> #Задание 1

> $expr := \dfrac{\dfrac{7x^4 - 126x^2 + 567}{x^5 - 8x^4 - 27x^2 + 216x}}{\dfrac{x^3 + 3x^2 - 9x - 27}{x^3 - 5x^2 - 15x - 72}}$:

> $simplify(expr);$

$$\frac{7}{x} \qquad (1)$$

>

#Задание 2

$expr := (2x - 5) \cdot (3x^2 + 2) \cdot (4x + 3);$

$$expr := (2x - 5)\,(3x^2 + 2)\,(4x + 3) \qquad (2)$$

> $expand(expr);$

$$24x^4 - 42x^3 - 29x^2 - 28x - 30 \qquad (3)$$

>

>

> #Задание 3

$expr := x^4 + x^3 - 9x^2 + 11x - 4;$

$$expr := x^4 + x^3 - 9x^2 + 11x - 4 \qquad (4)$$

> $factor(expr);$

$$(x + 4)\,(x - 1)^3 \qquad (5)$$

>

#Задание 4

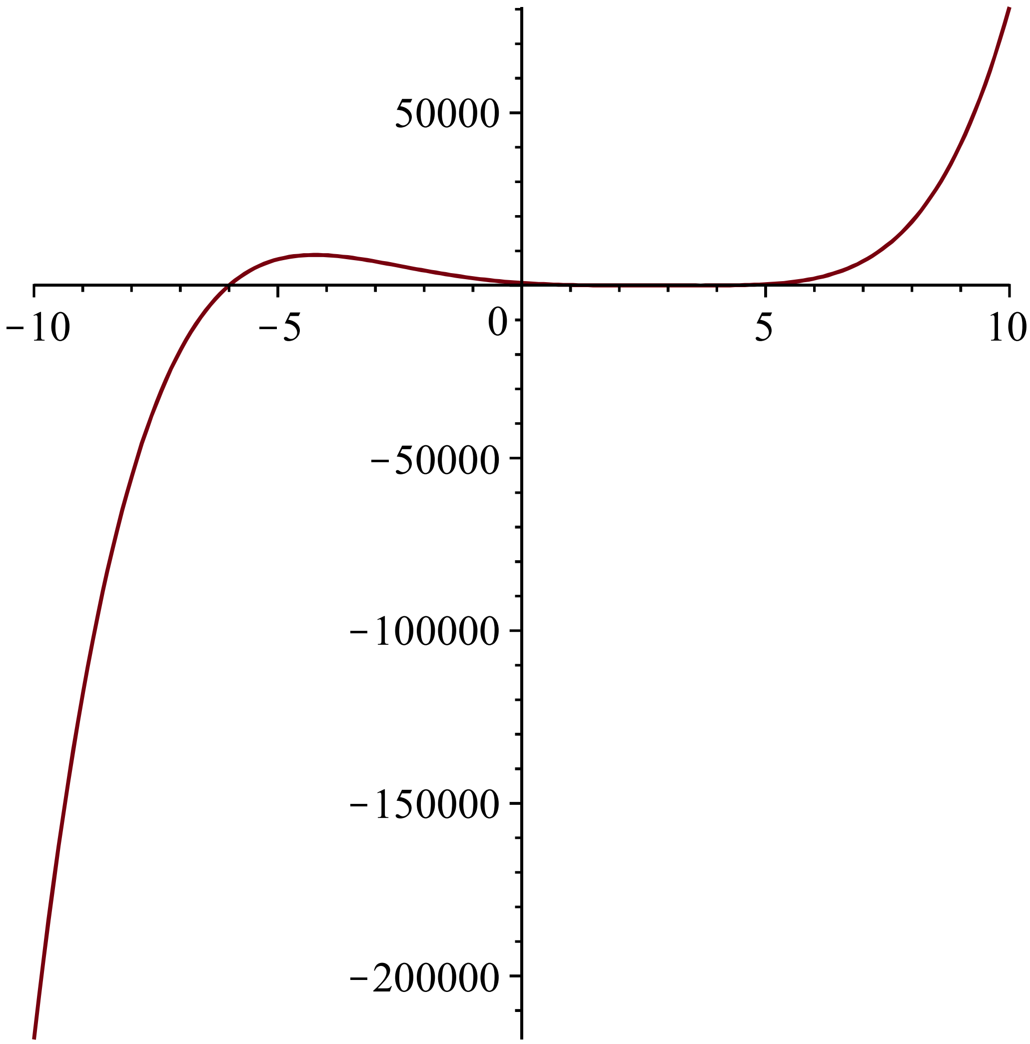
$P := 2x^5 - 11x^4 - 41x^3 + 404x^2 - 948x + 720;$

$$P := 2x^5 - 11x^4 - 41x^3 + 404x^2 - 948x + 720 \qquad (6)$$

> $f := unapply(P, x);$

$$f := x \mapsto 2x^5 - 11x^4 - 41x^3 + 404x^2 - 948x + 720 \qquad (7)$$

> $plot(f);$



> $solve(f(x), x);$

$$2, 3, 4, -6, \frac{5}{2} \quad (8)$$

>

>

> #Задание 5

> $expr := \frac{2x^4 + 3x^3 + 5x - 4}{(x^2+1)\cdot(x-3)^2\cdot(x^2-4)};$

$$expr := \frac{2x^4 + 3x^3 + 5x - 4}{(x^2+1)\,(x-3)^2\,(x^2-4)} \quad (9)$$

> $convert(expr, parfrac, x);$

$$\frac{127}{25\,(x-3)^2} + \frac{-x+7}{125\,(x^2+1)} - \frac{388}{125\,(x-3)} + \frac{3}{250\,(x+2)} + \frac{31}{10\,(x-2)} \quad (10)$$

>

>

> #Задание 7

$$a := (n) \to \frac{(6n-5)}{5n+1};$$
$$A := \frac{6}{5};$$
$$\varepsilon := 0.1;$$

$$a := n \mapsto \frac{6n-5}{5n+1}$$
$$A := \frac{6}{5}$$
$$\varepsilon := 0.1 \qquad \textbf{(11)}$$

> $expr1 := \mathrm{abs}(a(n) - A) < \varepsilon;$
> $expr2 := n > 0;$

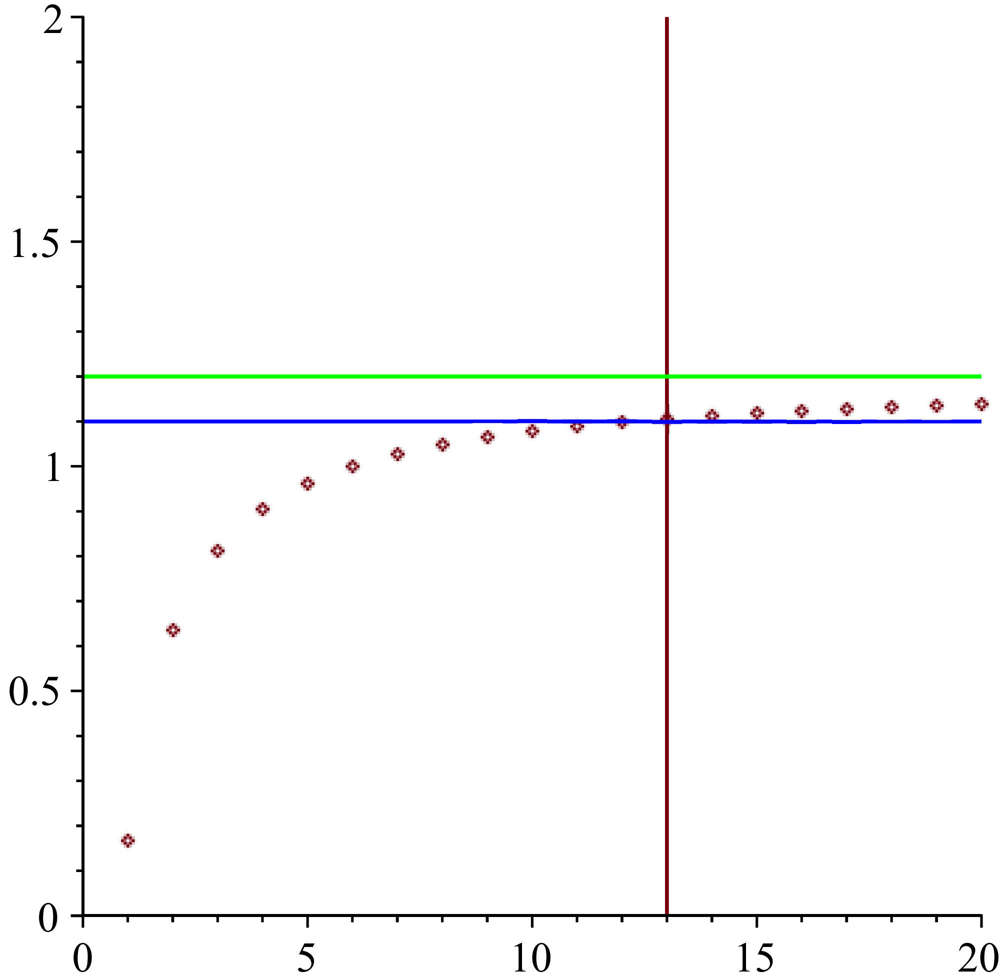
$$expr1 := \left| \frac{6n-5}{5n+1} - \frac{6}{5} \right| < 0.1$$
$$expr2 := 0 < n \qquad \textbf{(12)}$$

> $solve(\{expr1, expr2\}, n);$

$$\{12.20000000 < n\} \qquad \textbf{(13)}$$

> $N := 13;$
> $t1 := plot(\{seq([n, a(n)], n = 1..20)\}, style = point):$
> $t2 := plot(\{seq([13, r], r = 0..2)\}):$
> $t3 := plot((x) \to A, 0..20, colour = green):$
> $t4 := plot\big((x) \to A - \varepsilon, 0..20, color = blue\big):$
> $plots[display]([t1, t2, t3, t4]);$

$$N := 13$$



>

>

>

> *#Задание 6*
$expr1 := \ln^2(x+1):$
$f1 := unapply(expr1, x);$

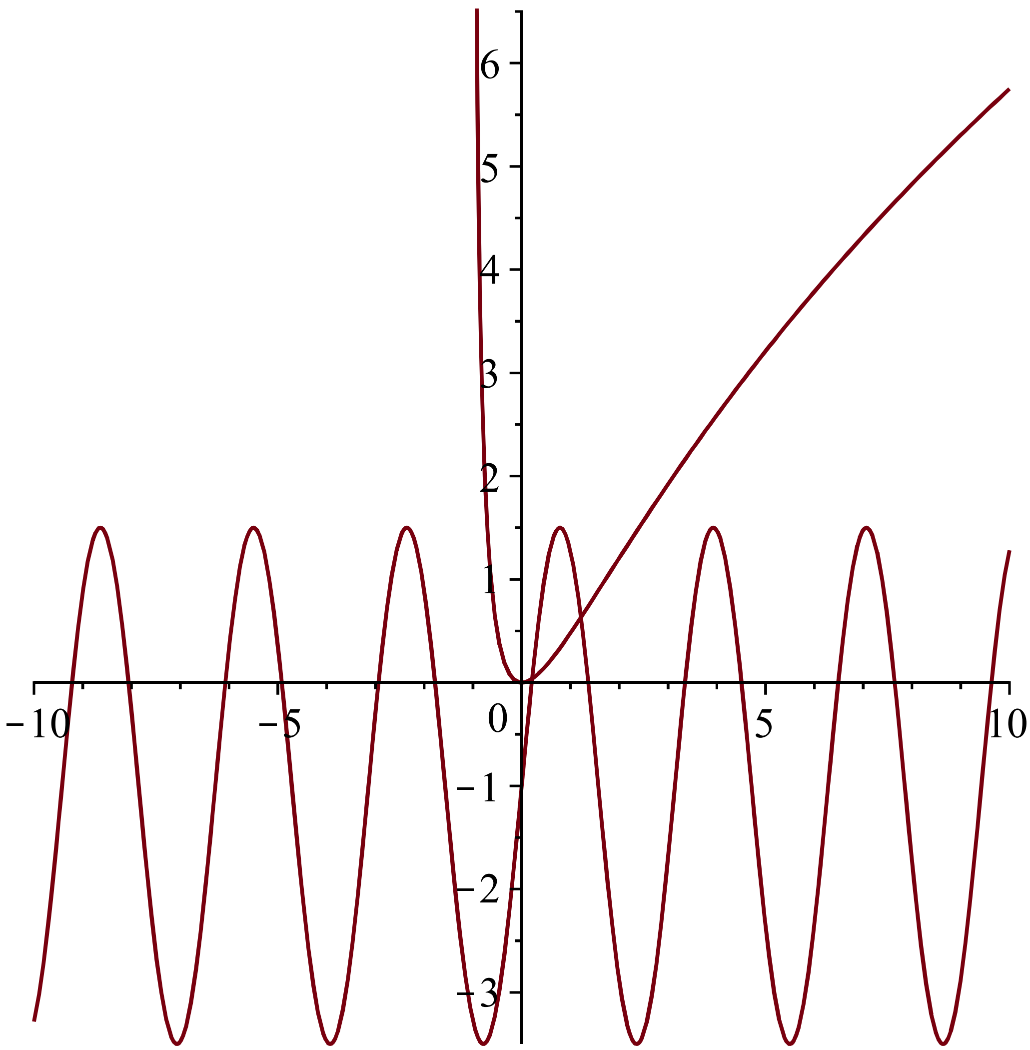
$$f1 := x \mapsto \ln(x+1)^2 \quad \textbf{(14)}$$

> $expr2 := 2.5 \cdot \sin(2\,x) - 1:$
$f2 := unapply(expr2, x);$

$$f2 := x \mapsto 2.5\,\sin(2\,x) - 1 \quad \textbf{(15)}$$

> $t1 := plot(f1):$

> $t2 := plot(f2):$
$plots[display]([t1, t2]);$

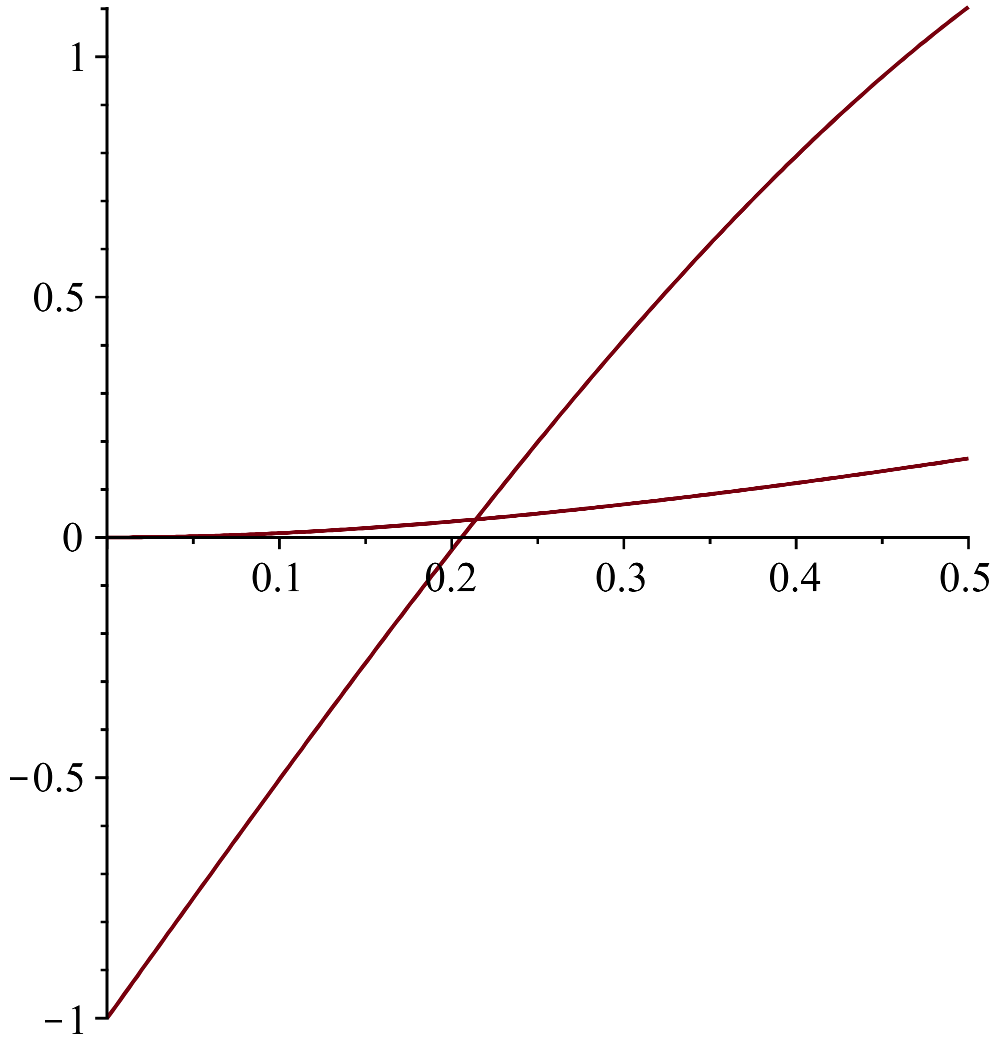


> *#нас интересуют промежутки 0..0.5 и 1..1.5 для поиска корней*
> *#начнем с первого*

"_noterminate" **(16)**

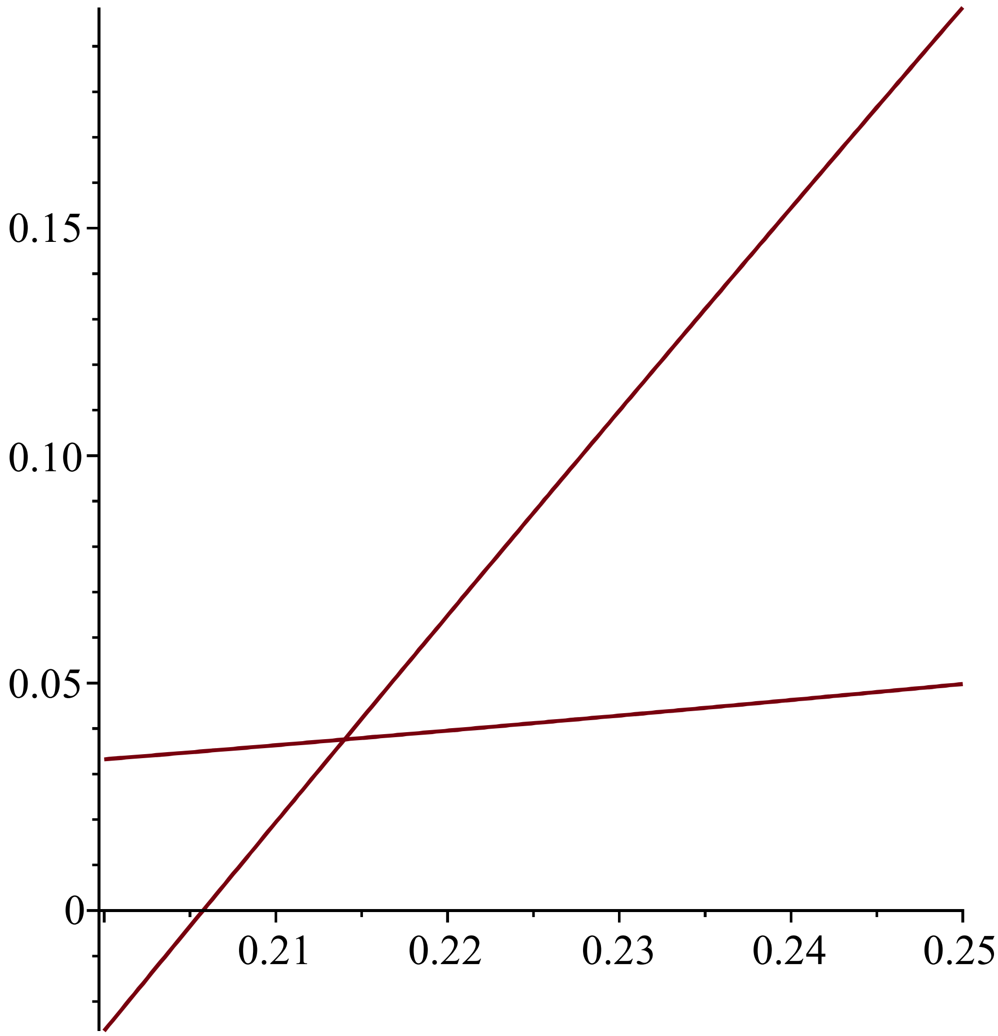
> $t1 := plot(f1, 0..0.5)$:

> $t2 := plot(f2, 0..0.5)$:
> $plots[display]([t1, t2])$;



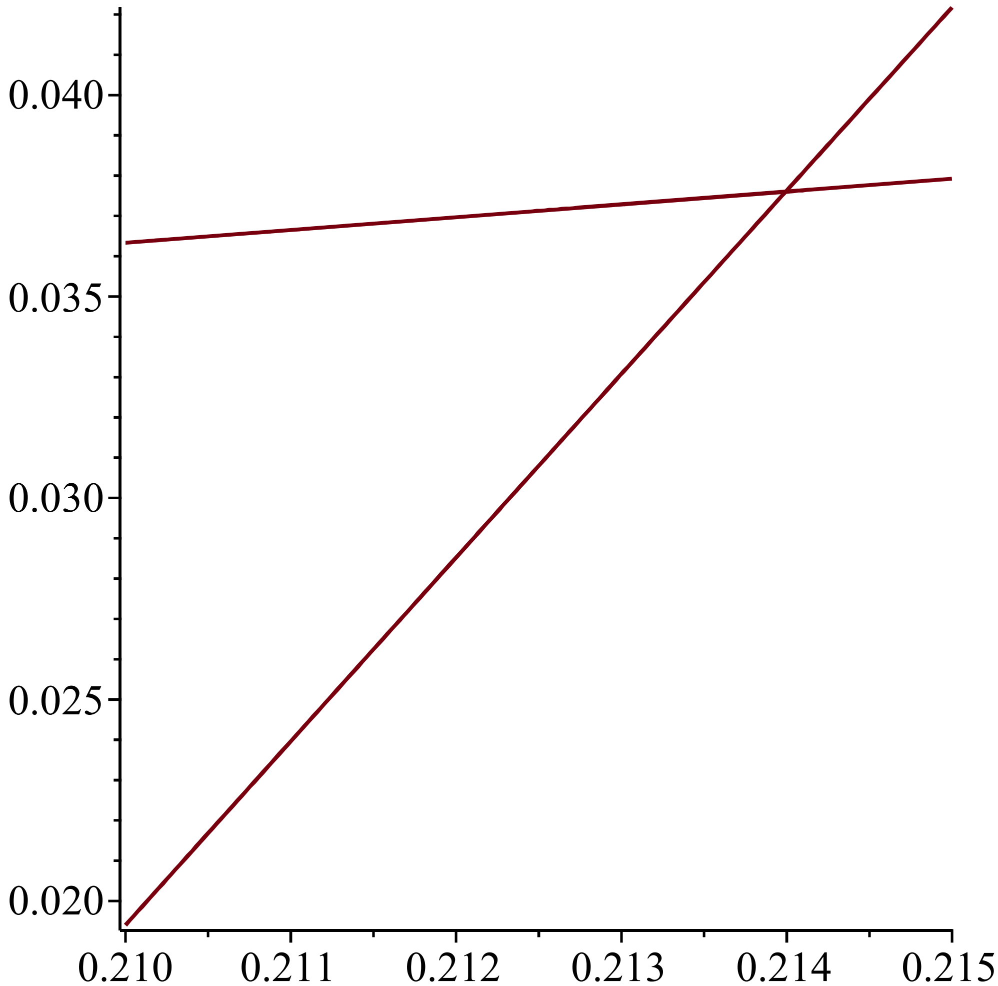
> $t1 := plot(f1, 0.2\,..0.25)$:

> $t2 := plot(f2, 0.2\,..0.25)$:
$plots[display]([t1, t2])$;



> $t1 := plot(f1, 0.21..0.215)$:

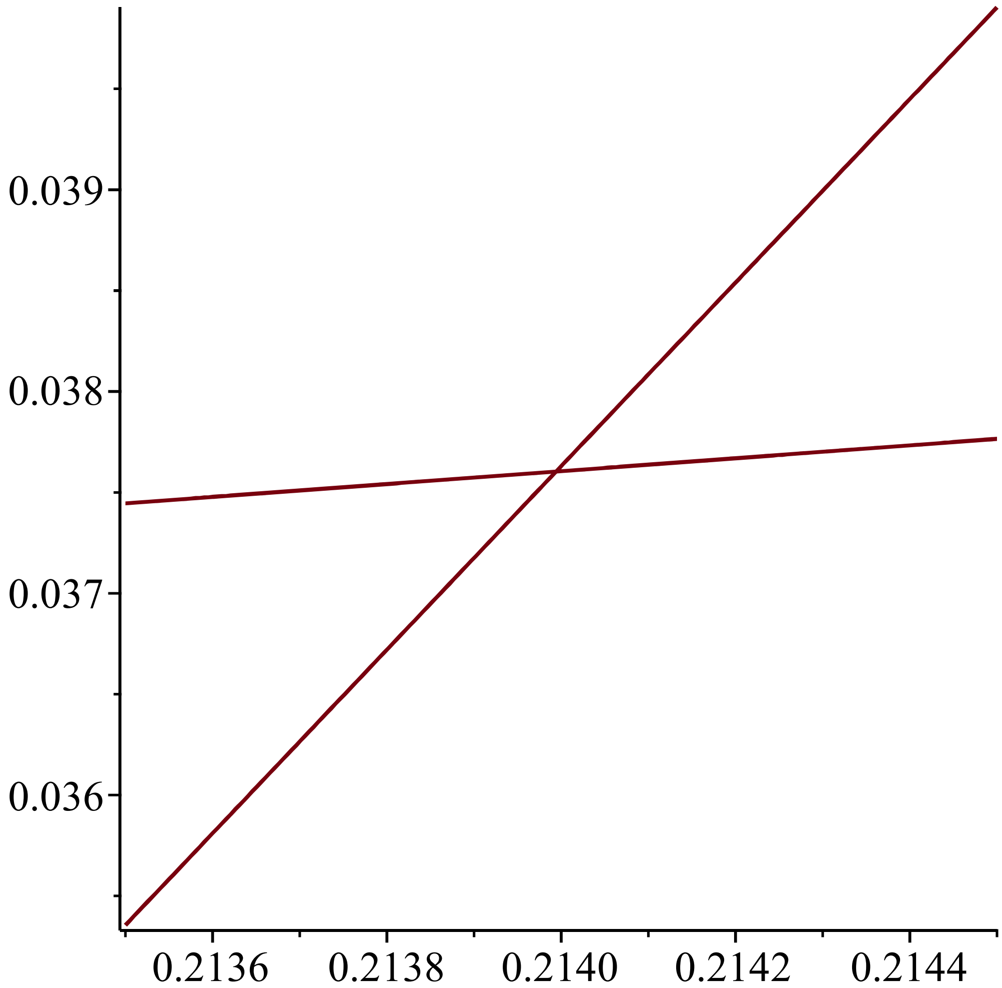
> $t2 := plot(f2, 0.21..0.215)$:
$plots[display]([t1, t2])$;



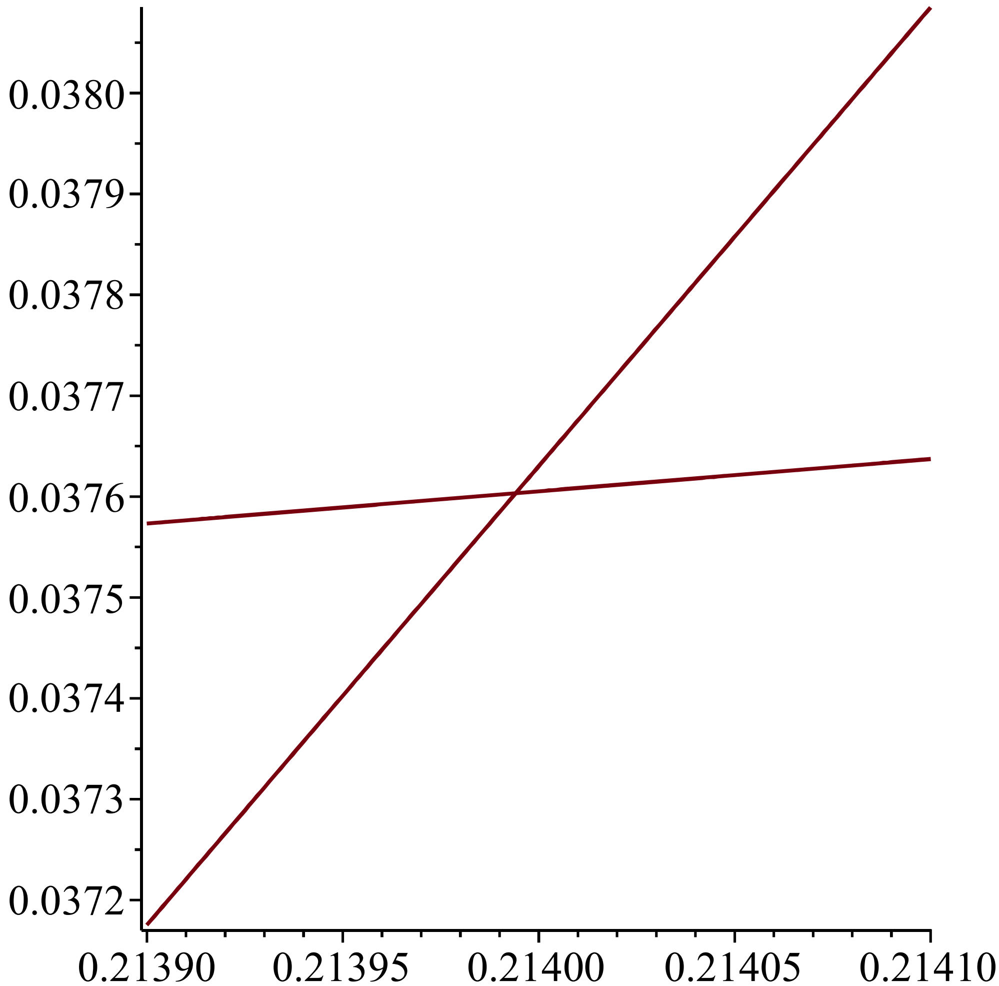
> $interval := 0.2135 ..0.2145 :$

> $t1 := plot(f1, interval) :$

> $t2 := plot(f2, interval) :$
> $plots[display]([t1, t2]);$

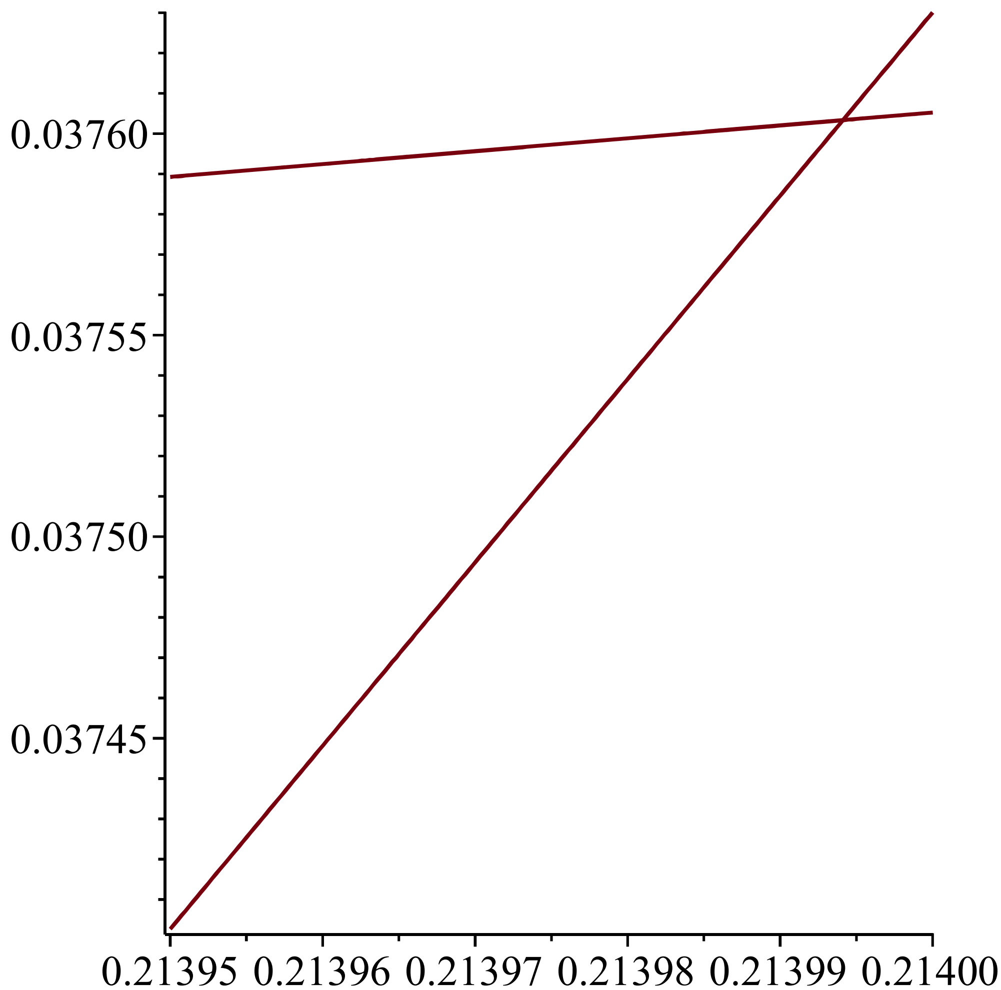



```
> interval := 0.2139 ..0.2141 :
> t1 := plot( f1, interval) :
> t2 := plot( f2, interval) :
  plots[display]([t1, t2]);
```



> $interval := 0.21395 .. 0.21400 :$

> $t1 := plot(f1, interval) :$
$t2 := plot(f2, interval) :$
$plots[display]([t1, t2]);$



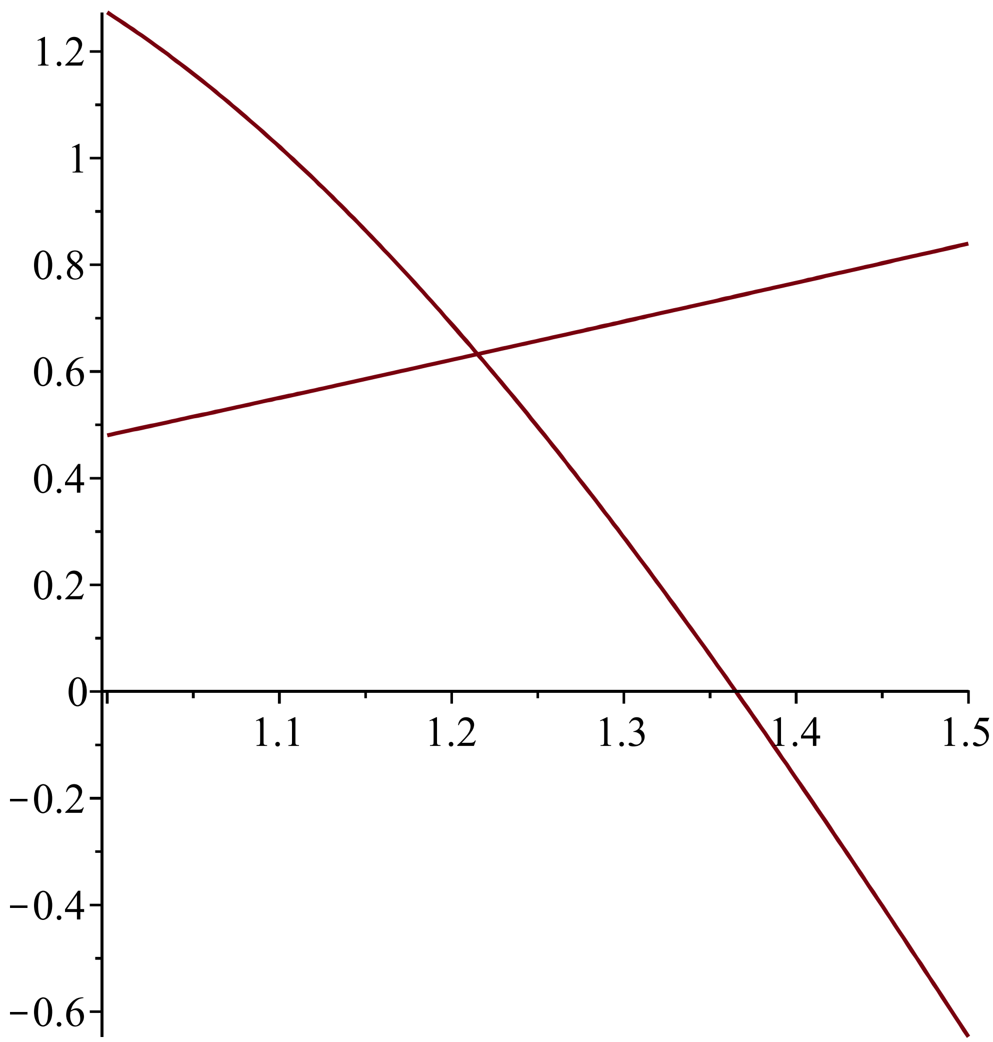
>

> *#Т. о. точное решение находится в промежутке 0.213990 ..0.21394*
→ответ с *точностью до* 10^{-5} $x1 = 0.21399$
#2ой промежуток

"_noterminate" **(17)**

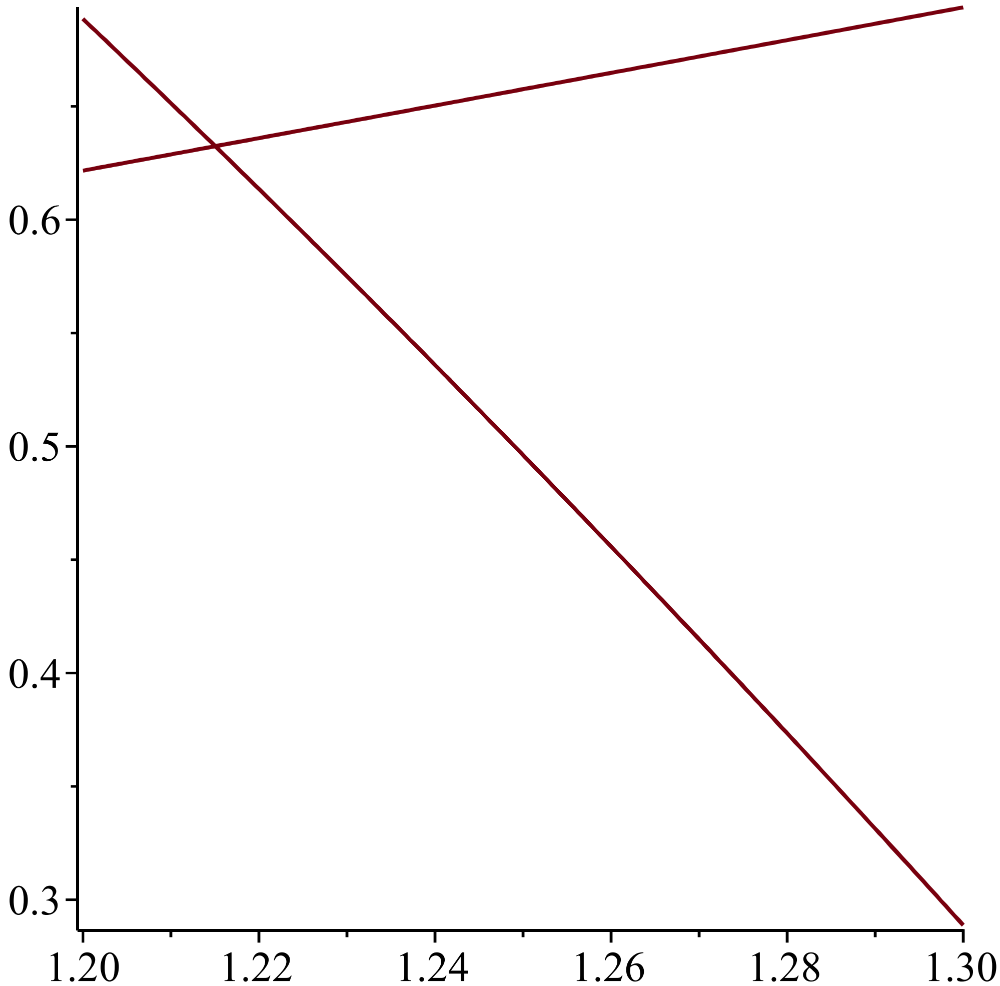
> $interval := 1 ..1.5 :$

> $t1 := plot(f1, interval) :$
$t2 := plot(f2, interval) :$
$plots[display]([t1, t2]);$

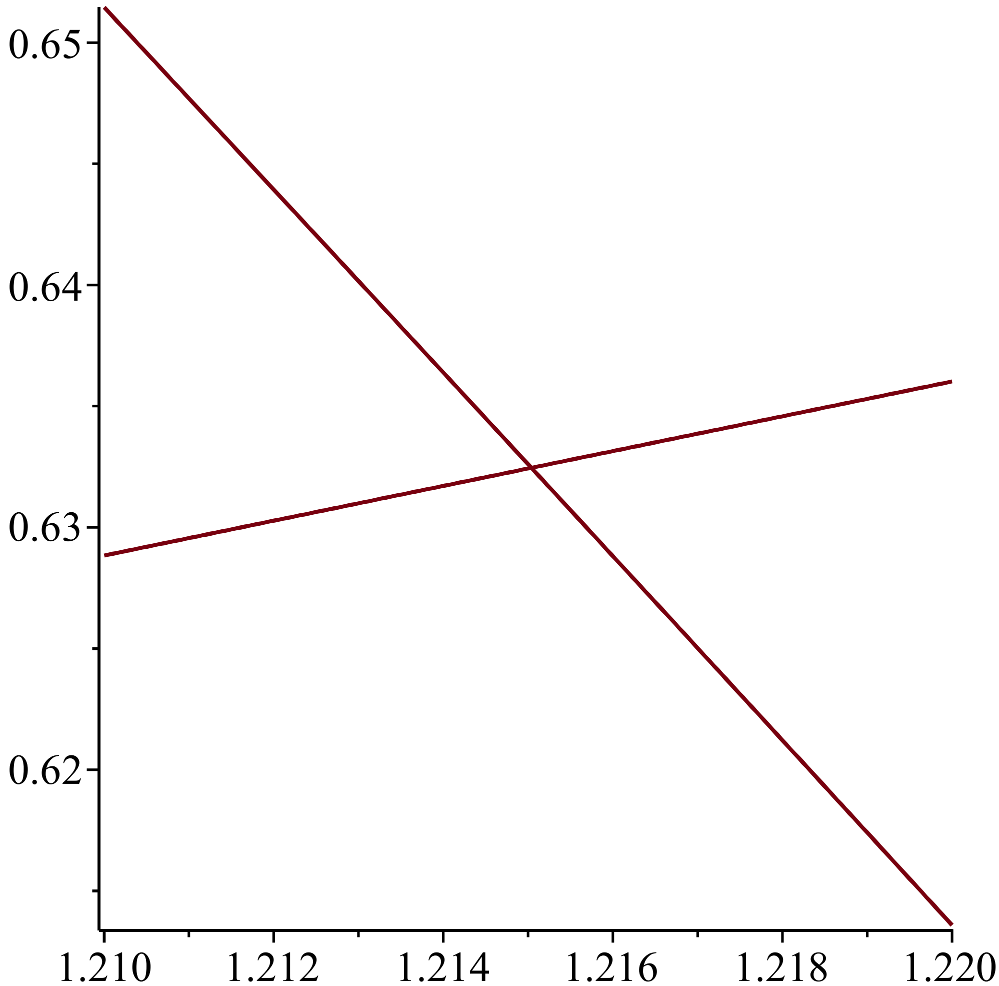


> $interval := 1.2 .. 1.3 :$

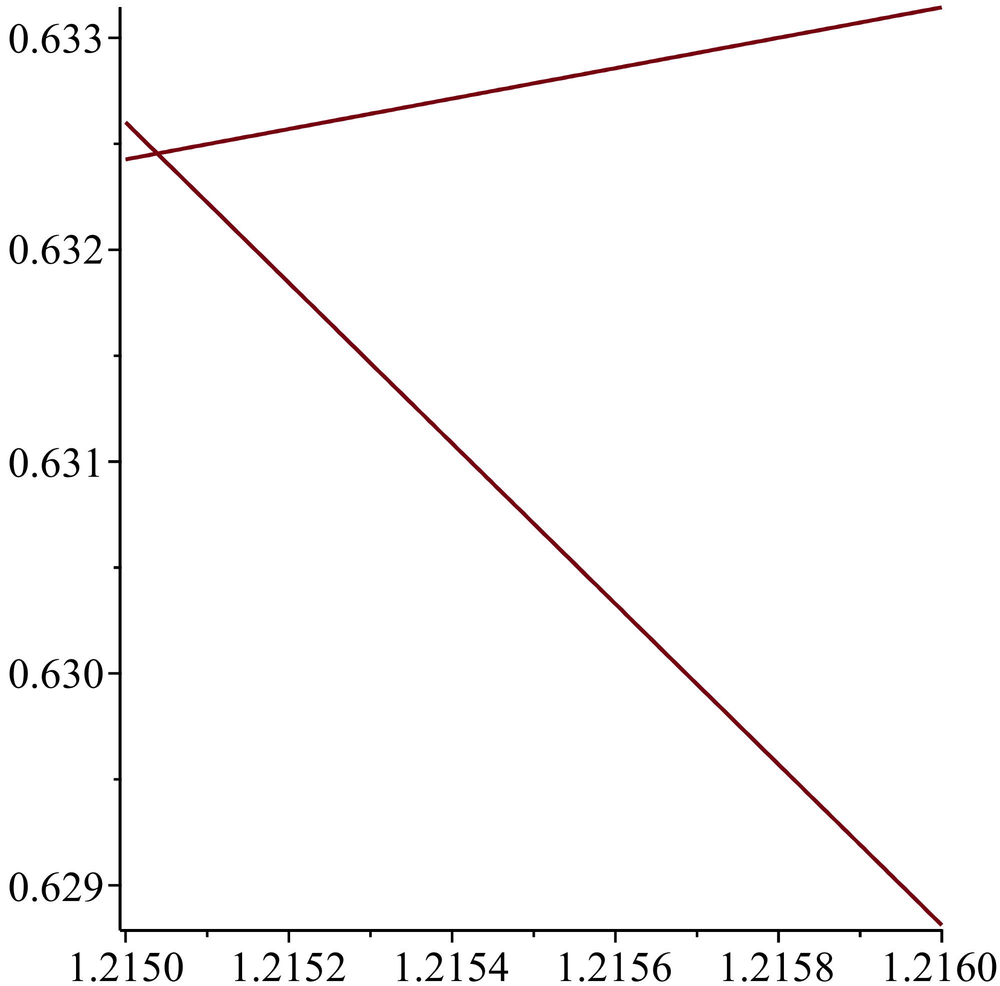
> $t1 := plot(f1, interval) :$
$t2 := plot(f2, interval) :$
$plots[display]([t1, t2]);$




```
> interval := 1.21 .. 1.22 :
> t1 := plot(f1, interval) :
  t2 := plot(f2, interval) :
  plots[display]([t1, t2]);
```

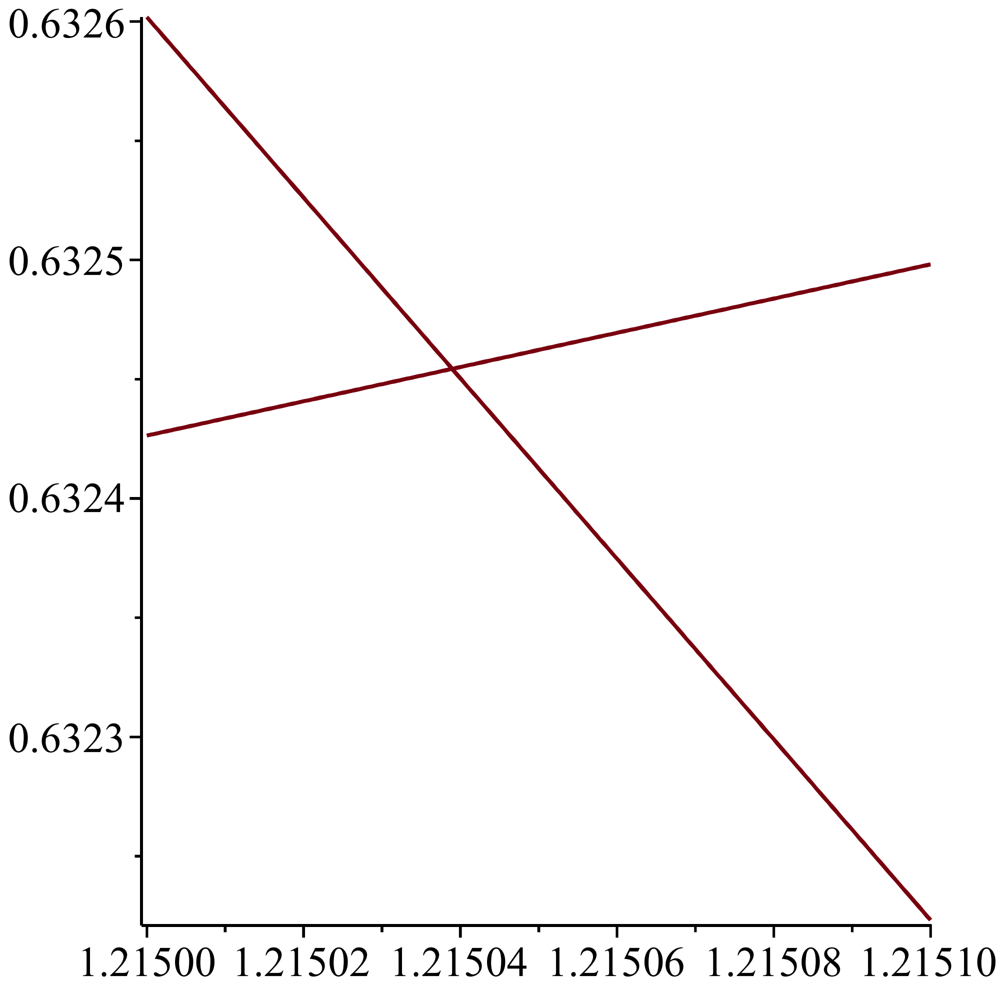



```
> interval := 1.215 ..1.216 :
> t1 := plot(f1, interval) :
  t2 := plot(f2, interval) :
  plots[display]([t1, t2]);
```



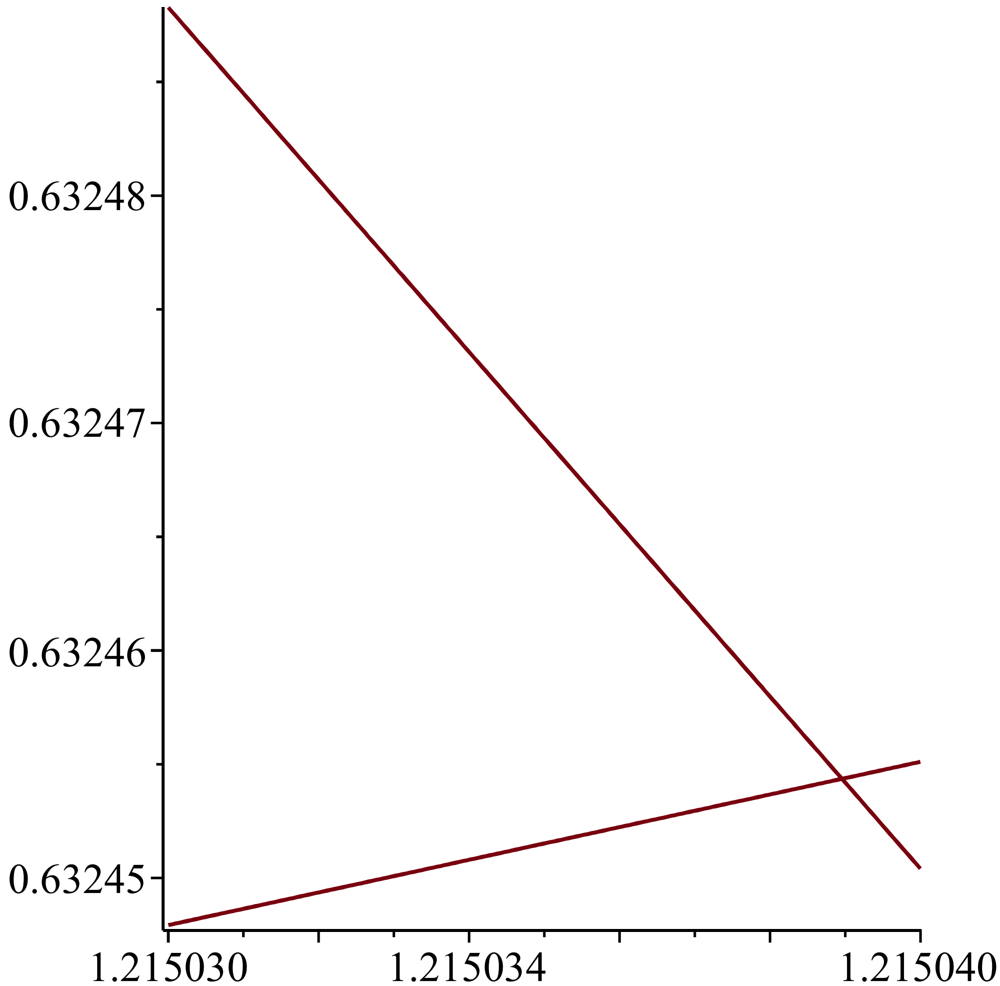
> $interval := 1.2150 .. 1.2151 :$

> $t1 := plot(f1, interval) :$
$t2 := plot(f2, interval) :$
$plots[display]([t1, t2]);$



> $interval := 1.21503 .. 1.21504:$

> $t1 := plot(f1, interval):$
$t2 := plot(f2, interval):$
$plots[display]([t1, t2]);$



> *#Следовательно с учётом окургления x2 = 1.215040*
#Ответ x1 = 0.21399, x2 = 1.215040

#Задание 8
#a)
$expr := \mathrm{sqrt}(x)\cdot(\mathrm{sqrt}(x+2) - \mathrm{sqrt}(x-3));$

$$expr := \sqrt{x}\,\left(\sqrt{x+2} - \sqrt{x-3}\right) \tag{18}$$

> $f := unapply(expr, x);$

$$f := x \mapsto \sqrt{x}\,\left(\sqrt{x+2} - \sqrt{x-3}\right) \tag{19}$$

> $limit(f(x), x = \mathrm{infinity});$

$$\frac{5}{2} \tag{20}$$

> *#б)*

$expr := \dfrac{3\,x^2 + 4\,x - 1}{3\,x^2 + 2\,x + 7};$

$$expr := \frac{3x^2+4x-1}{3x^2+2x+7} \quad (21)$$

> $f := unapply(expr, x);$

$$f := x \mapsto \frac{3x^2+4x-1}{3x^2+2x+7} \quad (22)$$

> $limit(f(x), x = \text{infinity});$

$$1 \quad (23)$$

>

>

>

> #Задание 9
$cond1 := x < -\mathrm{Pi} :$

> $cond2 := x \geq -\mathrm{Pi} :$
$expr1 := 5 \cdot \cos(2\,x) :$
$expr2 := 7 \cdot \exp(-0.5\,x) :$
$f := unapply(piecewise(cond1, expr1, cond2, expr2), x);$

$$f := x \mapsto \begin{cases} 5\cos(2\,x) & x < -\pi \\ 7\,\mathrm{e}^{-0.5\,x} & -\pi \leq x \end{cases} \quad (24)$$

>

> $discont(f(x), x);$

$$\{-\pi\} \quad (25)$$

> $limit(f(x), x = -\mathrm{Pi}, left);$

$$5. \quad (26)$$

> $limit(f(x), x = -\mathrm{Pi}, right);$

$$33.67334167 \quad (27)$$

> $limit(f(x), x = -\text{infinity});$

$$-5. .. 5. \quad (28)$$

> $limit(f(x), x = \text{infinity});$

$$0. \quad (29)$$

> $diff(f(x), x)$ assuming$(cond1);$

$$-10\sin(2\,x) \quad (30)$$

> $dexpr := diff(f(x), x)$ assuming$(cond2) :$
$d := unapply(dexpr, x);$

$$d := x \mapsto -3.5\,\mathrm{e}^{-0.5\,x} \quad (31)$$

> $iexpr := int(f(x), x)$ assuming$(cond1) :$
$i := unapply(iexpr, x);$

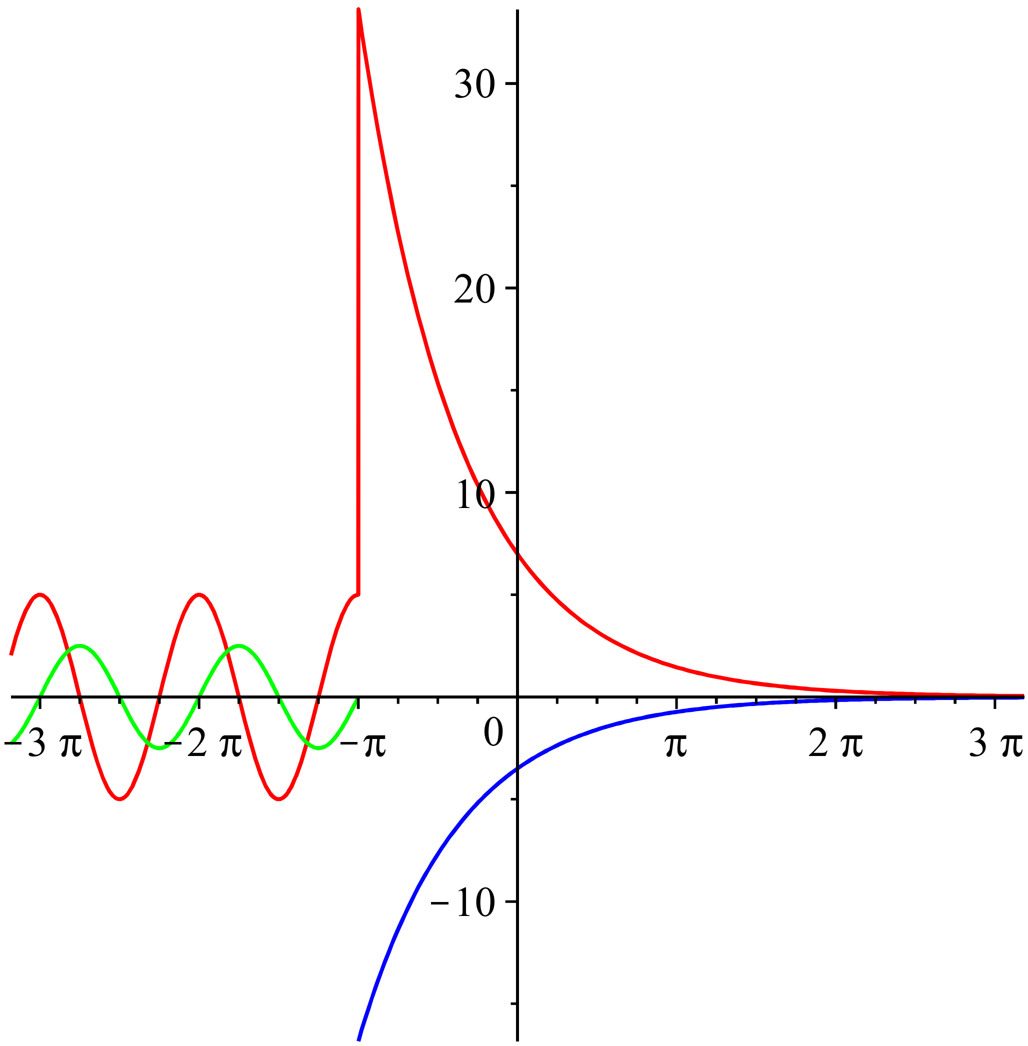
$$i := x \mapsto \frac{5\sin(2\,x)}{2} \quad (32)$$

> $int(f(x), x)$ assuming$(cond2);$

$$-14.\,\mathrm{e}^{-0.5000000000\,x} \quad (33)$$

> $t1 := plot(f, colour = red) :$
$t2 := plot(d, -\mathrm{Pi}..10, colour = blue,) :$

```
t3 := plot(i, -10 .. -Pi, colour = green) :
plots[display]([t1, t2, t3]);
```



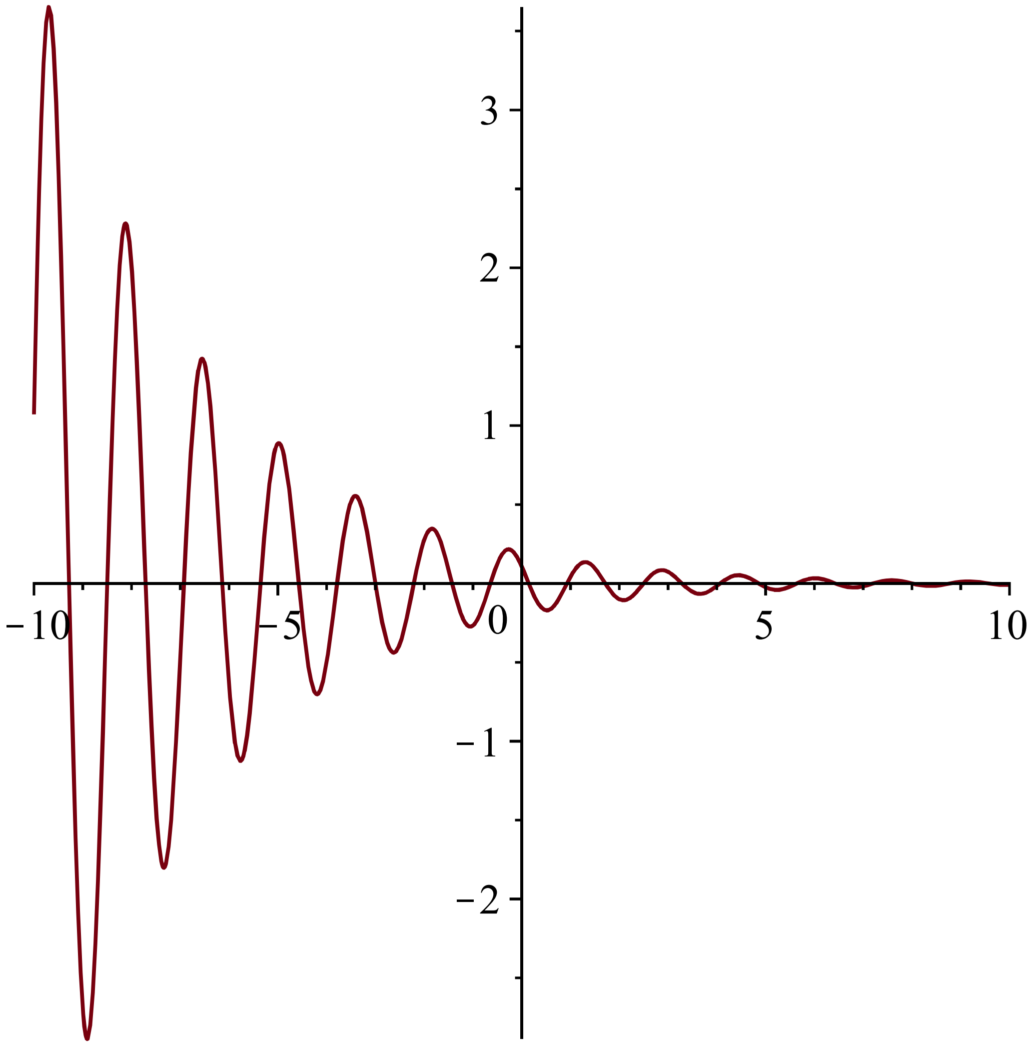

```
> S := i(5) − i(1);
```

$$S := \frac{5\sin(10)}{2} - \frac{5\sin(2)}{2} \quad \textbf{(34)}$$

```
> S := evalf(S);
```

$$S := -3.633296344 \quad \textbf{(35)}$$

```
> #Задание 10
expr := 0.2 exp(-0.3 x)·cos(4 x + 1) :
f := unapply(expr, x) :
plot(f);
```

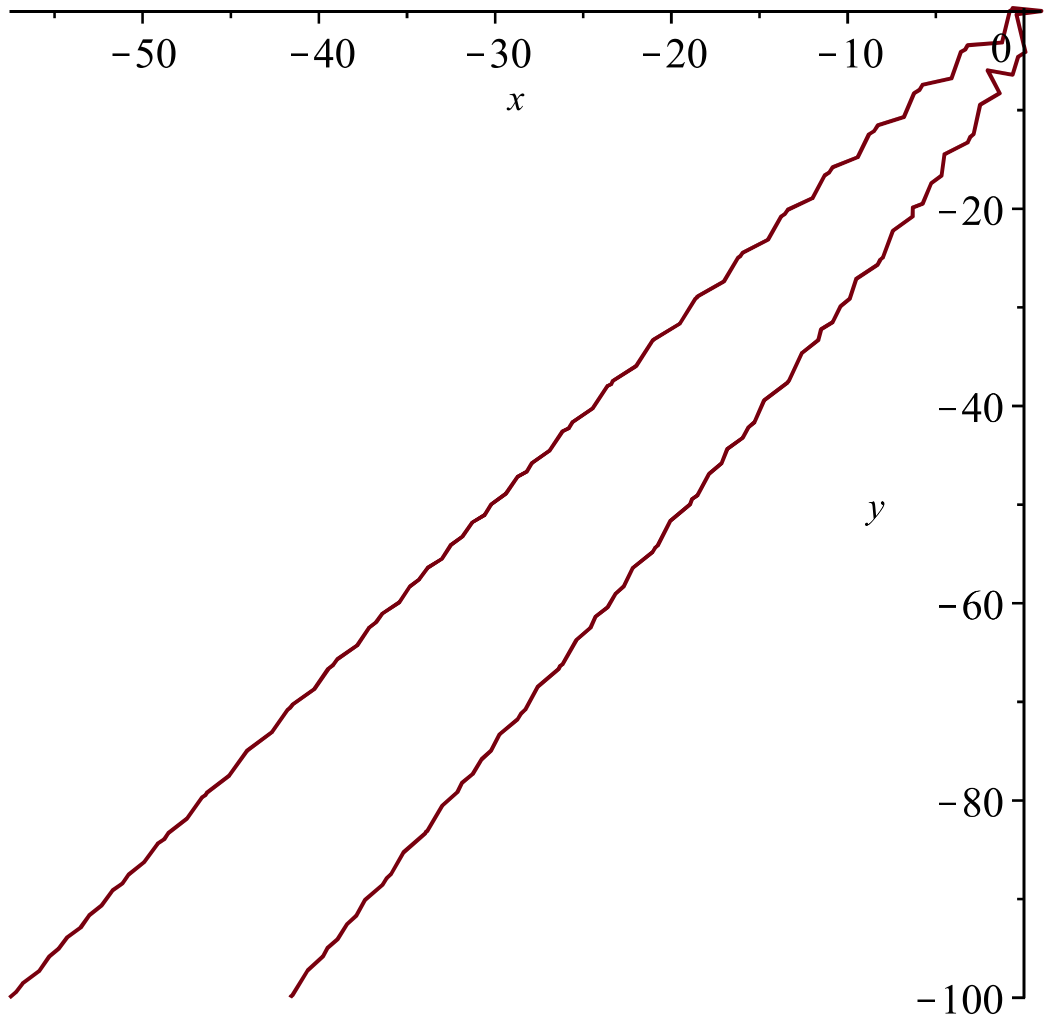


> $expr := 4\,x^2 - 4\,x \cdot y + y^2 - 3\,x + 4\,y - 7 = 0$:
> $expr2 := x - y$;
> $f := unapply(expr, x, y)$;

$$expr2 := x - y$$

$$f := (x, y) \mapsto 4\,x^2 - 4\,y\,x + y^2 - 3\,x + 4\,y - 7 = 0 \tag{36}$$

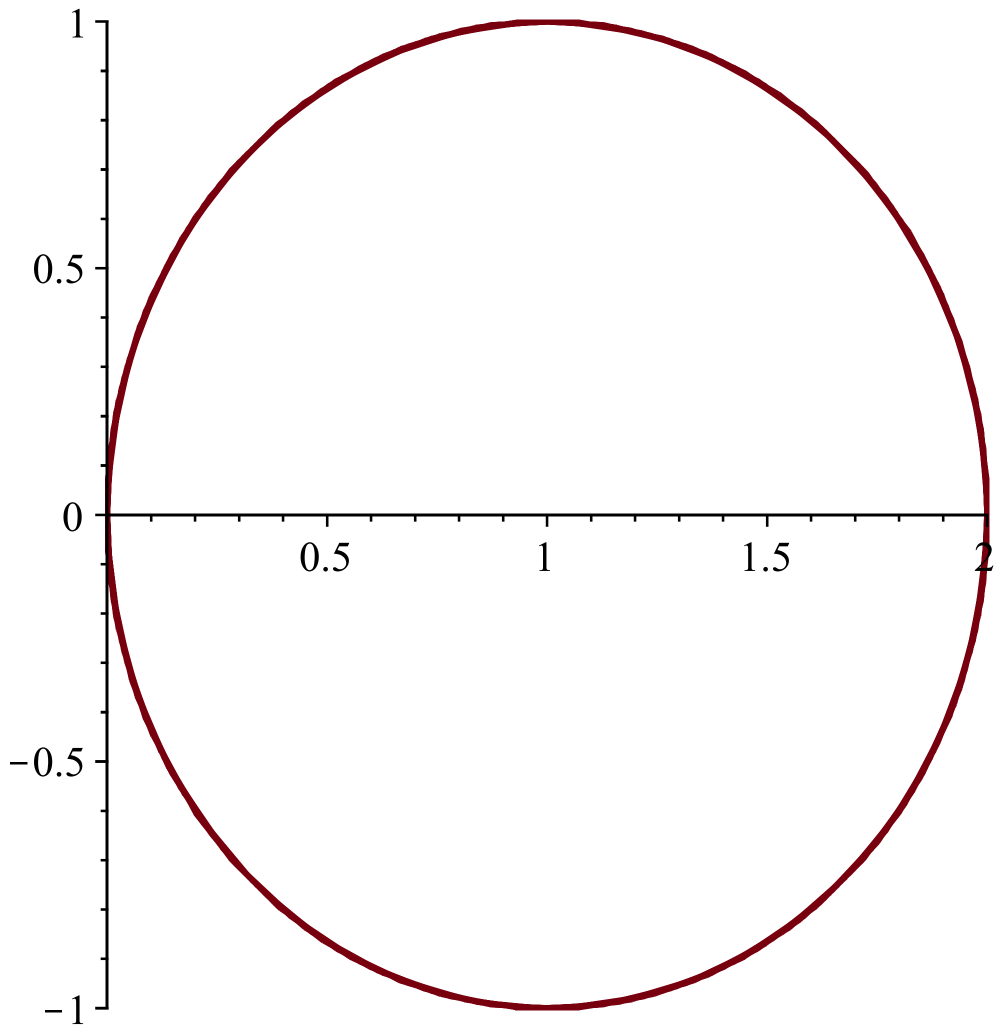
> $plots[implicitplot](f(x, y), x = -100\,..100, y = -100\,..100)$;



>

>

> $expr1 := 2(\sin(t))^2 :$
$expr2 := \sin(2t) :$
$x := unapply(expr1, t) :$
$y := unapply(expr2, t) :$
$plot([x(t), y(t), t = -100..100]);$



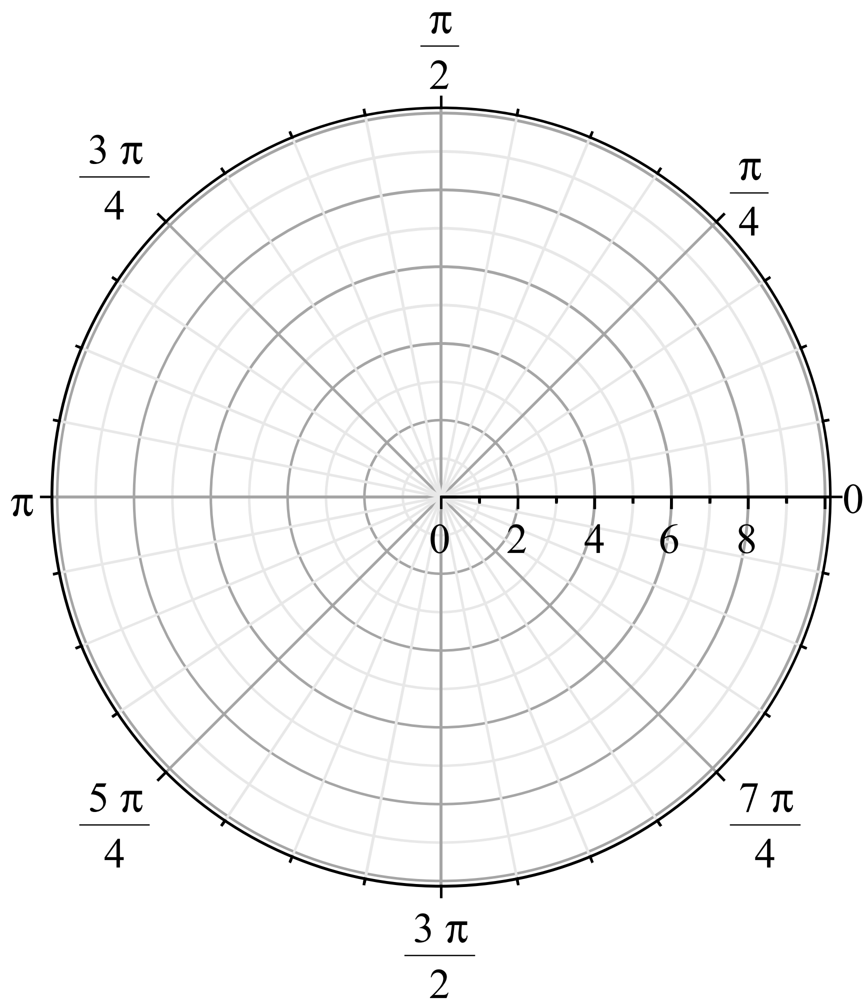
>

> $expr := 1 - 2\cos\left(3\,x + \frac{\mathrm{Pi}}{6}\right);$
$r := unapply(expr, x);$
$plots[polarplot](expr);$

$$expr := 1 - 2\cos\left(3\,x + \frac{\pi}{6}\right)$$

$$r := x \mapsto 1 - 2\cos\left(3\,x + \frac{\pi}{6}\right)$$

Warning, unable to evaluate the function to numeric values in the region; see the plotting command's help page to ensure the calling sequence is correct



$\frac{\pi}{2}$
$\frac{3\pi}{4}$
$\frac{\pi}{4}$
π
0
0
2
4
6
8
$\frac{5\pi}{4}$
$\frac{7\pi}{4}$
$\frac{3\pi}{2}$