Řešte rovnici $x^3 - 5x + 4 = 0$

```
> restart;
```

```
> rov:=x^3-5*x+4=0;
```

$$rov := x^3 - 5x + 4 = 0$$

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

$$1, -\frac{1}{2} + \frac{\sqrt{17}}{2}, -\frac{1}{2} - \frac{\sqrt{17}}{2}$$

```
> D3:=-4*p^3-27*q^2;
```

$$D3 := -4p^3 - 27q^2$$

```
> p:=-5; q:=4;
```

$$p := -5$$

$$q := 4$$

```
> D3;
```

$$68$$

```
> u1:=(-q/2+1/18*sqrt(-3*D3))^(1/3);
  v1:=(-q/2-1/18*sqrt(-3*D3))^(1/3); epsilon:=-1/2+I*sqrt(3)/2;
```

$$u1 := \left(-2 + \frac{1}{9} I\sqrt{51}\right)^{(1/3)}$$

$$v1 := \left(-2 - \frac{1}{9} I\sqrt{51}\right)^{(1/3)}$$

$$\varepsilon := -\frac{1}{2} + \frac{1}{2} I\sqrt{3}$$

```
> x1:=u1+v1; x2:=epsilon*u1+epsilon^2*v1;
  x3:=epsilon^2*u1+epsilon*v1;
```

$$x1 := \left(-2 + \frac{1}{9} I\sqrt{51}\right)^{(1/3)} + \left(-2 - \frac{1}{9} I\sqrt{51}\right)^{(1/3)}$$

$$x2 := \left(-\frac{1}{2} + \frac{1}{2} I\sqrt{3}\right)\left(-2 + \frac{1}{9} I\sqrt{51}\right)^{(1/3)} + \left(-\frac{1}{2} + \frac{1}{2} I\sqrt{3}\right)^2\left(-2 - \frac{1}{9} I\sqrt{51}\right)^{(1/3)}$$

$$x3 := \left(-\frac{1}{2} + \frac{1}{2} I\sqrt{3}\right)^2\left(-2 + \frac{1}{9} I\sqrt{51}\right)^{(1/3)} + \left(-\frac{1}{2} + \frac{1}{2} I\sqrt{3}\right)\left(-2 - \frac{1}{9} I\sqrt{51}\right)^{(1/3)}$$

```
> evalf(x1); evalf(x2); evalf(x3);
```

$$1.561552813 + 0.\,I$$

$$-2.561552814 + 0.4\,10^{-9}\,I$$

$$1.000000001 + 0.\,I$$

Řešení casus irreducibilis užitím trigonometrické substituce

```
> restart;
```

```
> rov:=x^3-5*x+4=0;
```

$$rov := x^3 - 5\,x + 4 = 0$$

```
> p:=-5; q:=4;
```

$$p := -5$$

$$q := 4$$

```
> alpha:=1/3*arccos((-q/2)/sqrt((-p/3)^3));
```

$$\alpha := \frac{\pi}{3} - \frac{1}{3}\arccos\left(\frac{6\sqrt{15}}{25}\right)$$

```
> x1:=2*sqrt(-p/3)*cos(alpha); x2:=2*sqrt(-p/3)*cos(alpha+2*Pi/3);
  x3:=2*sqrt(-p/3)*cos(alpha+4*Pi/3);
```

$$x1 := \frac{2}{3}\sqrt{15}\,\sin\left(\frac{\pi}{6} + \frac{1}{3}\arccos\left(\frac{6\sqrt{15}}{25}\right)\right)$$

$$x2 := -\frac{2}{3}\sqrt{15}\,\cos\left(\frac{1}{3}\arccos\left(\frac{6\sqrt{15}}{25}\right)\right)$$

$$x3 := \frac{2}{3}\sqrt{15}\,\sin\left(\frac{\pi}{6} - \frac{1}{3}\arccos\left(\frac{6\sqrt{15}}{25}\right)\right)$$

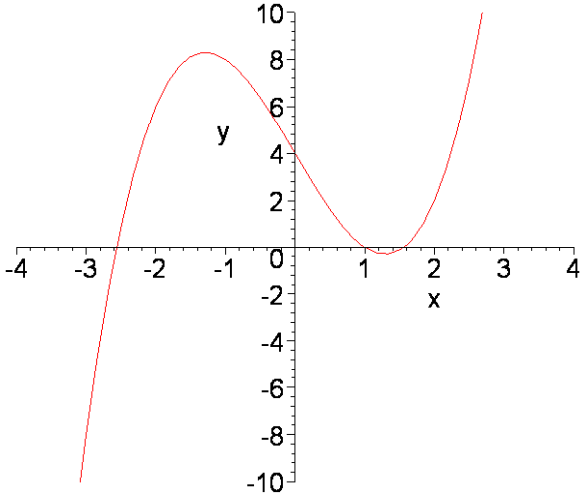
```
> evalf(x1); evalf(x2); evalf(x3);
```

1.561552813

-2.561552813

1.000000000

```
> plot(lhs(rov),x=-4..4,y=-10..10);
```




```
>
```