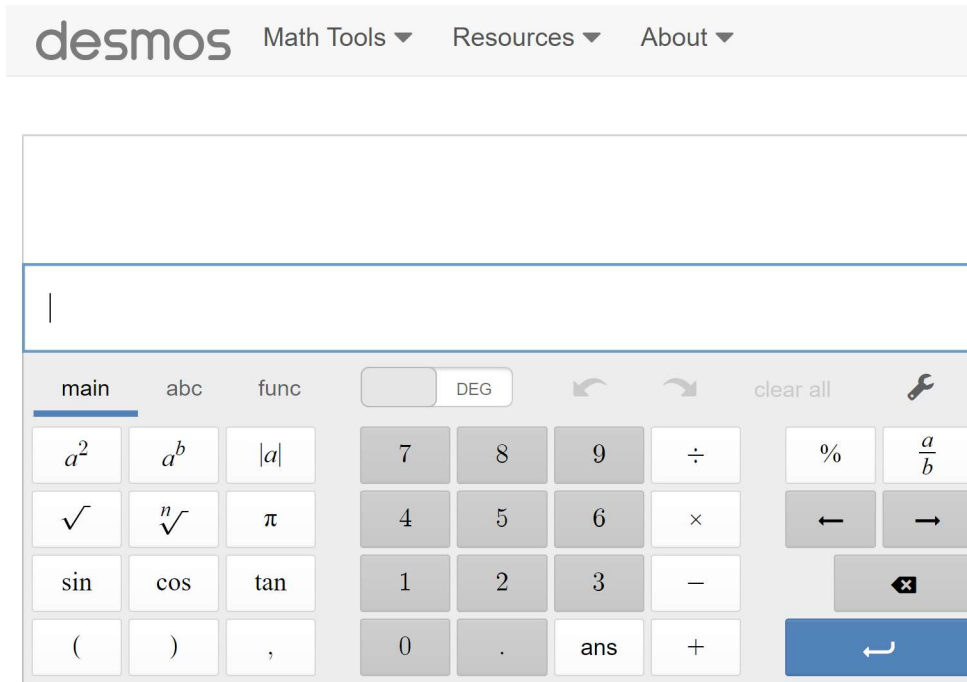


You will need a scientific
or graphing calculator for
today's assignment.



Warm-up: Put at top of today's paper for 4.5

a) evaluate without
a calculator:

$$\frac{\log 10}{\log 100} = \boxed{\frac{1}{2}}$$

**NOW VERIFY WITH
A CALCULATOR!**

b) evaluate with
a calculator:

$$\ln 10 = 2.3$$

$$\ln 100 = 4.6$$

$$\frac{\ln 10}{\ln 100} = \frac{2.3}{4.6} = \boxed{\frac{1}{2}}$$

Solution will be the same due to ratios computed with like bases.

Notes: 4.5 Solving Logarithmic Equations

Reminders:

$$\ln e = 1$$

base *exp*

because $e^1 = e$

base *exp* *value*

$$\ln 1 = 0$$

e

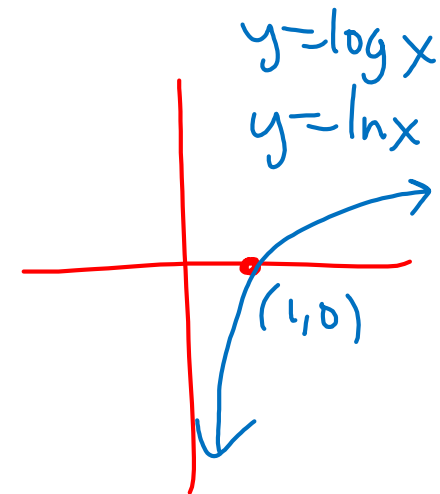
$$e^0 = 1$$

$$\log_{10} 10 = 1$$

because $10^1 = 10$

$$\log_{10} 1 = 0$$

$$10^0 = 1$$



Notes: 4.5

Reminder:

$\log_{10} 0 = \text{no solution}$

← or undefined

(because $10^x \neq 0$)

$\log(\text{neg \#}) = \text{no solution}$

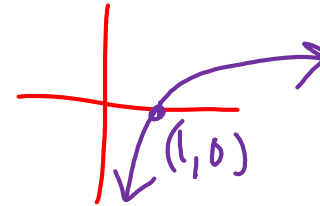
$10^x \neq \text{neg \#}$

$\ln 0 = \text{no solution}$

$e^x \neq 0$

$\ln(\text{neg \#}) = \text{no solution}$

$e^x \neq \text{neg \#}$



The same is true for any given base!

Notes: 4.5 Solving Logarithmic Equations

- Isolate exponential term.
- Apply **ln** or **log** to both sides of the equation.
- “Bring down” the exponent.
- Solve for x .

Important:

- *If given base **e**, use **ln** to solve.
- *If given base **10**, use **log** to solve.
- *If given any other base, use ln or log.

natural log used most often ↑

Show work! Clearly show all steps.

$$16. \quad 3^{2x-1} = 5$$

✓ $\ln 3^{2x-1} = \ln 5$

$$\frac{(2x-1)\ln 3}{\ln 3} = \frac{\ln 5}{\ln 3}$$

$$2x-1 = \frac{\ln 5}{\ln 3}$$

$$\frac{1}{2} 2x = \frac{1}{2} \left(\frac{\ln 5}{\ln 3} + 1 \right)$$

$$x = \frac{1}{2} \left(\frac{\ln 5}{\ln 3} + 1 \right)$$

$$x \approx 1.232487$$

- Isolate exponential term
- Apply ln or log to both sides of the equation
- “Bring down” the exponent
- Solve for x (exact value and approximate value)

Show work! Clearly show all steps.

$$18. \quad \frac{2e^{12x}}{2} = \frac{17}{2}$$

$$\ln e^{12x} = \ln \frac{17}{2}$$

$$12x \cancel{\ln e} = \ln \frac{17}{2}$$

$$x = \frac{1}{12} \ln \frac{17}{2}$$

$$x \approx .178339$$

or ~~$$\frac{\ln \frac{17}{2}}{12}$$~~

- Isolate exponential term
- Apply ln or log to both sides of the equation
- “Bring down” the exponent
- Solve for x (exact value and approximate value)

Show work! Clearly show all steps.

$$32. \quad (5^3)^x + 5^{3x+1} = 200$$

$$5^{3x} + 5^{3x+1} = 200$$

$$\underline{5}^{3x} + \underline{5}^{3x} \cdot 5^1 = 200$$

$$5^{3x} (1 + 5^1) = 200$$

$$5^{3x} \left(\frac{6}{6} \right) = \frac{200}{6} \begin{matrix} -2 \\ -2 \end{matrix}$$

$$5^{3x} = \frac{100}{3}$$

- Rewrite with like bases, then factor

- Isolate exponential term

- Apply ln or log to both sides of the equation

- “bring down” the exponent

- Solve for x

→ Continued on next slide

$$\log 5^{3x} = \log \frac{100}{3}$$

$$\frac{3x \log 5}{3 \log 5} = \frac{\log \frac{100}{3}}{3 \log 5}$$

$$x = \frac{\log \frac{100}{3}}{3 \log 5}$$

exact value

$$x \approx 0.726249$$

Show work! Clearly show all steps.

Use **like bases** on both sides to solve, if possible.

If not, then **apply ln or log** to both sides.

3. $5^{x-1} = 125$

19. CHECK ANSWER: $t = \frac{\ln \frac{10}{3}}{12 \ln 1.025}$

book answer $\rightarrow t = \frac{\ln \frac{10}{3}}{12 \ln \frac{41}{40}}$

← They converted the decimal to a fraction. (Not necessary.)

25. CHECK ANSWER: $x = \frac{-14}{\log 3}$

book answer $\rightarrow t = \frac{14 \log 0.1}{\log 3}$

← log 0.1 can be simplified further. (which will be required on the unit test)