Il ne suffit pas de voir les TPs déjà faits sur Maple et enregistrés sur des fichiers pdf, mais il faut bien refaire ces TPs directement sur Maple plusieurs fois sur différents exemples, c'est comme ça qu'on arrive à se familiariser avec Maple, et notamment il faut avoir le courage de revenir tout le temps au help pour bien apprendre les instructions et pour voir s'il n'y a pas quelque chose de plus rapide et de plus performant.

```
> restart;#   Fonctions usuelles
> f:=x->exp(x);
```

$$f := x \to \mathbf{e}^x$$

```
> f(1.);# c'est e
```

$$2.718281828$$

```
> g:=x->ln(x);
```

$$g := x \to \ln(x)$$

```
> ln(2.);
```

$$0.6931471806$$

```
> log[10](20);
```

$$\frac{\ln(20)}{\ln(10)}$$

```
> simplify(%);
```

$$\frac{2\ln(2)+\ln(5)}{\ln(2)+\ln(5)}$$

```
> log[10](20.);
```

$$1.301029996$$

```
> sin(1.);
```

$$0.8414709848$$

```
> cos(2.);
```

$$-0.4161468365$$

```
> tan(Pi/18);
```

$$\tan\left(\frac{\pi}{18}\right)$$

```
> value(%);
```

$$\tan\left(\frac{\pi}{18}\right)$$

```
> eval(%);
```

$$\tan\left(\frac{\pi}{18}\right)$$

```
> evalf(%);
```

$$0.1763269807$$

```
> cot(Pi/7);
```

$$\cot\left(\frac{\pi}{7}\right)$$

```
> value(%);
```

$$\cot\left(\frac{\pi}{7}\right)$$

```
> eval(%);
```

$$\cot\left(\frac{\pi}{7}\right)$$

```
> evalf(%);
```

$$2.076521396$$

```
> sinh(10.);
```

$$11013.23287$$

```
> cosh(20);
```

$$\cosh(20)$$

```
> evalf(%);
```

$$0.2425825977\ 10^{9}$$

```
> tanh(1.);
```

$$0.7615941560$$

```
> coth(54);
```

$$\coth(54)$$

```
> evalf(%);
```

$$1.$$

```
> arcsin(0.5);
```

$$0.5235987756$$

```
> arccos(0.125);
```

$$1.445468496$$

```
> arctan(100.);
```

$$1.560796660$$

```
> arccot(12.);
```

$$0.08314123189$$

```
> arctan(1,2);
```

$$\arctan\left(\frac{1}{2}\right)$$

```
> arctan(5,45);
```

$$\arctan\left(\frac{1}{9}\right)$$

```
> arcsinh(10.);
```

$$2.998222950$$

```
> arccosh(10.);
```

$$2.993222846$$

```
> arctanh(0.825);
```

$$1.172274646$$

```
> arccoth(-2.);
```

$$-0.5493061443$$

```
> arccoth(2.2569);
```

$$0.4760637254$$

```
> restart;# Limites
> f:=x->(1-cos(x))/x**2;
```

$$f := x \to \frac{1-\cos(x)}{x^2}$$

```
> limit(f(x),x=0);
```

$$\frac{1}{2}$$

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

$$0$$

```
> g:=x->sin(x)/abs(x);
```

$$g := x \to \frac{\sin(x)}{|x|}$$

```
> limit(g(x),x=0);
```

$$undefined$$

```
> limit(g(x),x=0,right);
```

$$1$$

```
> limit(g(x),x=0,left);
```

$$-1$$

```
> limit(g(x),x=-infinity);
```

$$0$$

```
> h:=x->(exp(x)-1-x-x^2/2)/x**3;
```

$$h := x \to \frac{\mathbf{e}^x - 1 - x - \frac{1}{2}x^2}{x^3}$$

```
> limit(h(x),x=0);
```

$$\frac{1}{6}$$

```
> limit(h(x),x=infinity);
```

$$\infty$$

```
> limit(h(x),x=-infinity);
```

$$0$$

Faire d'autres exemples.

```
> restart;# Développement limités
> f:=x->1/cos(x);
```

$$f := x \to \frac{1}{\cos(x)}$$

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

$$1+\frac{1}{2}x^2+\frac{5}{24}x^4+O(x^6)$$

```
> taylor(f(x),x=Pi,15);
```

$$-1-\frac{1}{2}(x-\pi)^2-\frac{5}{24}(x-\pi)^4-\frac{61}{720}(x-\pi)^6-\frac{277}{8064}(x-\pi)^8-\frac{50521}{3628800}(x-\pi)^{10}-\frac{540553}{95800320}(x-\pi)^{12}-\frac{199360981}{87178291200}(x-\pi)^{14}+O((x-\pi)^{15})$$

```
> taylor(f(x),x=Pi/3);
```

$$2+2\sqrt{3}\left(x-\frac{\pi}{3}\right)+7\left(x-\frac{\pi}{3}\right)^2+\frac{23\sqrt{3}}{3}\left(x-\frac{\pi}{3}\right)^3+\frac{305}{12}\left(x-\frac{\pi}{3}\right)^4+\frac{1681\sqrt{3}}{60}\left(x-\frac{\pi}{3}\right)^5+O\left(\left(x-\frac{\pi}{3}\right)^6\right)$$

```
> g:=x->x/sin(x);
```

$$g := x \to \frac{x}{\sin(x)}$$

```
> series(g(x),x);
```

$$1+\frac{1}{6}x^2+\frac{7}{360}x^4+O(x^5)$$

```
> series(g(x),x,20);
```

$$1+\frac{1}{6}x^2+\frac{7}{360}x^4+\frac{31}{15120}x^6+\frac{127}{604800}x^8+\frac{73}{3421440}x^{10}+\frac{1414477}{653837184000}x^{12}+\frac{8191}{37362124800}x^{14}+\frac{16931177}{762187345920000}x^{16}+\frac{5749691557}{2554547108585472000}x^{18}+O(x^{19})$$

```
> series(g(x),x=Pi/2);
```

$$\frac{\pi}{2}+x-\frac{\pi}{2}+\frac{\pi}{4}\left(x-\frac{\pi}{2}\right)^2+\frac{1}{2}\left(x-\frac{\pi}{2}\right)^3+\frac{5\pi}{48}\left(x-\frac{\pi}{2}\right)^4+\frac{5}{24}\left(x-\frac{\pi}{2}\right)^5+O\left(\left(x-\frac{\pi}{2}\right)^6\right)$$

```
> convert(%,polynom);
```

$$x+\frac{\pi\left(x-\frac{\pi}{2}\right)^2}{4}+\frac{\left(x-\frac{\pi}{2}\right)^3}{2}+\frac{5\pi\left(x-\frac{\pi}{2}\right)^4}{48}+\frac{5\left(x-\frac{\pi}{2}\right)^5}{24}$$

```
> h:=x->tan(sin(x))-sin(tan(x));
```

$$h := x \to \tan(\sin(x))-\sin(\tan(x))$$

```
> series(h(x),x);
```

$$O(x^7)$$

```
> series(h(x),x,10);
```

$$\frac{1}{30}x^7+\frac{29}{756}x^9+O(x^{10})$$

```
> series(leadterm(h(x)),x,6);
```

$$O(x^7)$$

```
> series(leadterm(h(x)),x,16);
```

$$\frac{1}{30}x^7$$

```
> series(h(x),x=Pi);
```

$$-2(x-\pi)-\frac{1}{3}(x-\pi)^3+\frac{1}{20}(x-\pi)^5+O((x-\pi)^6)$$

```
> series(leadterm(h(x)),x=Pi);
```

$$-2(x-\pi)$$

```
> u:=series(sinh(x),x);v:=series(cosh(x),x);
```

$$u := x+\frac{1}{6}x^3+\frac{1}{120}x^5+O(x^6)$$

$$v := 1+\frac{1}{2}x^2+\frac{1}{24}x^4+O(x^6)$$

```
> expand(u*v);
```

$$\left(x+\frac{1}{6}x^3+\frac{1}{120}x^5+O(x^6)\right)\left(1+\frac{1}{2}x^2+\frac{1}{24}x^4+O(x^6)\right)$$

```
> series(u*v,x);
```

$$x+\frac{2}{3}x^3+\frac{2}{15}x^5+O(x^6)$$

```
> series(u/v,x);
```

$$x-\frac{1}{3}x^3+\frac{2}{15}x^5+O(x^6)$$

```
> restart;
> S:=series(sqrt(2/(1+exp(x))),x,4);
```

$$S := 1-\frac{1}{4}x-\frac{1}{32}x^2+\frac{5}{384}x^3+O(x^4)$$

```
> T:=series(ln(1/x*ln(1+x)),x,4);
```

$$T := -\frac{1}{2}x+\frac{5}{24}x^2-\frac{1}{8}x^3+O(x^4)$$

```
> series(S*T,x,3);
```

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

```
> series(S/T,x,4);
```

$$-2x^{-1}-\frac{1}{3}+\frac{61}{144}x+O(x^2)$$

```
> restart;
> f:=x->(sqrt(x^3+x^2)-sqrt(x^3-x^2))/x;
```

$$f := x \rightarrow \frac{\sqrt{x^3+x^2}-\sqrt{x^3-x^2}}{x}$$

```
> series(f(x),x=infinity);
```

$$\sqrt{\frac{1}{x}}+\frac{\left(\frac{1}{x}\right)^{(5/2)}}{8}+\frac{7\left(\frac{1}{x}\right)^{(9/2)}}{128}+O\left(\left(\frac{1}{x}\right)^{(13/2)}\right)$$

```
> series(f(x),x=infinity,10);
```

$$\sqrt{\frac{1}{x}}+\frac{\left(\frac{1}{x}\right)^{(5/2)}}{8}+\frac{7\left(\frac{1}{x}\right)^{(9/2)}}{128}+\frac{33\left(\frac{1}{x}\right)^{(13/2)}}{1024}+\frac{715\left(\frac{1}{x}\right)^{(17/2)}}{32768}+O\left(\left(\frac{1}{x}\right)^{(21/2)}\right)$$

```
> restart;
> series(1/(1+x),x=infinity,25);
```

$$\frac{1}{x}-\frac{1}{x^2}+\frac{1}{x^3}-\frac{1}{x^4}+\frac{1}{x^5}-\frac{1}{x^6}+\frac{1}{x^7}-\frac{1}{x^8}+\frac{1}{x^9}-\frac{1}{x^{10}}+\frac{1}{x^{11}}-\frac{1}{x^{12}}+\frac{1}{x^{13}}-\frac{1}{x^{14}}+\frac{1}{x^{15}}-\frac{1}{x^{16}}+\frac{1}{x^{17}}-\frac{1}{x^{18}}+\frac{1}{x^{19}}-\frac{1}{x^{20}}+\frac{1}{x^{21}}-\frac{1}{x^{22}}+\frac{1}{x^{23}}-\frac{1}{x^{24}}+O\left(\frac{1}{x^{25}}\right)$$

```
> series(ln(1+x**2),x=infinity,10);
```

$$2\ln(x)+\frac{1}{x^2}-\frac{1}{2x^4}+\frac{1}{3x^6}-\frac{1}{4x^8}+O\left(\frac{1}{x^{10}}\right)$$

```
> series(x+sqrt(1+x^2),x=-infinity);
```

$$-\frac{1}{2x}+\frac{1}{8x^3}-\frac{1}{16x^5}+O\left(-\frac{1}{x^7}\right)$$

```
> series(x+sqrt(1+x^2),x=-infinity,14);
```

$$-\frac{1}{2x}+\frac{1}{8x^3}-\frac{1}{16x^5}+\frac{5}{128x^7}-\frac{7}{256x^9}+\frac{21}{1024x^{11}}-\frac{33}{2048x^{13}}+O\left(-\frac{1}{x^{15}}\right)$$

```
> restart;
> g:=x->ln(x*tan(1/x));
```

$$g := x \to \ln\left(x\tan\left(\frac{1}{x}\right)\right)$$

```
> asympt(g(x),x);
```

$$\frac{1}{3x^2}+\frac{7}{90x^4}+O\left(\frac{1}{x^6}\right)$$

```
> asympt(g(x),x,15);
```

$$\frac{1}{3x^2}+\frac{7}{90x^4}+\frac{62}{2835x^6}+\frac{127}{18900x^8}+\frac{146}{66825x^{10}}+\frac{1414477}{1915538625x^{12}}+\frac{32764}{127702575x^{14}}+O\left(\frac{1}{x^{15}}\right)$$

```
> h:=x->x*ln(1+sin(1/x));
```

$$h := x \to x\ln\left(1+\sin\left(\frac{1}{x}\right)\right)$$

```
> asympt(h(x),x,10);
```

$$1-\frac{1}{2x}+\frac{1}{6x^2}-\frac{1}{12x^3}+\frac{1}{24x^4}-\frac{1}{45x^5}+\frac{61}{5040x^6}-\frac{17}{2520x^7}+\frac{277}{72576x^8}+O\left(\frac{1}{x^9}\right)$$

```
> f:=x->exp(1/x)*arctan(x);
```

$$f := x \to \mathbf{e}^{\left(\frac{1}{x}\right)} \arctan(x)$$

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

$$\frac{\pi}{2} + \frac{-1+\frac{\pi}{2}}{x} + \frac{-1+\frac{\pi}{4}}{x^2} + \frac{-\frac{1}{6}+\frac{\pi}{12}}{x^3} + \frac{\frac{\pi}{48}+\frac{1}{6}}{x^4} + \frac{-\frac{3}{40}+\frac{\pi}{240}}{x^5} + \mathrm{O}\left(\frac{1}{x^6}\right)$$

```
> asympt(f(-x),x);
```

$$-\frac{\pi}{2} + \frac{1+\frac{\pi}{2}}{x} + \frac{-1-\frac{\pi}{4}}{x^2} + \frac{\frac{1}{6}+\frac{\pi}{12}}{x^3} + \frac{-\frac{\pi}{48}+\frac{1}{6}}{x^4} + \frac{\frac{3}{40}+\frac{\pi}{240}}{x^5} + \mathrm{O}\left(\frac{1}{x^6}\right)$$

Faire d'autres exemples.

```
> restart;# Equations et inéquations
> S:=solve(x^3-3*sqrt(2)*x^2+4*sqrt(2)-4,x);
```

$$S := 1+\sqrt{2}+\sqrt{3},\ 1+\sqrt{2}-\sqrt{3},\ -2+\sqrt{2}$$

```
> S1:=solve(x^3-3*x^2+3*x+11);
```

$$S1 := -12^{(1/3)}+1,\ \frac{12^{(1/3)}}{2} - \frac{1}{2} I \sqrt{3}\ 12^{(1/3)} + 1,\ \frac{12^{(1/3)}}{2} + \frac{1}{2} I \sqrt{3}\ 12^{(1/3)} + 1$$

```
> evalf(%);
```

$$-1.289428485,\ 2.144714242 - 1.982703228\, I,\ 2.144714242 + 1.982703228\, I$$

```
> s:={x+2*y+3*z=0,2*x+3*y+4*z=1,3*x+4*y+5*z=2};
```

$$s := \{x+2y+3z=0,\ 2x+3y+4z=1,\ 3x+4y+5z=2\}$$

```
> solve(s,{x,y,z});
```

$$\{y=-1-2z,\ x=2+z,\ z=z\}$$

```
> solve(x^2+1<=2,x);
```

$$\mathrm{RealRange}(-1, 1)$$

c'est à dire l'intervalle [-1,1].

```
> solve(x^2+1<2,x);
```

$$\mathrm{RealRange}(\mathrm{Open}(-1), \mathrm{Open}(1))$$

c'est à dire l'intervalle]-1,1[.

```
> solve(1-x^2<=-1,x);
```

$$\mathrm{RealRange}(-\infty, -\sqrt{2}),\ \mathrm{RealRange}(\sqrt{2}, \infty)$$

L'ensemble des solutions est une réunion de deux intervalles.

```
> solve(1-x^2>-1,x);
```

$$\mathrm{RealRange}(\mathrm{Open}(-\sqrt{2}), \mathrm{Open}(\sqrt{2}))$$

```
> restart;
> P:=x^4-2*x^3+5*x^2-x+1;
```

$$P := x^4 - 2x^3 + 5x^2 - x + 1$$

```
> solve(P);
```

$$\mathrm{RootOf}(_Z^4 - 2\,_Z^3 + 5\,_Z^2 - _Z + 1, index = 1),$$
$$\mathrm{RootOf}(_Z^4 - 2\,_Z^3 + 5\,_Z^2 - _Z + 1, index = 2),$$

$$\mathrm{RootOf}(_Z^4 - 2\,_Z^3 + 5\,_Z^2 - _Z + 1, index = 3),$$
$$\mathrm{RootOf}(_Z^4 - 2\,_Z^3 + 5\,_Z^2 - _Z + 1, index = 4)$$

```
> evalf(%);
```

$$0.9352303314 + 1.913805353\,I,\ 0.06476966861 + 0.4649730679\,I,\ 0.06476966861 - 0.4649730679\,I,\ 0.9352303314 - 1.913805353\,I$$

```
> fsolve(P);
> fsolve(P,x,real);# P n'a pas de racine réelle.
> fsolve(P,x,complex);
```

$$0.06476966861 - 0.4649730679\,I,\ 0.06476966861 + 0.4649730679\,I,\ 0.9352303314 - 1.913805353\,I,\ 0.9352303314 + 1.913805353\,I$$

```
> restart;
> f:=x->x*exp(x)-x^2+x^3;
```

$$f := x \to x\,\mathbf{e}^x - x^2 + x^3$$

```
> solve(f(x)=2,x);
```

$$\mathrm{RootOf}(\mathbf{e}^{-Z}\,_Z - _Z^2 + _Z^3 - 2)$$

```
> evalf(%);
```

$$-0.4105399915 - 1.170803211\,I$$

ça donne ici une racine complexe !

```
> fsolve(f(x)=2,x=-10..10);
```

$$0.8743428938$$

```
> fsolve(f(x)=10,x=-infinity..infinity);
```

$$1.630376937$$

```
> fsolve(f(x)=-1,x,real);
```

$$-0.6365756122$$

```
> fsolve(f(x)=-1,x,complex);
```

$$-0.6365756122$$

```
> solve({x^2+y^2=1,x^2-y^2=1/2},{x,y});
>
```

$$\{y = \frac{1}{2}, x = \frac{1}{2}\,\mathrm{RootOf}(_Z^2 - 3, label = _L1)\},\ \{y = \frac{-1}{2}, x = \frac{1}{2}\,\mathrm{RootOf}(_Z^2 - 3, label = _L1)\}$$

```
> simplify(%);
```

$$\{\frac{1}{2}\,\mathrm{RootOf}(_Z^2 - 3, label = _L1) = \frac{1}{2}\,\mathrm{RootOf}(_Z^2 - 3, label = _L1), \frac{-1}{2} = \frac{1}{2}\}$$

```
> value(%);
```

$$\{\frac{1}{2}\,\mathrm{RootOf}(_Z^2 - 3, label = _L1) = \frac{1}{2}\,\mathrm{RootOf}(_Z^2 - 3, label = _L1), \frac{-1}{2} = \frac{1}{2}\}$$

```
> eval(%);
```

$$\{\frac{1}{2}\,\mathrm{RootOf}(_Z^2 - 3, label = _L1) = \frac{1}{2}\,\mathrm{RootOf}(_Z^2 - 3, label = _L1), \frac{-1}{2} = \frac{1}{2}\}$$

```
> evalf(%);
```

$$\{0.8660254040 = 0.8660254040, -0.5000000000 = 0.5000000000\}$$

```
> fsolve({x^2+y^2=1,x^2-y^2=1/2},{x,y});
```

$$\{x = 0.8660254038, y = -0.5000000000\}$$

Posez vous d'autres équations et inéquations et demandez à Maple de les résoudre.

```
> restart;# Suites récurrentes
> u[n]:=rsolve({u(n)=2*u(n-1)-u(n-2),u(0)=1,u(1)=-1},u);
```

$$u_n := 1 - 2\,n$$

```
> limit(u[n],n=infinity);
```

$$-\infty$$

```
> restart;
> u[n]:=rsolve({u(n)=-u(n-1)-u(n-2),u(0)=0,u(1)=1},u);
```

$$u_n := -\frac{1}{3} I \sqrt{3} \left(-\frac{1}{2} + \frac{1}{2} I \sqrt{3}\right)^n + \frac{1}{3} I \sqrt{3} \left(-\frac{1}{2} - \frac{1}{2} I \sqrt{3}\right)^n$$

```
> restart;
> u[n]:=rsolve({u(n)=3*u(n-1)+2*u(n-2),u(0)=-1,u(1)=2},u);
```

$$u_n := \left(-\frac{7\sqrt{17}}{34} - \frac{1}{2}\right)\left(\frac{3}{2} - \frac{\sqrt{17}}{2}\right)^n + \left(\frac{7\sqrt{17}}{34} - \frac{1}{2}\right)\left(\frac{3}{2} + \frac{\sqrt{17}}{2}\right)^n$$

```
> limit(u[n],n=infinity);
```

$$\infty$$

```
> restart;
> u[n]:=rsolve({u(n)=6*u(n-1)-11*u(n-2)+6*u(n-3),u(m=0..2)=m},u);
```

$$u_n := 2\,2^n - \frac{3}{2} - \frac{3^n}{2}$$

```
> limit(u[n],n=infinity);
```

$$-\infty$$

```
> u[10]:=subs(n=10,u[n]);
```

$$u_{10} := -27478$$

```
> u[5]:=subs(n=5,u[n]);
```

$$u_5 := -59$$

```
> restart;# Développements asymptotiques et équivalents
> f:=x->cos(1/x)**x;
```

$$f := x \to \cos\left(\frac{1}{x}\right)^x$$

```
> asympt(f(x),x,15);
```

$$1 - \frac{1}{2\,x} + \frac{1}{8\,x^2} - \frac{5}{48\,x^3} + \frac{17}{384\,x^4} - \frac{379}{11520\,x^5} + \frac{251}{15360\,x^6} - \frac{1481}{129024\,x^7} + \frac{190243}{30965760\,x^8} - \frac{3887381}{928972800\,x^9} + \frac{137887}{58982400\,x^{10}} - \frac{383390719}{245248819200\,x^{11}} + \frac{586925819}{653996851200\,x^{12}} - \frac{70591927621}{119027426918400\,x^{13}} + O\left(\frac{1}{x^{14}}\right)$$

```
> series(f(x),x=infinity);
```

$$1-\frac{1}{2\,x}+\frac{1}{8\,x^2}-\frac{5}{48\,x^3}+\frac{17}{384\,x^4}-\frac{379}{11520\,x^5}+\mathrm{O}\left(\frac{1}{x^6}\right)$$

```
> series(f(x),x=-infinity);
```

$$1-\frac{1}{2\,x}+\frac{1}{8\,x^2}-\frac{5}{48\,x^3}+\frac{17}{384\,x^4}+\mathrm{O}\left(-\frac{1}{x^5}\right)$$

```
> series(leadterm(1-f(x)),x=infinity);
```

$$\frac{1}{2\,x}$$

```
> u[n]:=ln(n+1)-ln(n);
```

$$u_n := \ln(n+1)-\ln(n)$$

```
> series(u[n],n=infinity);
```

$$\frac{1}{n}-\frac{1}{2\,n^2}+\frac{1}{3\,n^3}-\frac{1}{4\,n^4}+\frac{1}{5\,n^5}+\mathrm{O}\left(\frac{1}{n^6}\right)$$

```
> asympt(u[n],n);
```

$$\frac{1}{n}-\frac{1}{2\,n^2}+\frac{1}{3\,n^3}-\frac{1}{4\,n^4}+\frac{1}{5\,n^5}+\mathrm{O}\left(\frac{1}{n^6}\right)$$

```
> v[n]:=sum(1/k,k=1..n);
```

$$v_n := \Psi(n+1)+\gamma$$

```
> asympt(v[n],n);
```

$$\ln(n)+\gamma+\frac{1}{2\,n}-\frac{1}{12\,n^2}+\frac{1}{120\,n^4}+\mathrm{O}\left(\frac{1}{n^6}\right)$$

```
> series(v[n],n=infinity);
```

$$\ln(n)+\gamma+\frac{1}{2\,n}-\frac{1}{12\,n^2}+\frac{1}{120\,n^4}+\mathrm{O}\left(\frac{1}{n^6}\right)$$

```
> w[n]:=sum(1/(k**3),k=n+1..infinity);
```

$$w_n := -\frac{1}{2}\,\Psi(2,n+1)$$

```
> asympt(w[n],n);
```

$$\frac{1}{2\,n^2}-\frac{1}{2\,n^3}+\frac{1}{4\,n^4}+\mathrm{O}\left(\frac{1}{n^6}\right)$$

```
> asympt(w[n],n,20);
```

$$\frac{1}{2\,n^2}-\frac{1}{2\,n^3}+\frac{1}{4\,n^4}-\frac{1}{12\,n^6}+\frac{1}{12\,n^8}-\frac{3}{20\,n^{10}}+\frac{5}{12\,n^{12}}-\frac{691}{420\,n^{14}}+\frac{35}{4\,n^{16}}-\frac{3617}{60\,n^{18}}+\mathrm{O}\left(\frac{1}{n^{20}}\right)$$

```
> x[n]:=sum(1/sqrt(k),k=1..n);
```

$$x_n := \sum_{k=1}^{n}\frac{1}{\sqrt{k}}$$

```
> asympt(x[n],n,10);
```

$$\frac{2}{\sqrt{\frac{1}{n}}} + \zeta\left(\frac{1}{2}\right) + \frac{\sqrt{\frac{1}{n}}}{2} - \frac{\left(\frac{1}{n}\right)^{(3/2)}}{24} + \frac{\left(\frac{1}{n}\right)^{(7/2)}}{384} - \frac{\left(\frac{1}{n}\right)^{(11/2)}}{1024} + \frac{143\left(\frac{1}{n}\right)^{(15/2)}}{163840} - \frac{1105\left(\frac{1}{n}\right)^{(19/2)}}{786432} + O\left(\frac{1}{n^{10}}\right)$$

```
>
```