Porovnání zadaných příkladů v Počítačových algebraických systémech (PAS):

Maple 9.51, Derive 6, Mathematica

Zjednodusovani: – Priklad c. 1 –

```
> reset;
```

$$reset$$

```
> a:=(sqrt(x*y*abs(z)^2))/(sqrt(x)*abs(z));
```

$$a := \frac{\sqrt{x\,y}}{\sqrt{x}}$$

```
> simplify(a, assume=positive);
```

$$\sqrt{y}$$

```
> expand(a);
```

$$\frac{\sqrt{x\,y}}{\sqrt{x}}$$

```
> combine(a);
```

$$\frac{\sqrt{x\,y}}{\sqrt{x}}$$

Derive 6: $\sqrt{y}$

Mathematica:

$$\frac{\sqrt{x\,y}}{\sqrt{x}}$$

pokud bude kladné x:

$$\sqrt{y}$$

Priklad c.: 2:

a) z komplexní

```
> z:='z';
```

$$z := z$$

```
> b:=ln(exp(z));
```

$$b := \ln(e^z)$$

```
> simplify(b, assume=complexcons);
```

$$\ln(e^z)$$

Derive 6: LN(e^z)

Mathematica 5.1:

```
Log[e^z]
```

b)z reálné

```
>
> simplify(b, assume=real);
```

$$z$$

Derive 6: z

Mathematica 5.1: z

c)z = 10i

```
> z:=10*I;
```

$$z := 10\,I$$

```
> evalf(z);
```

$$10.\,I$$

```
>
> evalf(b);
```

$$\ln(e^z)$$

```
> simplify(b);
```

$$10\,I - 4\,I\,\pi$$

```
> subs(z=10*I, b);
```

$$\ln(e^{(10\,I)})$$

```
> simplify(b);
```

$$\ln(e^z)$$

```
>
```

Derive 6: 2·i·(5 – 2·Pi)

Mathematica 5.1:

$$-2\,i\,(-5+2\,\pi)$$

Priklad c. 3:

```
> c:='c';
```

$$c := c$$

```
> z:='z';
```

$$z := z$$

```
> c:=sqrt(z)-(z^3)^(1/6);
```

$$c := \sqrt{z} - (z^3)^{(1/6)}$$

```
> R1 := simplify( z^(1/2)-(z^3)^(1/6), 'assume=nonnegative' );
```

$$R1 := 0$$

a) z – komplexní

```
> assume(z, complexcons);
> simplify(c);
```

$$\sqrt{z\sim} - (z\sim^3)^{(1/6)}$$

Derive: 3 1/6
#30: $\sqrt{z} - (z)$

Mathematica 5.1:

$$\sqrt{z} - \left(z^3\right)^{1/6}$$

b) z – realne

```
> assume(z, real);
> simplify(c);
```

$$-\sqrt{z\sim}\,(-1 + \mathrm{signum}(z\sim))$$

Derive: $\sqrt{z} - \sqrt{z} \bullet \mathrm{SIGN}(z)$

Mathematica 5.1:

$$\sqrt{z} - \left(z^3\right)^{1/6}$$

c) z – kladné

```
> assume(z, positive);
```

```
> simplify(c);
```

$$0$$

Derive: 0

Mathematica 5.1: 0

d) z = 999983

```
> subs(z=999983, c);
```

$$c$$

```
> R2 := evalf[100]( 999983^(1/2)-9999490008669950 87^(1/6) );
```

$$R2 := 0.$$

Derive: 0

Mathematica 5.1: 0

Priklad c. 4 – reseni rovnic, nerovnic:

Prvni rovnice (nerovnice):

```
> prvni := abs(x^2-5*x+4) > 1;
```

$$prvni := 1 < \left| x^2 - 5\,x + 4 \right|$$

```
> solve(prvni, x);
```

$$RealRange\left(-\infty, Open\left(\frac{5}{2} - \frac{1}{2}\sqrt{13}\right)\right), RealRange\left(Open\left(\frac{5}{2} + \frac{1}{2}\sqrt{13}\right), \infty\right),$$
$$RealRange\left(Open\left(\frac{5}{2} - \frac{1}{2}\sqrt{5}\right), Open\left(\frac{5}{2} + \frac{1}{2}\sqrt{5}\right)\right)$$

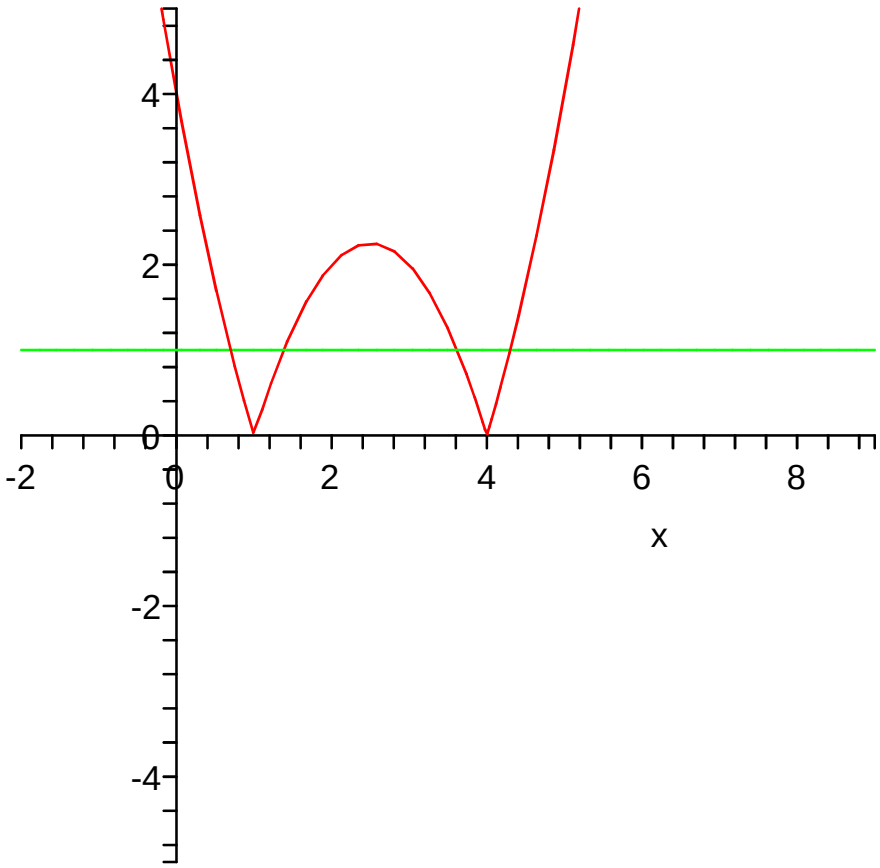
```
> evalf(solve(prvni, {x}));
```

$$\{x < 0.697224362\}, \{4.302775638 < x\}, \{x < 3.618033988, 1.381966012 < x\}$$

```
> R6 := `union`( {x < 5/2-1/2*13^(1/2)}, {5/2+1/2*13^(1/2) < x},
  {5/2-1/2*5^(1/2) < x, x < 5/2+1/2*5^(1/2)} );
```

$$R6 := \left\{ x < \frac{5}{2} - \frac{1}{2}\sqrt{13}, \frac{5}{2} + \frac{1}{2}\sqrt{13} < x, \frac{5}{2} - \frac{1}{2}\sqrt{5} < x, x < \frac{5}{2} + \frac{1}{2}\sqrt{5} \right\}$$

```
> plot([abs(x^2-5*x+4), 1], x=-2..9,-5..5);
```



Derive:x < 0.6972243622 ∨ 1.381966011 < x < 3.618033988 ∨
x > 4.302775637

Mathematica 5.1:

$$x < \frac{1}{2}\left(5 - \sqrt{13}\right) \,||\, \frac{1}{2}\left(5 - \sqrt{5}\right) < x < \frac{1}{2}\left(5 + \sqrt{5}\right) \,||\, x > \frac{1}{2}\left(5 + \sqrt{1}\right.$$

Druha rovnice:

```
> x:='x';
```

$$x := x$$

```
> druha:= sin(x) = tan(x);
```

$$druha := \sin(x) = \tan(x)$$

```
> R9 := solve( {sin(x) = tan(x)}, x);
```

$$R9 := \{x = 0\}$$

```
> _EnvAllSolutions := true;
```

$$\_EnvAllSolutions := true$$

```
> solve(sin(x)=tan(x), x);
```

$$\pi \_Z1\sim$$

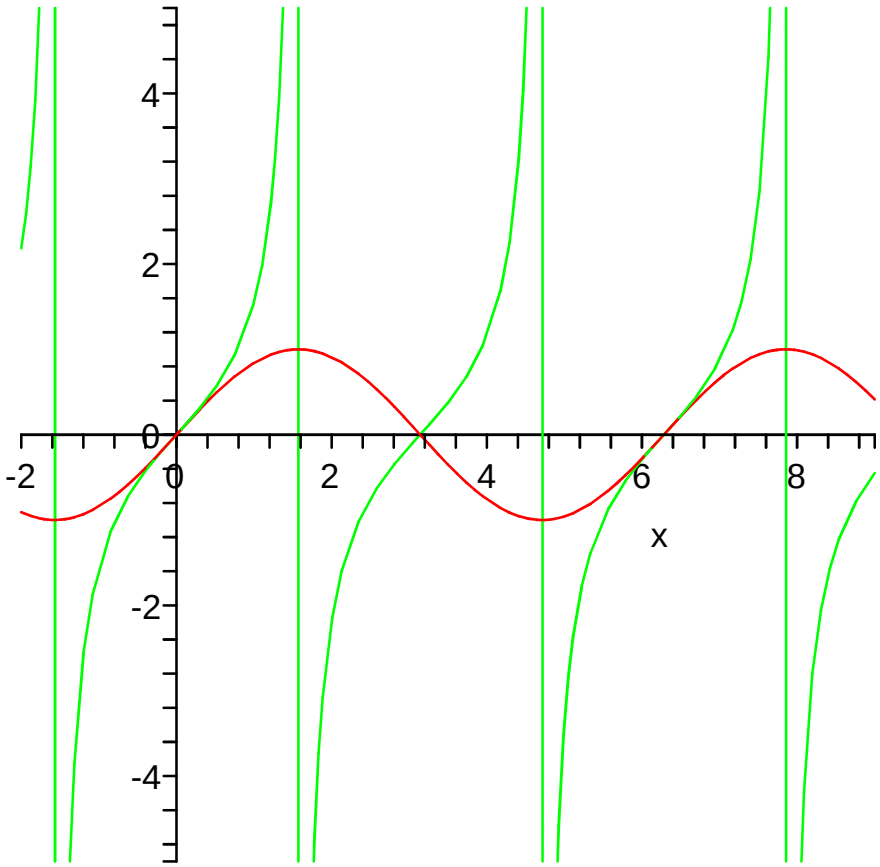
```
> about(indets(%, name));
{Pi, _Z1}:
  is used in the following assumed objects
  [Pi] assumed Pi
  [_Z1] assumed integer
```

Derive: $x = -2 \bullet Pi \vee x = 2 \bullet Pi \vee x = -Pi \vee x = Pi \vee x = 0$

Mathematica 5.1:

```
C[1] ∈ Integers && (x == 2 π C[1] || x == π + 2 π C[1])
```

```
> plot([sin(x), tan(x)], x=-2..9,-5..5);
```



Treti rovnice:

```
> treti := (x^2-1)*(ln(x))*(sin(x))^3*(cos(x))^2 = 0;
```

$$treti := (x^2 - 1)\ln(x)\sin(x)^3\cos(x)^2 = 0$$

```
> R12 := solve( {(x^2-1)*ln(x)*sin(x)^3*cos(x)^2 = 0} );
```

$$R12 := \{x = 1\}, \{x = -1\}, \left\{x = \frac{1}{2}\pi - \pi\_B1\sim + 2\,\pi\_Z2\sim\right\}, \{x = \pi\_Z3\sim\}$$

Derive:

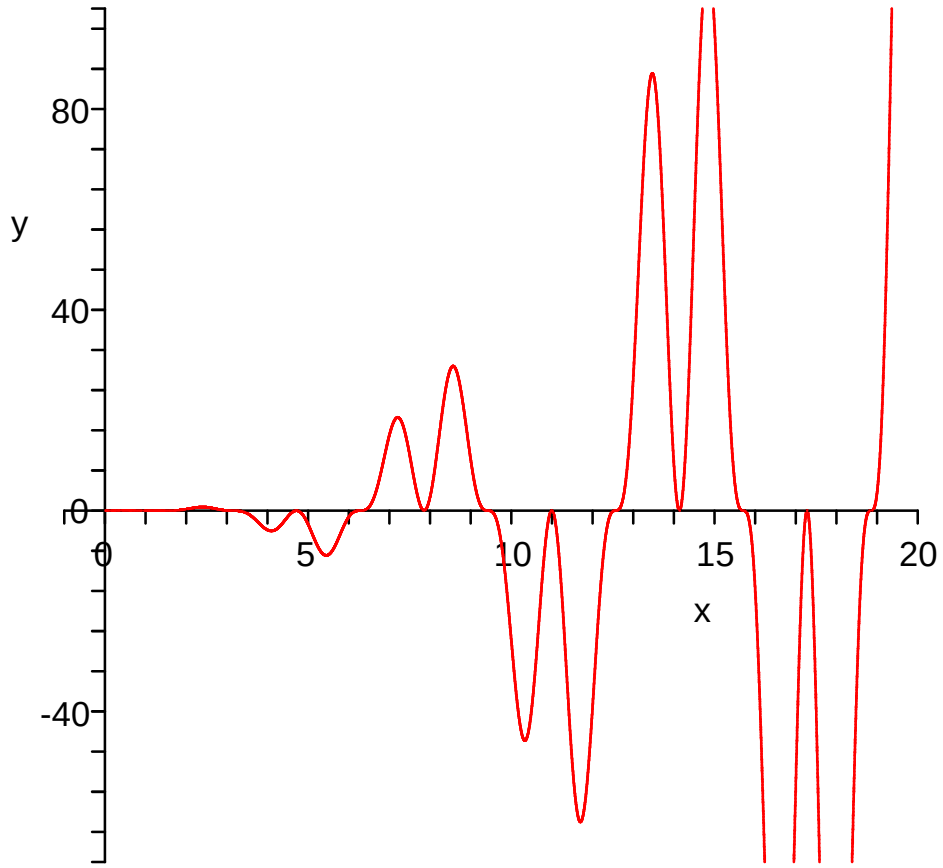
$$x = \frac{3\cdot\pi}{2} \vee x = -\frac{\pi}{2} \vee x = \frac{\pi}{2} \vee x = -\pi \vee x = \pi \vee x = -1 \vee x =$$

$$\vee x = 0$$

Mathematica 5.1:

$$\left(C[1] \in \text{Integers} \&\& x \neq 0 \&\& \left(x == -\frac{\pi}{2} + 2\pi C[1] \,||\, x == \frac{\pi}{2} + 2\pi C[1] \right.\right.$$
$$\left.\left. x == 2\pi C[1] \,||\, x == \pi + 2\pi C[1]\right)\right) \,||\, x == -1 \,||\, x == 1$$

```
> plot((x^2-1)*(ln(x))*(sin(x))^3*(cos(x))^2, x=-1..20, y=-70..100,
  numpoints=10000, resolution=2000);
```



Ctvrta rovnice:

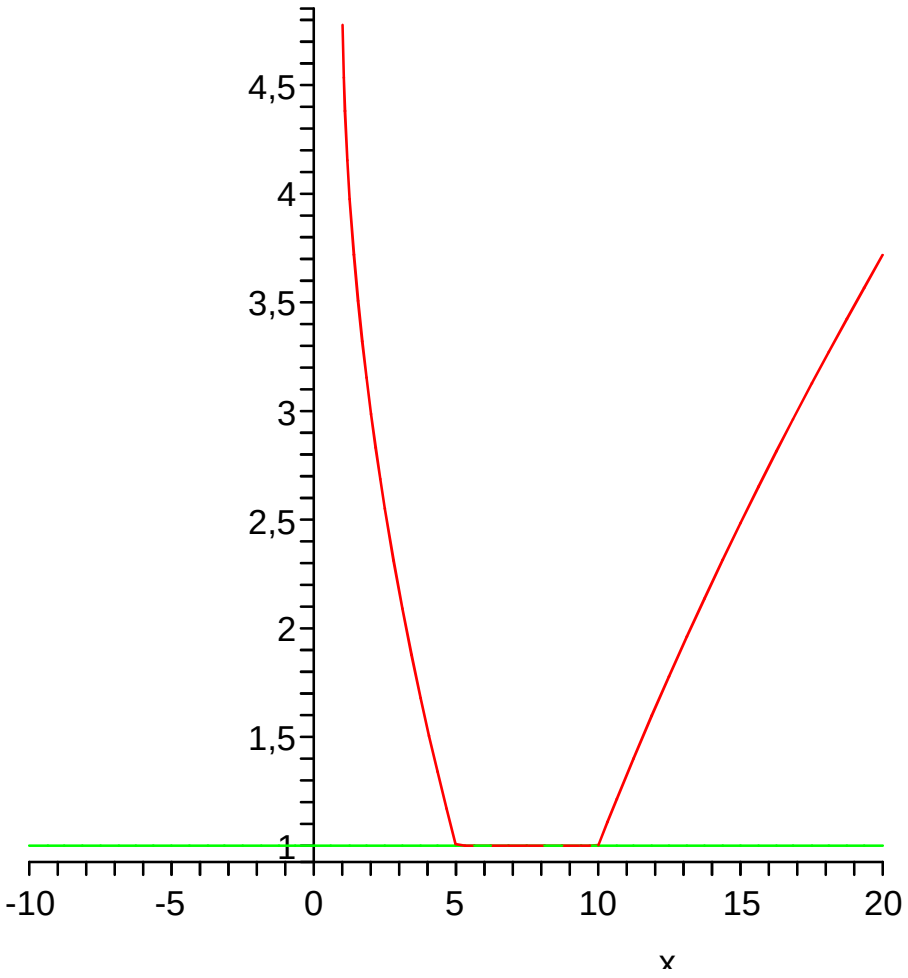
```
> sqrt(x+8-6*(sqrt(x-1)))+sqrt(x+3-4*sqrt(x-1))=1;
```

$$\sqrt{x+8-6\sqrt{x-1}}+\sqrt{x+3-4\sqrt{x-1}}=1$$

```
> R1 := solve( {(x+8-6*(x-1)^(1/2))^(1/2)+(x+3-4*(x-1)^(1/2))^(1/2) =
  1} );
```

$$R1 := \{x = x\}$$

```
> plot([(x+8-6*(x-1)^(1/2))^(1/2)+(x+3-4*(x-1)^(1/2))^(1/2), 1],
  x=-10..20);
```




```
> f:=(x+8-6*(x-1)^(1/2))^(1/2)+(x+3-4*(x-1)^(1/2))^(1/2) = 1;
```

$$f := \sqrt{x + 8 - 6\sqrt{x - 1}} + \sqrt{x + 3 - 4\sqrt{x - 1}} = 1$$

```
> unassign(x);
> nerov:=(x+8-6*(x-1)^(1/2))^(1/2)+(x+3-4*(x-1)^(1/2))^(1/2) <= 1;
```

$$nerov := \sqrt{x + 8 - 6\sqrt{x - 1}} + \sqrt{x + 3 - 4\sqrt{x - 1}} \le 1$$

```
> solve(nerov,x);
```

$$RealRange(5, 10)$$

```
> solve(nerov,{x});
```

$$\{5 \le x, x \le 10\}$$

Derive: $5 \le x \le 10$

Mathematica 5.1:

$$5 \le x \le 10$$

Derivace a integraly

```
> x:='x';
```

$$x := x$$

Priklad c. 5:

```
> restart;
> with(Student[Precalculus]);
> with(Student[Calculus1]);
> f:=abs(x);
```

$$f := |x|$$

```
> diff(f,x);
```

$$\mathrm{abs}(1, x)$$

```
> Diff(f,x);
```

$$\frac{d}{dx} |x|$$

```
> int(f,x);
```

$$\begin{cases} -\frac{1}{2} x^2 & x \le 0 \\ \frac{1}{2} x^2 & 0 < x \end{cases}$$

Derive: x·SIGN(x)

Mathematica 5.1: S tímto typem prikladu ma Mathematica potize, musel bych ji to manualne rozdelit...

Priklad c. 6:

```
> 2*x*(x^2+1)^24;
```

$$2 x (x^2 + 1)^{24}$$

```
> R3 := int(2*x*(x^2+1)^24, x);
```

$$R3 := 81719 x^{18} + x^2 + 43263 x^{16} + 19228 x^{14} + 178296 x^{22} + 178296 x^{28} + 208012 x^{24} + 92 x^6 + 19228 x^{36} + 12 x^4 + 208012 x^{26} + 43263 x^{34} + 506 x^{$$
$$+ 92 x^{44} + 12 x^{46} + 7084 x^{38} + 7084 x^{12} + 81719 x^{32} + \frac{653752}{5} x^{30}$$

$$+\frac{653752}{5}x^{20}+\frac{1}{25}x^{50}+\frac{10626}{5}x^{10}+x^{48}+\frac{10626}{5}x^{40}+506\,x^{42}$$

```
> R3:=combine(R3, power);
```

$$R3 := 81719\,x^{18}+x^{2}+43263\,x^{16}+19228\,x^{14}+178296\,x^{22}+178296\,x^{28}$$
$$+208012\,x^{24}+92\,x^{6}+19228\,x^{36}+12\,x^{4}+208012\,x^{26}+43263\,x^{34}+506\,x^{8}$$
$$+92\,x^{44}+12\,x^{46}+7084\,x^{38}+7084\,x^{12}+81719\,x^{32}+\frac{653752}{5}x^{30}$$
$$+\frac{653752}{5}x^{20}+\frac{1}{25}x^{50}+\frac{10626}{5}x^{10}+x^{48}+\frac{10626}{5}x^{40}+506\,x^{42}$$

Kontrola z toho, co jsem vypocital v ruce:

```
> (x^2+1)^25/25;
```

$$\frac{1}{25}\left(x^{2}+1\right)^{25}$$

```
> R0 := simplify( 1/25*(x^2+1)^25 );
```

$$R0 := \frac{1}{25}\left(x^{2}+1\right)^{25}$$

```
> R1 := expand( 1/25*(x^2+1)^25 );
```

$$R1 := 81719\,x^{18}+x^{2}+43263\,x^{16}+19228\,x^{14}+178296\,x^{22}+178296\,x^{28}$$
$$+208012\,x^{24}+92\,x^{6}+19228\,x^{36}+12\,x^{4}+208012\,x^{26}+43263\,x^{34}+506\,x^{8}$$
$$+92\,x^{44}+12\,x^{46}+7084\,x^{38}+7084\,x^{12}+81719\,x^{32}+\frac{653752}{5}x^{30}$$
$$+\frac{653752}{5}x^{20}+\frac{1}{25}+\frac{1}{25}x^{50}+\frac{10626}{5}x^{10}+x^{48}+\frac{10626}{5}x^{40}+506\,x^{42}$$

```
> R1-R3;
```

$$\frac{1}{25}$$

```
>
```

Derive:

$$\frac{(x^{2}+1)^{25}}{25}+c$$

Mathematica 5.1:

$$2\left(\frac{x^2}{2}+6x^4+46x^6+253x^8+\frac{5313x^{10}}{5}+3542x^{12}+9614x^{14}+\frac{43263x^{16}}{2}+\frac{81719x^{18}}{2}+\frac{326876x^{20}}{5}+89148x^{22}+104006x^{24}+104006x^{26}+89148x^{28}+\frac{326876x^{30}}{5}+\frac{81719x^{32}}{2}+\frac{43263x^{34}}{2}+9614x^{36}+3542x^{38}+\frac{5313x^{40}}{5}+253x^{42}+46x^{44}+6x^{46}+\frac{x^{48}}{2}+\frac{x^{50}}{50}\right)$$

Priklad c. 7:

```
> Int7:=Int(1/x^(1/3),x=-1..1);
```

$$Int7 := \int_{-1}^{1} \frac{1}{x^{(1/3)}}\,dx$$

```
> value(Int7);
  simplify(%);
```

$$-\frac{3}{2}(-1)^{(2/3)}+\frac{3}{2}$$

$$\frac{9}{4}-\frac{3}{4}I\sqrt{3}$$

```
> Int7a:=Int(surd(1/x, 3),x=-1..1):%=value(%);
```

$$\int_{-1}^{1} \operatorname{surd}\left(\frac{1}{x}, 3\right)\,dx = 0$$

Derive: 0

Mathematica 5.1:

$$-\frac{3}{2}\left(-1+(-1)^{2/3}\right)$$

Priklad c.8:

```
> with(inttrans);
```

[*addtable*, *fourier*, *fouriercos*, *fouriersin*, *hankel*, *hilbert*, *invfourier*, *invhilbert*, *invlaplac*
invmellin, *laplace*, *mellin*, *savetable*]

obraz k z=cos(omega*t+phi)

```
> o:=cos(omega*t+phi);
```

$$o := \cos(\omega\, t + \phi)$$

```
> laplace(o, t, p);
```

$$\frac{\cos(\phi)\, p - \sin(\phi)\, \omega}{p^2 + \omega^2}$$

Derive:

$$\frac{(s \cdot \mathrm{COS}(\phi) - \omega \cdot \mathrm{SIN}(\phi))}{s^2 + \omega^2}$$

Mathematica 5.1:

$$\frac{p\,\mathrm{Cos}[\phi] - \sqrt{\omega^2}\,\mathrm{Sign}[\omega]\,\mathrm{Sin}[\phi]}{p^2 + \omega^2}$$

vzor k (ap+b)/(p^2+p+1)

```
> v:=(a*p+t)/(p^2+p+1);
```

$$v := \frac{a\, p + t}{p^2 + p + 1}$$

```
> invlaplace(v, p, t);
```

$$\frac{1}{3}\, \mathbf{e}^{\left(-\frac{1}{2} t\right)} \left(3\, a \cos\left(\frac{1}{2} \sqrt{3}\, t \right) + \sqrt{3}\, \sin\left(\frac{1}{2} \sqrt{3}\, t \right) (-a + 2\, t) \right)$$

Derive: Zde se prapodivnými cestami dostáváme k úplnému nesmyslu..., prostě to neumí efektivně a celé najednou udělat ani s pomocným balíčkem:

--- při zadání celého výrazu najdenou nedokázal PC předložit výsledek ani za 2 hodiny nepřetržitého počítání,
přičemž se pak PC restartoval. Prováděno na: Celeron(R) 3,06 GHz

Mathematica 5.1:

$$\frac{1}{3}\, e^{-t/2}\left(3\,a\,\mathrm{Cos}\left[\frac{\sqrt{3}\,t}{2}\right] - \sqrt{3}\,(a-2b)\,\mathrm{Sin}\left[\frac{\sqrt{3}\,t}{2}\right]\right)$$

Priklad c.9:

```
> M:={seq(5*k+1, k=1..30)};
```

$M := \{6, 11, 16, 21, 26, 31, 36, 41, 46, 51, 56, 61, 66, 71, 76, 81, 86, 91, 96, 101, 106, 111, 116, 121, 126, 131, 136, 141, 146, 151\}$

```
> S:=2:
  for i to 100
     do
      if isprime(i)
             then S:=S,i;
      fi;
     od;
  S;
  P:={S};
```

2, 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73, 79, 83, 89, 97

$P := \{2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73, 79, 83, 89, 97\}$

```
> M intersect P;
```

$\{11, 31, 41, 61, 71\}$

Derive:P := {1, 3, ..., 100}

#106: P

#107: {1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35,
37, 39, 41, 43, 45, 47, 49, 51, 53, 55, 57, 59, 61, 63, 65, 67,
69, 71, 73, 75, 77, 79, 81, 83, 85, 87, 89, 91, 93, 95, 97, 99}

#108: M := 5•k + 1

#109: k := {1, ..., 30}

#110: M := {{5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80,
85, 90, 95, 100, 105, 110, 115, 120, 125, 130, 135, 140, 145, 150}
+ 1}

#111: P ∩ M

#112: {5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85,
90, 95, 100, 105, 110, 115, 120, 125, 130, 135, 140, 145, 150} + 1
∩ {1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33,
35, 37, 39, 41, 43, 45, 47, 49, 51, 53, 55, 57, 59, 61, 63, 65,

67, 69, 71, 73, 75, 77, 79, 81, 83, 85, 87, 89, 91, 93, 95, 97, 99}

---- také takové zvláštní :-)

Mathematica 5.1:

```
M = Table[5 * k + 1, {k, 30}]
```

```
{6, 11, 16, 21, 26, 31, 36, 41, 46, 51, 56, 61, 66, 71, 76, 81, 86
 91, 96, 101, 106, 111, 116, 121, 126, 131, 136, 141, 146, 151}
```

```
{2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37,
 41, 43, 47, 53, 59, 61, 67, 71, 73, 79, 83, 89, 97}
```

```
{11, 31, 41, 61, 71}
```

Priklad c.10:

```
> with(Logic);
```

[*&and*, *&iff*, *&implies*, *&nand*, *&nor*, *&not*, *&or*, *&xor*, *BooleanSimplify*, *Canonicalize*, *Contradiction*, *Dual*, *Environment*, *Equal*, *Equivalent*, *Export*, *Implies*, *Import*, *Normalize*, *Random*, *Satisfy*, *Tautology*, *TruthTable*]

```
> a &or &not a;
  BooleanSimplify(%);
```

a &or *&not*(*a*)

true

Derive: True

Mathematica: True

```
> a &or b &or (a &and b);
  BooleanSimplify(%);
```

(*a* &or *b*) &or (*a* &and *b*)

a &or *b*

Derive: a ∨ b

Mathematica:

```
a || b
```

```
> not Equivalent(a,c) or (b and c and d) or (a and c and (b\d));
```

not *Equivalent*(*a*, *c*) **or** *b* **and** *c* **and** *d* **or** *a* **and** *c* **and** *bd*

Derive: (d ∩ f` ∨ ¬ c ∨ (d ∧ f) ∨ ¬ e) ∧ (c ∨ e) //pouzita pismena posunuta od a,b

Mathematica 5.1:

```
a ≠ c || b && c && d || a && c && ! (b && d)
```

>

Závěr:

Pokud mám porovnat systémy, které jsme měli možnost v tomto předmětu ozkoušet, rozdělil bych to ze dvou hledisek. Pokud potřebuji jenom něco malého intuitivně a rychle naklikat a spočítat, považuji Derive za poměrně dobrou volbu, ovšem s nevýhodou, že to není software k dispozici volně ani pro studenty.

Maple ale co jsem měl možnost vidět v nové verzi 10.0 šlape v této výhodě Derivu silně na paty, jelikož pro typicky "klikačské" výpočty má k dispozici kalkulátor, který je docel "user friendly". Pro složitější výpočty je pro mě Maple jasná volba, například jak je zapracováno na rovnicích s absolutní hodnotou je velmi slušné.

Při porovnávání Mathematiky jsem možná poněkud zaujatý, ale přijde mi to jako strašně nepohodlný program oproti třeba Maplu. Prostě jsem se s ní nedokázal sžít, spíše naopak... :–)

Matematické programy jsou ale vesměs užitečné a vyplatí se spíše než počítání v ruce, i když je někdy třeba obezřetnosti.