

Solving Exponential Equations Using Technology

Example 1: Solve $2^x = 16$. Explain your strategy.

Ans: $2^x = 16$
 $2^x = 2^4$ ← write 16 as a power with base 2
 $\therefore \boxed{x = 4}$ ← equate the exponents

Example 2: Can you use the same strategy to solve $2^x = 25$?

Explain.

Ans: We cannot use the same strategy to solve $2^x = 25$ since we cannot write 25 as a power with base 2.

Most exponential equations cannot be easily expressed as powers of the same base.

Use Systematic Trial and Error to solve $2^x = 25$ to 2 decimal places.

What powers of 2 does 25 fall between? Which value is it closer to?

$$2^4 = 16$$

$$2^5 = 32$$

so, x must be between 4 and 5 and it's slightly closer to 5.

Try $x = 4.5$, $2^{4.5} \doteq 22.6$

Try $x = 4.7$, $2^{4.7} \doteq 25.99$

Try $x = 4.6$, $2^{4.6} \doteq 24.25$

Try $x = 4.65$, $2^{4.65} \doteq 25.1$

So, $x = 4.65$.

Solving $2^x = 25$ algebraically.

$$2^x = 25$$

$$\log 2^x = \log 25 \quad \leftarrow \text{take the log of both sides}$$

$$x \log 2 = \log 25$$

$$\frac{x \log 2}{\log 2} = \frac{\log 25}{\log 2} \quad \leftarrow \text{divide by } \log 2$$

$$x = \frac{\log 25}{\log 2}$$

$$\boxed{x \doteq 4.64}$$

Using a Graph $2^x = 25$

1. Enter the equation $y = 2^x$ in Y1. Enter 25 in Y2. (Follow instructions on Pg. 383)

$$Y_1 = 2^x \text{ \& } Y_2 = 25$$

2. Check your window settings and adjust as necessary.

```
WINDOW
Xmin=-2
Xmax=10
Xscl=1
Ymin=-2
Ymax=30
Yscl=5
Xres=1
```

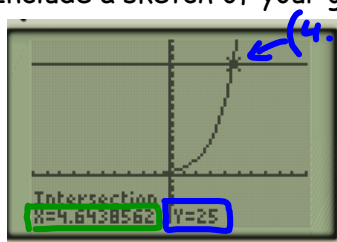
3. Pres Graph.

4. Use the INTERSECT function on the graphing calculator to find the point of intersection.

Press **2nd** **TRACE** **5** At each prompt press ENTER.

Record the value of x to two decimal places.

Include a sketch of your graph in your notes.

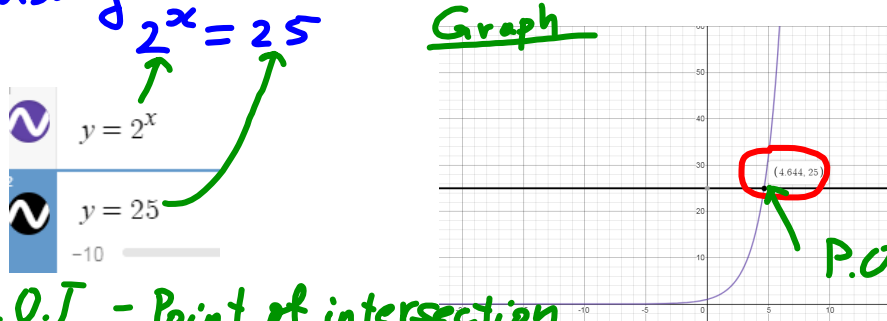


So, $x \approx 4.64$ is the approximate solution.

Keystrokes to remember:

1. Store the left side of the exp. equation in Y_1
Store the right side of the exp. equ. in Y_2
2. Adjust the window settings \leftarrow Press **w**
3. Graph \leftarrow Press **Graph**
4. Find the intersection (solution) \leftarrow 3 times
 \leftarrow **2nd** **TRACE** **5** **ENTER**

Using www.desmos.com



P.O.I. - Point of intersection.

$\therefore x = 4.644$ is the approximate solution.

Homework: Pg. 384: #9, 13-16, 18, 19