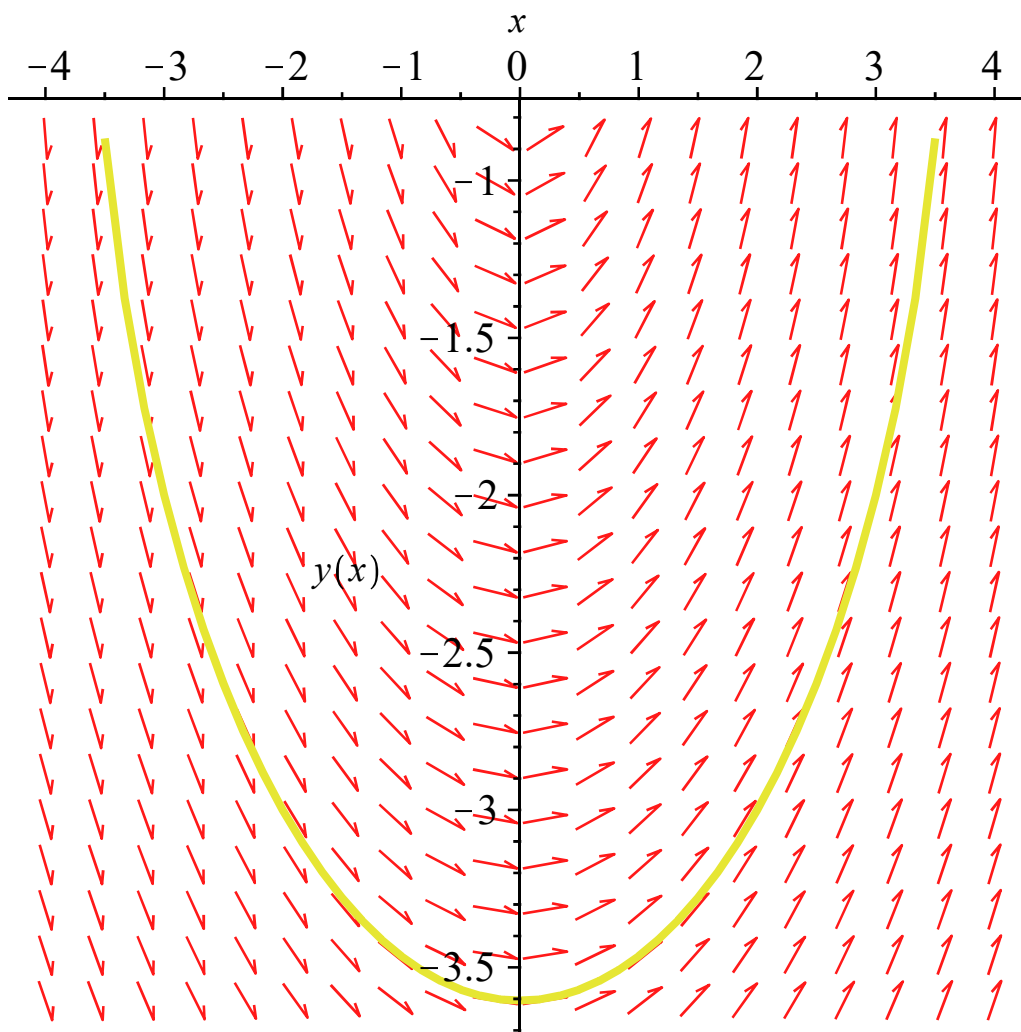


```

> #Лабораторная 3 Вариант 6 Тимофеев К.А.
> with(DEtools) :
  with(plots) :
  with(LinearAlgebra) :
> #Задание 1.1
> d := DEplot(y(x)·diff(y(x),x) + x=0, y(x), x=-4..4, [[-2, -3]]);
Warning, plot may be incomplete, the following errors(s) were
issued:
  cannot evaluate the solution further right of 3.6055515,
  probably a singularity
  cannot evaluate the solution further left of -3.6055514,
  probably a singularity

```



```

> #Задание 1.2
  #a)
  M := [4, 1];
  expr := int(sqrt(x^2/(a^2 - x^2)), x) assuming x > 0;

  f := unapply(expr + j, [x, a, j]);
  C := solve(f(M[1], 5, j) = M[2], j);

```

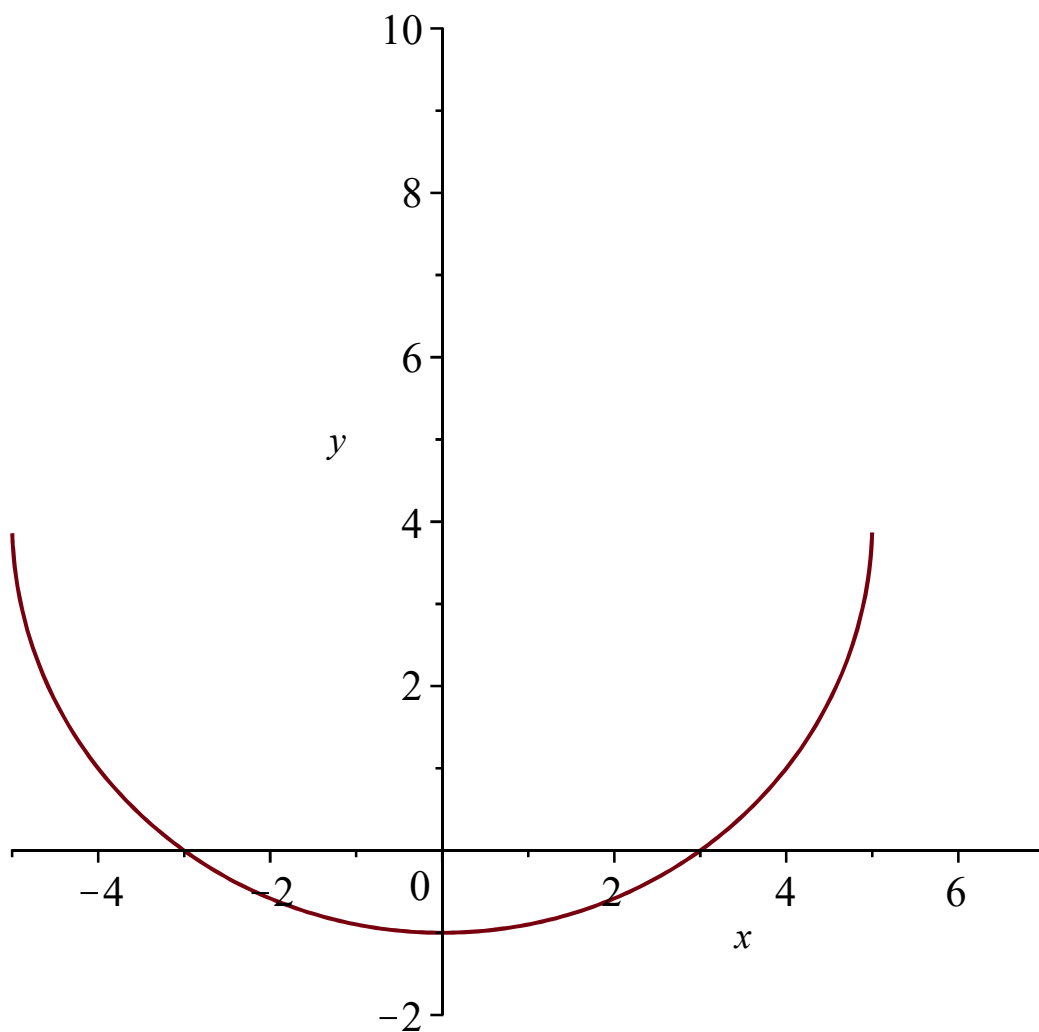
```
plot(f(x, 5, C), x=-5..7, y=-2..10);
```

```
M := [4, 1]
```

```
expr := -(a - x) (a + x)  $\sqrt{\frac{1}{a^2 - x^2}}$ 
```

```
f := (x, a, j)  $\mapsto$  -(a - x) (a + x)  $\sqrt{\frac{1}{a^2 - x^2}}$  + j
```

```
C := 1 +  $\sqrt{9}$ 
```



```
>
```

```
#6)
```

```
> f := unapply( j * exp(  $\frac{x^2}{2 \cdot a}$  ), [x, a, j] );
```

```
M := [-1, exp(-0.5)];
```

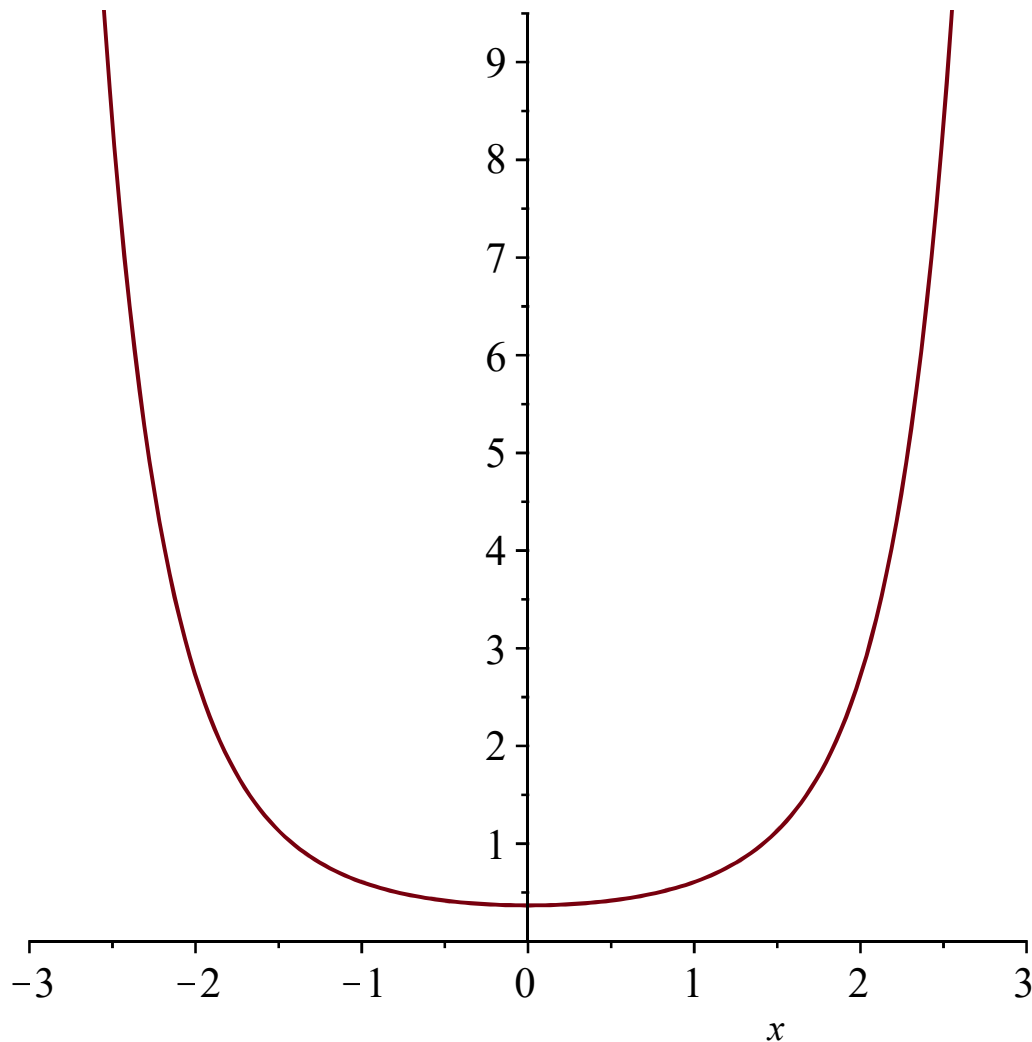
```
C := solve(f(M[1], 1, j) = M[2], j);
```

```
plot( f( x, 1,  $\frac{1}{\exp(1)}$  ), x=-3..3 );
```

```
f := (x, a, j)  $\mapsto$  j e  $\frac{x^2}{2a}$ 
```

$M := [-1, 0.6065306597]$

$C := 0.3678794412$



> #Задание 1.3

```
DEplot(diff(y(x), x) =  $\frac{-6 \cdot x - 5 \cdot y(x) + 4}{y(x) + 4}$ , y(x), x = -10 .. 10, [y(9) = -8, y(0) = 0, y(-3) = 3], linecolor = [blue, yellow, green]);
```

Warning, plot may be incomplete, the following error(s) were issued:

cannot evaluate the solution further right of 9.4773663, probably a singularity

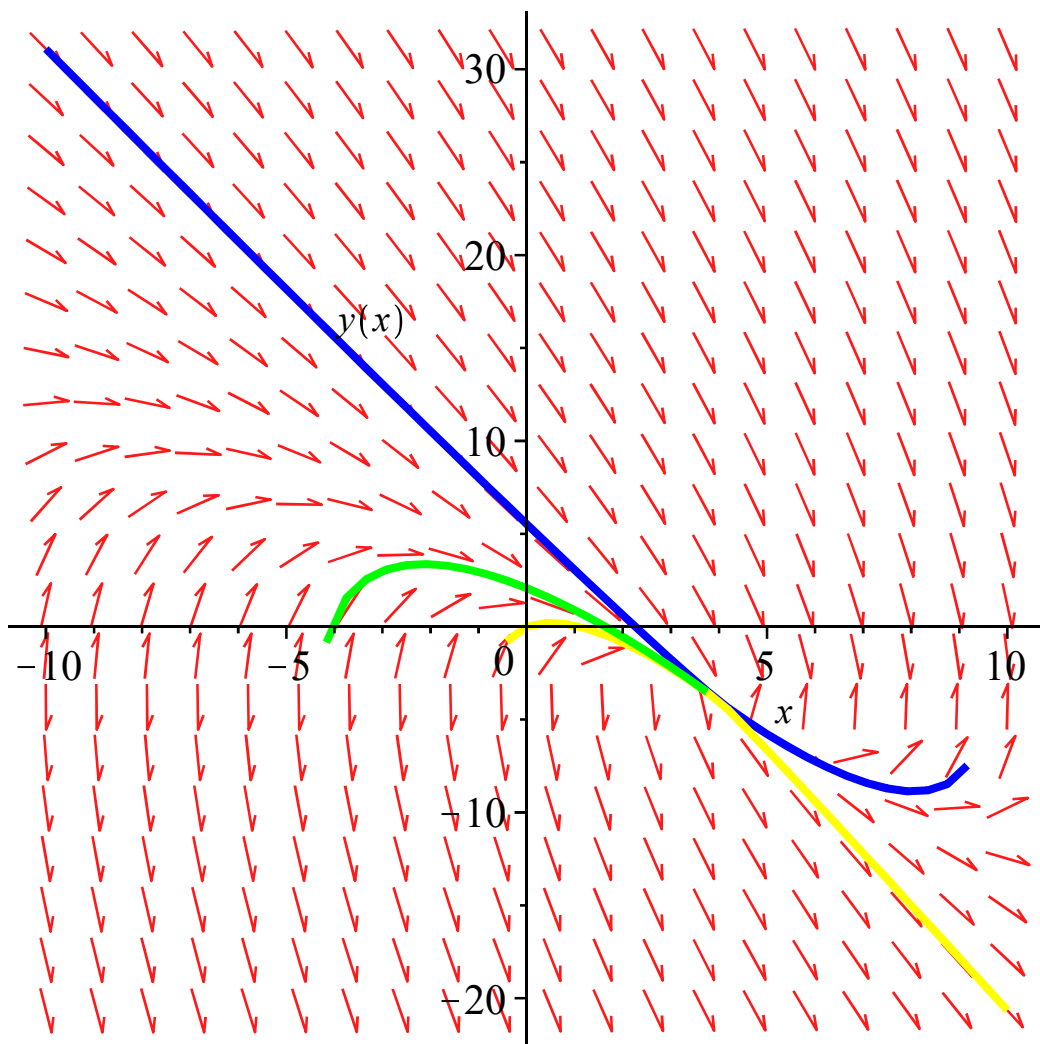
Warning, plot may be incomplete, the following error(s) were issued:

cannot evaluate the solution further left of -0.74074078, probably a singularity

Warning, plot may be incomplete, the following error(s) were issued:

cannot evaluate the solution further right of 4.0189746, maxfun limit exceeded (see ?dsolve, maxfun for details)

cannot evaluate the solution further left of -4.2962963, probably a singularity



```
>
=>
>
```

```
> DEplot(de, y(x), x=-10..10, y=-10..10, [y(0)=0, y(-3)=1, y(-2)=-2], linecolor=[blue,
=> green, yellow]);
```

```
>
```

```
> #Задание 1.4
```

```
> eq := 2(diff(y(x), x) + x*y(x)) = (1 + x) * exp(-x) * (y(x))^2;
=> dsolve(eq);
```

```
d := dsolve({eq, y(0)=2});
```

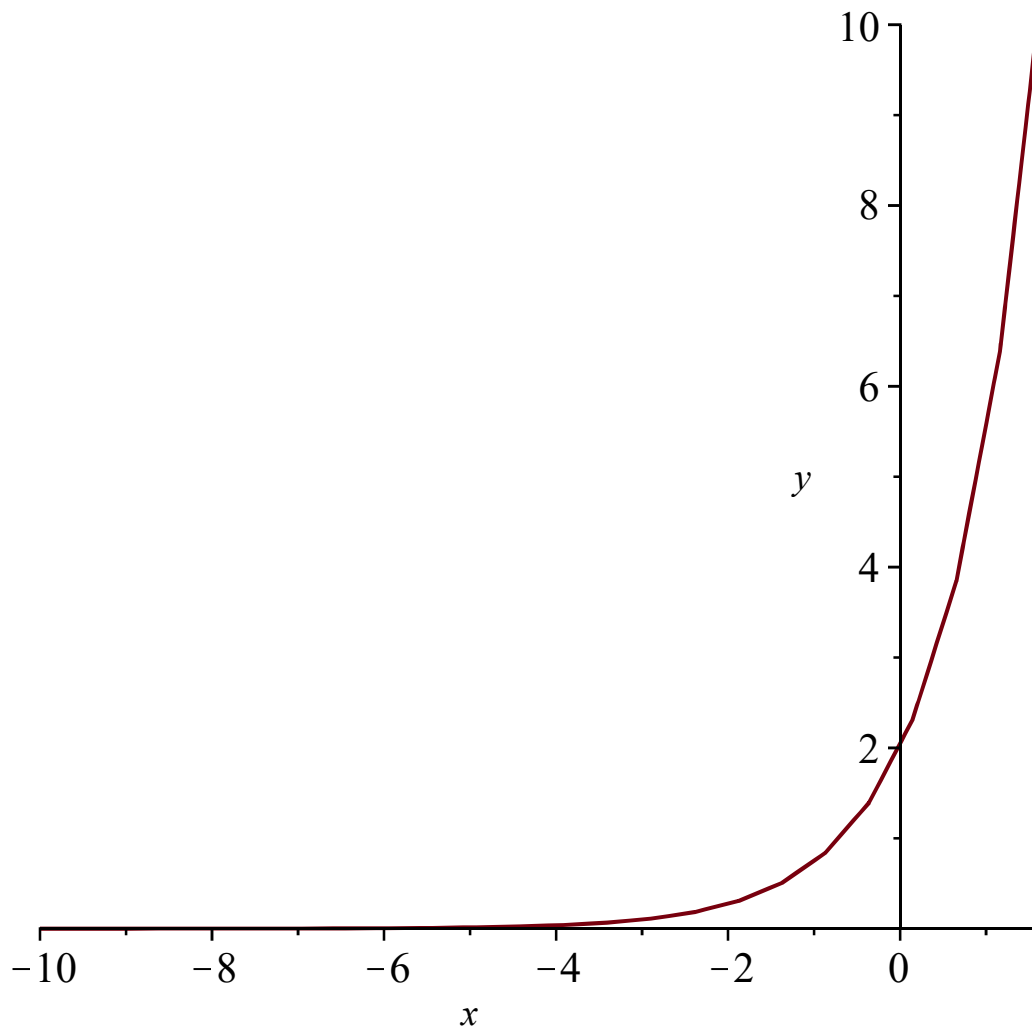
$$eq := 2 \frac{d}{dx} y(x) + 2xy(x) = (1+x)e^{-x}y(x)^2$$

$$y(x) = \frac{2}{2e^{\frac{x^2}{2}}_CI + e^{-x}}$$

$$d := y(x) = \frac{2}{e^{-x}}$$

(1)

```
> implicitplot(%, x = -10..10, y=-10..10);
```



```
> #Задание 1.5
```

```
#a)
```

```
> eq := diff(y(x), x) * cosh(diff(y(x), x)) - sinh(diff(y(x), x));
```

```
X := subs(diff(y(x), x) = t, eq);
```

```
dy := diff(X, t) * t;
```

```
Y := int(dy, t);
```

$$eq := \left(\frac{d}{dx} y(x) \right) \cosh\left(\frac{d}{dx} y(x) \right) - \sinh\left(\frac{d}{dx} y(x) \right)$$

$$X := t \cosh(t) - \sinh(t)$$

$$dy := t^2 \sinh(t)$$

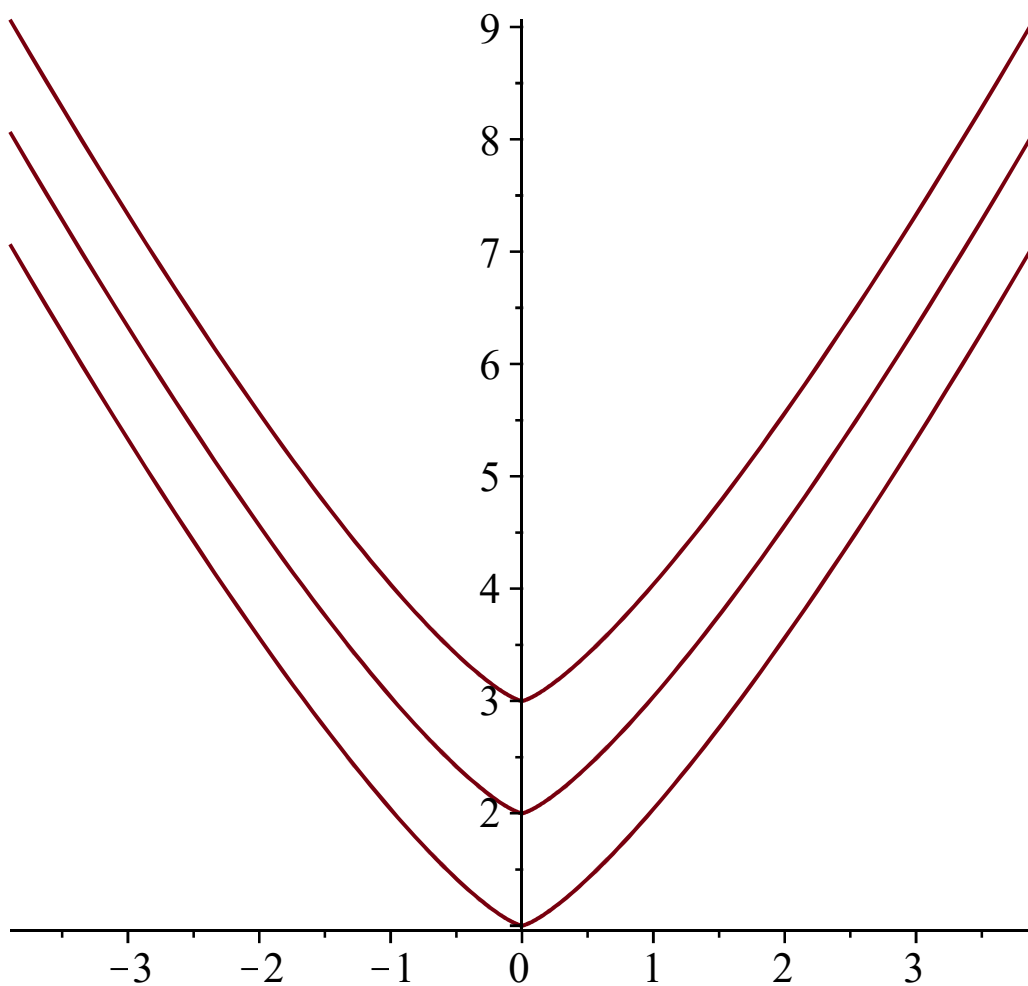
$$Y := t^2 \cosh(t) - 2 t \sinh(t) + 2 \cosh(t)$$

(2)

```
> arr :
```

```
for i from -1 to 1 do arr[i + 2] := plot([X, Y + i, t=-2..2]); end do;
```

```
display(arr[1], arr[2], arr[3]);
```



> #6)

> $eq := \frac{(diff(y(x), x)^2 + 1)}{2} \cdot \arctan(diff(y(x), x)) - \frac{diff(y(x), x)}{2};$

$Y := subs(diff(y(x), x) = t, eq);$

$dx := \frac{diff(Y, t)}{t};$

$X := int(dx, t);$

$$eq := \frac{\left(\left(\frac{d}{dx} y(x) \right)^2 + 1 \right) \arctan\left(\frac{d}{dx} y(x) \right)}{2} - \frac{\frac{d}{dx} y(x)}{2}$$

$$Y := \frac{(t^2 + 1) \arctan(t)}{2} - \frac{t}{2}$$

$$dx := \arctan(t)$$

$$X := t \arctan(t) - \frac{\ln(t^2 + 1)}{2}$$

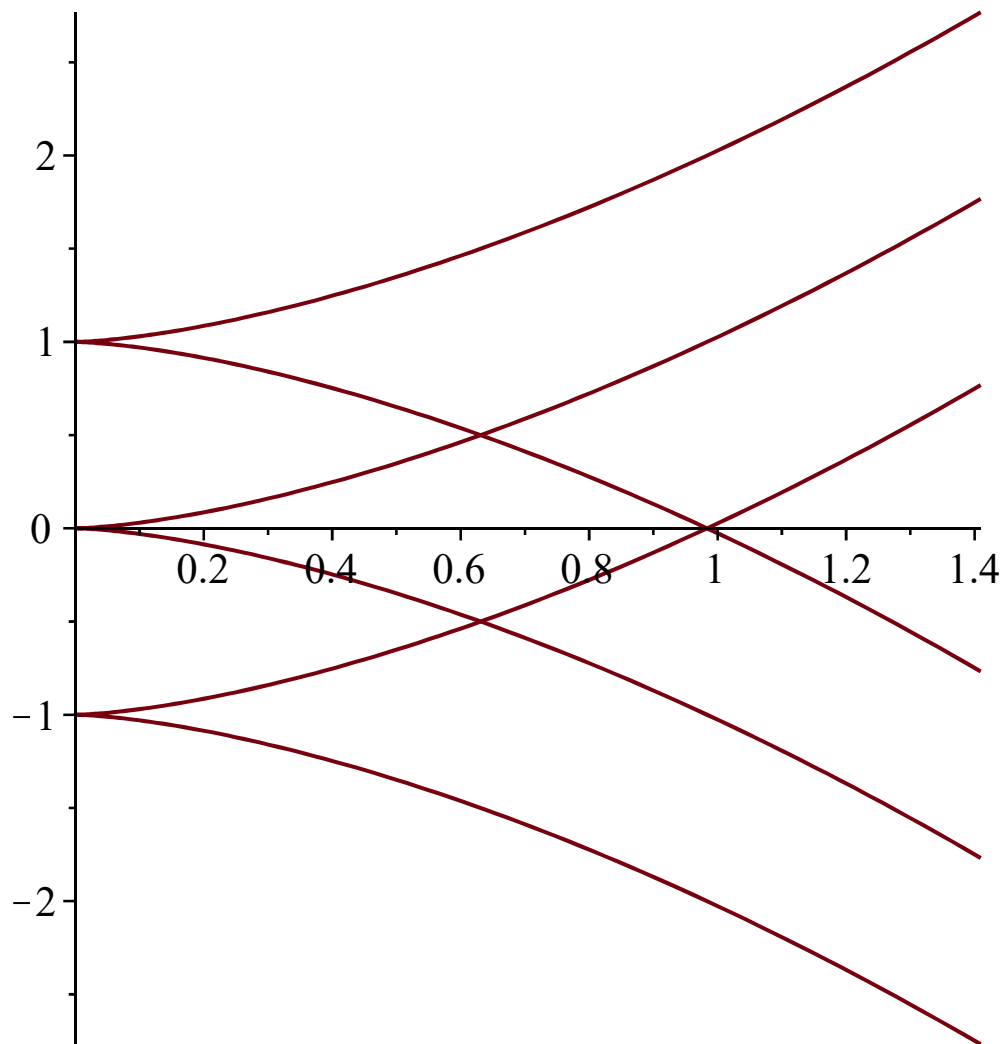
(3)

> arr :

```

for  $i$  from -1 to 0 do  $arr[i + 2] := plot([X, Y + i, t = -2 .. 2]);$  end do;
display( $arr[1]$ ,  $arr[2]$ ,  $arr[3]$ );

```



> #Задание 1.6

```

eq := y(x) = x·diff(y(x), x) + 2·diff(y(x), x)2 - 2;

```

```

arr := [dsolve(eq)];

```

```

p[0] := implicitplot(arr[1], x = -10..10, y = -10..10);

```

```

color := [red, blue, green, black, purple];

```

```

for  $i$  from -2 to 2 do  $p[i + 3] := implicitplot((unapply(arr[2], [x, _CI]))(x, i), x = -10..10,$ 
 $y = -10..10, colour = color[i + 3]);$  end do;

```

```

display({p[0], p[1], p[2], p[3], p[4], p[5]});

```

$$eq := y(x) = \left(\frac{d}{dx} y(x) \right) x + 2 \left(\frac{d}{dx} y(x) \right)^2 - 2$$

$$arr := \left[y(x) = -\frac{x^2}{8} - 2, y(x) = 2_CI^2 +_CI x - 2 \right]$$

