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

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>
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;

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

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

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

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

(1)

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

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

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

(2)

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> y := int(y1·cosh(t), t) + _C2;

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$$y := \frac{\cosh(t)^2 t}{2} - \frac{3 \sinh(t) \cosh(t)}{4} - \frac{3 t}{4} + \frac{\sinh(t) t^2}{2} - t \cosh(t) + \sinh(t) + \sinh(t) _C1 + _C2$$

(3)

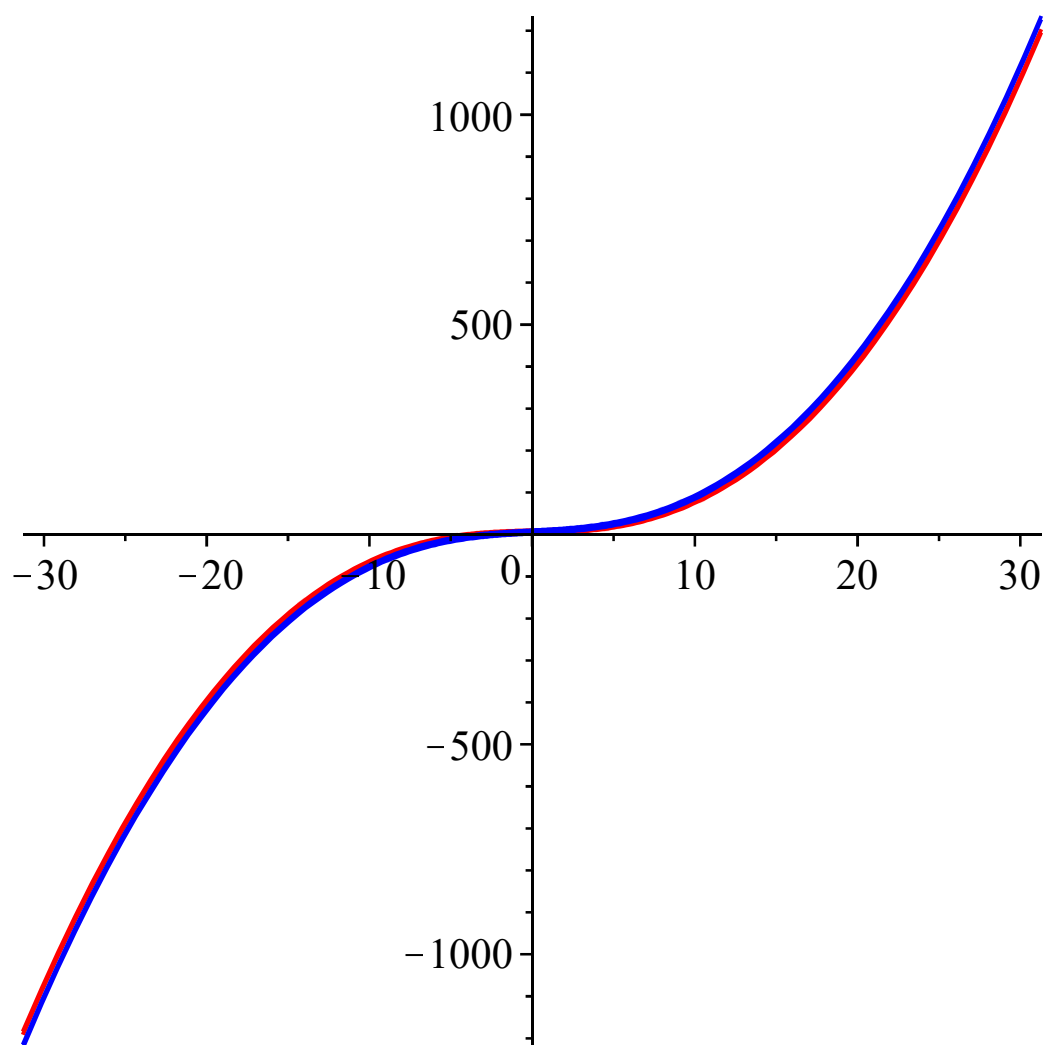
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>
x := unapply(xe, t);
expr := y;
f[1] := unapply(subs(_C1 = 2, _C2 = 2, expr), t) :
f[2] := unapply(subs(_C1 = 2, _C2 = 10, expr), t) :
f[3] := unapply(subs(_C1 = 3, _C2 = 2, expr), t) :
f[4] := unapply(subs(_C1 = 3, _C2 = 10, expr), t) :
p1 := plot([x, 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]);

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

$$expr := \frac{\cosh(t)^2 t}{2} - \frac{3 \sinh(t) \cosh(t)}{4} - \frac{3 t}{4} + \frac{\sinh(t) t^2}{2} + \sinh(t) _C1 + \frac{t^3}{6} - \sinh(t) + _C1 t + _C2$$



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> #6)
restart :
dsolve(sqrt(1 - x^2) * arcsin(x) * (y(x) * diff(y(x), x$2) - (diff(y(x), x))^2) = y(x) * diff(y(x),
x) , y(x));

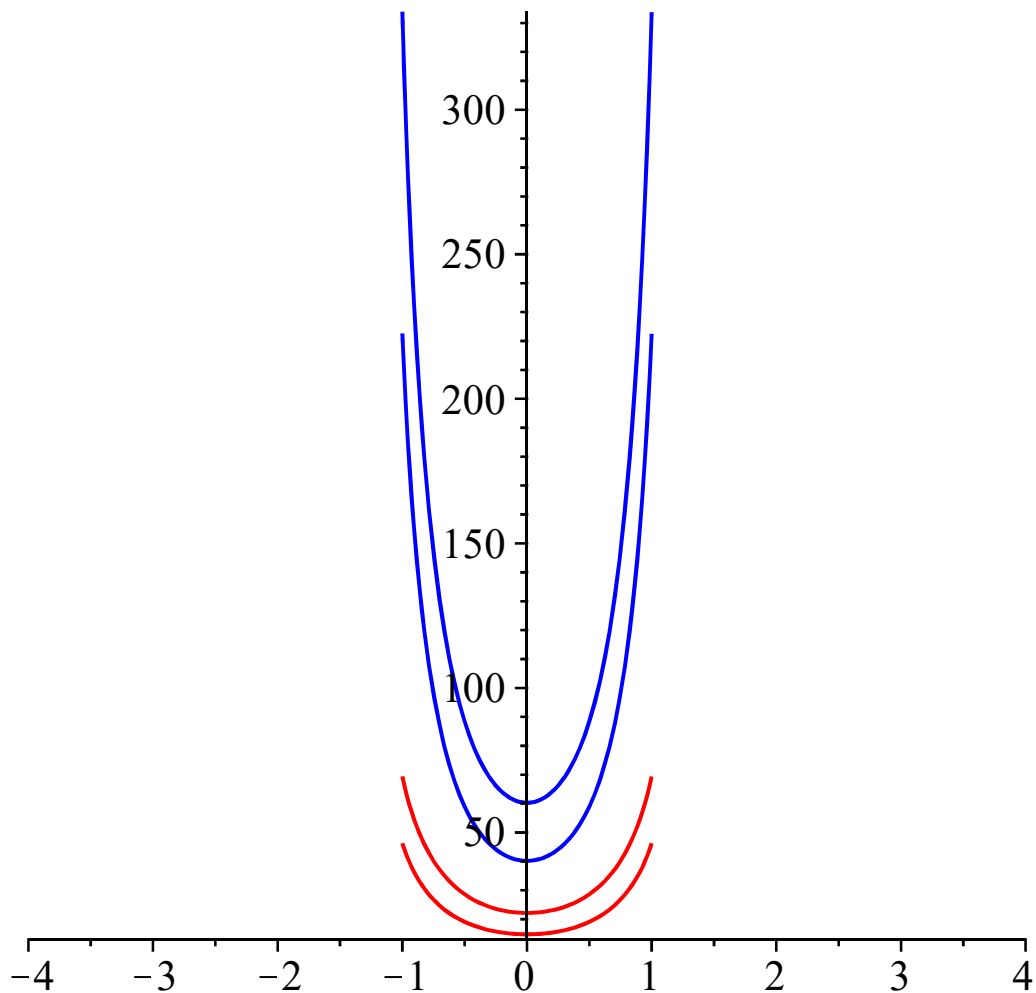
expr := e^arcsin(x) _C1 x e^sqrt(-x^2 + 1) _C1 _C2;
f[1] := unapply(subs(_C1 = 2, _C2 = 2, expr), x):
f[2] := unapply(subs(_C1 = 2, _C2 = 3, expr), x):
f[3] := unapply(subs(_C1 = 3, _C2 = 2, expr), x):
f[4] := unapply(subs(_C1 = 3, _C2 = 3, expr), x):
p1 := plot(f[1], -4..4, colour = red):
p2 := plot(f[2], -4..4, colour = red):
p3 := plot(f[3], -4..4, colour = blue):

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p4 := plot(f[4], -4..4, colour = blue):
plots[display]([p1, p2, p3, p4]);
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$$y(x) = e^{\arcsin(x) - C1 x} e^{\sqrt{-x^2 + 1} - C1 - C2}$$

$$expr := e^{\arcsin(x) - C1 x} e^{\sqrt{-x^2 + 1} - C1 - C2}$$



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> #6)
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restart :
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dsolve(diff(y(x), x$2) = (diff(y(x), x))^2 * exp(x), y(x));
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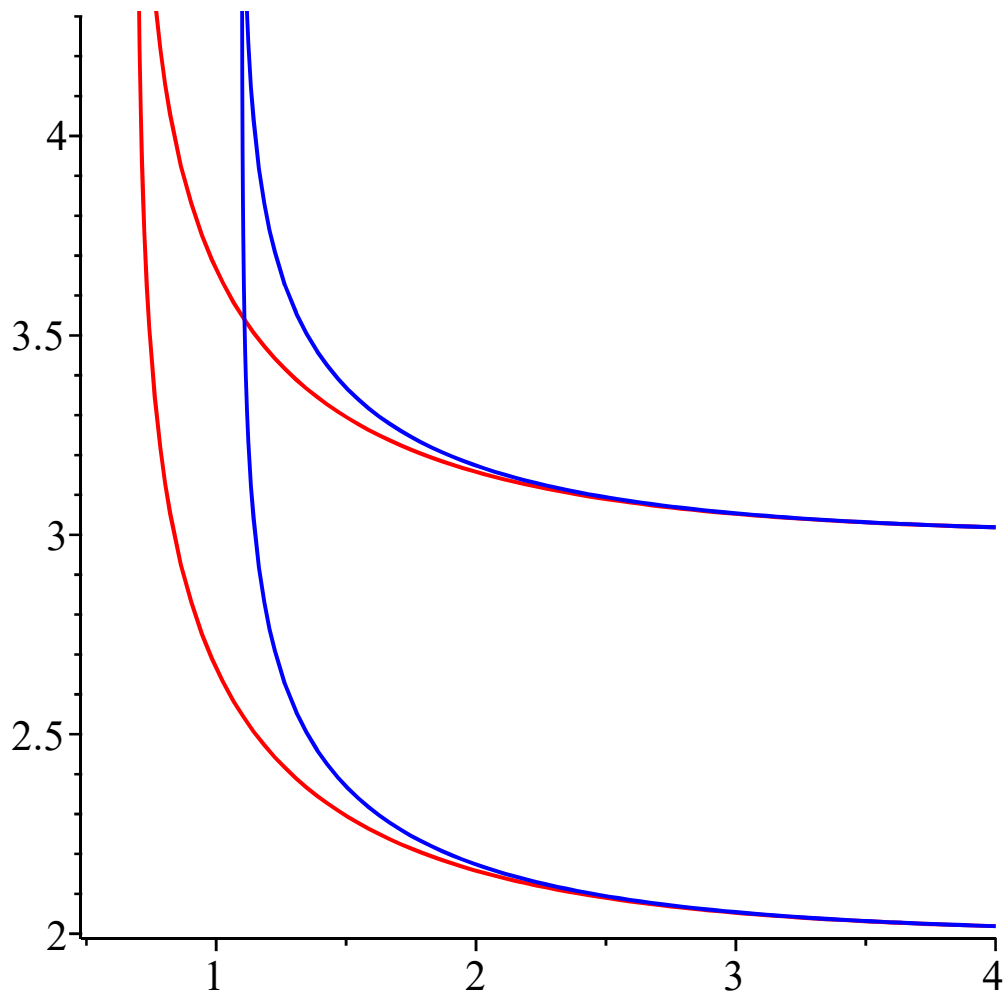
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expr := -ln(e^x - C1) / C1 + ln(e^x) / C1 + C2 :
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f[1] := unapply(subs(_C1 = 2, _C2 = 2, expr), x):
f[2] := unapply(subs(_C1 = 2, _C2 = 3, expr), x):
f[3] := unapply(subs(_C1 = 3, _C2 = 2, expr), 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]);

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$$y(x) = -\frac{\ln(e^x - C1)}{C1} + \frac{\ln(e^x)}{C1} + C2$$



> #2)

restart :

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

$$expr := \frac{C2}{x^4} + x_C1 - \frac{\sin(x^5)}{x^4};$$

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

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

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

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

$p1 := \text{plot}(f[1], 1..4, \text{colour}=\text{red}) :$

$p2 := \text{plot}(f[2], 1..4, \text{colour}=\text{red}) :$

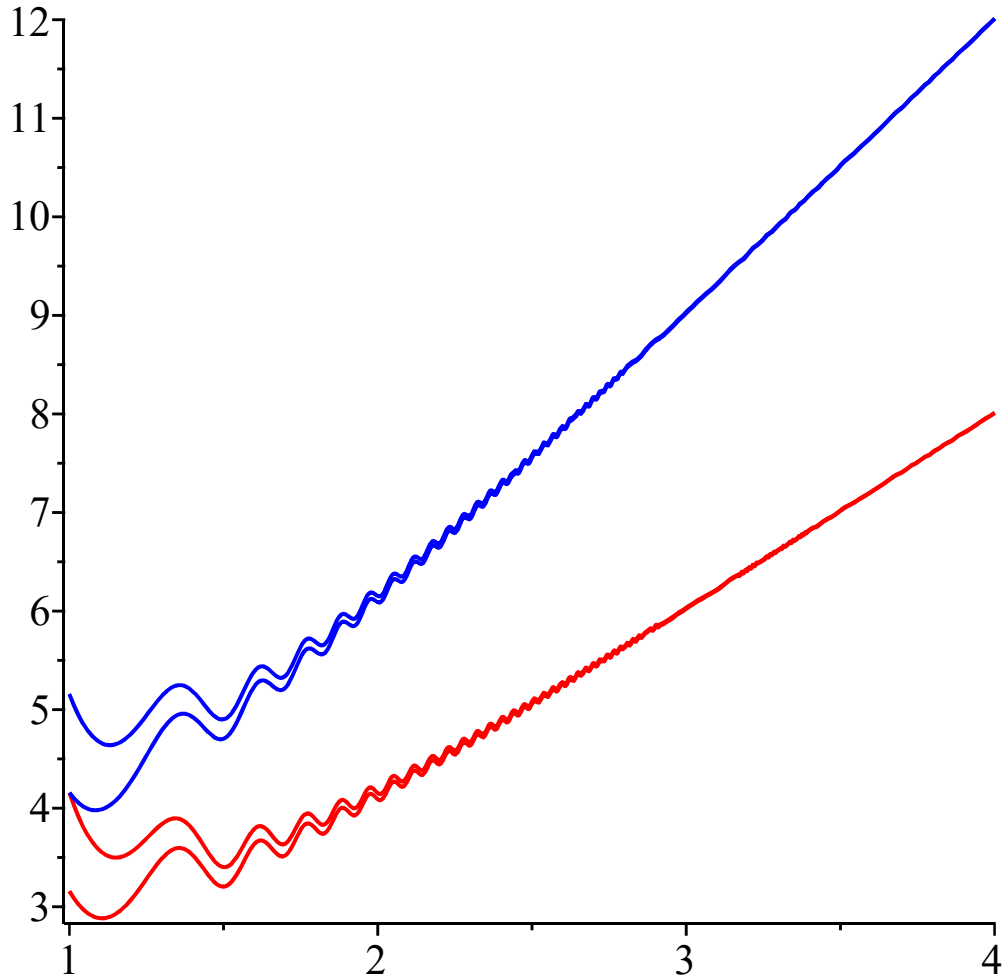
$p3 := \text{plot}(f[3], 1..4, \text{colour}=\text{blue}) :$

$p4 := \text{plot}(f[4], 1..4, \text{colour}=\text{blue}) :$

$\text{plots}[\text{display}]([p1, p2, p3, p4]);$

$$y(x) = \frac{C2}{x^4} + x_C1 - \frac{\sin(x^5)}{x^4}$$

$$expr := \frac{C2}{x^4} + x_CI - \frac{\sin(x^5)}{x^4}$$



> #Задание 2

restart :

$dsolve(x^2 \cdot diff(y(x), x^2) + x \cdot diff(y(x), x) = 1, y(x));$

$$y(x) = \frac{\ln(x)^2}{2} + _CI \ln(x) + _C2$$

(4)

> #Задание 3

restart :

$dsolve(diff(y(x), x^2) - 4 \cdot diff(y(x), x) + 8 \cdot y(x) = \exp(x) \cdot (5 \cdot \sin(x) - 3 \cdot \cos(x)), y(x))$

$$y(x) = e^{2x} \sin(2x) _C2 + e^{2x} \cos(2x) _CI - \frac{e^x (-13 \sin(x) + \cos(x))}{10}$$

(5)

> $dsolve\left(diff(y(x), x^2) + \frac{4}{x} \cdot diff(y(x), x) - \frac{4}{x^2} \cdot y(x) = 0, y(x)\right)$

$$y(x) = x_CI + \frac{C2}{x^4}$$

(6)

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