> # . . 1 5 3 5 0 2 5
1 . .

> $simplify\left(\dfrac{\dfrac{9\cdot x^5+36\cdot x^4+9\cdot x^3-90\cdot x^2-36\cdot x+72}{x^4+x^3-9\cdot x^2+11\cdot x-4}}{\dfrac{x^3+6\cdot x^2+12\cdot x+8}{x^3+3\cdot x^2-4\cdot x}}\right)$

$$9\,x \tag{1}$$

> # 2 . .

> $expand((5\cdot x-1)\cdot(3\cdot x^2+2)\cdot(4\cdot x+1))$

$$60\,x^4+3\,x^3+37\,x^2+2\,x-2 \tag{2}$$

> # 3 . .

> $factor(6\cdot x^4+23\cdot x^3-9\cdot x^2-92\cdot x-60)$

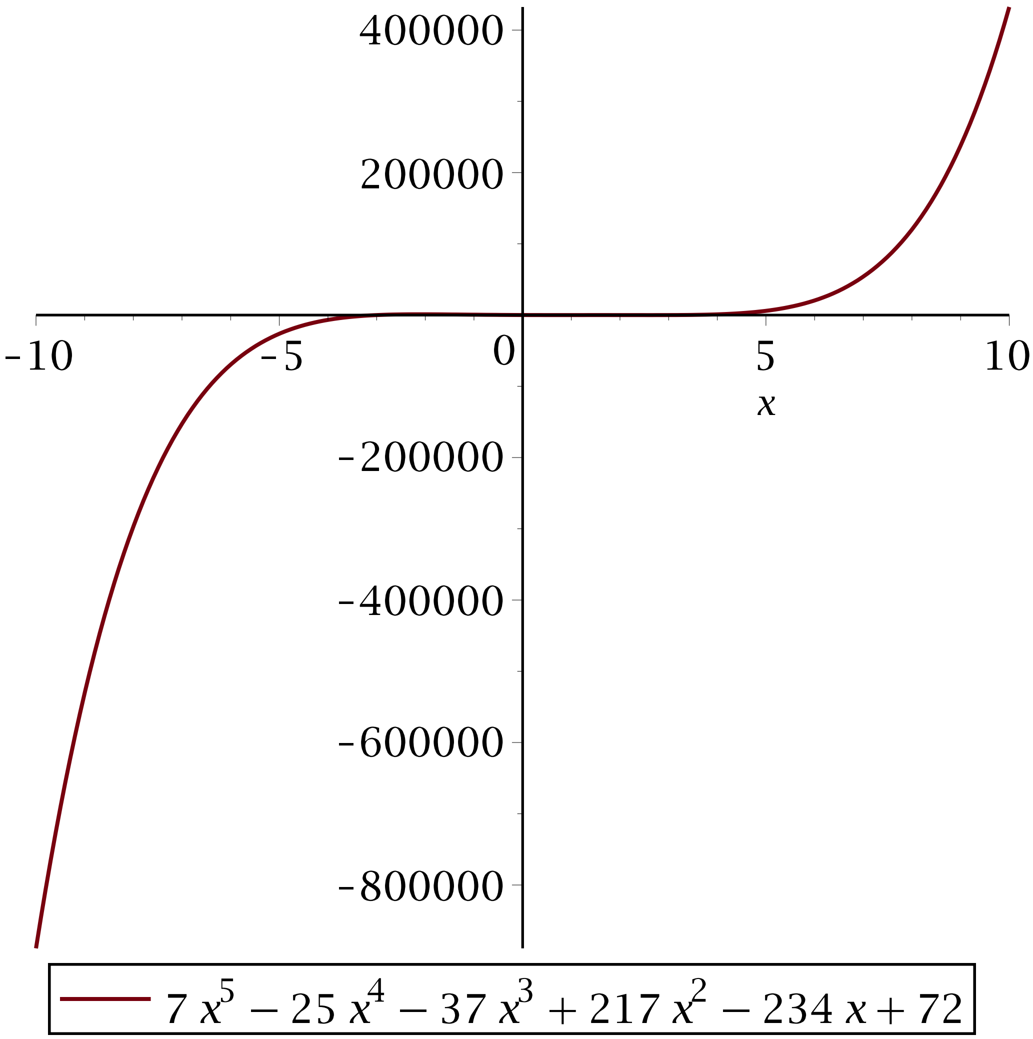
$$(6\,x+5)\,(x-2)\,(x+3)\,(x+2) \tag{3}$$

> # 4 . P 5 (x)
.

> $f4 := (7\cdot x^5-25\cdot x^4-37\cdot x^3+217\cdot x^2-234\cdot x+72)$

$$f4 := 7\,x^5-25\,x^4-37\,x^3+217\,x^2-234\,x+72 \tag{4}$$

> $plot([f4], legend=[f4]);\ roots\ are\ solve(f4)$



$$\textit{roots are}\left(1, 2, 3, -3, \frac{4}{7}\right) \quad \textbf{(5)}$$

> # 5 .

.

> $convert\left(\frac{3\cdot x^4 + 7\cdot x^3 + 2\cdot x - 4}{(x^2+1)\cdot(x-4)^2\cdot(x^2-9)}, parfrac, x\right)$

$$\frac{1}{2890}\,\frac{83\,x-25}{x^2+1} - \frac{102626}{14161\,(x-4)} - \frac{11}{735\,(x+3)} + \frac{217}{30\,(x-3)} + \frac{1220}{119\,(x-4)^2} \quad \textbf{(6)}$$

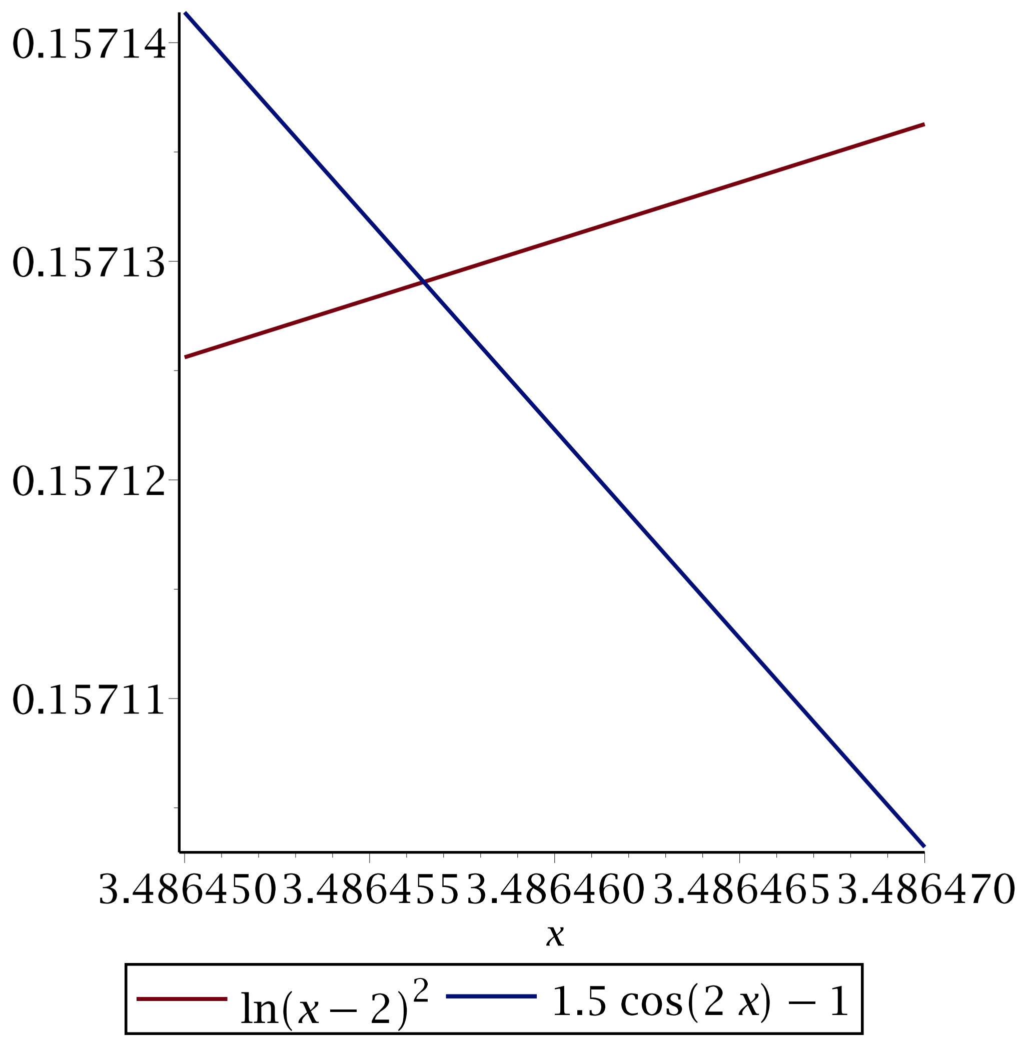
> # 6 .

1 0 ^ 5 .

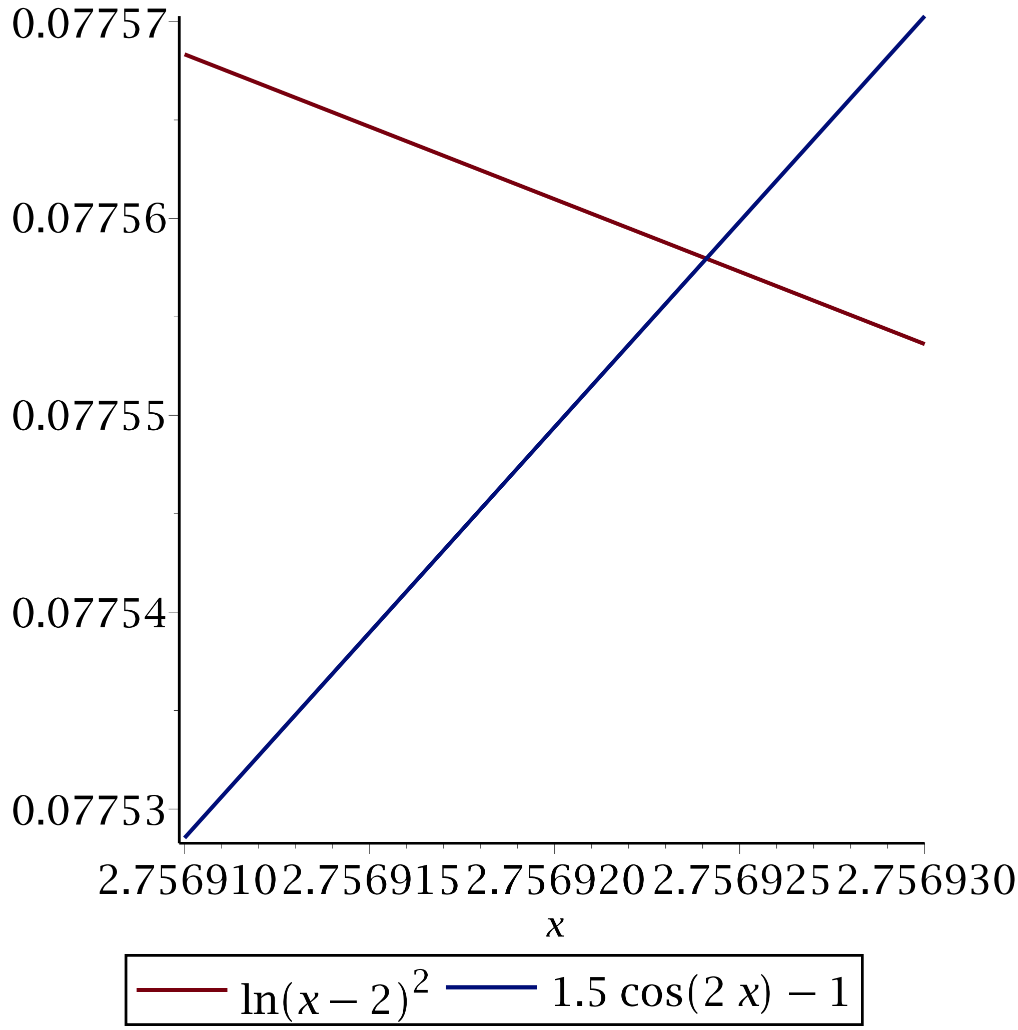
> $f6 := \ln^2(x-2)$:

> $g6 := 1.5\cdot\cos(2\,x)$ - 1 :

> $plot([f6, g6], x = 3.48645..3.48647, legend = [f6, g6])$;



> $plot([f6, g6], x = 2.75691..2.75693, legend = [f6, g6]);$




```
> # 7. , lim an = a, n->inf n ,
( an ) e -
a.
Maple, - e = 0,1.
```

$$> f7 := \frac{7 \cdot n + 2}{2 \cdot n - 1} :$$

$$e := \frac{1}{10} :$$

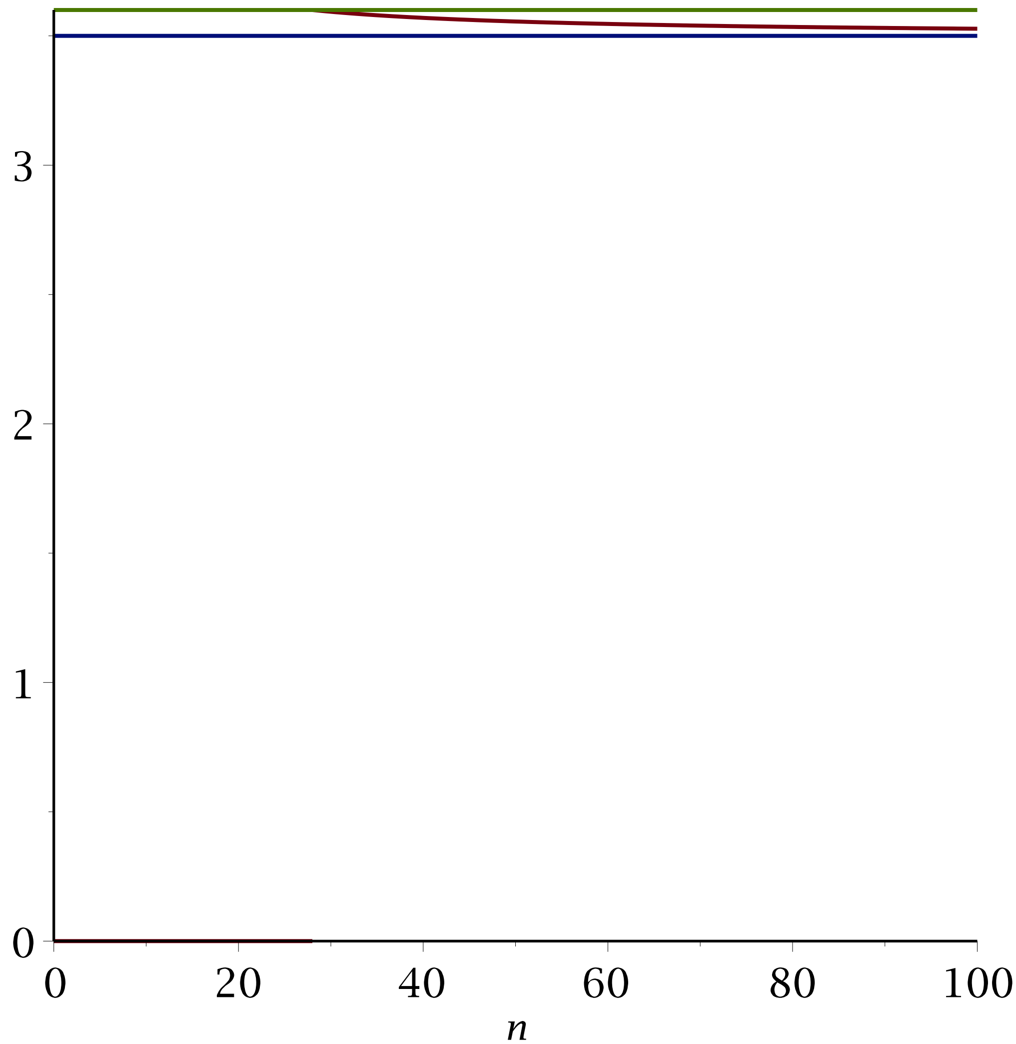
$$solve\left(\frac{7}{2} - e < f7 < \frac{7}{2} + e, n\right)$$

$$RealRange(-\infty, Open(-27)), RealRange(Open(28), \infty) \tag{7}$$

$$> f71 := piecewise(-infinity < n < -27, f7, 28 < n < infinity, f7)$$

$$f71 := \begin{cases} \frac{7\,n+2}{2\,n-1} & -\infty < n \textbf{ and } n < -27 \\ \frac{7\,n+2}{2\,n-1} & 28 < n \textbf{ and } n < \infty \end{cases} \tag{8}$$

> $plot\left(\left[f71, \frac{7}{2}, \frac{7}{2}+e\right], n=0..100, discont=true\right)$



> # 8 . .

> $limit(n\cdot(\text{sqrt}(n^2+1)-\text{sqrt}(n^2-1)), n=infinity)$

$$1 \tag{9}$$

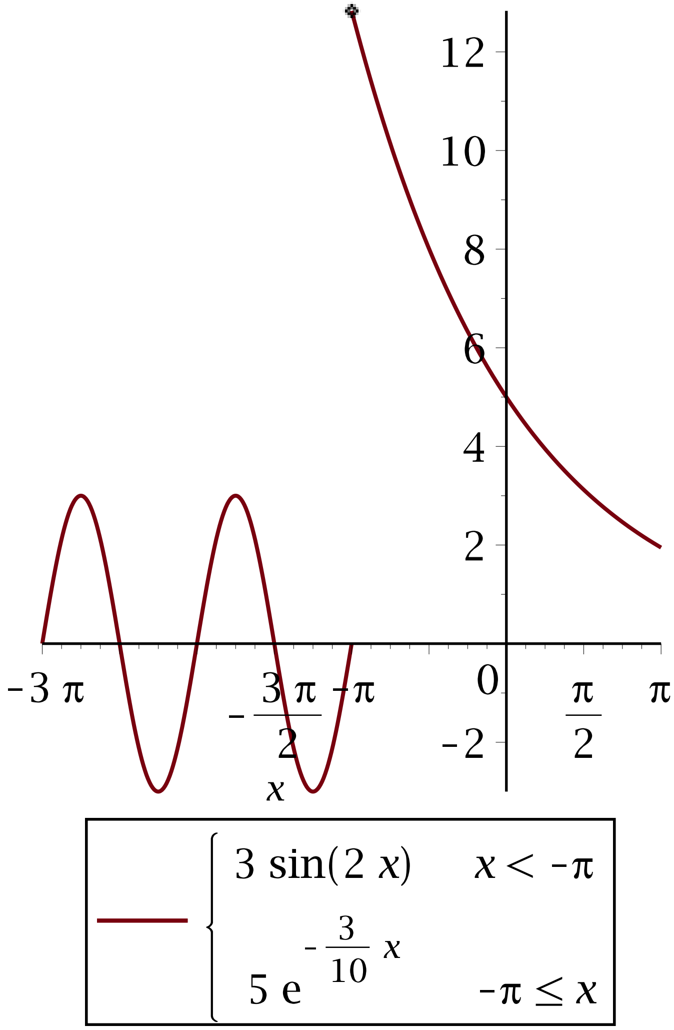
> # 9 . -
:

> $f := x \rightarrow piecewise\left(x < -\text{Pi}, 3\cdot\sin(2\cdot x), x \geq -\text{Pi}, 5\cdot\exp\left(-\frac{3}{10}\cdot x\right)\right):$

> $f(x)$

$$\begin{cases} 3\sin(2x) & x < -\pi \\ 5\,e^{-\frac{3}{10}x} & -\pi \leq x \end{cases} \tag{10}$$

> $plot(f(x), x=-3\cdot\text{Pi}...\text{Pi}, legend=f(x), scaling=constrained, discont=true)$



> limit(f(x), x = -Pi, left) #

$$0 \tag{11}$$

> limit(f(x), x = -Pi, right) #

$$5\left(e^{\pi}\right)^{3/10} \tag{12}$$

> limit(f(x), x = infinity)

$$0 \tag{13}$$

> limit(f(x), x = -infinity)

$$-3..3 \tag{14}$$

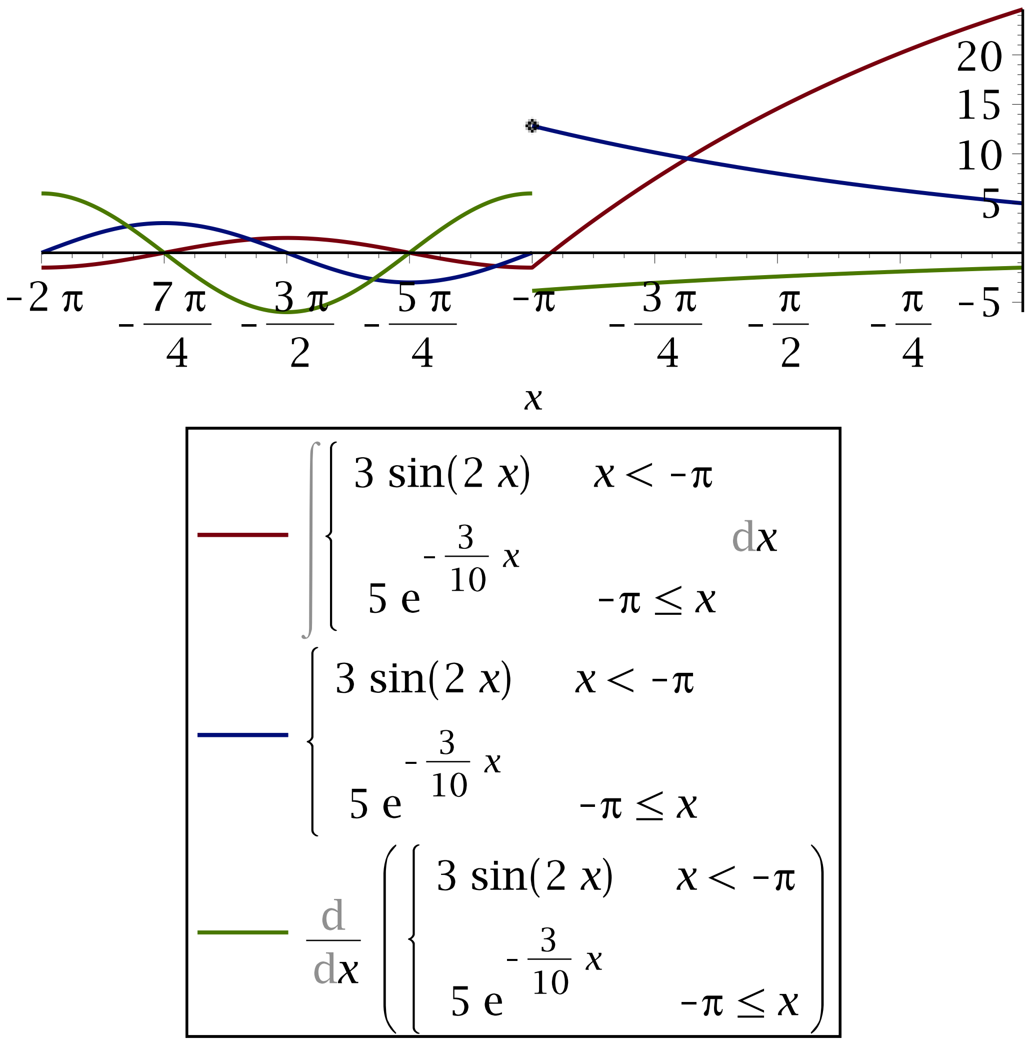
> int(f(x), x)

$$\begin{cases} -\frac{3}{2}\cos(2x) & x \leq -\pi \\ -\frac{50}{3}e^{-\frac{3}{10}x} - \frac{3}{2} + \frac{50}{3}\left(e^{\pi}\right)^{3/10} & -\pi < x \end{cases} \tag{15}$$

> diff(f(x), x)

$$\begin{cases} 6\cos(2x) & x < -\pi \\ \mathit{undefined} & x = -\pi \\ -\frac{3}{2}\,\mathrm{e}^{-\frac{3}{10}x} & -\pi < x \end{cases} \tag{16}$$

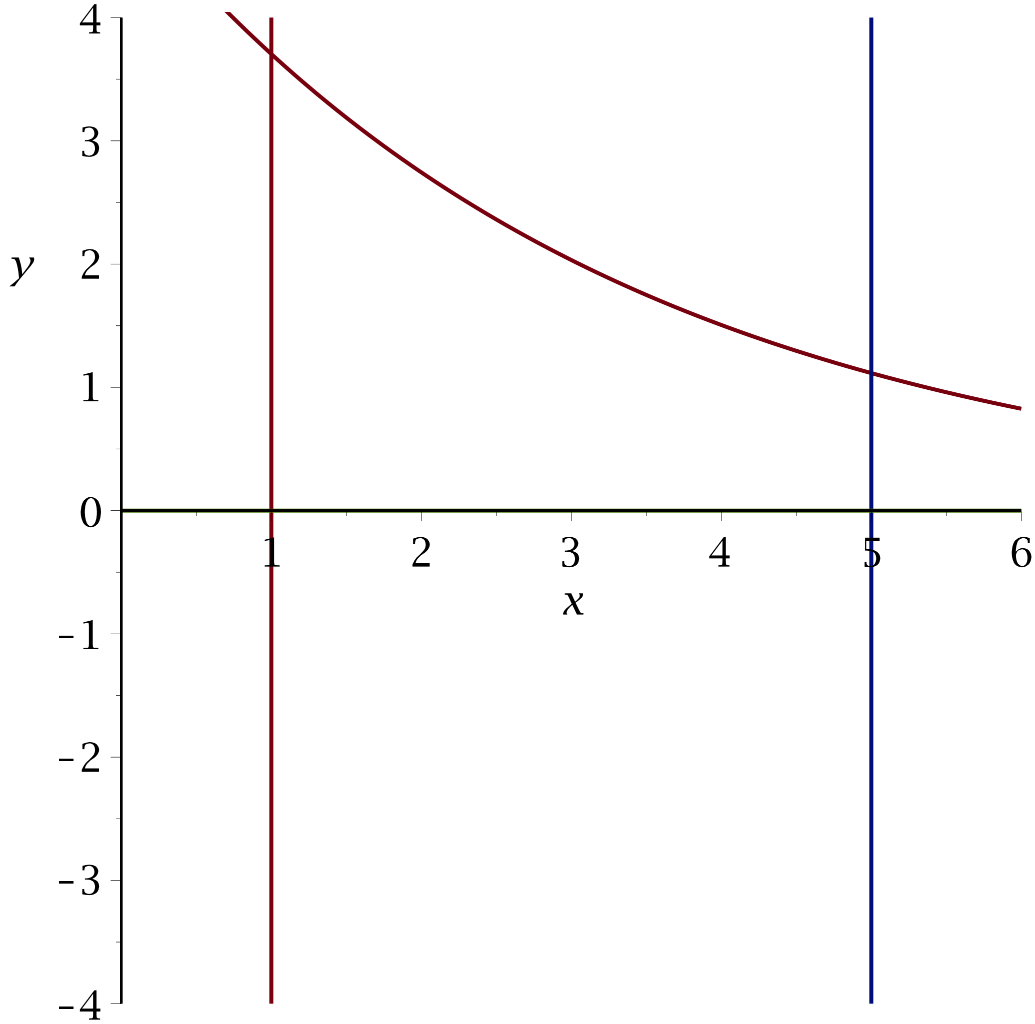
> *plot*([*int*(*f*(*x*), *x*), *f*(*x*), *diff*(*f*(*x*), *x*)], *x* = −2·Pi ..0, *legend* = [*Int*(*f*(*x*), *x*), *f*(*x*), *Diff*(*f*(*x*), *x*)], *discont* = *true*)



> *result* = *int*(*f*(*x*), *x* = 1 ..5) :

> *p1* ≔ *plot*([[[1,−4], [1, 4]], [[5,−4], [5, 4]], 0], *x* = 0 ..6, *y* = −4 ..4) :
p2 ≔ *plot*(*f*(*x*), *discont* = *true*, *x* = 0 ..6, *y* = −4 ..4) :

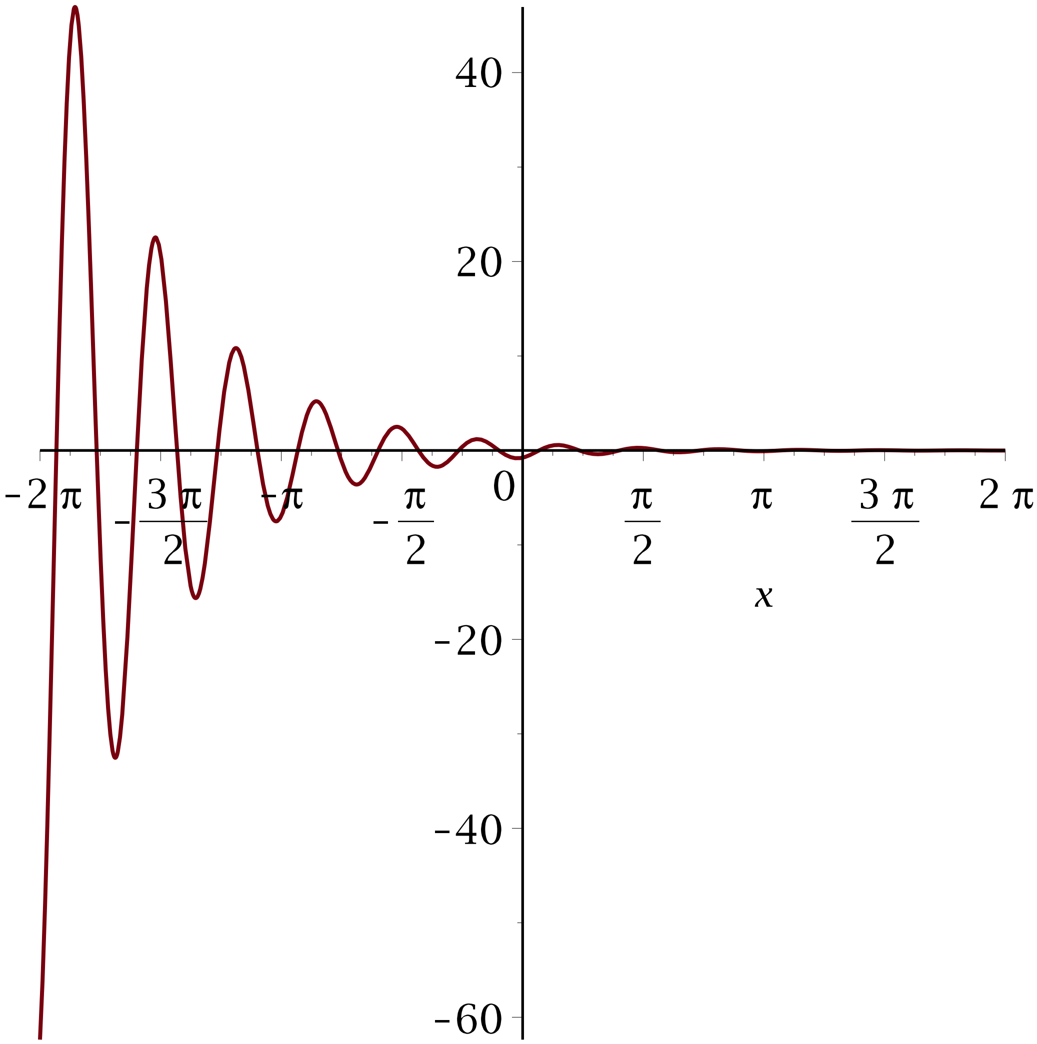
> *with*(*plots*) :
display({*p1*, *p2*}); *eval*(*result*)



result **(17)**

> **# 1 0 . . 2 -**
(2)

> *plot*(0.8·exp(−0.7·*x*)·sin(6·*x* + 5))



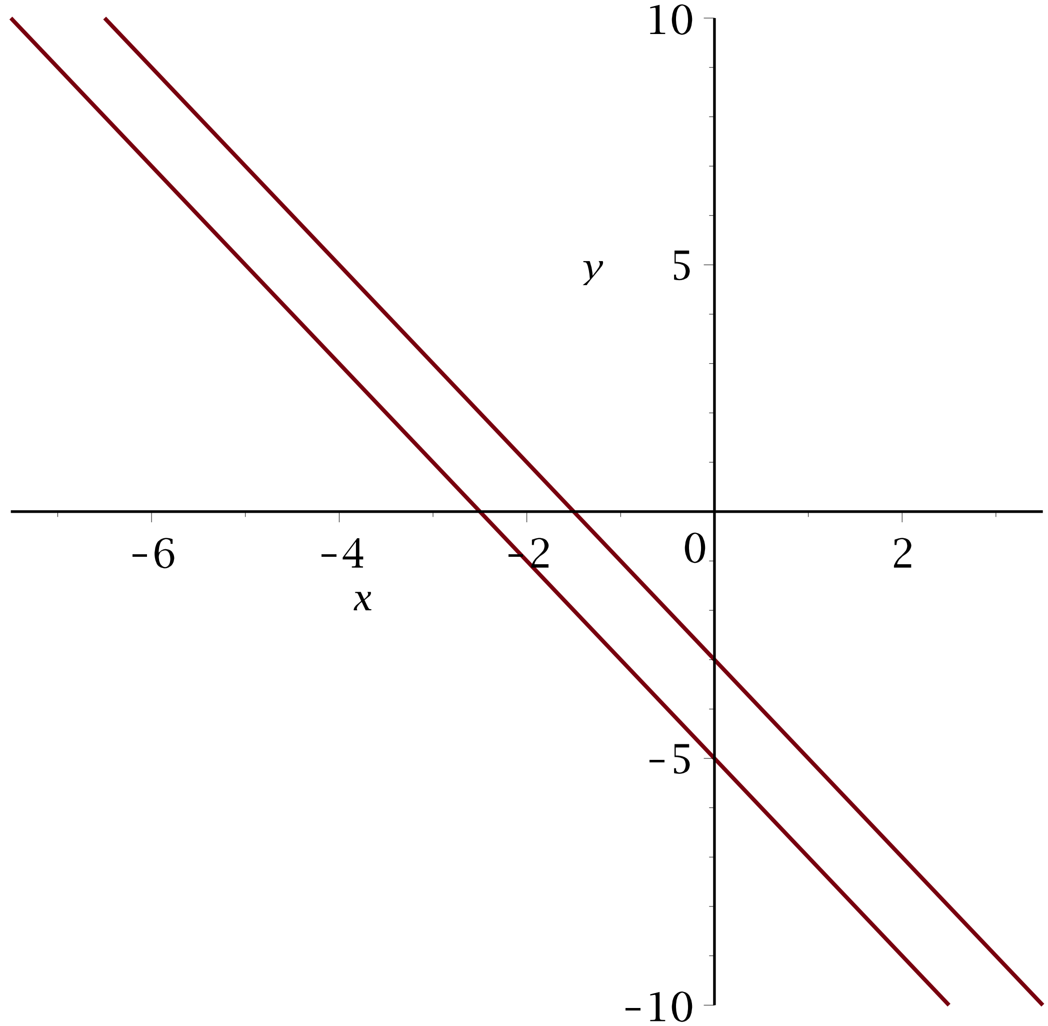
> f10(x, y) := $4\cdot x^2 + y^2 + 4\cdot x\cdot y + 16\cdot x + 8\cdot y + 15 = 0$

$$f10 := (x, y) \rightarrow 4\,x^2 + y^2 + 4\,y\,x + 16\,x + 8\,y + 15 = 0 \tag{18}$$

> *factor*(*f10*(*x*, *y*))

$$(2\,x + y + 5)\,(2\,x + y + 3) = 0 \tag{19}$$

> *implicitplot*(*f10*(*x*, *y*), $x = -10..10$, $y = -10..10$, *gridrefine* = 5)



> $with(linalg):$
> $with(LinearAlgebra):$

> $A := convert\left(hessian\left(op\left(1, \frac{f10(x, y)}{2}\right), [x, y]\right), Matrix\right);$

$$A := \begin{bmatrix} 4 & 2 \\ 2 & 1 \end{bmatrix} \quad \textbf{(20)}$$

> $detA := det(A)$

$$detA := 0 \quad \textbf{(21)}$$

> lambda, e $:= Eigenvectors(A)$

$$\lambda, e := \begin{bmatrix} 5 \\ 0 \end{bmatrix}, \begin{bmatrix} 2 & -\frac{1}{2} \\ 1 & 1 \end{bmatrix} \quad \textbf{(22)}$$

> $P := GramSchmidt\left(\left[\langle 2, 1\rangle, \left\langle -\frac{1}{2}, 1\right\rangle\right], normalized\right)$

$$P := \left[\begin{bmatrix} \frac{2}{5}\sqrt{5} \\ \frac{1}{5}\sqrt{5} \end{bmatrix}, \begin{bmatrix} -\frac{1}{5}\sqrt{5} \\ \frac{2}{5}\sqrt{5} \end{bmatrix} \right] \quad (23)$$

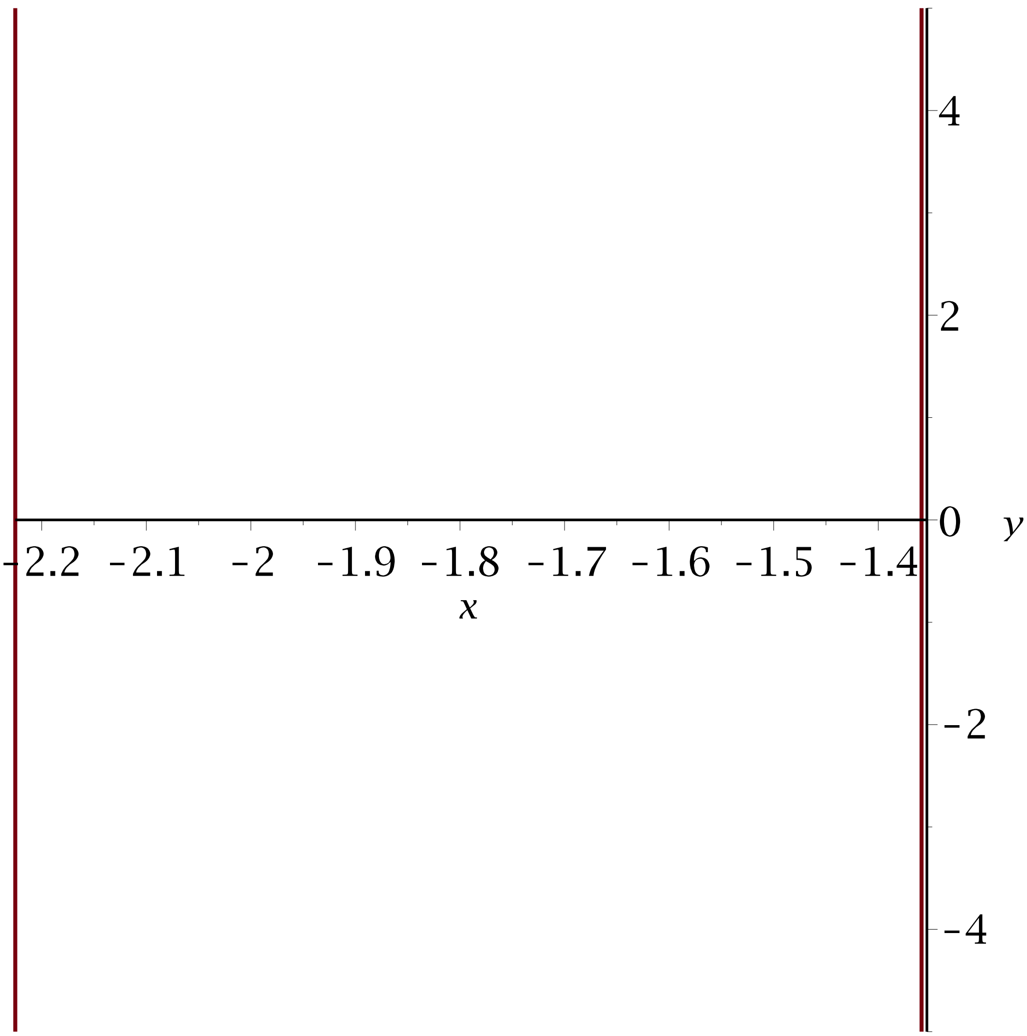
> $x1 := \frac{2}{\mathrm{sqrt}(5)} \cdot x - \frac{1}{\mathrm{sqrt}(5)} \cdot y:$

> $y1 := \frac{1}{\mathrm{sqrt}(5)} \cdot x + \frac{2}{\mathrm{sqrt}(5)} \cdot y:$

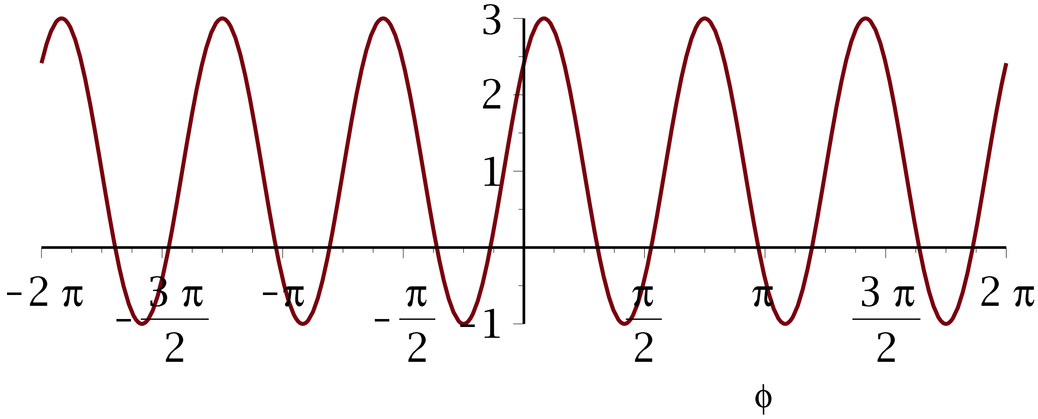
> $factor(f10(x1, y1))$

$$\left(5\,x + 3\sqrt{5}\right)\left(x + \sqrt{5}\right) = 0 \quad (24)$$

> $implicitplot(f10(x1, y1), x = -5..5, y = -5..5)$



> $plot\left(1 + 2 \cdot \cos\left(3 \cdot \mathrm{phi} - \frac{\mathrm{Pi}}{4}\right), scaling = constrained\right)$


3
2
1
−1
−2 π
−3π/2
−π
−π/2
π/2
π
3π/2
2 π
ϕ