Section 1.4: Graphing (PREP WORK)

Using a graphing calculator or online at desmos.com/calculator, draw the graph of the following functions (Sketch all graphs in the space below each question. Use a window $X = -3 \cdots 3$, $Y = -10 \cdots 10$):

$Y_1 = X^2$
$Y_2 = X^2 + 3$
$Y_3 = X^2 + 6$
$Y_4 = X^2 - 3$
$Y_5 = X^2 - 6$

Explain how the constant at the end affects the graph of $f(x) = x^2$.

Draw the graph of the following functions (use a window $X = -5 \cdots 5$, $Y = -10 \cdots 10$):

$Y_1 = X^2$
$Y_2 = (X + 2)^2$
$Y_3 = (X + 4)^2$
$Y_4 = (X - 2)^2$
$Y_5 = (X - 4)^2$

Explain how the constant inside the parentheses affects the graph of $f(x) = x^2$.

Draw the graph of $Y_1 = X^2$ and $Y_2 = -X^2$. How does the negative sign affect the graph?

Draw the graph of $Y_1 = \ln(X)$ and $Y_2 = \ln(-X)$. How does the negative sign inside the parentheses affect the graph?

Graphs often use a **Logarithmic Scale**. Solve the following equations explicitly for y (NOTE: use properties of exponents to simplify!):

1. $\log_{10} y = mx + b$
2. $\log_{10} y = m(\log_{10} x) + b$.

Section 1.4: Graphing

Shifting/Reflecting Functions

From your prep work:
The graph of $y = f(x) + C$ shifts the graph of $f(x)$:

The graph of $y = f(x + C)$ shifts the graph of $f(x)$:

The graph of $y = -f(x)$

The graph of $y = f(-x)$

Vertical and horizontal stretching and compressing (trig functions only):

Logarithmic Scales

Since much of biology deals at the molecular/microscopic level, graphs can be difficult to illustrate. For example, masses at the microbial level can be measured in picograms (10^{-9} grams), nanograms (10^{-6} grams), and micrograms (10^{-3}grams). This is where **logarithmic scales** come in handy. Consider the above masses:

(NOTE: for a more in-depth discussion of scaling and measurement, see the following website: https://www.cell.com/current-biology/pdf/S0960-9822(08)01411-5.pdf)

Examples:

1. Sketch the graph of $f(x) = -(x-2)^2 + 3$. Describe how this graph is transformed from an appropriate "parent function".

2. Use logarithmic transformations to obtain linear equations. Sketch the graph on an appropriate logarithmic plot:

   (a) $R = 200r^{-4}$ (b) $P = 60(2^{t/4})$.