MAT 121-G13 Writing Project #2 Spring, 2019

Graphing Functions by Transforming Basic Functions

FORMATTING: This is semi-formal writing, here. You don't have to type it out, but you do need to be very clear. For the formatting guidelines, please see Writing Project #1. They're the same for tests and (face-to-face) homework, except on Tests and Writing Projects, don't waste time writing out the question details, because they come WITH (the cover sheet).

Online Students: Bring your Writing Project with you to the testing center, and turn it in before you take the test. Early Birds may mail the Writing Project to my mailing address, given in the syllabus.

DEADLINE for Early-Bird 10% Bonus is FRIDAY, February 22nd. Otherwise, just bring it with you to the test on Wednesday or Thursday, the 27th or 28th for full credit. Solutions will be revealed Monday, February 25th.

Main Resources: Chapter 2 Videos (and notes) and Writing Project 2 Videos (and notes).

Method 1: (See Problem #1 on which the following is based.)

0. $f(x)=\frac{1}{x^2}$; 1. $3f(x)=\frac{3}{x^2}$; 2. $3f(x-15)=\frac{3}{(x-15)^2}$; 3. $3f(5x-15)=\frac{3}{(5x-15)^2}$; 4. $3f(5x-15)-6=g(x)$

1. $(x,y)\mapsto(x,3y)$ 2. $(x,y)\mapsto(x+15,y)$ 3. $(x,y)\mapsto\left(\frac{1}{5}x,y\right)$ 4. $(x,y)\mapsto(x,y-6)$

1. vertical stretch by factor of 3; 2. Right 15 (delay); 3. Horizontal shrink by factor of 1/5; 4. Down 6.

Method 2:

0. $f(x)=\frac{1}{x^2}$; 1. $3f(x)=\frac{3}{x^2}$; 2. $3f(5x)=\frac{3}{(5x)^2}$; 3. $3f(5(x-3))=\frac{3}{(5(x-3))^2}$; 4. $3f(5(x-3)-6=g(x)$

1. $(x,y)\mapsto(x,3y)$ 2. $(x,y)\mapsto\left(\frac{1}{5}x,y\right)$ 3. $(x,y)\mapsto(x+3,y)$ 4. $(x,y)\mapsto(x,y-6)$

1. vertical stretch by factor of 3; 2. Horizontal shrink by factor of 1/5; 3. Right 3; 4. Down 6.

I prefer Method 2, because it's just better, for later (Trig, Calculus, Analysis in general), but beginners like Method 1, more, even though it puts a ceiling on their later understanding, which I don't like. In #1, by factoring out the 5 inside, you can SEE where the center of the action is, immediately. (Vertical asymptote: $x = 3$).

Graph the function $g(x)$ by transforming the graph of a basic function, $f(x)$.

1. $g(x)=\frac{3}{(5x-15)^2}-6$ (Use $(0,0),(1,1)$, and $(-1,11)$ as the 3 $(x,y)'s$ in the 1st graph.)
2. $g(x)=7(3x-21)^{1/3}+13$ (Use $(-1,-1),(0,0)$ and $(1,1)$ as the 3 points in the 1st graph.)
3. $g(x)=\frac{-3}{(5x-15)^3}-7$ (Asymptotes!)
4. $g(x)=5\sqrt{3x-12}-11$
5. $g(x)=-5\sqrt[3]{3x-12}+7$
6. $g(x)=7(5x-40)^4-9$

We treat lines and parabolas a little differently. They come up so often – plus the completing-the-square trick – we sidestep the whole $f(bx)$ issue and just work with $g(x)=a(x-h)^2+k$ and $g(x)=m(x-h)+k=m(x-x_1)+y_1$.

7. $g(x) = -7(x+4)+5$
8. $g(x) = 5(x+6)^2 - 8$

I expect you to complete the square to re-write these, just like the bonus problems in Test 1 (and tests to come).

9. $g(x) = x^2 + 8x - 9$

10. $g(x) = 7x^2 - 6x - 71$

One reason I stress point-slope form is that $y = m(x-h)+k$ corresponds to: $y = m(x - x_1) + y_1$.

The "cheat" for completing the square: $g(x) = ax^2 + bx + c = a(x-h)^2 + k = a\left(x - \frac{-b}{2a}\right)^2 + g\left(-\frac{b}{2a}\right)$

I think it's fine to use the "cheat" for a backup/check, but you really want to master the moves. They're much easier to remember, long-term than trying to memorize the $\frac{-b}{2a}$ thing, and how it fits in the formula. The moves are demonstrated over and over again in videos. Practice them. Own them. By the time you get to calculus, you want this technique to be quick-twitch, muscle memory.