> # Курсовая работа

> # ММА. 3 семестр

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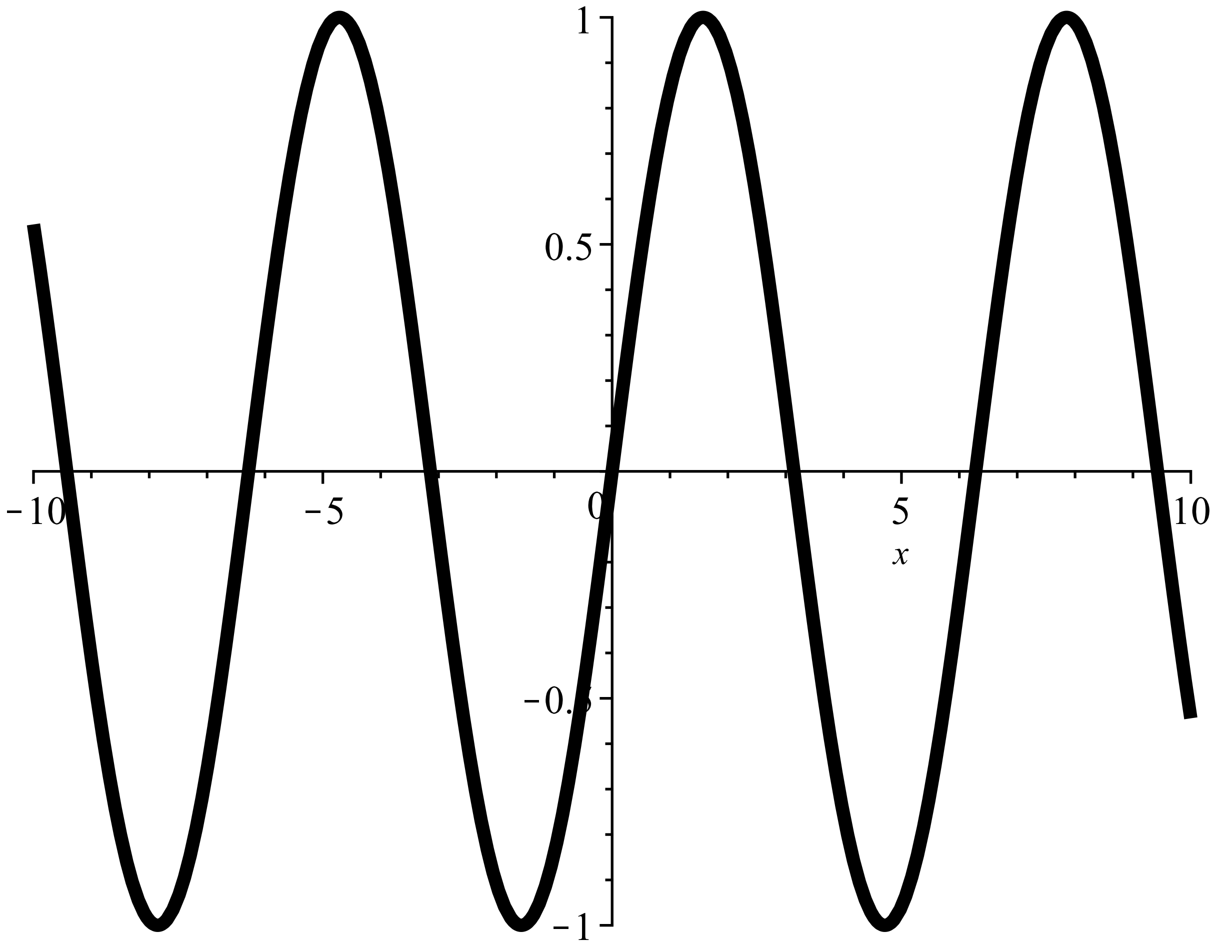
>

> restart;

> plot(sin(x), x=-10..10, thickness=5, color=black)



>

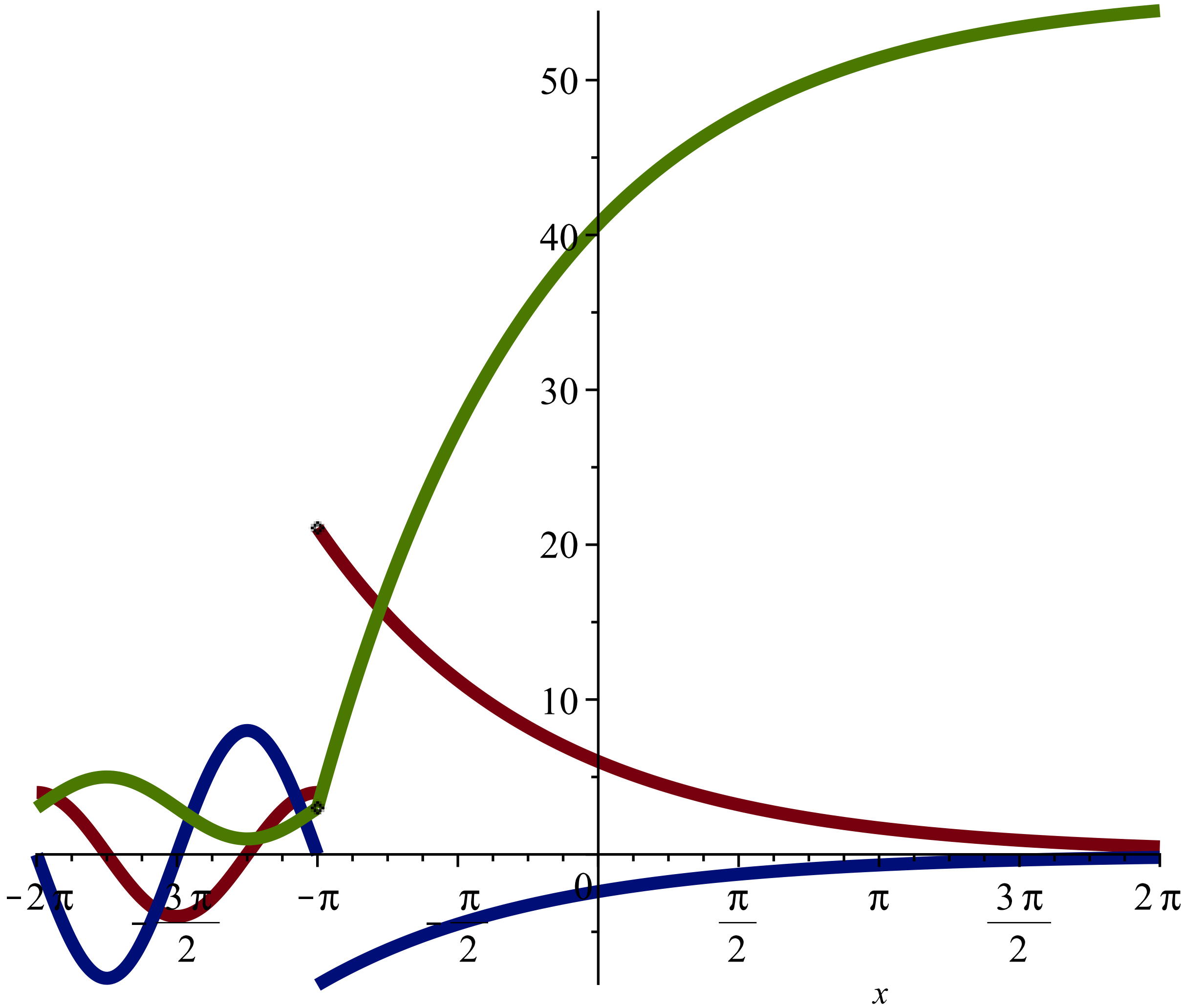
>

> restart;

>

> func := piecewise(x < -Pi, 4 · cos(2·x), x ≥ -Pi, 6 · exp(1)^{-0.4·x}) :

> plot([func, diff(func, x), int(func, x) + 3], discont = true, thickness = 5);



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>

> *restart*;

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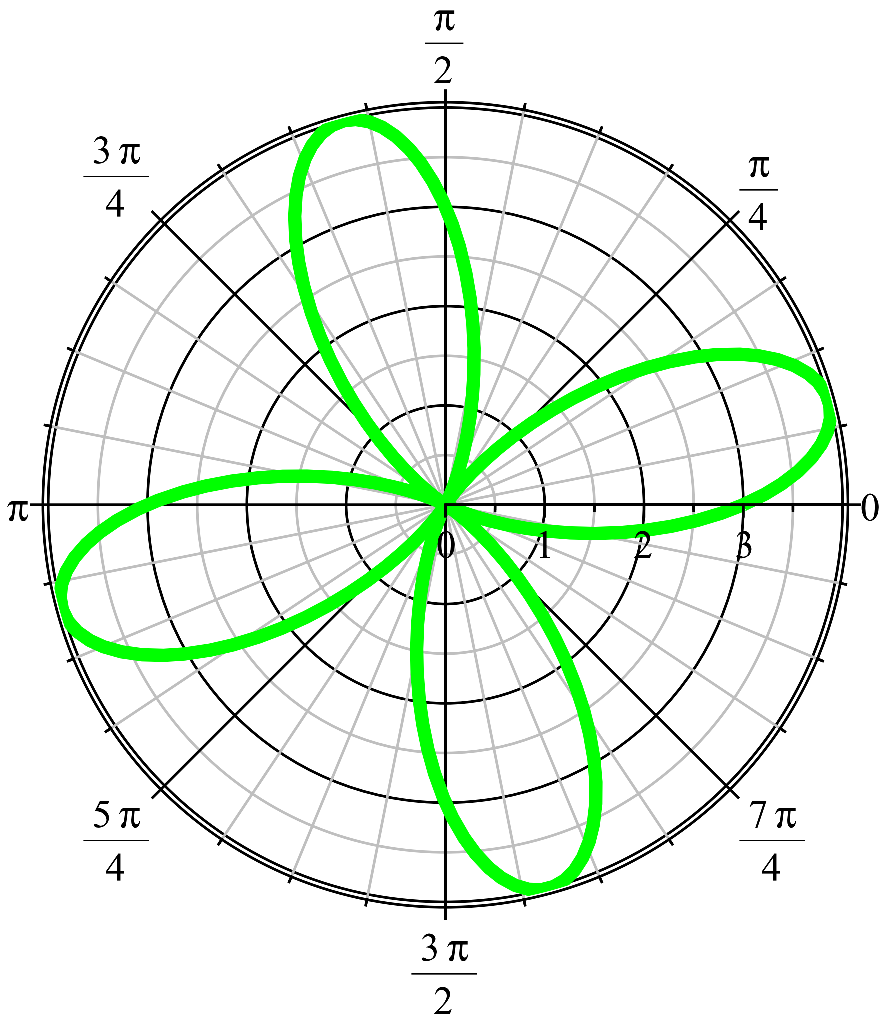
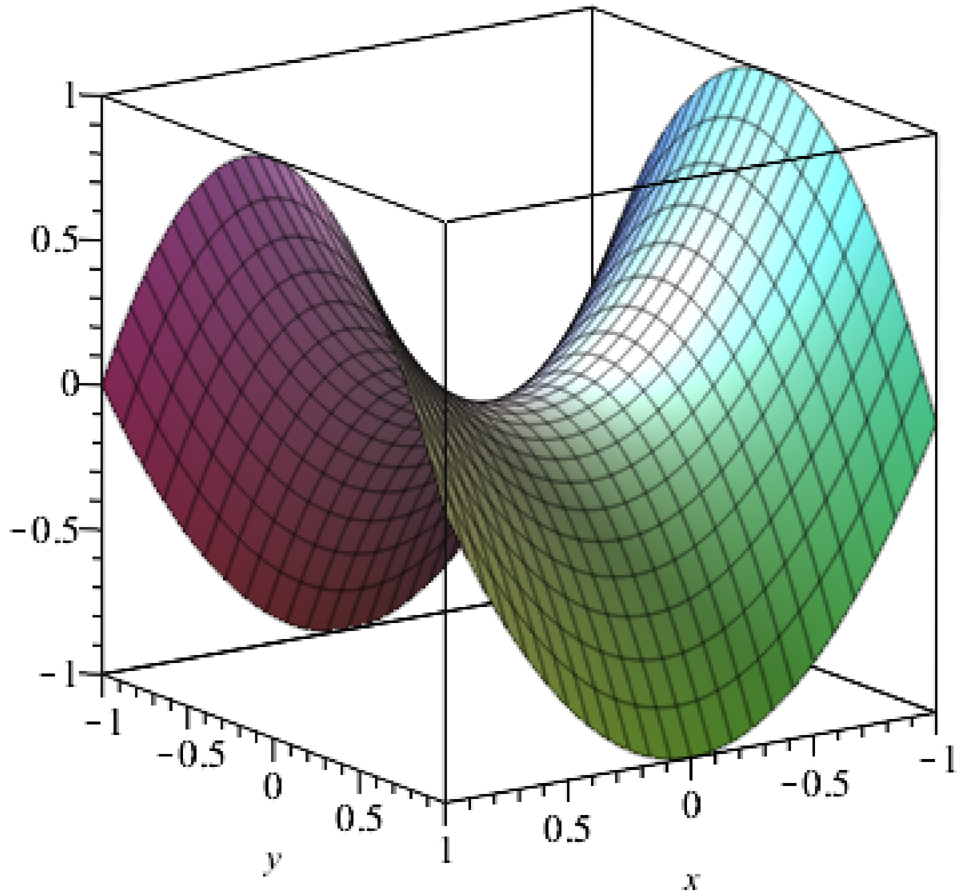
> `with(plots) :`

$$polarplot\left(2+2\cos\left(4\cdot\theta-\frac{Pi}{3}\right), \theta=0..2\pi, thickness=5, color=green\right);$$



> $plot3d(x^2 - y^2, x = -1 .. 1, y = -1 .. 1);$



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> *restart*;

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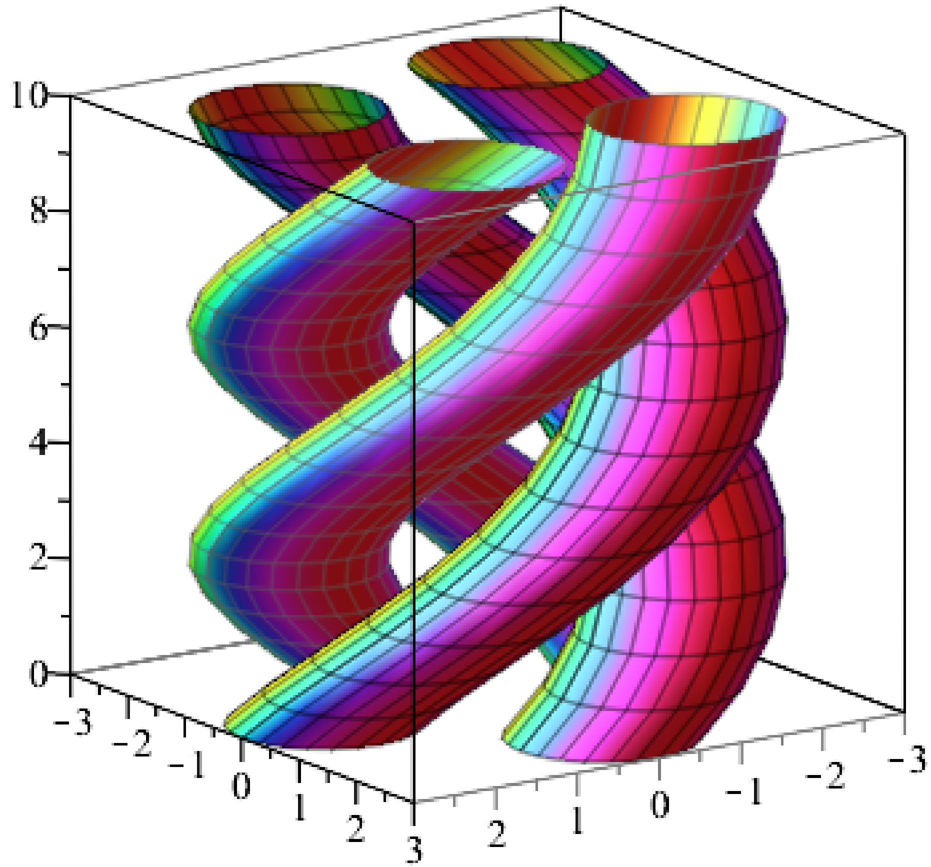
$c1 := [\cos(x) - 2\cos(0.4\,y), \sin(x) - 2\sin(0.4\,y), y]$:
$c2 := [\cos(x) + 2\cos(0.4\,y), \sin(x) + 2\sin(0.4\,y), y]$:
$c3 := [\cos(x) + 2\sin(0.4\,y), \sin(x) - 2\cos(0.4\,y), y]$:
$c4 := [\cos(x) - 2\sin(0.4\,y), \sin(x) + 2\cos(0.4\,y), y]$:
$plot3d(\{c1, c2, c3, c4\}, x = 0..2\pi, y = 0..10, grid = [25, 15], color = \sin(x))$;



> *restart*;

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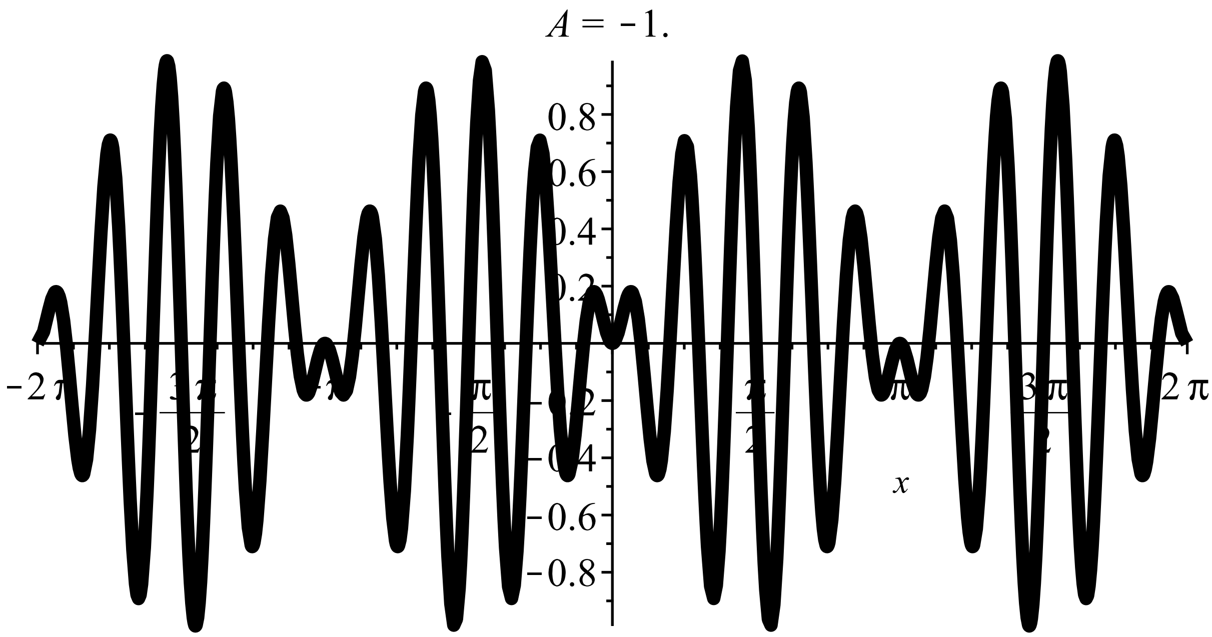
```
plots[animate]( plot, [sin(10· A·x)·sin(A·x), x=-2· Pi..2· Pi, thickness
    =5, color=black], A=-1..1 )
```

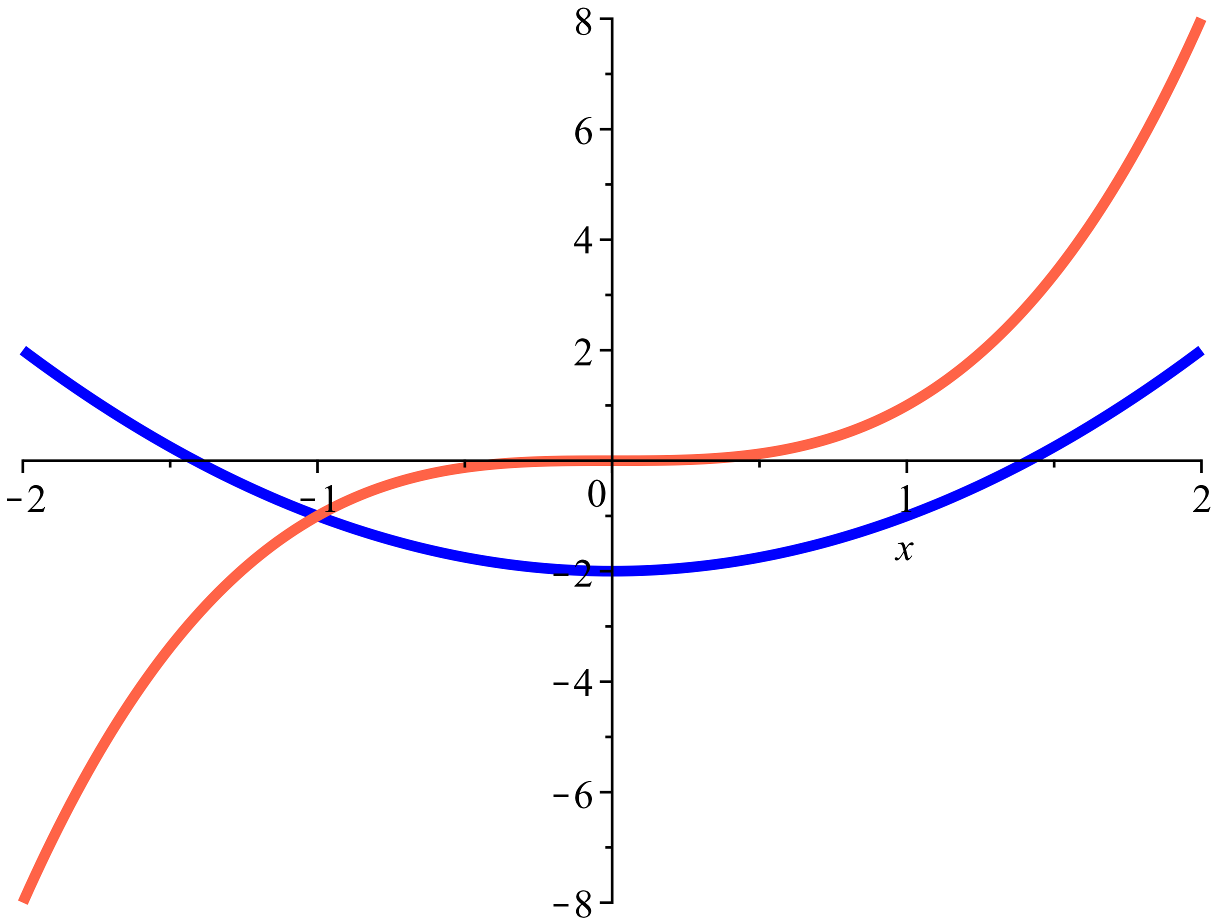


> *restart*;

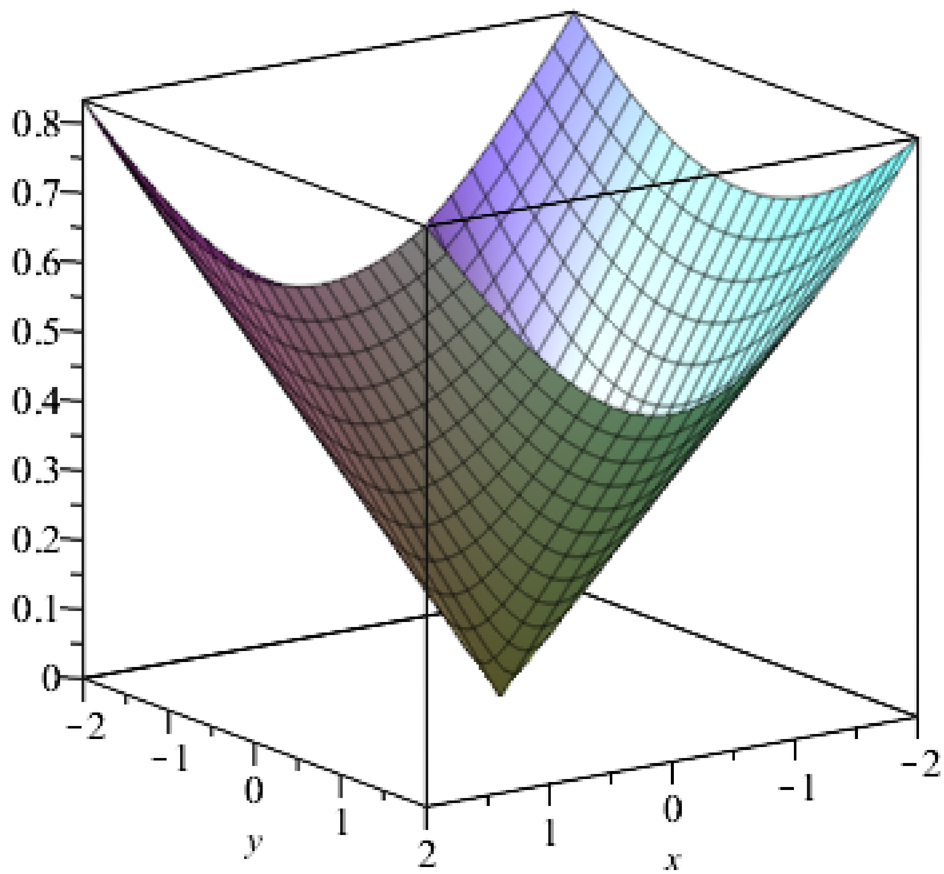
> $y1 := plot(x^2 - 2, x = -2..2, thickness = 4, color = blue)$:

> $y2 := plot(x^3, x = -2..2, thickness = 4, color = \text{"Tomato"})$:

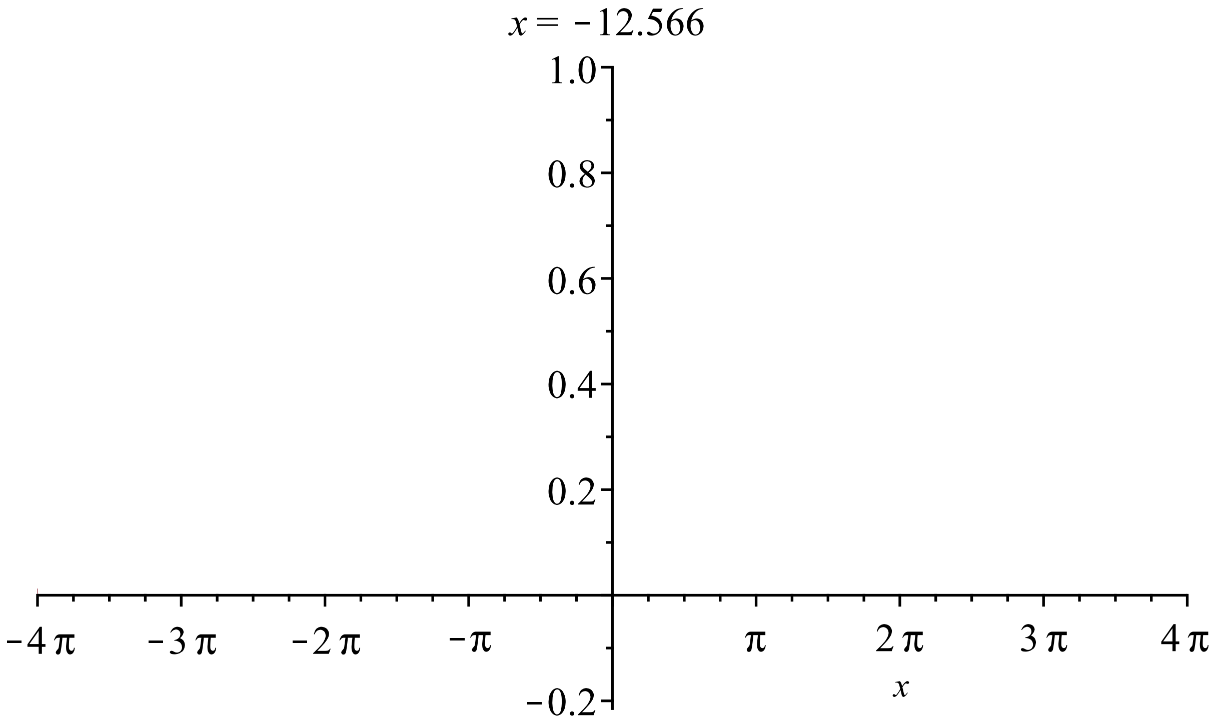
> *plots[display](y1, y2)*;



> $plot3d\left(\mathrm{sqrt}\left(\frac{x^2}{3^2}+\frac{y^2}{4^2}\right), x=-2..2, y=-2..2\right);$



> $plots[animatecurve]\left(\frac{\sin(x)}{x}, x=-4\cdot\mathrm{Pi}..4\cdot\mathrm{Pi}, frames = 60, thickness = 5\right);$



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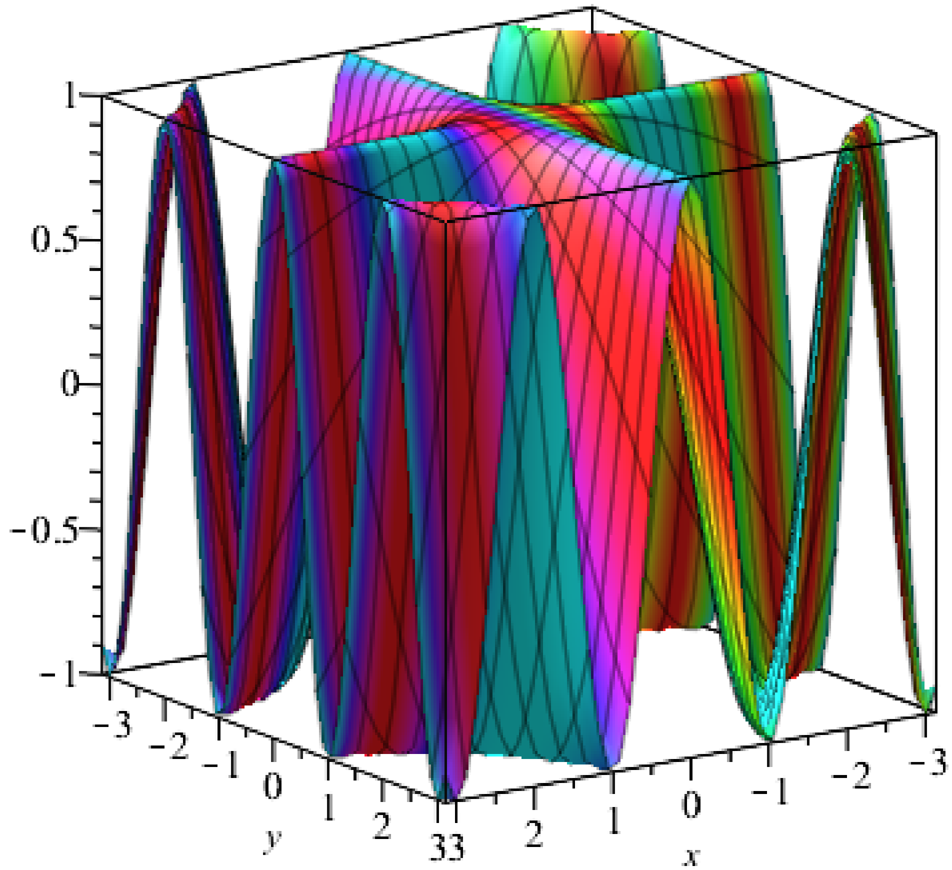
> $plots[animate3d]\left(\cos\left(\frac{t \cdot x \cdot y}{3}\right), x = -\mathrm{Pi}..\mathrm{Pi}, y = -\mathrm{Pi}..\mathrm{Pi}, t = -3..2, color = \sin(x) \cdot \cos(x)^{2^2}\right);$



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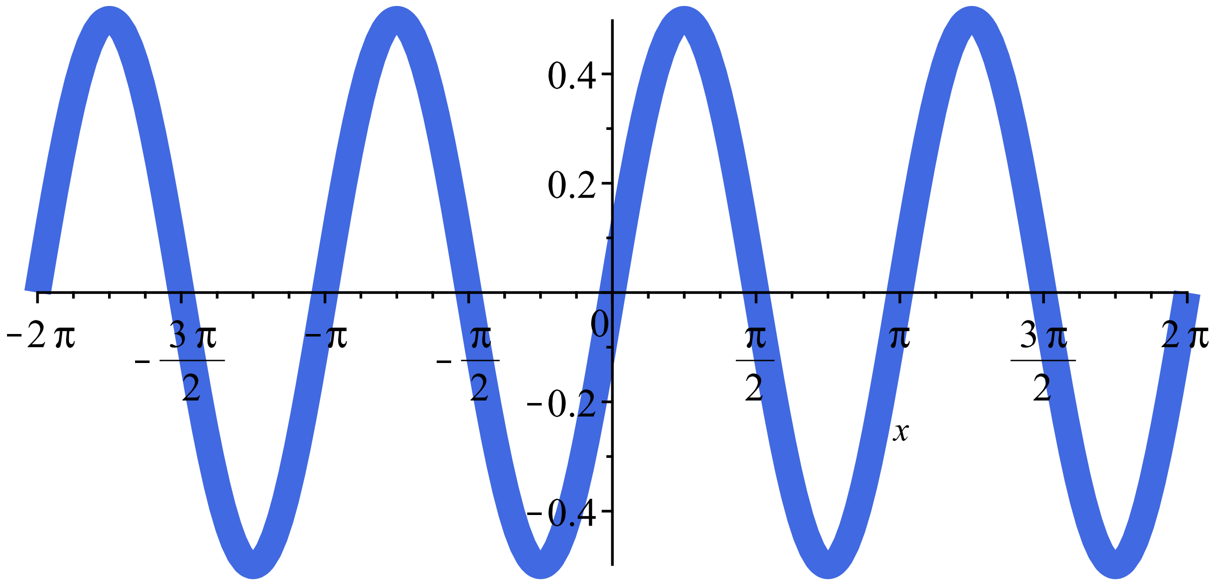
> $a1 := plot(\sin(x) \cdot \cos(x), color = \text{"RoyalBlue"},\ thickness = 10) :$

> $a2 := plot(\sin(x) \cdot \cos(x), color = \text{"Tomato"},\ thickness = 10) :$

> $a3 := plot(\sin(x) \cdot \cos(x), color = yellow,\ thickness = 10) :$

> $plots[display](a1, a2, a3, insequence = true);$



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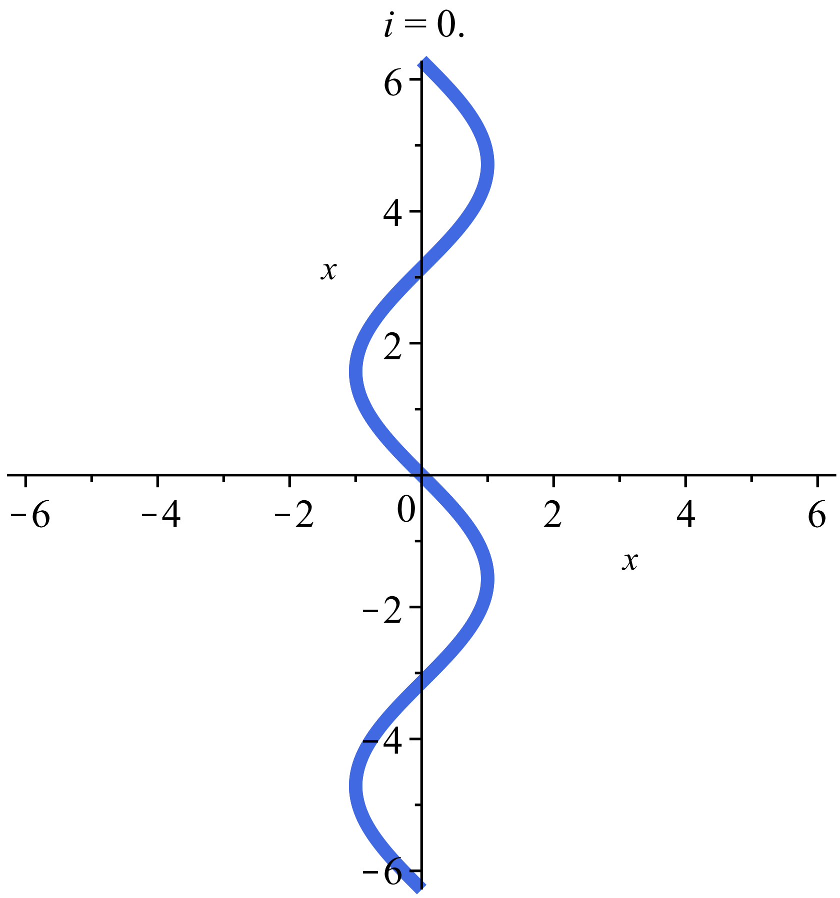
>

> *restart*;

>

>

with(*plottools*) :
with(*plots*) :
$p := rotate\left(plot(\sin(x), x, x = 0 ..2\,\pi, color = \text{"RoyalBlue"}, thickness = 5), \frac{\mathrm{Pi}}{2}\right)$:
$r := animate\left(rotate, \left[p, \frac{\mathrm{Pi}\cdot i}{3}\right], i = 0 ..10\right)$:
display(*p*, *r*, *scaling* = *constrained*)



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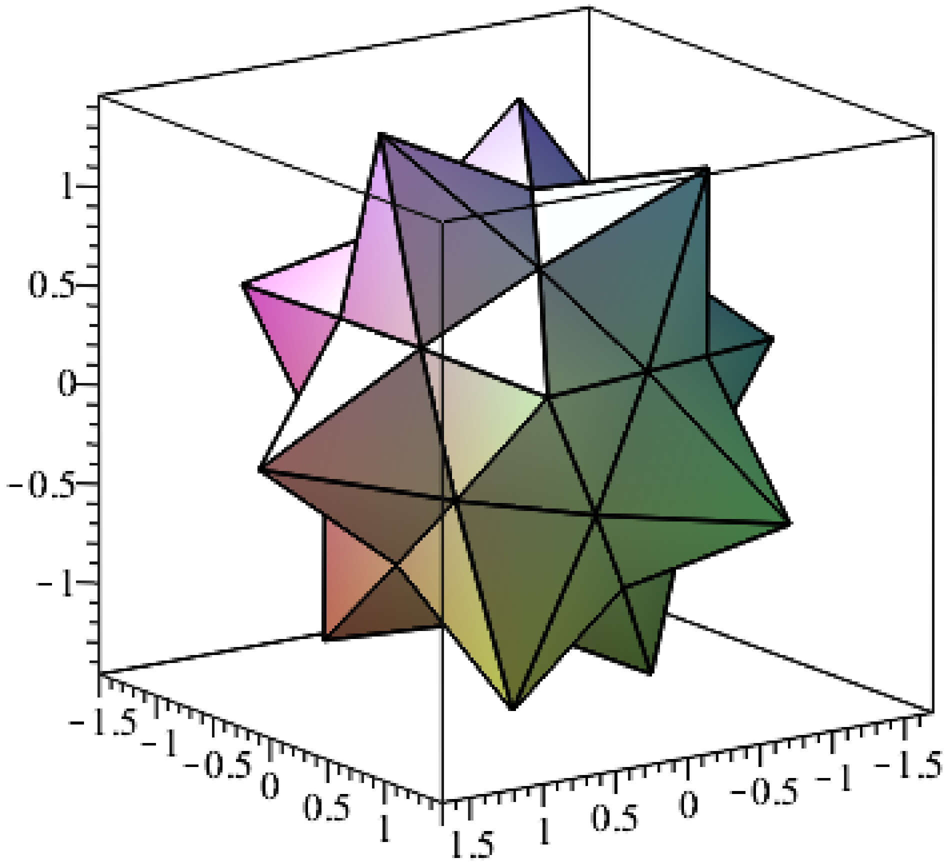
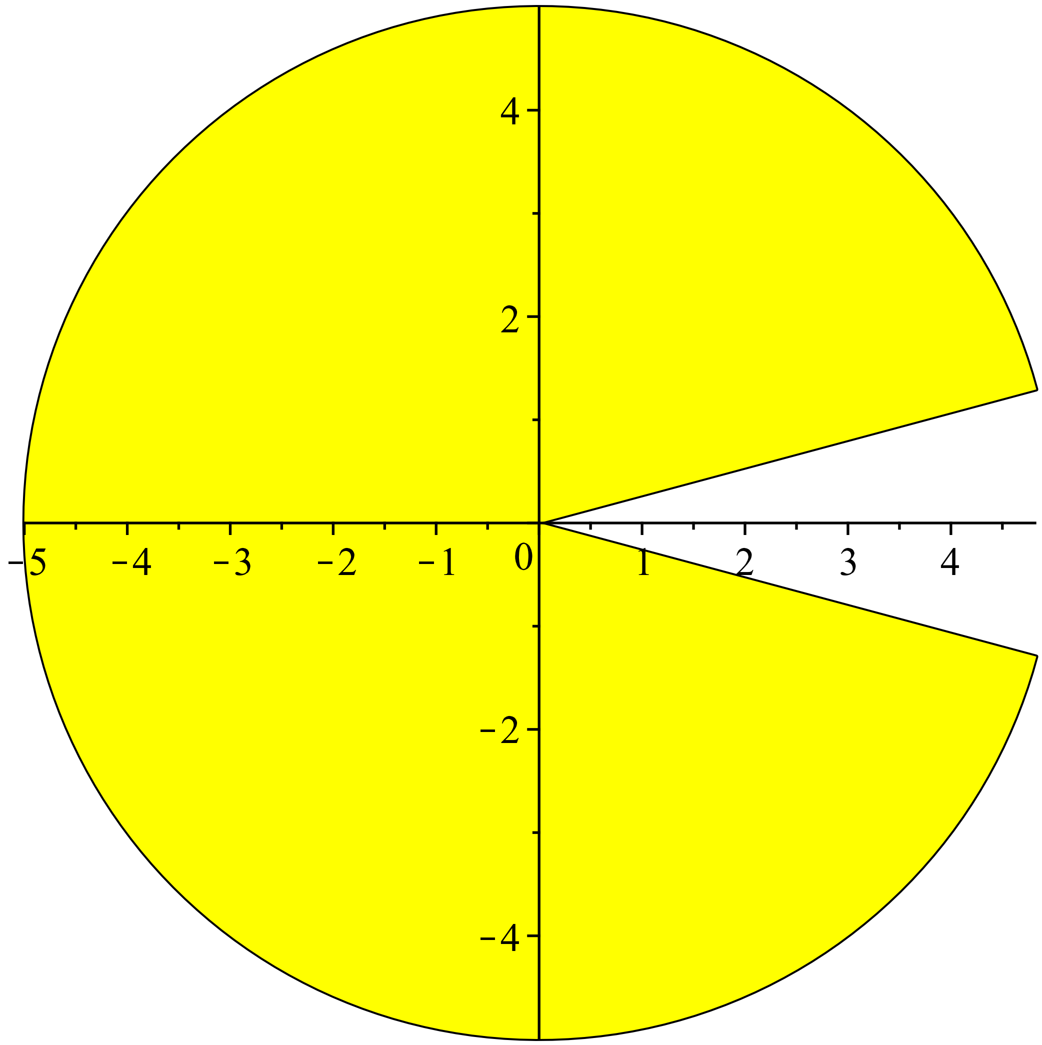
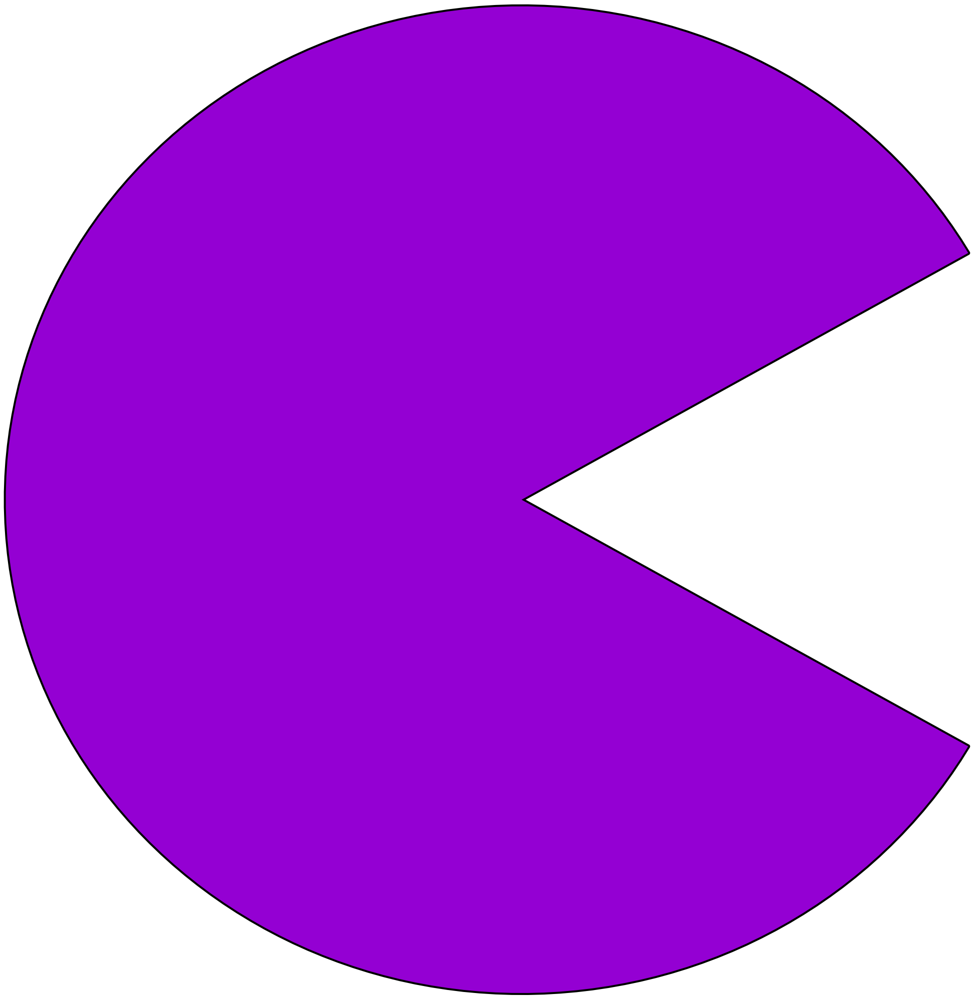
$plots[display](plottools[stellate](plottools[dodecahedron](\ ), axes = none))$




```
>
>
>
> ggg := plots[display](plottools[pieslice]([0, 0], 5, (1/6)*Pi - (1/12)*1*Pi .. (11/6)*Pi
      + (1/12)*1*Pi, color = yellow));
```



> $body := \textbf{proc}(n)$
>
> $plots[display]\left(plottools[pieslice]\left([5, 10], 1, \frac{1}{6} * \mathrm{Pi} - \frac{1}{12} * n * \mathrm{Pi} .. \frac{11}{6} * \mathrm{Pi} + \frac{1}{12} * n * \mathrm{Pi}, color = \text{"DarkViolet"}\right)\right)$
>
> **end proc**:
>
> $plots[animate](body, [n], n = [0, 1, 2, 1], title = \text{""}, axes = none);$



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>

>

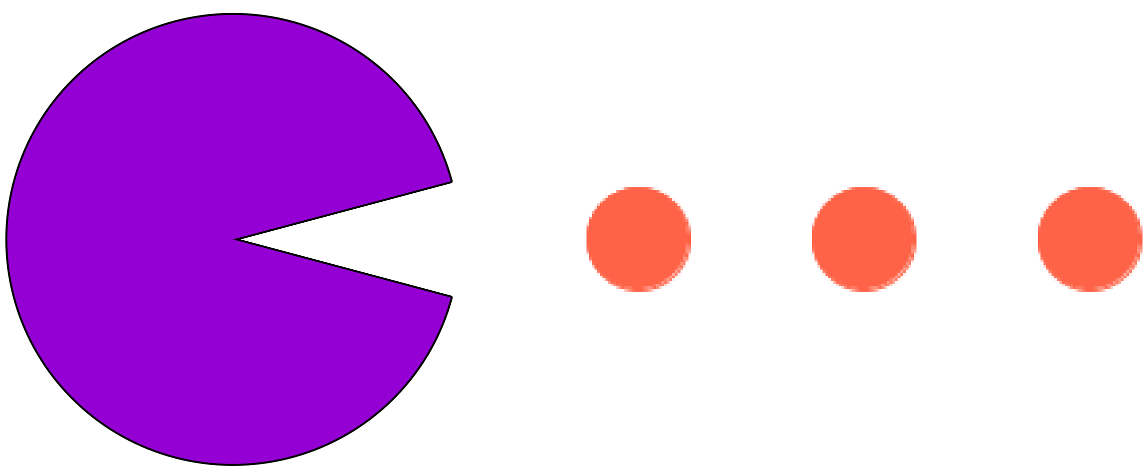
> *restart*;

>

>

```
> frame := proc(n)
    plots[display](
      plots[pointplot]([[10 - (mod(n, 10)), 0], [15 - (mod(n, 10)), 0], [20 - (mod(n,
     10)), 0]], color = "Tomato", symbol = solidcircle, symbolsize = 60),
       plottools[pieslice]([0, 0], 5, (1/6) * Pi- (1/12) * n* Pi .. (11/6) * Pi + (1/12) * n* Pi,
     color = "DarkViolet"), scaling = constrained
    )
  end proc:
plots[animate](frame, [n], n = [0, 1, 2, 1], axes = none);
```

$n = 1.$

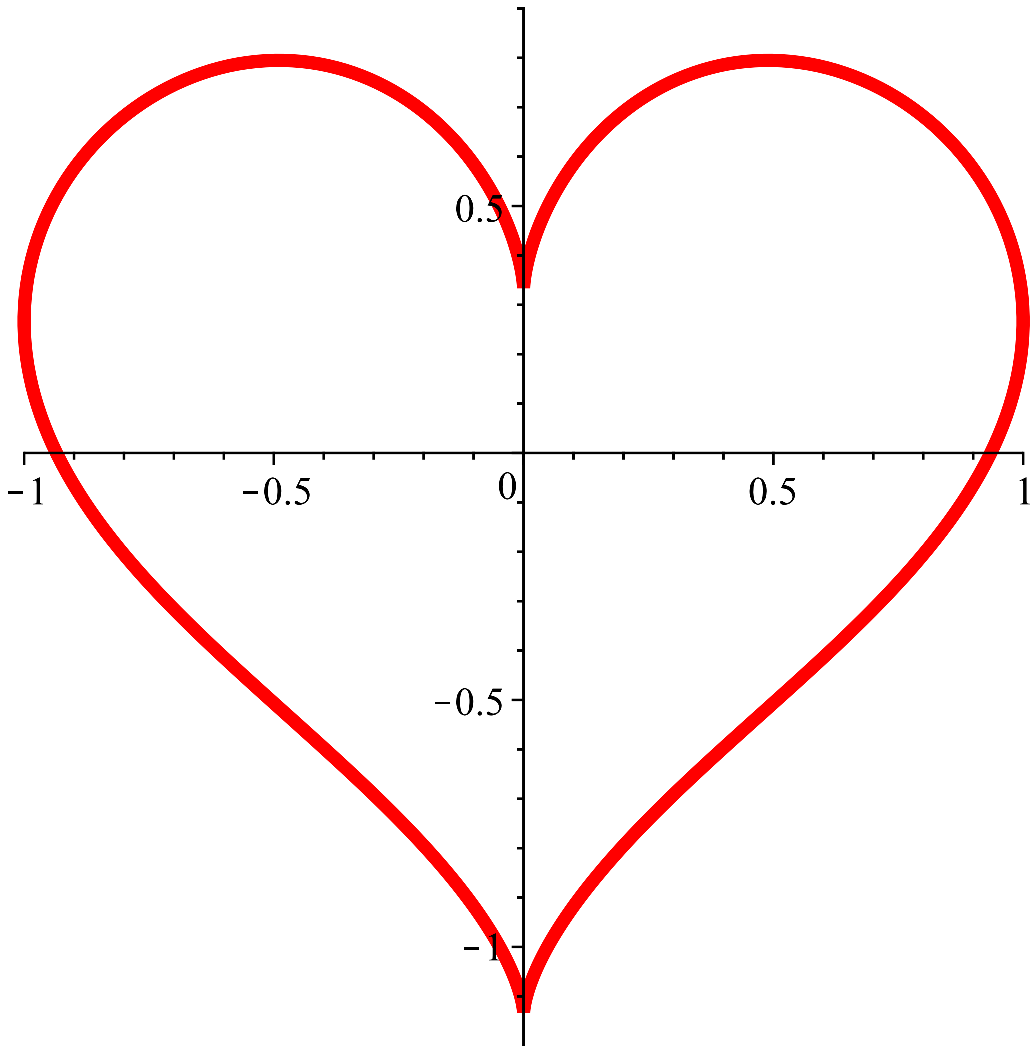


```
> 
> 
> restart;
> 
> 
> N := 144 : # The number of frames

A := seq(plot([[sin(t)^3, 13*cos(t)*(1/15) - (1/3)*cos(2*t) - 2*cos(3*t)*(1/15)
    - (1/15)*cos(4*t), t = 0 .. Pi*i/N], [-sin(t)^3, 13*cos(t)*(1/15) - (1/3)*cos(2
    *t) - 2*cos(3*t)*(1/15) - (1/15)*cos(4*t), t = 0 .. Pi*i/N]], color = red, thickness
    = 5, i = 1 .. N)) :
```

plots[display](A, insequence = true);

Error, (in plot) expecting a real constant as range endpoint but received (1/144)*Pi*i



>

>

> *restart;*

>

>

> $outernal := plottools[arc]\left([0, 0], 3, \frac{\text{Pi}}{6} .. \frac{19\ \text{Pi}}{16}, color = \text{"Tomato"}, thickness = 10\right) :$

> $internal := plottools[arc]\left([0, 0], 1, 0 .. -\frac{3 \cdot \text{Pi}}{2}, color = \text{"RoyalBlue"}, thickness = 5\right) :$

> $middle := plottools[circle]([0, 0], 2, thickness = 5, color = yellow, background = yellow, filled = true) :$

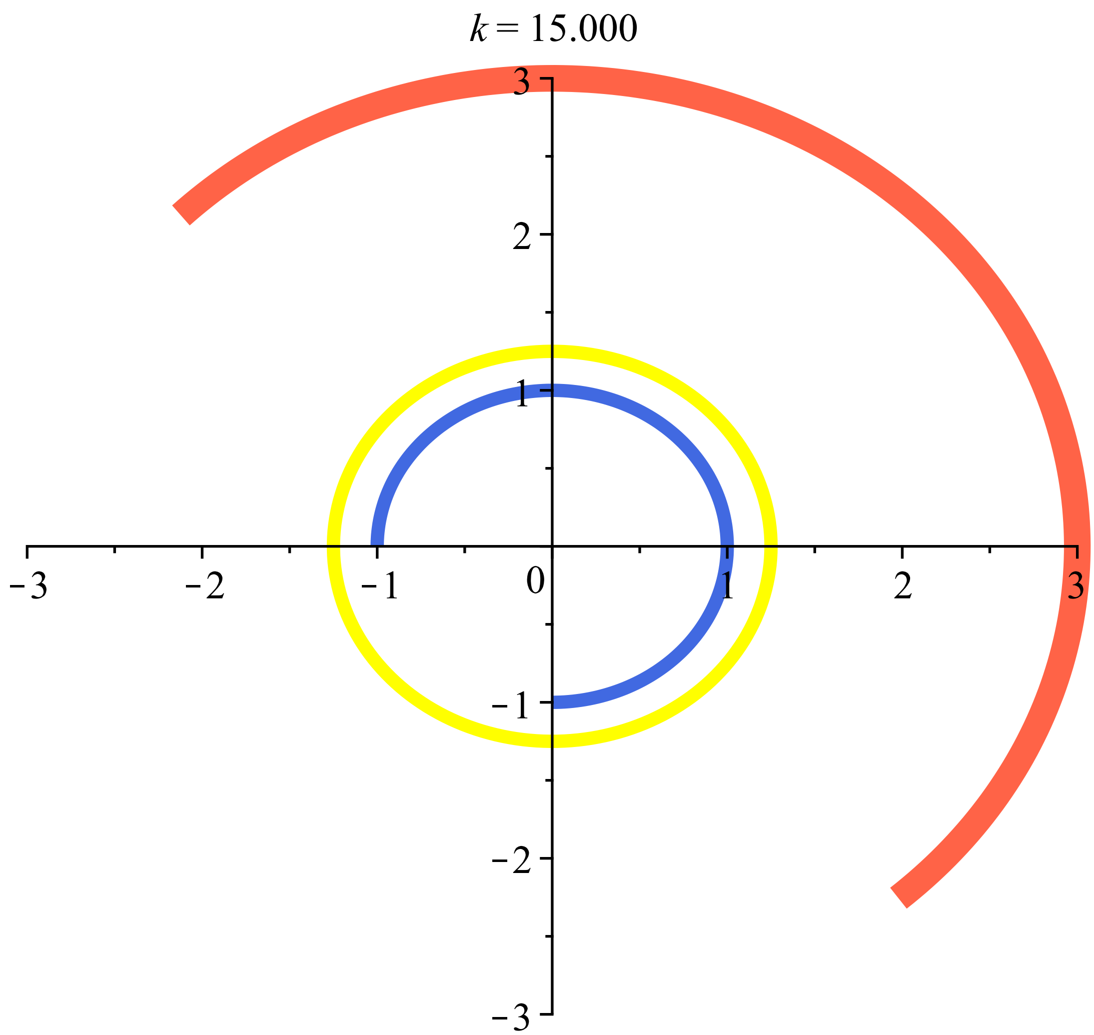
> $middle\_animation := animate\left(plottools[scale], \left[plots[display](middle), \frac{j}{100}, \frac{j}{100}\right], j = 0\right.$

..100) :

> outernal_animation := animate(rotate, [plots[display](outernal), $\frac{Pi}{12}$ · i], i = 0 ..30) :

> internal_animation := animate(plottools[rotate], [plots[display](internal), − $\frac{Pi}{15}$ · k], k = 0 ..24) :

> plots[display](middle_animation, outernal_animation, internal_animation);



>

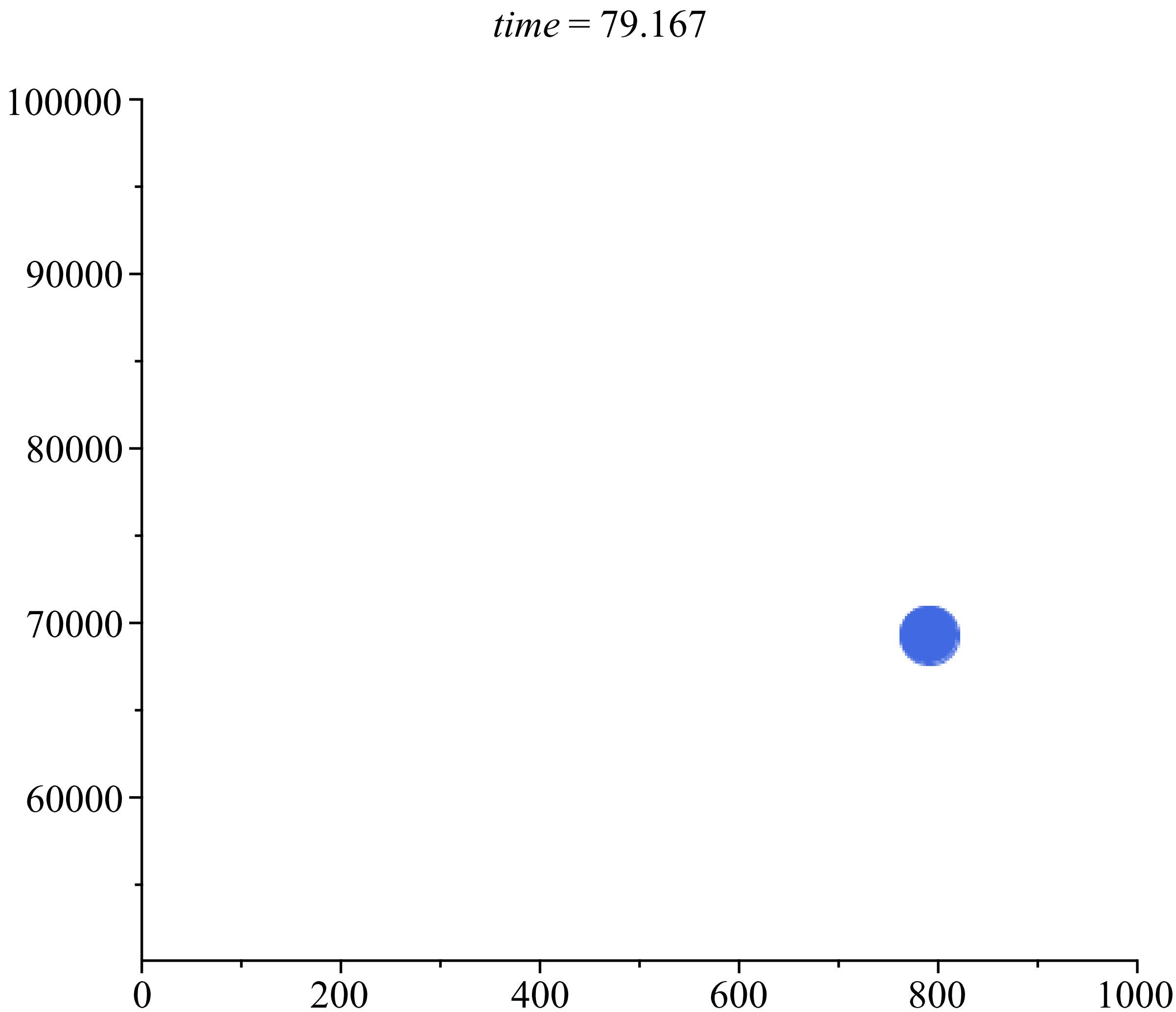
> restart;

>

> horizontal_speed := 10 :

> ball := plots[pointplot]([0, 100000], symbolsize = 40, symbol = solidcircle, color = "RoyalBlue") :

> $ball\_thrown := plots[animate]\left(plottools[translate], \left[ball, time \cdot horizontal\_speed, -\frac{9.81 \cdot time^2}{2}\right], time = 0..100\right);$



>

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>

> $GetA0 := \textbf{proc}(functionExpression, halfPeriod, leftIntBorder, rightIntBorder)$
$simplify\left(\frac{1}{halfPeriod} \cdot int(functionExpression, x = leftIntBorder..rightIntBorder)\right)$
end proc:

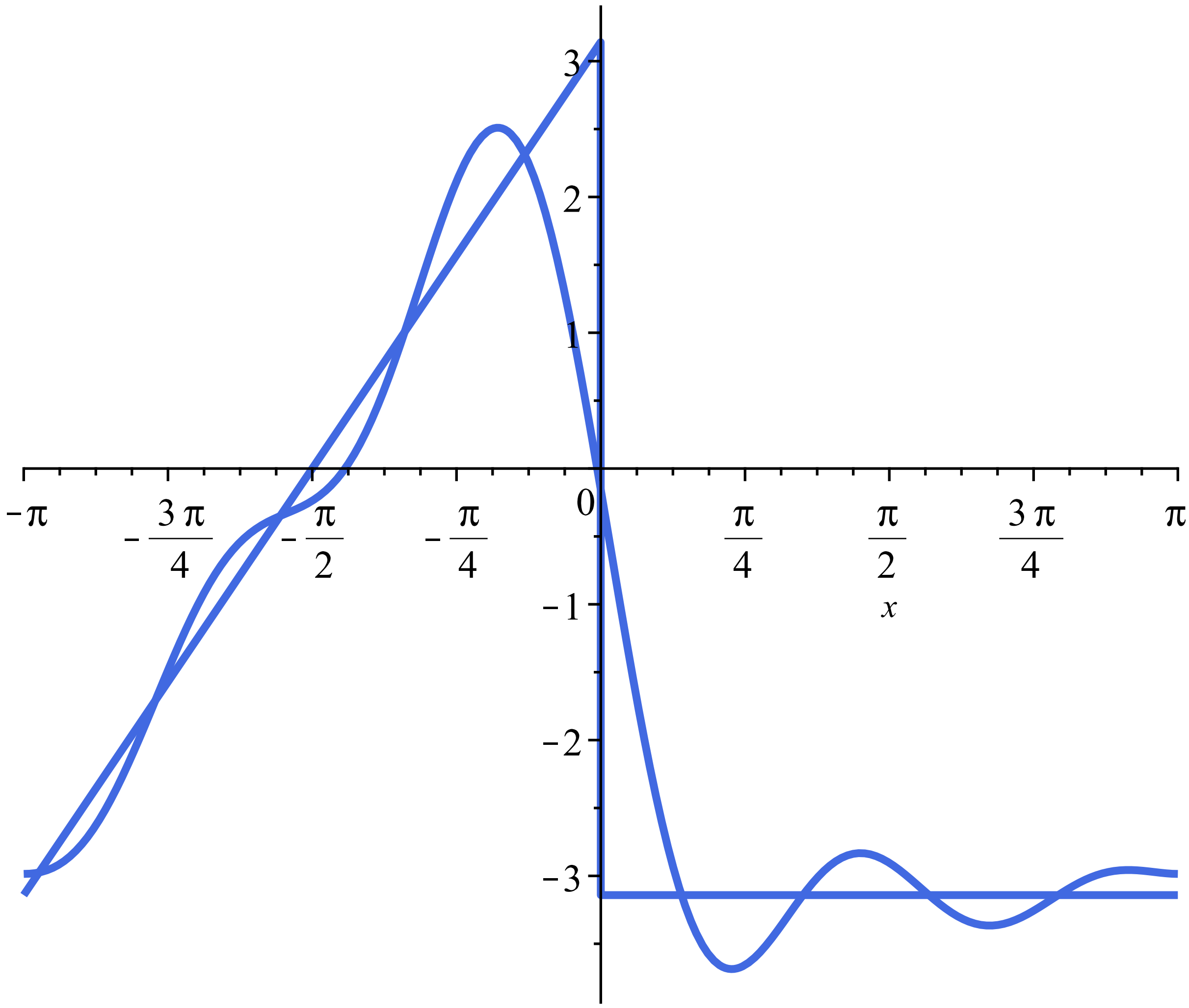
>

> $GetAn := \textbf{proc}(functionExpression, halfPeriod, leftIntBorder, rightIntBorder)$
$simplify\left(\frac{1}{halfPeriod} \cdot int\left(functionExpression \cdot \cos\left(\frac{n \cdot \pi \cdot x}{halfPeriod}\right), x = leftIntBorder..rightIntBorder\right)\right)$ assuming $n :: posint$
end proc:

> $GetBn := \textbf{proc}(functionExpression, halfPeriod, leftIntBorder, rightIntBorder)$

```
simplify( 1/halfPeriod · int( functionExpression · sin( n·π·x / halfPeriod ), x = leftIntBorder ..rightIntBorder ) ) assuming n
        :: posint
end proc:
>
> GetFourierSumValue := proc( expression, m, halfPeriod, leftIntBorder, rightIntBorder )
  # (напоминаю, теорема Дирихле: ф-я кусочно-гладкая => её ряд Фурье для каждого X сходится к f(X))
  GetA0( expression, halfPeriod, leftIntBorder, rightIntBorder ) / 2 + sum( ( GetAn( expression, halfPeriod, leftIntBorder,
        rightIntBorder ) · cos( n·π·x / halfPeriod ) + GetBn( expression, halfPeriod, leftIntBorder, rightIntBorder )
        · sin( n·π·x / halfPeriod ) ), n = 1 .. m )
end proc:
>
>
>
> expression1 := piecewise( x < 0 and x ≥ -π, π + 2 ·x, x ≥ 0 and x < π, -π ) :
> array_plots := Array( [1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20] ) :
> index1 := 1 :

> for i from 1 by 1 to 20 do
    array_plots[index1] := plot( [GetFourierSumValue( expression1, index1, π, -π, π ),
        expression1], x = -Pi ..Pi, thickness = 1, color = "RoyalBlue" ) :
    index1 := index1 + 1 :
  end do:
>
> plots[display]( array_plots[1], array_plots[2], array_plots[3], array_plots[4], array_plots[5],
      array_plots[6], array_plots[7] , array_plots[8], array_plots[9], array_plots[10],
      array_plots[11], array_plots[12], array_plots[13], array_plots[14], array_plots[15],
      array_plots[16], array_plots[17], array_plots[18], array_plots[19], array_plots[20],
      insequence = true );
```



3
2
1
0
−1
−2
−3
−π
$-\frac{3\pi}{4}$
$-\frac{\pi}{2}$
$-\frac{\pi}{4}$
$\frac{\pi}{4}$
$\frac{\pi}{2}$
$\frac{3\pi}{4}$
π
x

>