

```
> with(DEtools):
```

```
> with(plots):
```

```
> eq := diff(y(x), x) = 2 · x · (1 + (y(x))2)
```

Error, invalid input: y uses a 2nd argument, c, which is missing

```
> dsolve(eq, y(x))
```

Error, invalid input: y uses a 2nd argument, c, which is missing

```
> sol := (x, k, c) → tan(x2 + 2 · c)
```

$sol := (x, k, c) \mapsto \tan(x^2 + 2 \cdot c)$

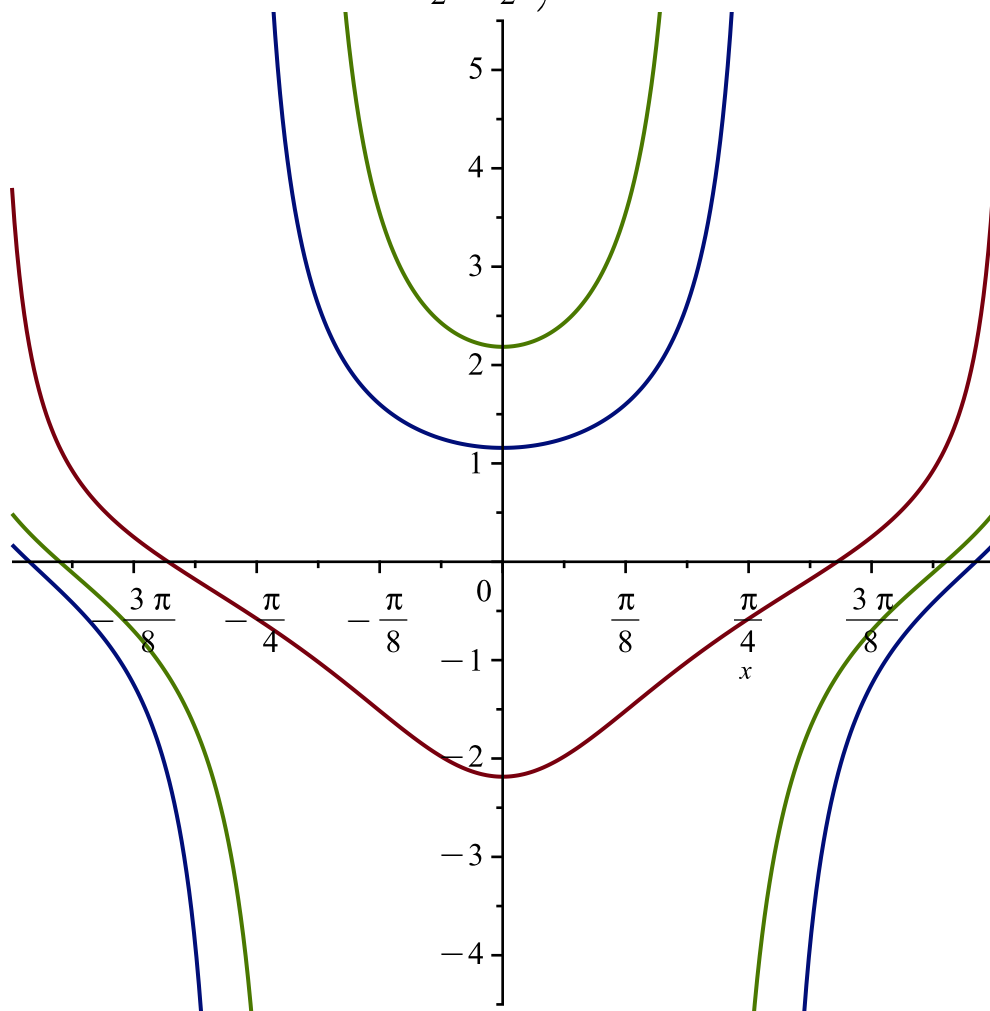
(1)

```
> y := (x, c) → sol(x, 20, c)
```

$y := (x, c) \mapsto sol(x, 20, c)$

(2)

```
> plot([y(x, 1), y(x, 2), y(x, -1)], x = -Pi/2 .. Pi/2)
```



```
> eq := diff(y(x), x) = (x2 + (y(x))2) / (2 · x2)
```

Error, invalid input: y uses a 2nd argument, c, which is missing

```
> dsolve(eq, y(x))
```

Error, invalid input: y uses a 2nd argument, c, which is missing

```
> eq := diff(y(x), x, x) = sin(x) + cos(x) - y(x)
```

Error, invalid input: y uses a 2nd argument, c, which is missing

> dsolve(eq, y(x))  
Error, invalid input: y uses a 2nd argument, c, which is missing

> eq := diff(y(x), x, x) = exp(2·x) + y(x)  
Error, invalid input: y uses a 2nd argument, c, which is missing

> dsolve(eq, y(x))  
Error, invalid input: y uses a 2nd argument, c, which is missing

> eq := diff(y(x), x, x) =  $\frac{1}{1 + \exp(x)} + \text{diff}(y(x), x)$   
Error, invalid input: y uses a 2nd argument, c, which is missing

> dsolve(eq, y(x))  
Error, invalid input: y uses a 2nd argument, c, which is missing

> eq := diff(y(x), x) = 1 + y(x)<sup>2</sup>  
Error, invalid input: y uses a 2nd argument, c, which is missing

> in\_cond := y(0) = 1  
Error, invalid input: y uses a 2nd argument, c, which is missing

> dsolve({eq, in\_cond}, y(x))  
Error, invalid input: y uses a 2nd argument, c, which is missing

> restart

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

$$eq := \frac{d}{dx} y(x) = \frac{x^2 + y(x)^2}{2 x^2} \quad (3)$$

> dsolve(eq, y(x))

$$y(x) = \frac{x (\ln(x) + \_CI - 2)}{\ln(x) + \_CI} \quad (4)$$

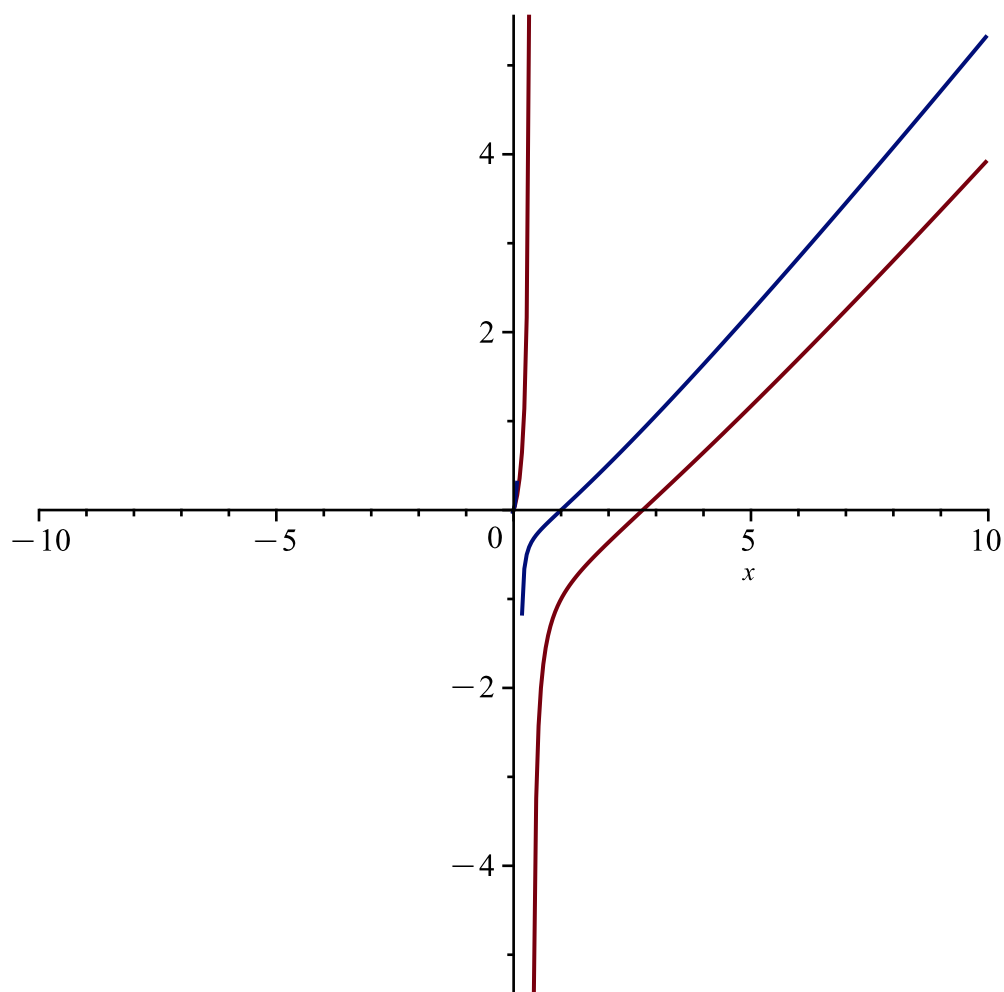
> sol := (x, c) →  $\frac{x (\ln(x) + c - 2)}{\ln(x) + c}$

$$sol := (x, c) \mapsto \frac{x \cdot (\ln(x) + c - 2)}{\ln(x) + c} \quad (5)$$

> y := (x, c) → sol(x, c)

$$y := (x, c) \mapsto sol(x, c) \quad (6)$$

> plot([y(x, 1), y(x, 2), y(3, c)], x = -10..10)  
Warning, expecting only range variable x in expression 3\*(ln(3)+c-2)/(ln(3)+c) to be plotted but found name c



> restart

> eq := diff(y(x), x, x) = sin(x) + cos(x) - y(x)

$$eq := \frac{d^2}{dx^2} y(x) = \sin(x) + \cos(x) - y(x) \quad (7)$$

> dsolve(eq, y(x))

$$y(x) = \sin(x) \_C2 + \cos(x) \_C1 + \frac{(1-x) \cos(x)}{2} + \frac{\sin(x) x}{2} \quad (8)$$

> sol := (x, c) → sin(x)c + cos(x)c +  $\frac{(1-x) \cos(x)}{2}$  +  $\frac{\sin(x) x}{2}$

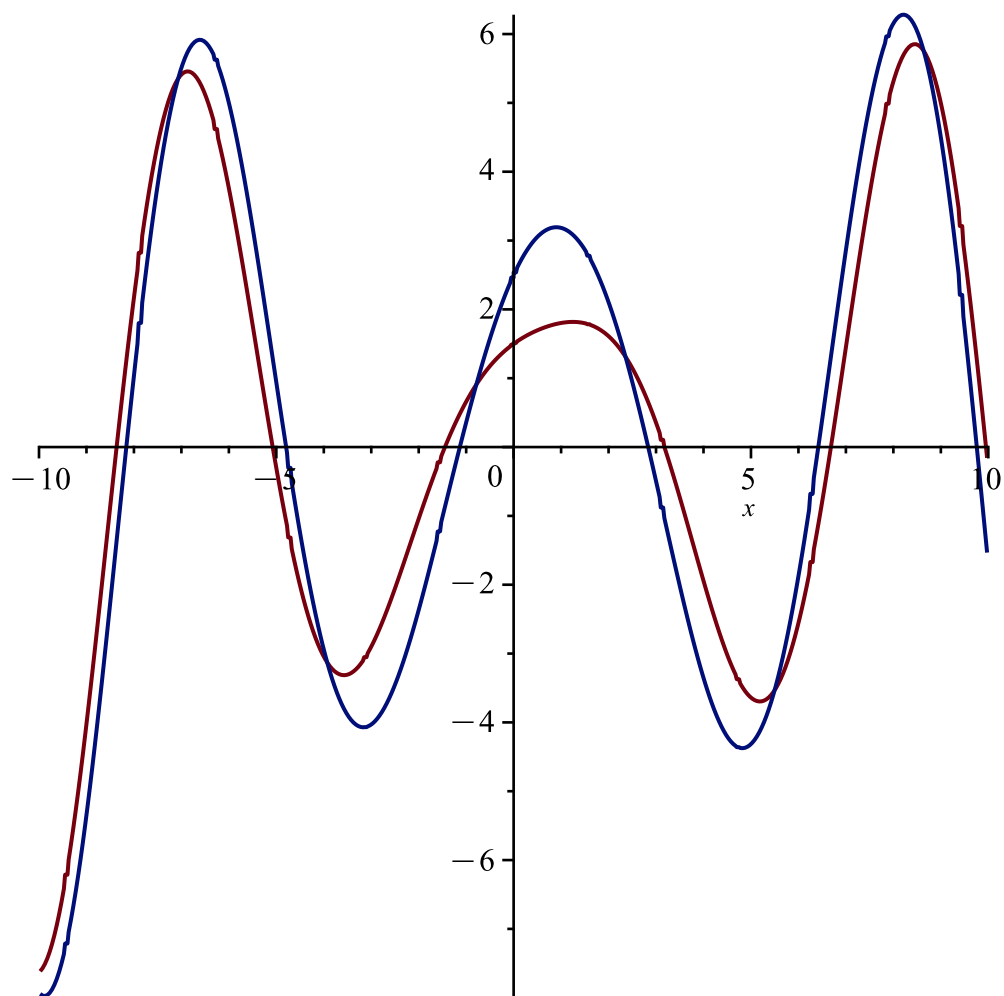
$$sol := (x, c) \mapsto \sin(x) \cdot c + \cos(x) \cdot c + \frac{(1-x) \cdot \cos(x)}{2} + \frac{\sin(x) \cdot x}{2} \quad (9)$$

> y := (x, c) → sol(x, c)

$$y := (x, c) \mapsto sol(x, c) \quad (10)$$

> plot([y(x, 1), y(x, 2), y(3, c)], x = -10..10)

Warning, expecting only range variable x in expression sin(3)\*c+cos(3)\*c-cos(3)+3/2\*sin(3) to be plotted but found name c



```
> restart
```

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

$$eq := \frac{d}{dx} y(x) = \frac{2 x y(x)^2}{-x^2 + 1} \quad (11)$$

```
> dsolve(eq, y(x))
```

$$y(x) = \frac{1}{\ln(-1 + x) + \ln(x + 1) + \_C1} \quad (12)$$

```
> sol := (x, c) ->  $\frac{1}{\ln(-1 + x) + \ln(x + 1) + c}$ 
```

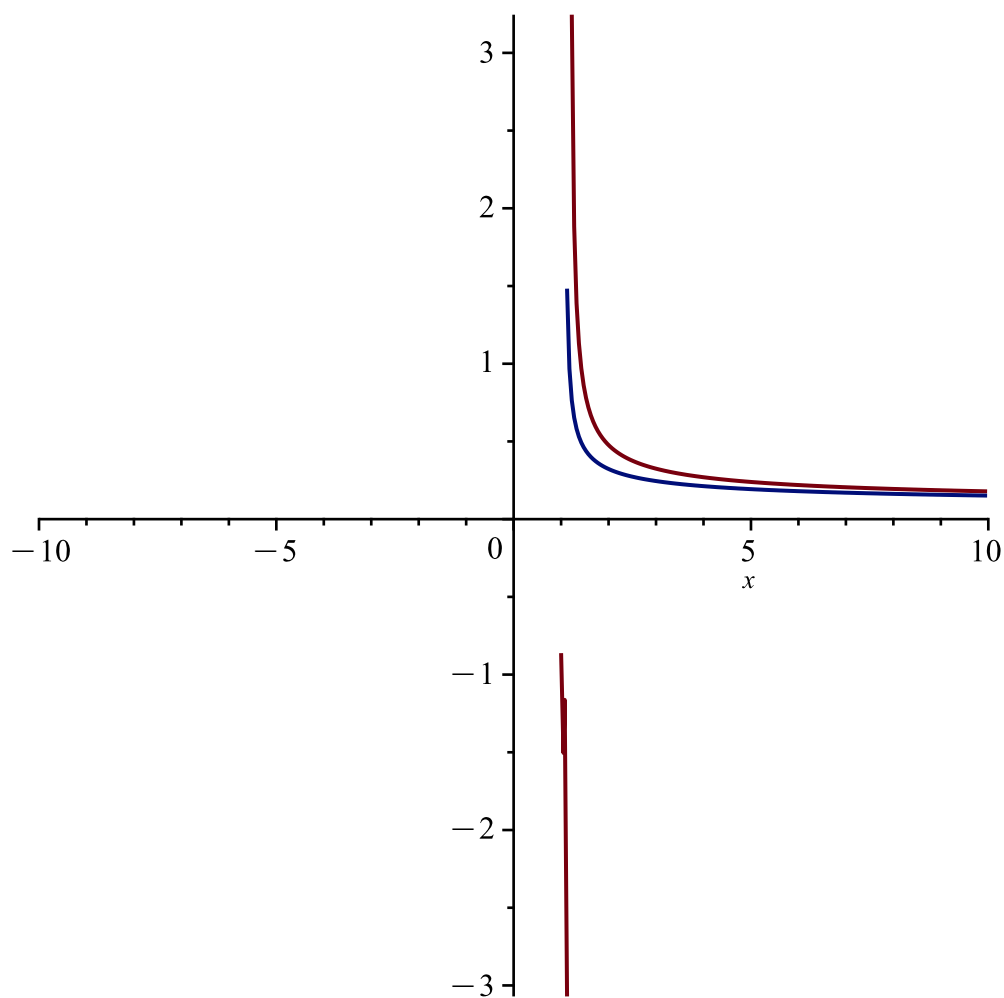
$$sol := (x, c) \mapsto \frac{1}{\ln(x - 1) + \ln(x + 1) + c} \quad (13)$$

```
> y := (x, c) -> sol(x, c)
```

$$y := (x, c) \mapsto sol(x, c) \quad (14)$$

```
> plot([y(x, 1), y(x, 2), y(3, c)], x = -10..10)
```

Warning, expecting only range variable x in expression 1/(3\*ln(2)+c) to be plotted but found name c



```
> restart
```

```
> eq := diff(y(x), x) = 1 + y(x)^2
```

$$eq := \frac{d}{dx} y(x) = 1 + y(x)^2 \quad (15)$$

```
> in_cond := y(0) = 1
```

$$in\_cond := y(0) = 1 \quad (16)$$

```
> dsolve({eq, in_cond}, y(x))
```

$$y(x) = \tan\left(x + \frac{\pi}{4}\right) \quad (17)$$

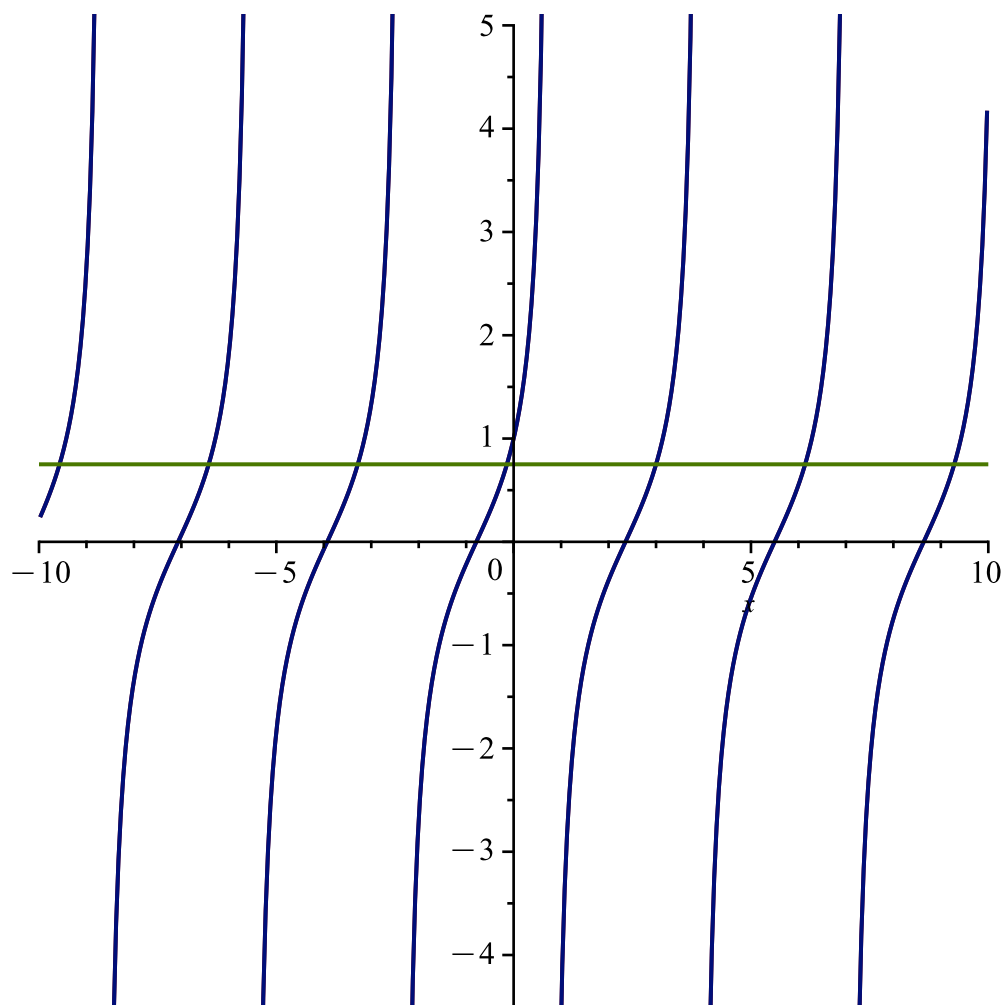
```
> sol := (x, c) → tan(x + π/4)
```

$$sol := (x, c) \mapsto \tan\left(x + \frac{\pi}{4}\right) \quad (18)$$

```
> y := (x, c) → sol(x, c)
```

$$y := (x, c) \mapsto sol(x, c) \quad (19)$$

```
> plot([y(x, 1), y(x, 2), y(3, c)], x = -10..10)
```



> restart

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

$$eq := \frac{d}{dx} y(x) = \frac{y(x)}{-x^2 + 1} + 1 + x \quad (20)$$

> in\_cond := y(0) = 0

$$in\_cond := y(0) = 0 \quad (21)$$

> dsolve({eq, in\_cond}, y(x))

$$y(x) = \frac{\left( \frac{x\sqrt{-x^2+1}}{2} + \frac{\arcsin(x)}{2} \right) (x+1)}{\sqrt{-x^2+1}} \quad (22)$$

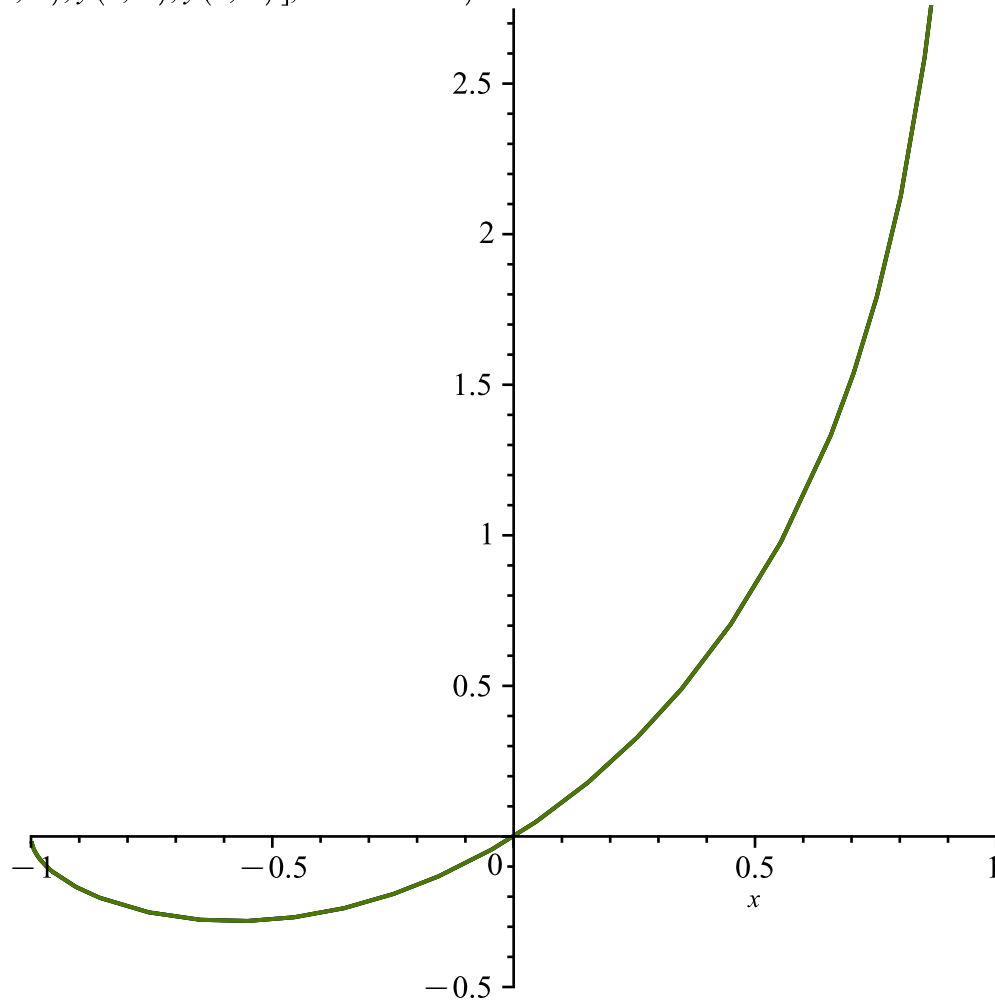
> sol := (x, c) →  $\frac{\left( \frac{x\sqrt{-x^2+1}}{2} + \frac{\arcsin(x)}{2} \right) (x+1)}{\sqrt{-x^2+1}}$

$$sol := (x, c) \mapsto \frac{\left( \frac{x \cdot \sqrt{-x^2 + 1}}{2} + \frac{\arcsin(x)}{2} \right) \cdot (x + 1)}{\sqrt{-x^2 + 1}} \quad (23)$$

>  $y := (x, c) \rightarrow sol(x, c)$

$$y := (x, c) \mapsto sol(x, c) \quad (24)$$

>  $plot([y(x, 1), y(x, 2), y(x, 3)], x = -10 .. 10)$



> *restart*

>  $eq := diff(y(x), x, x) = 2 \cdot x^2 \cdot \exp(x) + 4 \cdot diff(y(x), x) - 5 \cdot y(x)$

$$eq := \frac{d^2}{dx^2} y(x) = 2 x^2 e^x + 4 \frac{d}{dx} y(x) - 5 y(x) \quad (25)$$

>  $in\_cond1 := y(0) = 2$

$$in\_cond1 := y(0) = 2 \quad (26)$$

>  $in\_cond2 := D(y)(0) = 3$

$$in\_cond2 := D(y)(0) = 3 \quad (27)$$

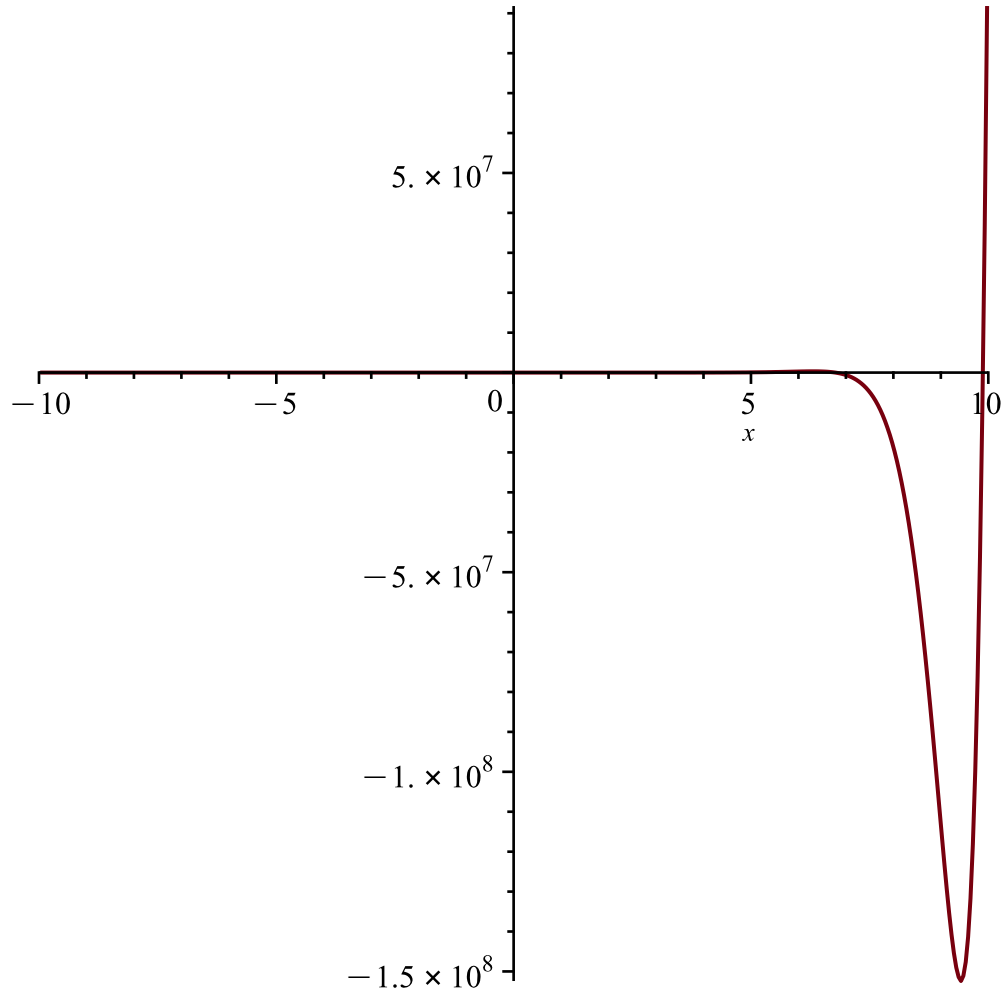
>  $dsolve(\{eq, in\_cond1, in\_cond2\}, y(x))$

$$y(x) = -2 e^{2x} \sin(x) + e^{2x} \cos(x) + (x + 1)^2 e^x \quad (28)$$

$$\begin{aligned} &> \text{sol} := (x) \rightarrow -2 e^{2x} \sin(x) + e^{2x} \cos(x) + (x+1)^2 e^x \\ &\quad \text{sol} := x \mapsto -2 \cdot e^{2 \cdot x} \cdot \sin(x) + e^{2 \cdot x} \cdot \cos(x) + (x+1)^2 \cdot e^x \end{aligned} \quad (29)$$

$$\begin{aligned} &> y := (x) \rightarrow \text{sol}(x) \\ &\quad y := x \mapsto \text{sol}(x) \end{aligned} \quad (30)$$

> plot([y(x)], x=-10..10)



> restart

$$\begin{aligned} &> \text{eq} := \text{diff}(y(x), x) = x^3 - \frac{k \cdot y(x)}{x} \\ &\quad \text{eq} := \frac{d}{dx} y(x) = x^3 - \frac{k y(x)}{x} \end{aligned} \quad (31)$$

> dsolve(eq, y(x))

$$y(x) = \frac{x^4}{4+k} + x^{-k} \_C1 \quad (32)$$

$$> \text{sol} := (x, k, c) \rightarrow \frac{x^4}{4+k} + x^{-k} c$$

$$\text{sol} := (x, k, c) \mapsto \frac{x^4}{4+k} + x^{-k} \cdot c \quad (33)$$

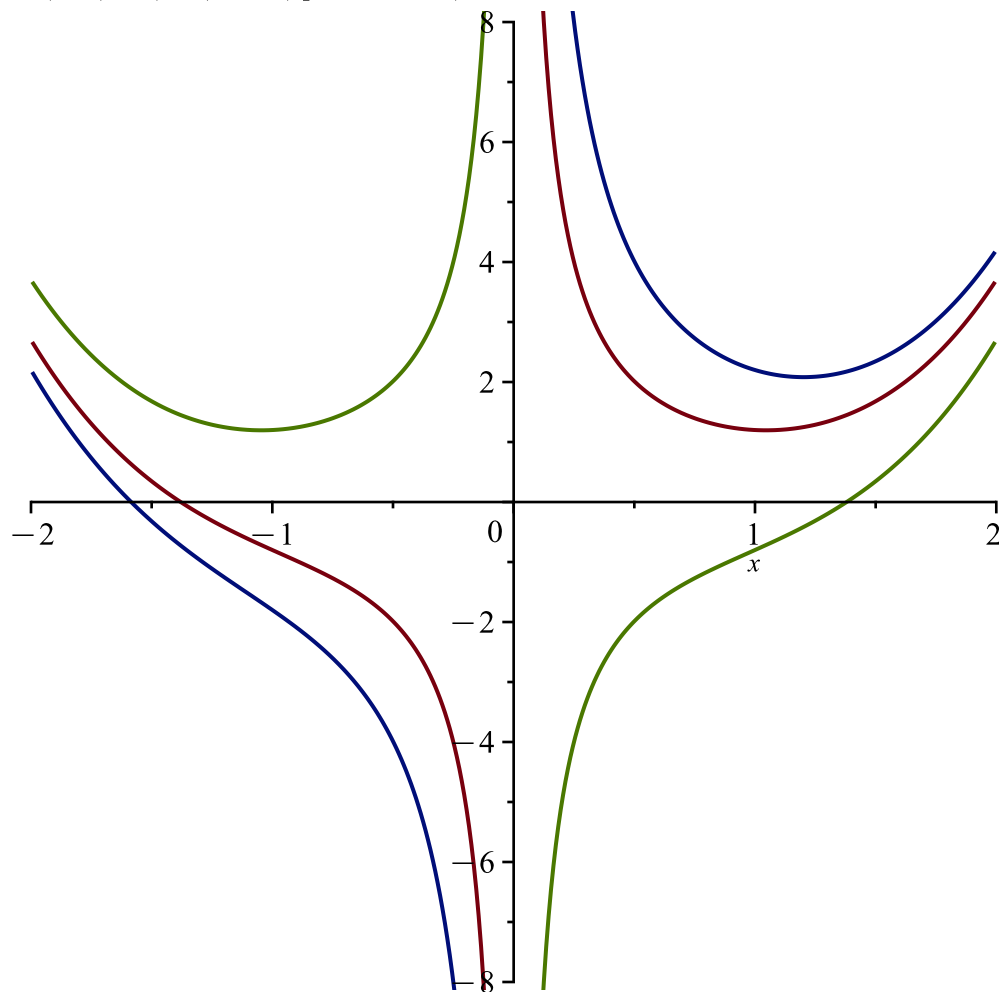


```
> y := (x, c) → sol(x, 1, c);
```

```
y := (x, c) ↦ sol(x, 1, c)
```

(34)

```
> plot([y(x, 1), y(x, 2), y(x, -1)], x = -2..2);
```

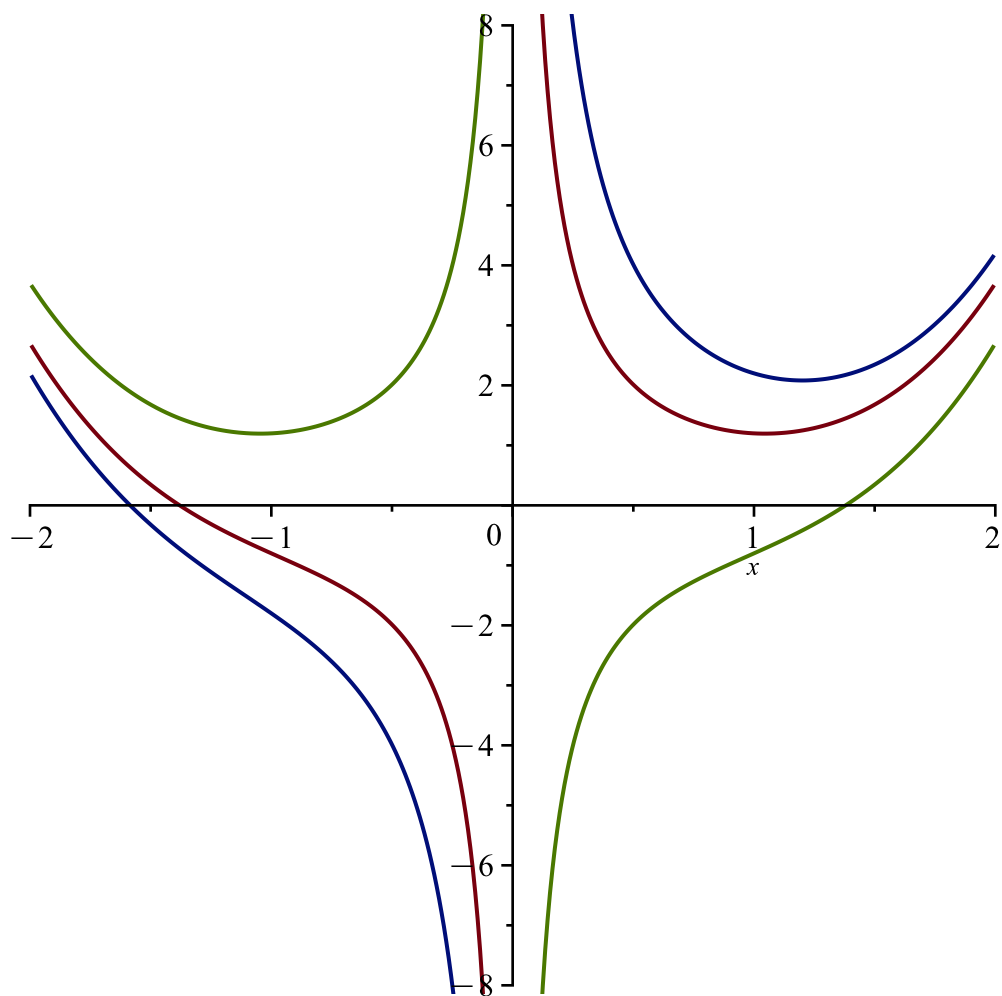


```
> in_cond := y(1, c) = 0
```

```
in_cond := 1/5 + c = 0
```

(35)

```
> plot([y(x, 1), y(x, 2), y(x, -1)], x = -2..2);
```



>  $y := 'y'$

$y := y$

(36)

>  $eq := \text{diff}(y(x), x) = x^3 - \frac{k \cdot y(x)}{x}$

$$eq := \frac{d}{dx} y(x) = x^3 - \frac{k y(x)}{x}$$

(37)

>  $k := 1$

$k := 1$

(38)

>  $eq$

$$\frac{d}{dx} y(x) = x^3 - \frac{y(x)}{x}$$

(39)

>  $\text{dsolve}(\{eq, y(1) = 0\}, y(x))$

$$y(x) = \frac{\frac{x^5}{5} - \frac{1}{5}}{x}$$

(40)

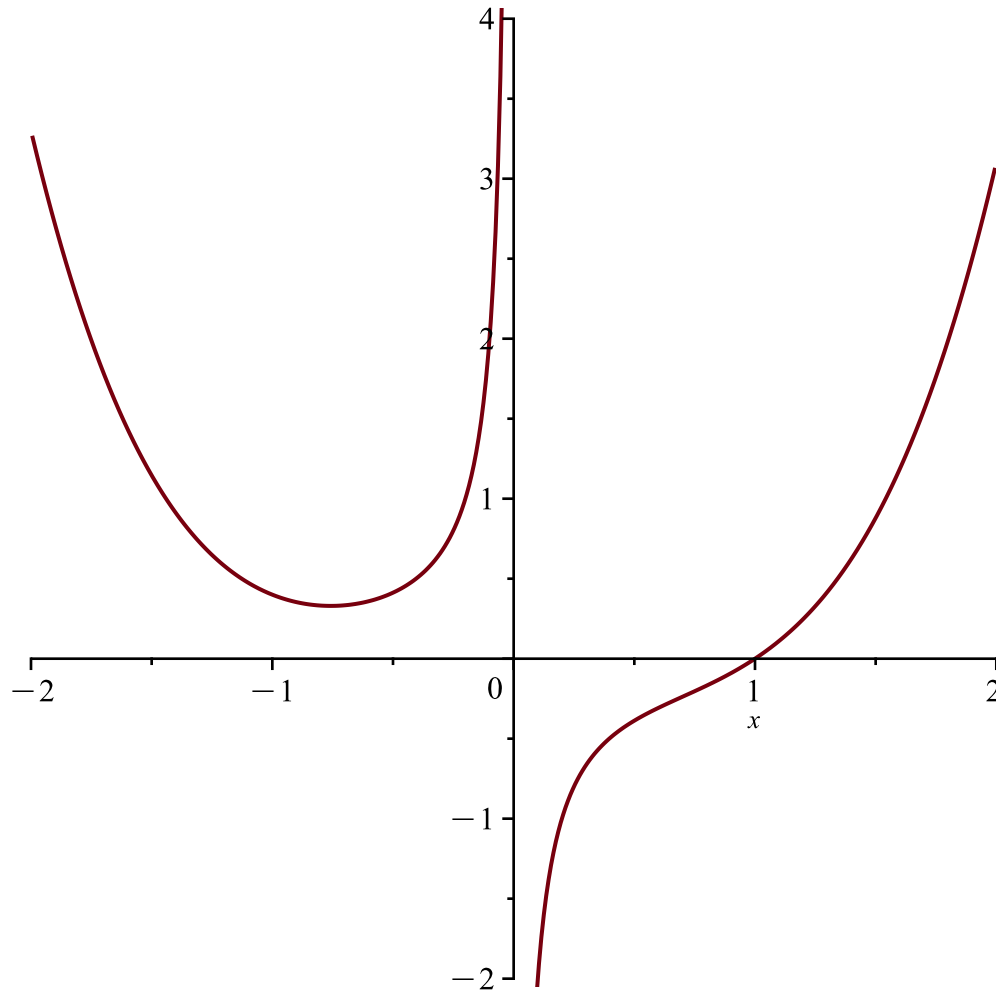
>  $sol := (x) \rightarrow \frac{\frac{x^5}{5} - \frac{1}{5}}{x}$

$$sol := x \mapsto \frac{\frac{x^5}{5} - \frac{1}{5}}{x} \quad (41)$$

```
> y := (x)→sol(x)
```

$$y := x \mapsto sol(x) \quad (42)$$

```
> plot([y(x)], x=-2..2);
```



```
>
```

```
> restart
```

```
> eq := diff(y(x), x, x) = 2*y(x) + diff(y(x), x)
```

$$eq := \frac{d^2}{dx^2} y(x) = 2y(x) + \frac{d}{dx} y(x) \quad (43)$$

```
> in_cond1 := y(0) = a
```

$$in\_cond1 := y(0) = a \quad (44)$$

```
> in_cond2 := D(y)(0) = 2
```

$$in\_cond2 := D(y)(0) = 2 \quad (45)$$

```
> dsolve({eq, in_cond1, in_cond2}, y(x))
```

(46)

$$y(x) = \left(-\frac{2}{3} + \frac{2a}{3}\right) e^{-x} + \left(\frac{a}{3} + \frac{2}{3}\right) e^{2x} \quad (46)$$

```
> sol := x -> \left(-\frac{2}{3} + \frac{2a}{3}\right) e^{-x} + \left(\frac{a}{3} + \frac{2}{3}\right) e^{2x}
```

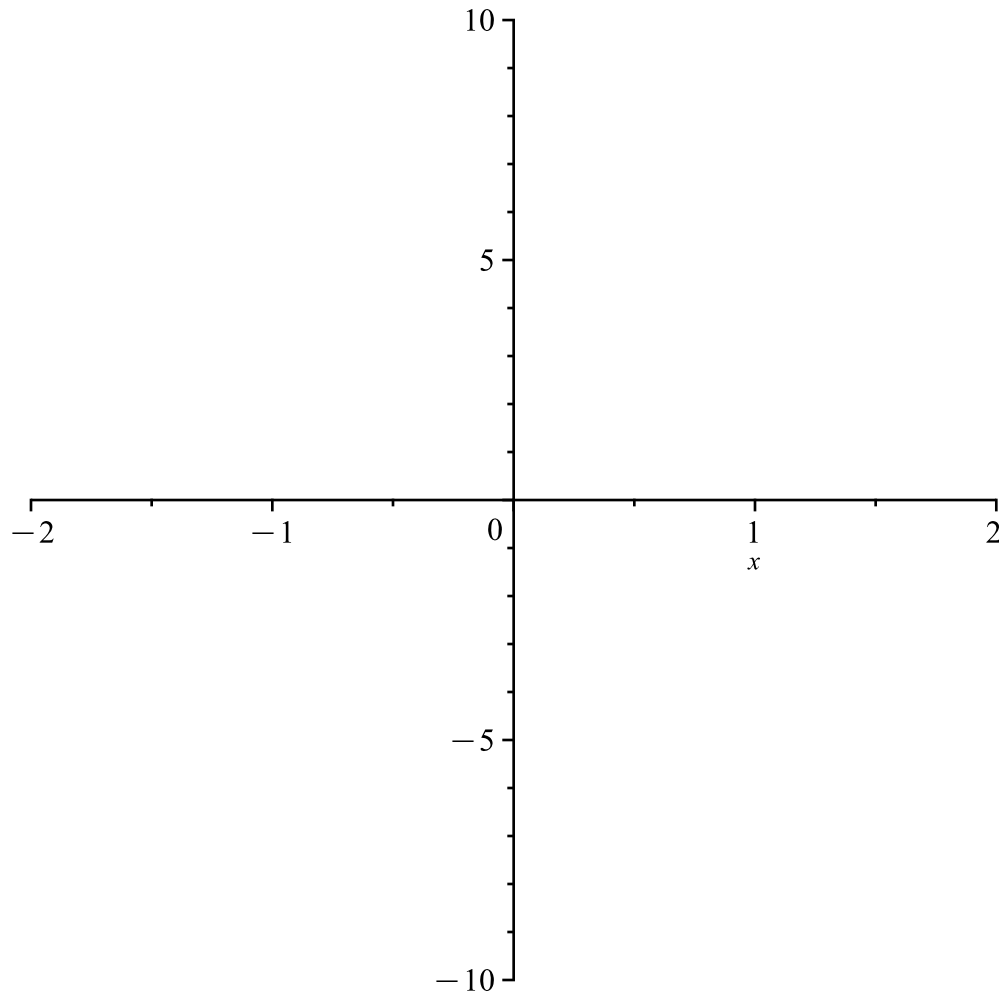
$$sol := x \mapsto \left(-\frac{2}{3} + \frac{2 \cdot a}{3}\right) \cdot e^{-x} + \left(\frac{a}{3} + \frac{2}{3}\right) \cdot e^{2 \cdot x} \quad (47)$$

```
> y := (x) -> sol(x)
```

$$y := x \mapsto sol(x) \quad (48)$$

```
> plot([y(x)], x=-2..2);
```

Warning, expecting only range variable x in expression  $(-2/3+2/3*a)*\exp(-x)+(1/3*a+2/3)*\exp(2*x)$  to be plotted but found name a



```
>
```