := \cosh(t) + \_C1 \qquad \textbf{(13)}$$

```
> g := C→ plot([subs(_C1 = C, x), y(t), t = -2..2]) :
> plots[display]([g(-1), g(0), g(1)], color = [red, gold, green]);
```




```
> #Задание 6
> restart;
> with(DEtools) :
> y_o := rhs(dsolve(y(x) = x·diff(y(x), x) + diff(y(x), x)^2 - 1, y(x))[2]);
```

$$y\_o := \_C1^2 + \_C1\, x - 1 \tag{14}$$

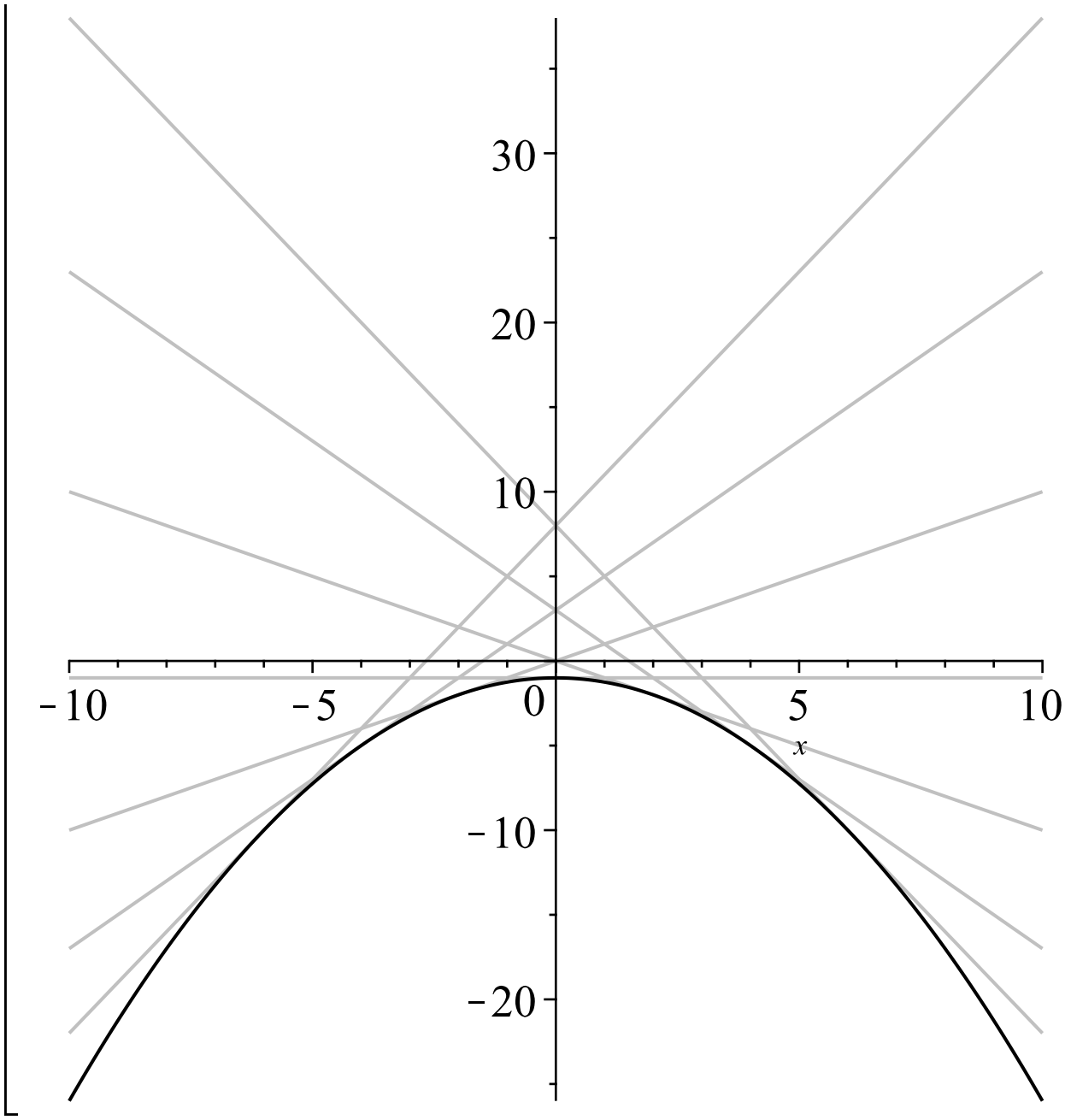
```
> y_ch := rhs(dsolve(y(x) = x·diff(y(x), x) + diff(y(x), x)^2 - 1, y(x))[1]);
```

$$y\_ch := -\frac{1}{4}\, x^2 - 1 \tag{15}$$

```
> g := C → subs(_C1 = C, y_o);
```

$$g := C \rightarrow subs(\_C1 = C, y\_o) \tag{16}$$

```
> plot([g(-3), g(-2), g(-1), g(0), g(1), g(2), g(3), y_ch], color = [grey, grey, grey, grey,
      grey, grey, grey, black]);
```


30
20
10
-10
-20
-10
-5
0
5
10
x