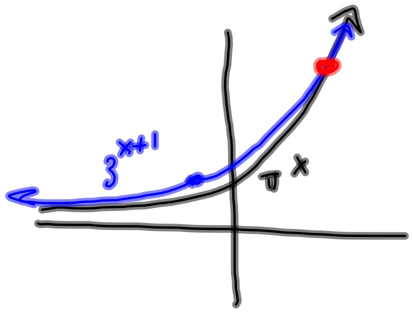
Solve

$\pi^x = 3^{x+1}$



$\log_\pi(\pi^x) = \log_\pi(3^{x+1})$

$x = (x+1)\log_\pi(3)$

Let $b = \log_\pi(3)$

$x = (x+1)b = bx + b$

$x - bx = b$

$x(1-b) = b$

$x = \dfrac{b}{1-b} = \dfrac{\log_\pi(3)}{1-\log_\pi(3)}$ $\dfrac{7}{10}$

$\dfrac{8}{10}$ $= \dfrac{\frac{\ln(3)}{\ln(\pi)}}{1-\frac{\ln(3)}{\ln(\pi)}} = \ln(3)/\ln(\pi)/(1-\ln(3)/\ln(\pi))$

To 4 places!

≈ 23.8220

$x = (x+1)(5)$

$x = 5x + 5$

$-5x = -5x$

$-4x = 5$

$x = -\dfrac{5}{4}$

```
/ln(81)
          .6031416942
1/√(2)
          .7071067812
ln(3)/ln(π)/(1-l
n(3)/ln(π))
          23.8219759
```

$$\pi^x = 3^{x+1}$$

$$\log_3(\pi^x) = \log_3(3^{x+1})$$

$$x \log_3 \pi = x + 1$$

$$x \log_3 \pi - x = 1$$

$$x(\log_3 \pi - 1) = 1$$

Take your pick

$$x = \frac{1}{\log_3 \pi - 1} = \frac{1}{\frac{\log \pi}{\log 3} - 1} = \frac{1}{\frac{\ln \pi}{\ln 3} - 1} \approx$$

23.8220

```
      .7071067812
ln(3)/ln(π)/(1-l
n(3)/ln(π))
       23.8219759
1/(ln(π)/ln(3)-1
)
       23.8219759
█
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$$3^{x+1} = \pi^{x}$$

$$\ln(3^{x+1}) = \ln(\pi^{x})$$

$$(x+1)\ln 3 = x\ln\pi$$

$$x\ln 3 + \ln 3 = x\ln\pi$$

$$(\ln 3)x + \ln 3 = (\ln\pi)x$$

$$(\ln 3)x - (\ln\pi)x = -\ln 3$$

$$(\ln 3 - \ln\pi)x = -\ln 3$$

$$x = \frac{-\ln 3}{\ln 3 - \ln\pi}$$

```
           23.8219759
1/(ln(π)/ln(3)-1
)
           23.8219759
-ln(3)/(ln(3)-ln
(π))
           23.8219759
```

Recall Annuity

Payments are made into a bank account at the beginning of the month for 4 years. The account earns 4% APR, compounded monthly. How much will you have @ maturity? Make pmts of \$400

$$i = \frac{r}{m} = \frac{.04}{12} \qquad \begin{cases} t = 4 \text{ yrs} \\ m = 12 \text{ per year} \\ r = .04 \end{cases} \quad n = mt = 48$$

$$a + ab + ab^2 + \cdots + ab^{n-1} = \frac{a(1-b^n)}{1-b}$$

$$R(1+i)^n + R(1+i)^{n-1} + \cdots + R(1+i)^2 + R(1+i)$$

$$\underbrace{R(1+i)}_{a} + \underbrace{R(1+i)^2}_{b} + \cdots + R(1+i)^{n-1} + R(1+i)^n$$

$$R(1+i)(1+i) + \cdots + R(1+i)(1+i)^{n-2} + R(1+i)(1+i)^{n-1}$$

$a = R(1+i)$

$b = (1+i)$

$n = 48$

$R = 400$

$$\text{So } S_{48} = \frac{a(1-b^n)}{1-b} = \frac{R(1+i)\left(1-(1+i)^{48}\right)}{1-(1+i)} \quad \xrightarrow{} -i$$

$$= \frac{400\left(1+\frac{.04}{12}\right)\left(1-\left(1+\frac{.04}{12}\right)^{48}\right)}{-\frac{.04}{12}}$$

$400 * (1 + \frac{.04}{12}) * (1 - (1 + \frac{.04}{12})^{\wedge} 48) / ((-).04/12)$

```
400*48
                19200
400*(1+.04/12)*(
1-(1+.04/12)^48)
/(-.04/12)
           20853.11986
```

$\approx \$20,853.12$

Nov 12-10:35 AM

Same Problem. Pmts @ END of month

$R(1+i)^{n-1} + R(1+i)^{n-2} + \cdots + R(1+i) + R$

1st pmt earns n-1 periods' worth of interest.

$= R + R(1+i) + \cdots + R(1+i)^{n-1}$

$= \dfrac{R(1-(1+i)^n)}{-i}$ Simple, ordinary annuity certain

$1-(1+i) = -i$

Nov 12-10:53 AM

Loans: Banker is buying an annuity from you.
He expects you to earn him interest for the money you borrowed

P = Principal R = Payments

$$A = P(1+i)^n = R\frac{(1-(1+i)^n)}{-i} = \text{FV of annuity}$$

The loan equation.

$$= \frac{R((1+i)^n - 1)}{i}$$