

Lesson 5: Representing Functions with Equations

Given the graph of a function, you can determine the transformations that have happened to the parent function to determine its equation.

1. Identify the **parent function** by observing the shape of the graph.
 - Each parent function has a distinct shape.
 - For exponential functions, this includes determining the base B if not given in the question.
2. Identify any **translations (shifts)** that have occurred.
 - It's often easiest to look at the vertex or the asymptotes, since those are not affected by dilations
 - Write the **equation** of the transformed function *with the appropriate shifts*.
3. Identify any **reflections** that have occurred. Represent those in the **equation**.
4. Finally, **choose a point** on the graph (not the vertex) and **substitute** its coordinates (x, y) into your equation to **solve algebraically** for either a or k . (usually identified in the question)

Jan 31-9:35 PM

Ex 1) The graph has undergone a transformation in the form $g(x) = a[k(x-d)] + c$. Determine the equation of the transformed function.

① Absolute Value: $g(x) = |k(x-d)| + c$ means $a = 1$

② Shifts: left 2 $d = -2$
down 5 $c = -5$

③ Reflections: No RITXA
maybe RITYA

④ Random Point:
Vertex $(-2, -5)$

$g(x) = |k(x-d)| + c$
 $1 = |k(0+2)| - 5$
 $6 = |k(2)|$
 $3 = |k|$
 $\pm 3 = k$

$g(x) = |3(x+2)| - 5$
or
 $g(x) = |-3(x+2)| - 5$

Apr 25-1:23 PM

Ex 2) The graph has undergone a transformation in the form $g(x) = a[f(x-d)] + c$. Determine the equation of the transformed function.

① Reciprocal: $g(x) = \frac{a}{f(x-d)} + c$ this means you can assume $k=1$

② Shifts: right 3 $d = +3$
up 2 $c = +2$

③ Reflections: RITXA
(Not RITYA this time because the question implied that $k=1$)

④ Random Point:
 $g(x) = \frac{a}{(x-d)} + c$
 $3 = \frac{a}{(-2-3)} + 2$
 $1 = \frac{a}{-5}$
 $-5 = a$

$g(x) = \frac{-5}{(x-3)} + 2$

Apr 25-1:33 PM

Ex 3) Determine an equation for the graph shown.

① Square Root: $g(x) = a\sqrt{k(x-d)} + c$

② Shifts: right 3 $d = +3$
down 1 $c = -1$

③ Reflections: RITXA
Both reflections happened

④ Solve for a ; set $k = -1$:
 $g(x) = a\sqrt{-k(x-d)} + c$
 $-3 = a\sqrt{-1(2-3)} - 1$
 $-2 = a\sqrt{-1(-1)}$
 $-2 = a\sqrt{1}$
 $-2 = a$
 $g(x) = -2\sqrt{-(x-3)} - 1$

Solve for k ; set $a = -1$:
 $g(x) = -1\sqrt{k(x-d)} + c$
 $-3 = -1\sqrt{k(2-3)} - 1$
 $-2 = -\sqrt{k(-1)}$
 $2 = \sqrt{-k}$
 $4 = -k$
 $-4 = k$

on $g(x) = -\sqrt{-4(x-3)} - 1$

Apr 25-1:35 PM

Determining the equation of an exponential function is especially challenging, since there are so many ways to write equivalent exponential functions using exponent laws.

Ex 4) Using exponent rules, find 3 equivalent functions for $f(x) = 4^x$

recall: $2^2 = 4$
 $16^{\frac{1}{2}} = 4$
 $\frac{1}{4}^{-1} = 4$

$g(x) = 2^{2x}$
 $g(x) = 16^{\frac{1}{2}x}$
 $g(x) = \frac{1}{4}^{-x}$

Apr 25-1:37 PM

Ex 5) The graph $f(x) = 3^x$ has undergone transformations including a horizontal dilation. Determine an equation for the transformed function.

① Exponential, base 3: $g(x) = 3^{k(x-d)} + c$ so you can assume that $a = 1$

② Shifts: up 6 $c = +6$

③ Reflections: RITXA
this means both reflections happened

④ $g(x) = aB^{k(x-d)} + c$
 $3 = -1(3)^{\frac{1}{5}(-5)} + 6$
 $-3 = -(3)^{-5k}$
 $3 = 3^{-5k}$
 $1 = -5k$
 $-\frac{1}{5} = k$

$g(x) = -(3)^{-\frac{1}{5}x} + 6$

May 3-10:48 AM

Ex 6) The graph $f(x) = 2^x$ has undergone transformations. Determine an equation for the function using

a) A vertical dilation \rightarrow means "a"

① Exponential $g(x) = a(2)^{k(x-d)} + c$
base 2

② Shifts: down 4 $c = -4$
We can assume $d = 0$

③ Reflections: No

④ $g(x) = a(2)^{k(x-d)} + c$
 $4 = a(2)^{1(0-0)} - 4$
 $8 = a(2)^0$
 $8 = a(1)$
 $8 = a$

$g(x) = 8(2)^x - 4$

Apr 25-1:42 PM

b) A horizontal shift \rightarrow "d"

① Exponential base 2 $g(x) = a(2)^{k(x-d)} + c$

② Shifts: down 4 $c = -4$
Something left $d = ?$
assume $k = 1, a = 1$

③ Reflections: no

④ $g(x) = a(2)^{k(x-d)} + c$
 $4 = 1(2)^{1(0-d)} - 4$
 $8 = 2^{-d}$
 $2^3 = 2^{-d}$
 $\therefore 3 = -d$
 $-3 = d$

$g(x) = 2^{x+3} - 4$

May 3-10:51 AM

HW U4L5 Day 1:

1. handout (do this first)
2. p. 73 #18, 22
3. p. 252 #9, 10