Lesson #42

Solving Systems of Equations on the Calculator:

1. Write down original equations.
2. Solve for y.
3. Plug in equations in the " $y =$" on your calculator.
4. Graph. Sketch on paper.
5. Find the solution(s). (Remember "solutions" means find the intersections. On calc: 2nd, Trace, #5 intersection .) Answers should be in point form.

Solve the system of Inequalities - no calculator:

1. Graph each equation by hand. Some may need special points. (You graph Quadratics and Absolute Values in the same way – special points, t-chart, etc…)
2. Decide if lines are dashed or solid.
3. Pick a test point for each equation to determine which side to shade.
4. Shade the solution. (Remember: The solution is where both shadings intersect.)

Lesson #43

- In **exponential functions**, the base is a constant and the exponent is variable. The exponential parent function is $\boldsymbol{y = b^x}$ where *b* is a positive number other than 1.
- For $y = b^x$, the asymptote is the x-axis, which is the horizontal line $y = k$, where $k = 0$.
- Since the graph never quite levels off completely, the **range** for $y = b^x$ is $y > k$
- Since the graph goes outward forever in both directions, the **domain** is *always* $\mathbb{R}$
- **Special Points for $\boldsymbol{y = b^x}$:**
    - The first special point is $(0, 1)$
    - The next special point is $(1, b)$
    - Other points: $(2,\ b^2),\ (3,\ b^3), etc$ ...
- **Transformation equation:** $\boldsymbol{y = b^{x-h} + k}$
    - *h* affects horizontal shift
    - *k* affects the vertical shift
    - Horizontal asymptote: $y = k$
- **Steps to Graph an Exponential Function:**

1. Identify and graph the horizontal asymptote (HA).
2. Write down special points (0, 1) (1, b).
3. Add the "h" value to the X's in your special points.
4. If “a” is negative (outside parentheses), make the “y” value in the special points negative.
   If “x” is negative (inside parentheses), make the “x” value in the special points negative.
   ~~ This is our reflection step. ~~
5. Add the "k" value to the Y's in your special points.
6. Plot the points and connect the dots. (Remember arrows!) The graph will always go horizontally along the asymptote.

- The letter $\boldsymbol{e}$ is used to represent a special irrational constant: $e \approx 2.71828$. This number is often used as a base for exponential functions.
- **Story Problems:** $\boldsymbol{y = Pe^{rt}}$
    - y = final amount (sometimes is denoted by A)
    - P = principal (initial amount)
    - r = rate (in decimal form)
    - t = time in years

Lesson #44

- $\mathrm{b^y = x}$ means $\log_{\mathrm{b}} \mathrm{x} = \mathrm{y}$
- $\mathrm{e^y = x}$ means $\ln \mathrm{x} = \mathrm{y}$
- $10^{\mathrm{y}} = \mathrm{x}$ means $\log_{10} \mathrm{x} = \mathrm{y}$ or $\log \mathrm{x} = \mathrm{y}$
- **<u>Transformation equation:</u>** $\boldsymbol{y = \log_b(x - h) + k}$
    - Vertical asymptote: $x = h$
    - The first special point is (1,0)
    - The next special point is $(b, 1)$
    - Other points: $(b^2, 2), (b^3, 3), etc$ ...
- **<u>Steps to Graph a Logarithm Function:</u>**

1. Identify and graph the Vertical asymptote (VA).
2. Write down special points (1, 0) (b, 1).
3. Add the "h" value to the X's in your special points.
4. If “a” is negative (outside parentheses), make the “y” value in the special points negative.
   If “x” is negative (inside parentheses), make the “x” value in the special points negative.
   ~~ This is our reflection step. ~~
5. Add the "k" value to the Y's in your special points.
6. Plot the points and connect the dots. (Remember arrows!) The graph will always go vertically along the asymptote.

Lesson #45

- Change of Base Property: $\log_{\mathrm{b}} \mathrm{x} = \frac{\log \mathrm{x}}{\log \mathrm{b}}$ or $\log_{\mathrm{b}} \mathrm{x} = \frac{\ln \mathrm{x}}{\ln \mathrm{b}}$
- Product Property: $\log_{\mathrm{b}}(\mathrm{mn}) = \log_{\mathrm{b}} \mathrm{m} + \log_{\mathrm{b}} \mathrm{n}$
- Quotient Property: $\log_{\mathrm{b}} \left(\frac{\mathrm{m}}{\mathrm{n}}\right) = \log_{\mathrm{b}} \mathrm{m} - \log_{\mathrm{b}} \mathrm{n}$
- Power Property: $\log_{\mathrm{b}}(\mathrm{m^p}) = \mathrm{p} \cdot \log_{\mathrm{b}} \mathrm{m}$