start with a general cubic polynomial

```
G[x_] := x^3 + A x^2 + B x + C
```

```
G[x - A / 3]
```

$$C + B \left(-\frac{A}{3} + x\right) + A \left(-\frac{A}{3} + x\right)^2 + \left(-\frac{A}{3} + x\right)^3$$

```
Simplify[G[x - A / 3]]
```

$$\frac{2 A^3}{27} - \frac{A B}{3} + C - \frac{A^2 x}{3} + B x + x^3$$

```
Collect[Simplify[G[x - A / 3]], x]
```

$$\frac{2 A^3}{27} - \frac{A B}{3} + C + \left(-\frac{A^2}{3} + B\right) x + x^3$$

and a solution!

```
(q + (q^2 - p^3)^(1 / 2))^(1 / 3) + (q - (q^2 - p^3)^(1 / 2))^(1 / 3)
```

$$\left(q - \sqrt{-p^3 + q^2}\right)^{1/3} + \left(q + \sqrt{-p^3 + q^2}\right)^{1/3}$$

```
p = d / 3; q = e / 2; (q + (q^2 - p^3)^(1 / 2))^(1 / 3) + (q - (q^2 - p^3)^(1 / 2))^(1 / 3)
```

$$\left(\frac{e}{2} - \sqrt{-\frac{d^3}{27} + \frac{e^2}{4}}\right)^{1/3} + \left(\frac{e}{2} + \sqrt{-\frac{d^3}{27} + \frac{e^2}{4}}\right)^{1/3}$$

```
d = 6; e = 9; %5
```

3

```
Clear[p, q, d, e]
```