```
> #Тимофеев К.А. 153501 Вариант 6 Лабораторная 3.2
  #Задание 1
  with(DETools) :
  with(plots) :
> #a)

>
  restart :
  xe := sinh(diff(y(x), x$2)) + diff(y(x), x$2);
  xe := subs(diff(y(x), x$2) = t, xe);
  dx := diff(xe, t);
  tdx := t·dx;
```

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

$$xe := \sinh(t) + t$$

$$dx := \cosh(t) + 1$$

$$tdx := t\,(\cosh(t) + 1) \tag{1}$$

```
> dy1 := tdx;
  y1 := int(dy1, t) + _C1;
```

$$dy1 := t\,(\cosh(t) + 1)$$

$$y1 := t\sinh(t) - \cosh(t) + \frac{t^2}{2} + \_C1 \tag{2}$$

```
> y := int(y1, t) + _C2;
```

$$y := \_C1\, t + t\cosh(t) - 2\sinh(t) + \frac{t^3}{6} + \_C2 \tag{3}$$
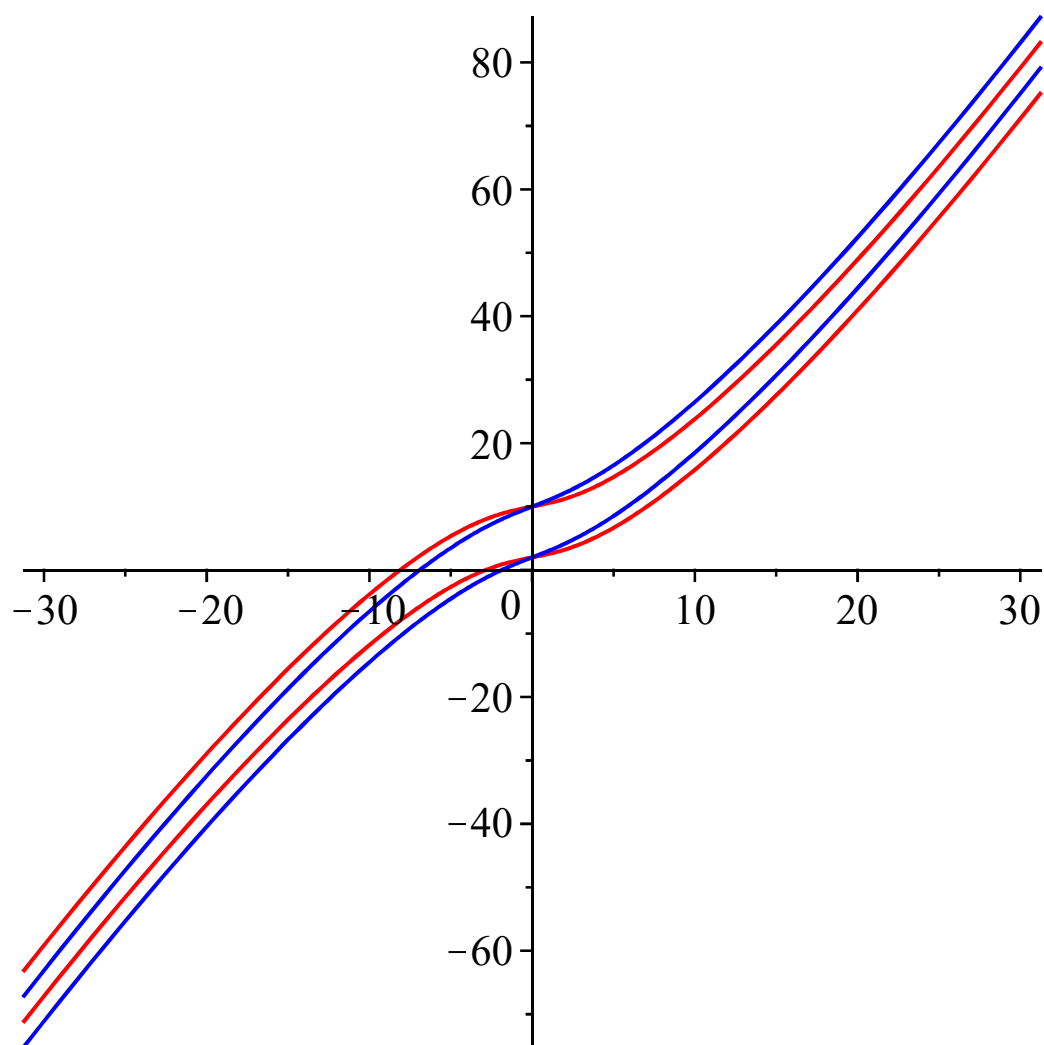
```
>
  x := unapply(xe, t);
  expr := y;
  f[1] := unapply(subs(_C1 = 2, _C2 = 2, expr), t) :
  f[2] := unapply(subs(_C1 = 2, _C2 = 10, expr), t) :
  f[3] := unapply(subs(_C1 = 3, _C2 = 2, expr), t) :
  f[4] := unapply(subs(_C1 = 3, _C2 = 10, expr), t) :
  p1 := plot([x, f[1], -4 ..4 ], colour = red) :
  p2 := plot([x, f[2], -4 ..4], colour = red) :
  p3 := plot([x, f[3], -4 ..4], colour = blue) :
  p4 := plot([x, f[4], -4 ..4], colour = blue) :
  plots[display]([p1, p2, p3, p4]);
```

$$x := t \mapsto \sinh(t) + t$$

$$expr := \_C1\, t + t\cosh(t) - 2\sinh(t) + \frac{t^3}{6} + \_C2$$

> #б)
restart :
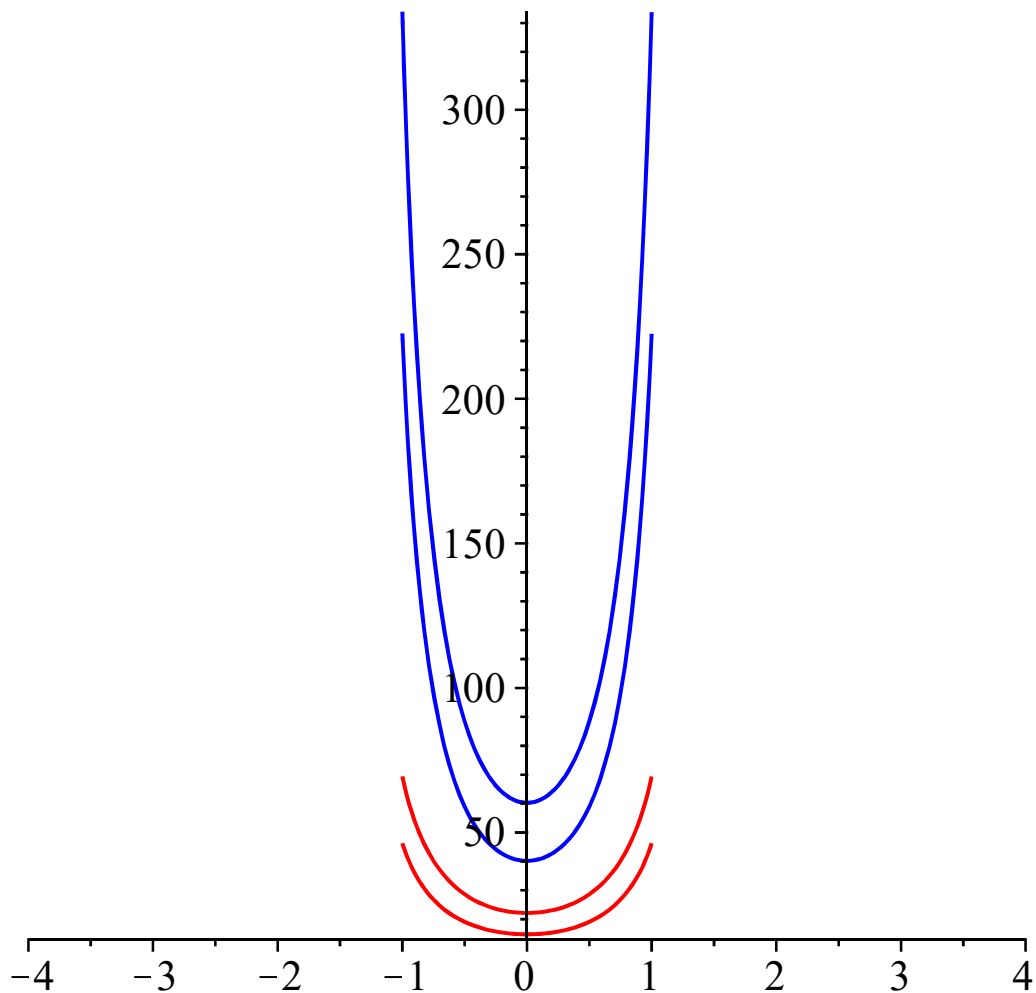dsolve(sqrt(1 − x²) · arcsin(x) · (y(x) · diff(y(x), x$2) − (diff(y(x), x))²) = y(x) · diff(y(x), x) , y(x));

$expr := e^{arcsin(x) \_C1\, x}\, e^{\sqrt{-x^2+1}\ \_C1}\, \_C2;$

$f[1] := unapply(subs(\_C1 = 2, \_C2 = 2, expr), x):$

$f[2] := unapply(subs(\_C1 = 2, \_C2 = 3, expr), x):$

$f[3] := unapply(subs(\_C1 = 3, \_C2 = 2, expr), x):$

$f[4] := unapply(subs(\_C1 = 3, \_C2 = 3, expr), x):$

$p1 := plot(f[1], -4..4, colour = red):$

$p2 := plot(f[2], -4..4, colour = red):$

$p3 := plot(f[3], -4..4, colour = blue):$

$p4 := plot(f[4], -4..4, colour = blue):$

$plots[display]([p1, p2, p3, p4]);$

$$y(x) = e^{\arcsin(x)\_C1\,x}\,e^{\sqrt{-x^2+1}\ \_C1}\ \_C2$$

$$expr := e^{\arcsin(x)\_C1\,x}\,e^{\sqrt{-x^2+1}\ \_C1}\ \_C2$$

> #в

$restart:$

$dsolve\left(diff(y(x), x\$2) = (diff(y(x), x))^2 \cdot \exp(x), y(x) \right);$

$$expr := -\frac{\ln(e^x - \_C1)}{\_C1} + \frac{\ln(e^x)}{\_C1} + \_C2:$$

$$f\left[1\right] := unapply\left(subs\left(\_C1 = 2, \_C2 = 2, expr\right), x\right):$$

$$f\left[2\right] := unapply\left(subs\left(\_C1 = 2, \_C2 = 3, expr\right), x\right):$$

$$f\left[3\right] := unapply\left(subs\left(\_C1 = 3, \_C2 = 2, expr\right), x\right):$$

$$f\left[4\right] := unapply\left(subs\left(\_C1 = 3, \_C2 = 3, expr\right), x\right):$$

$$p1 := plot\left(f\left[1\right], -4..4, colour = red\right):$$

$$p2 := plot\left(f\left[2\right], -4..4, colour = red\right):$$

$$p3 := plot\left(f\left[3\right], -4..4, colour = blue\right):$$

$$p4 := plot\left(f\left[4\right], -4..4, colour = blue\right):$$

$$plots\left[display\right]\left(\left[p1, p2, p3, p4\right]\right);$$

$$y(x) = -\frac{\ln\left(e^x - \_C1\right)}{\_C1} + \frac{\ln\left(e^x\right)}{\_C1} + \_C2$$

> #2)

restart :

$$dsolve\left(diff\,(y(x), x\$2) + \frac{4 \cdot diff\,(y(x), x)}{x} - \frac{4\,y(x)}{x^2} = 25 \cdot x^4 \cdot \sin\left(x^5\right)\right);$$

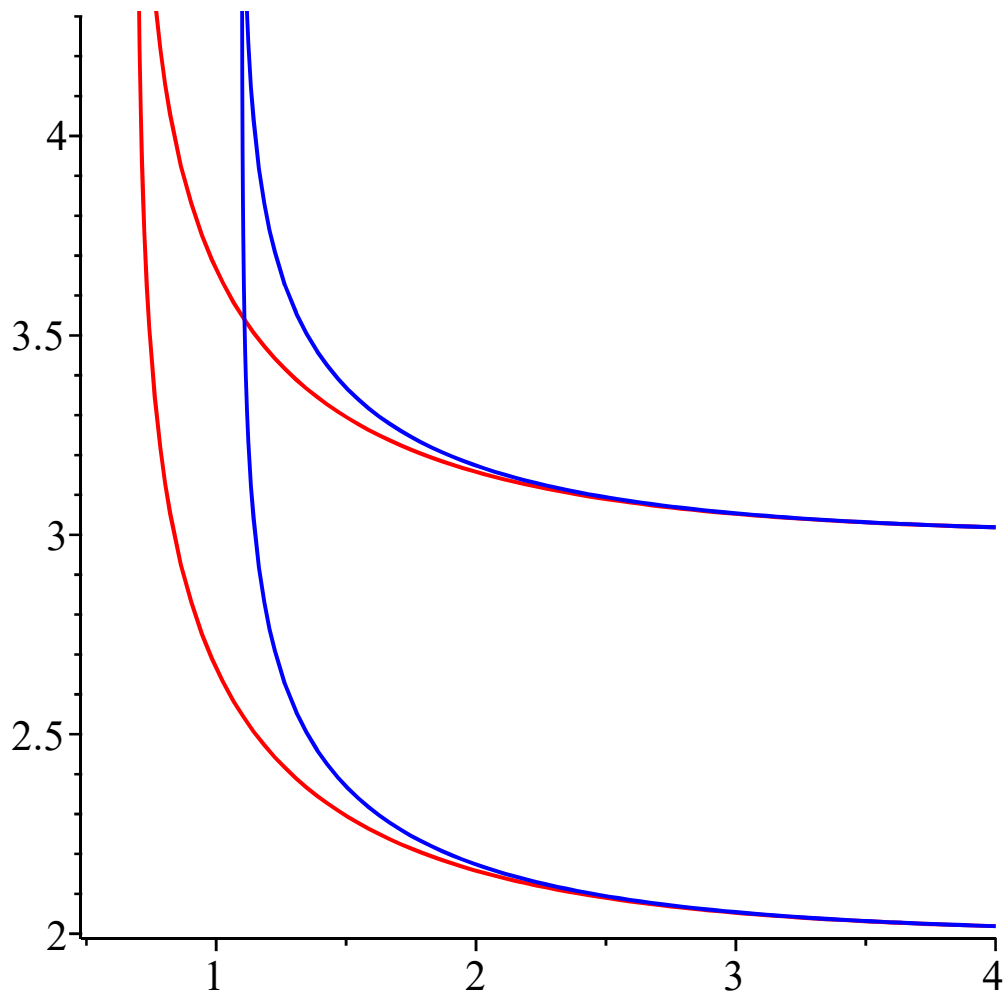$$expr := \frac{\_C2}{x^4} + x\_C1 - \frac{\sin\left(x^5\right)}{x^4};$$

$f[1] := unapply(subs(\_C1 = 2, \_C2 = 2, expr), x) :$
$f[2] := unapply(subs(\_C1 = 2, \_C2 = 3, expr), x) :$
$f[3] := unapply(subs(\_C1 = 3, \_C2 = 2, expr), x) :$
$f[4] := unapply(subs(\_C1 = 3, \_C2 = 3, expr), x) :$
$p1 := plot(f[1], 1..4, colour = red) :$
$p2 := plot(f[2], 1..4, colour = red) :$
$p3 := plot(f[3], 1..4, colour = blue) :$
$p4 := plot(f[4], 1..4, colour = blue) :$
$plots[display]([p1, p2, p3, p4]);$

$$y(x) = \frac{\_C2}{x^4} + x\_C1 - \frac{\sin\left(x^5\right)}{x^4}$$

$$expr := \frac{\_C2}{x^4} + x\_C1 - \frac{\sin(x^5)}{x^4}$$
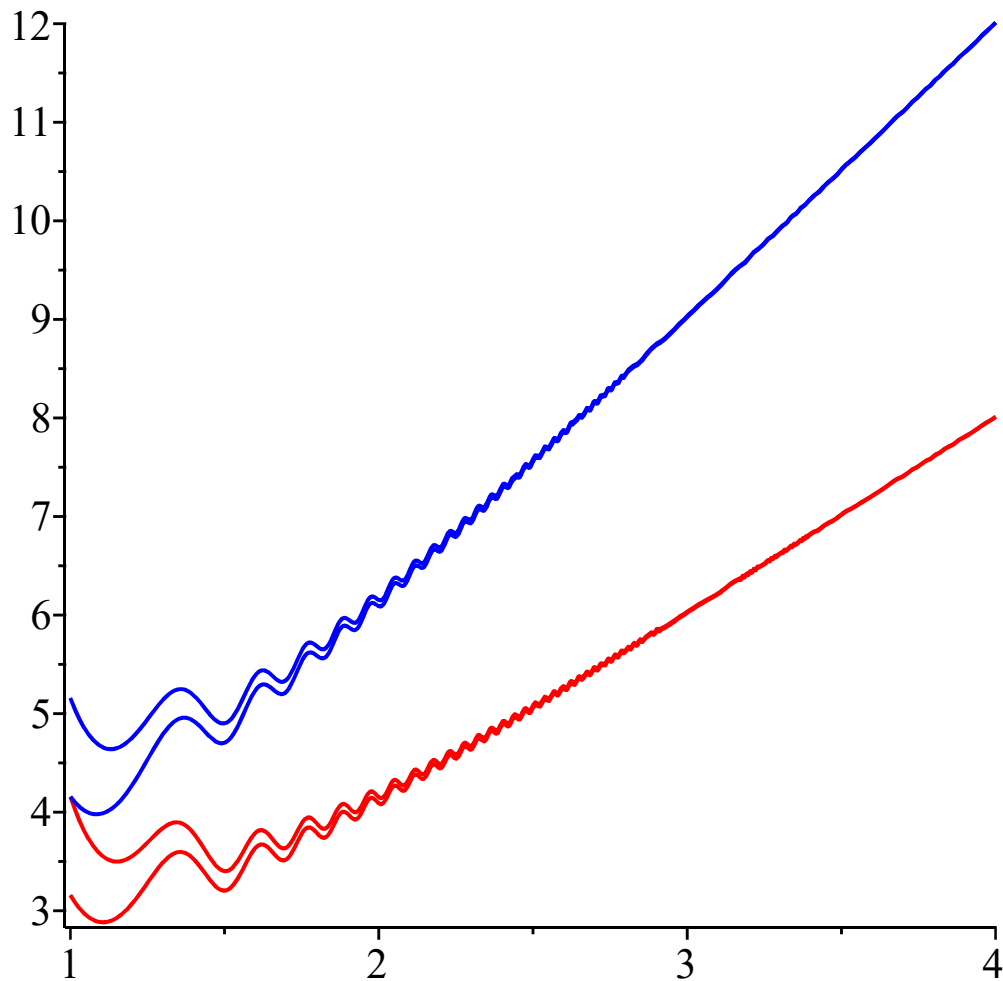
#Задание 2
   restart :
   $dsolve\left(x^2 \cdot diff(y(x), x\$2) + x \cdot diff(y(x), x) = 1, y(x)\right);$
$$y(x) = \frac{\ln(x)^2}{2} + \_C1 \ln(x) + \_C2 \tag{4}$$

> #Задание 3
   restart :
   $dsolve(diff(y(x), x\$2) - 4 \cdot diff(y(x), x) + 8 \cdot y(x) = \exp(x) \cdot (5 \cdot \sin(x) - 3 \cdot \cos(x)), y(x))$
$$y(x) = e^{2x}\sin(2x)\_C2 + e^{2x}\cos(2x)\_C1 - \frac{e^x(-13\sin(x) + \cos(x))}{10} \tag{5}$$

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