MA137 – Calculus 1 with Life Science Applications
Course Introduction & Preliminaries and Elementary Functions
(Sections 1.1 & 1.2)

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August 23, 2017

Instructor

- Instructor: Alberto Corso
- Lecture: MWF 10:00-10:50am – CB 118
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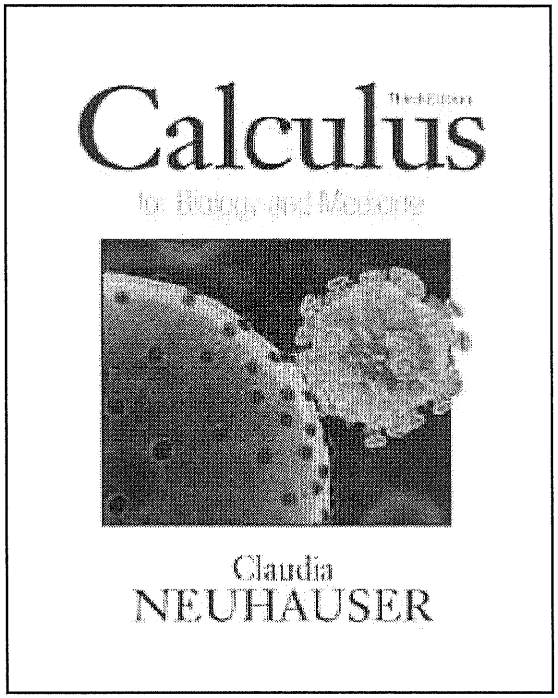
Teaching Assistants (TAs)

Section	Time/Location	TA information
005	TR 12:00-12:50pm – CB 339	**Eric Kaper**
007	TR 02:00-02:50pm – CB 339	eric.kaper@uky.edu
002	TR 09:00-09:50am – CB 339	**Darleen Perez-Lavin**
004	TR 11:00-11:50am – CB 339	darleenpl@uky.edu
006	TR 01:00-01:50pm – CB 339	**Chase Russell**
008	TR 03:00-03:50pm – CB 339	brandon.russell700@uky.edu
001	TR 08:00-08:50am – CB 339	**Julianne Vega**
003	TR 10:00-10:50am – CB 339	julianne.vega@uky.edu

Textbook



Title: Calculus for Biology and Medicine

Author: Claudia Neuhauser

Publisher: Pearson

Edition: Third

ISBN: ISBN 10: 0-321-64468-9
ISBN 13: 978-0-321-64468-8

Course Outline for MA 137

Ch. 1: Preview and review
Ch. 2: Discrete time models, sequences, and difference equations
Ch. 3: Limits and continuity
Ch. 4: Differentiation
Ch. 5: Applications of differentiation
Ch. 6: Integration

If you are planning on taking MA 138, the course outline for MA 138 is:

Ch. 7: Integration techniques and computational methods
Ch. 8: Differential equations
Ch. 9: Linear algebra and analytic geometry
Ch. 10: Multivariable calculus
Ch. 11: Systems of differential equations

Grading

You will be able to obtain a **maximum of 500 points** in this class, divided as follows:

- Three 2-hour exams, 100 points each;
- Final exam, 100 points;
- Homework, 40 points;
- Quizzes, 40 points;
- Final project (Gen Ed requirement), 20 points;

Your final grade for the course will be based on the total points you have earned as follows:

A: 450-500	B: 400-449	C: 350-399	D: 300-349	E: 0-299
$\geq 90\%$	$\geq 80\%$	$\geq 70\%$	$\geq 60\%$	$< 60\%$

Exams (Regular and Alternate)

Regular Exams will be given on Tuesdays from 5:00 to 7:00 pm

- September 19
- October 17
- November 14

The **Final Exam** will take place on Wednesday, December 13, from 6:00 to 8:00 pm

Alternate Exams for Exams 1-3 are given on the same day as the regular exams from 7:30 to 10:00 pm.

Review Sessions will be held on Monday September 18, October 16 and November 13 from 6:00 to 8:00 pm.

Homework

- The homework associated to MA137 is mostly done **online**. There are **three exceptions** where there are three **handwritten** homework assignments.
- The online homework (WeBWorK) can be accessed through
  https://webwork.as.uky.edu/webwork2/MA137F17/
- Your username is your **Link Blue user ID** (use capital letters!) and your password is **your 8 digit student ID number**.
- You can try online problems as many times as you like. The system will tell you if your answer is correct or not. You can email the TA a question from each of the problem. TAs will always do their best to respond within 24 hours.
- **Don't wait until the last minute!**

REEF Polling

- If you are taking an introductory Biology or Chemistry class you are likely to be required to use REEF Polling by iClicker.
- If you already have a REEF account, add this course by selecting the "+" button on the top-right of your Courses page, selecting the University of Kentucky as your institution, and searching for this course, "MA 137 - Calculus 1 with Life Science Applications."
- REEF polling by iClicker lets you use your laptop, smart phone, tablet, or physical iClicker remote to answer questions in class.
- To create an account, purchase a subscription, and/or register a physical iClicker remote, visit

  http://support.reef-education.com

- If none of your classes uses REEF Polling, there is no need to purchase a subscription.

¿Minoring in Mathematics?

To obtain a **minor in Mathematics**, a student who has completed MA 137/138 Calculus I and II must complete the following:

1. MA 213 – Calculus III (4 credits)
2. MA 322 – Matrix Algebra and Its Applications (3 credits)
3. Six additional credit hours of Mathematics courses (=two courses) numbered greater than 213.

   Two possible/relevant suggestions are for example:
   MA 327 – Introduction to Game Theory
   MA/BIO 337 – Mathematical Modeling in the Life Sciences

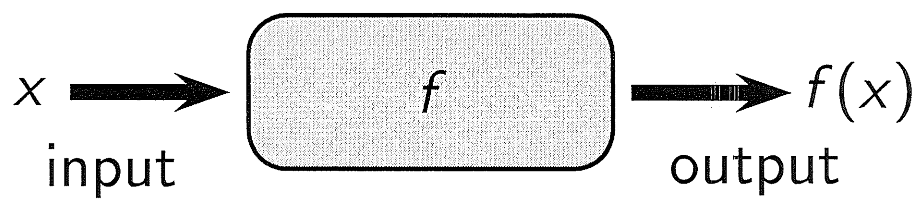
Thus you need 13 additional credit hours in Mathematics classes.

Definition of Function

A **function** f is a rule that assigns to each element x in a set A exactly one element, called $f(x)$, in a set B.

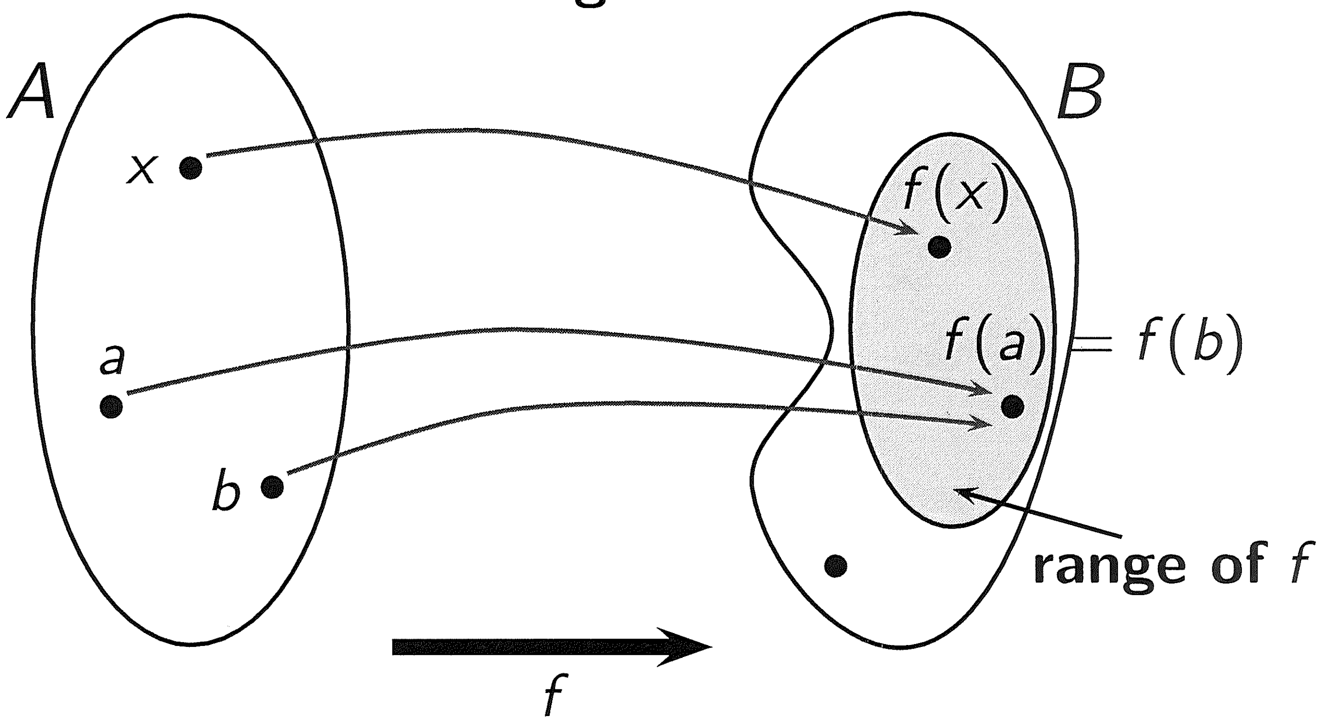
The set A is called the **domain** of f whereas the set B is called the **codomain** of f; $f(x)$ is called the **value of** f **at** x, or the **image of** x **under** f.

The **range** of f is the set of all possible values of $f(x)$ as x varies throughout the domain: range of $f = \{f(x) \mid x \in A\}$.



Machine diagram of f

Arrow diagram of f



Notation: To define a function, we often use the notation

$$f : A \longrightarrow B, \qquad x \mapsto f(x)$$

Evaluating a Function

The symbol that represents an arbitrary number in the domain of a function f is called an **independent variable**.

The symbol that represents a number in the range of f is called a **dependent variable**.

In the definition of a function the independent variable plays the role of a "placeholder".

For example, the function $f(x) = 2x^2 - 3x + 1$ can be thought of as

$$f(\square) = 2 \cdot \square^2 - 3 \cdot \square + 1.$$

To evaluate f at a number (expression), we substitute the number (expression) for the placeholder.

The Domain of a Function

The domain of a function is the set of all inputs for the function.

The domain may be stated explicitly.

For example, if we write

$$f(x) = 1 - x^2 \qquad -2 \leq x \leq 5$$

then the domain is the set of all real numbers x for which $-2 \leq x \leq 5$.

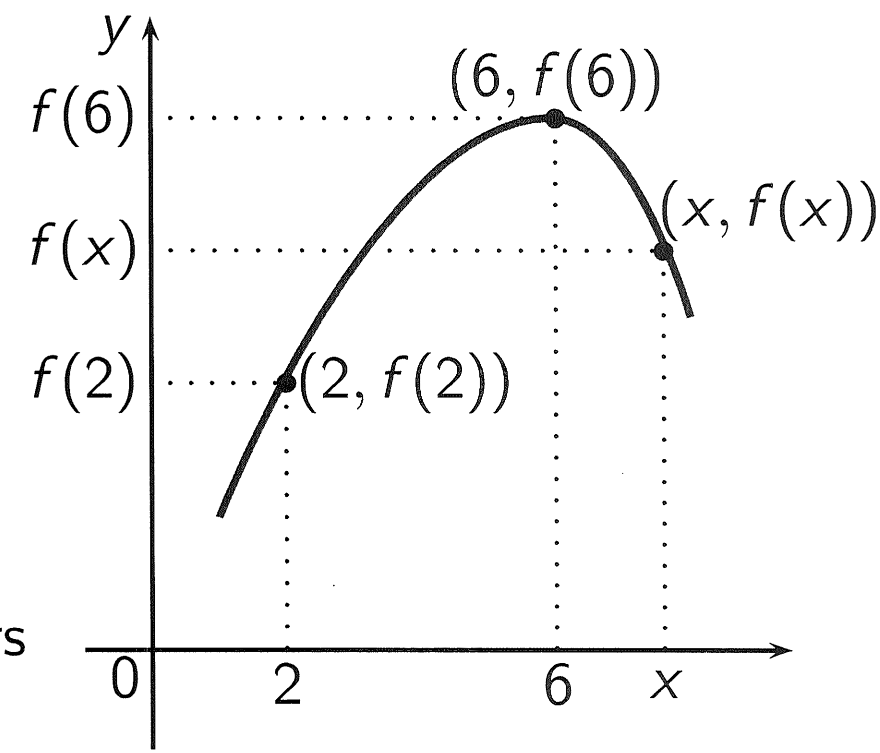
If the function is given by an algebraic expression and the domain is not stated explicitly, then by convention *the domain is the set of all real numbers for which the expression is defined*.

Fact: Two functions f and g are equal if and only if

1. f and g are defined on the same domain,
2. $f(x) = g(x)$ for all x in the domain.

Graphs of Functions

The graph of a function is the most important way to visualize a function. It gives a picture of the behavior or 'life history' of the function.
We can read the value of $f(x)$ from the graph as being the height of the graph above the point x.



If f is a function with domain A, then the graph of f is the set of ordered pairs

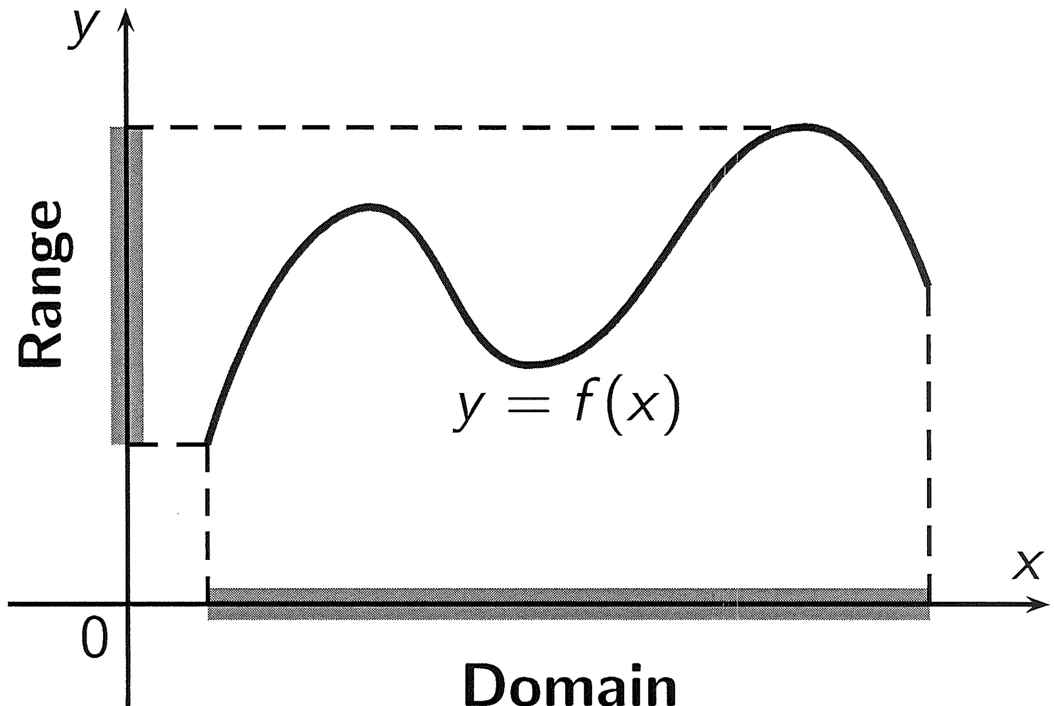
$$\textbf{graph of } f = \{(x, f(x)) \,|\, x \in A\}.$$

In other words, the graph of f is the set of all points (x, y) such that $y = f(x)$; that is, the graph of f is the graph of the equation $y = f(x)$.

Obtaining Information from the Graph of a Function

The values of a function are represented by the height of its graph above the x-axis. So, we can read off the values of a function from its graph.

In addition, the graph of a function helps us picture the domain and range of the function on the x-axis and y-axis as shown in the picture:

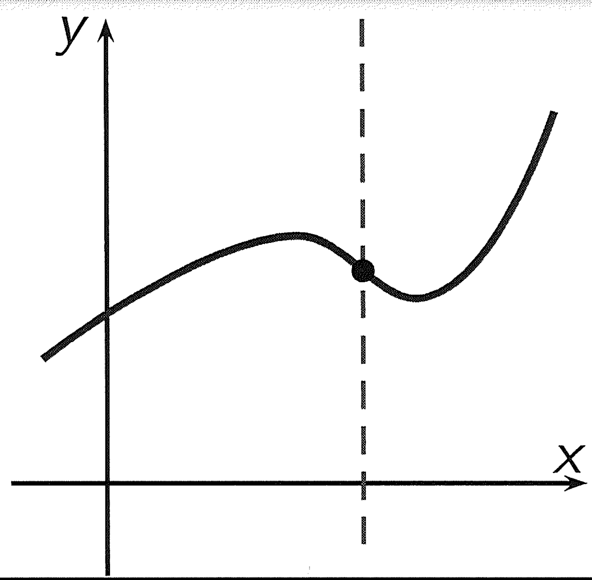


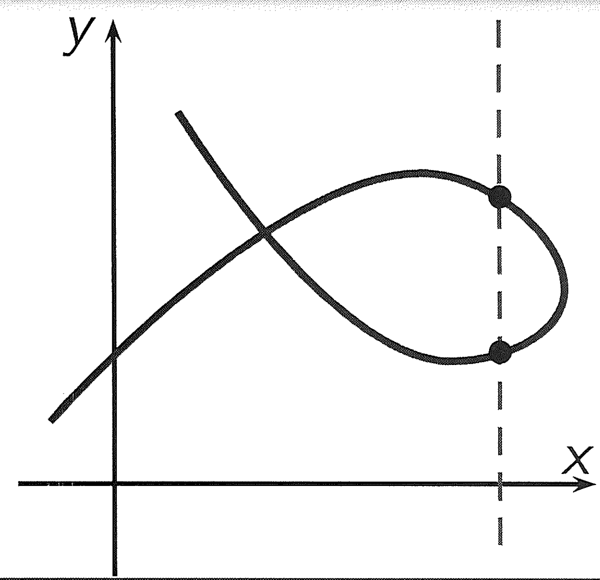
The Vertical Line Test

The graph of a function is a curve in the *xy*-plane. But the question arises: Which curves in the *xy*-plane are graphs of functions?

The Vertical Line Test

A curve in the coordinate plane is the graph of a function if and only if no vertical line intersects the curve more than once.



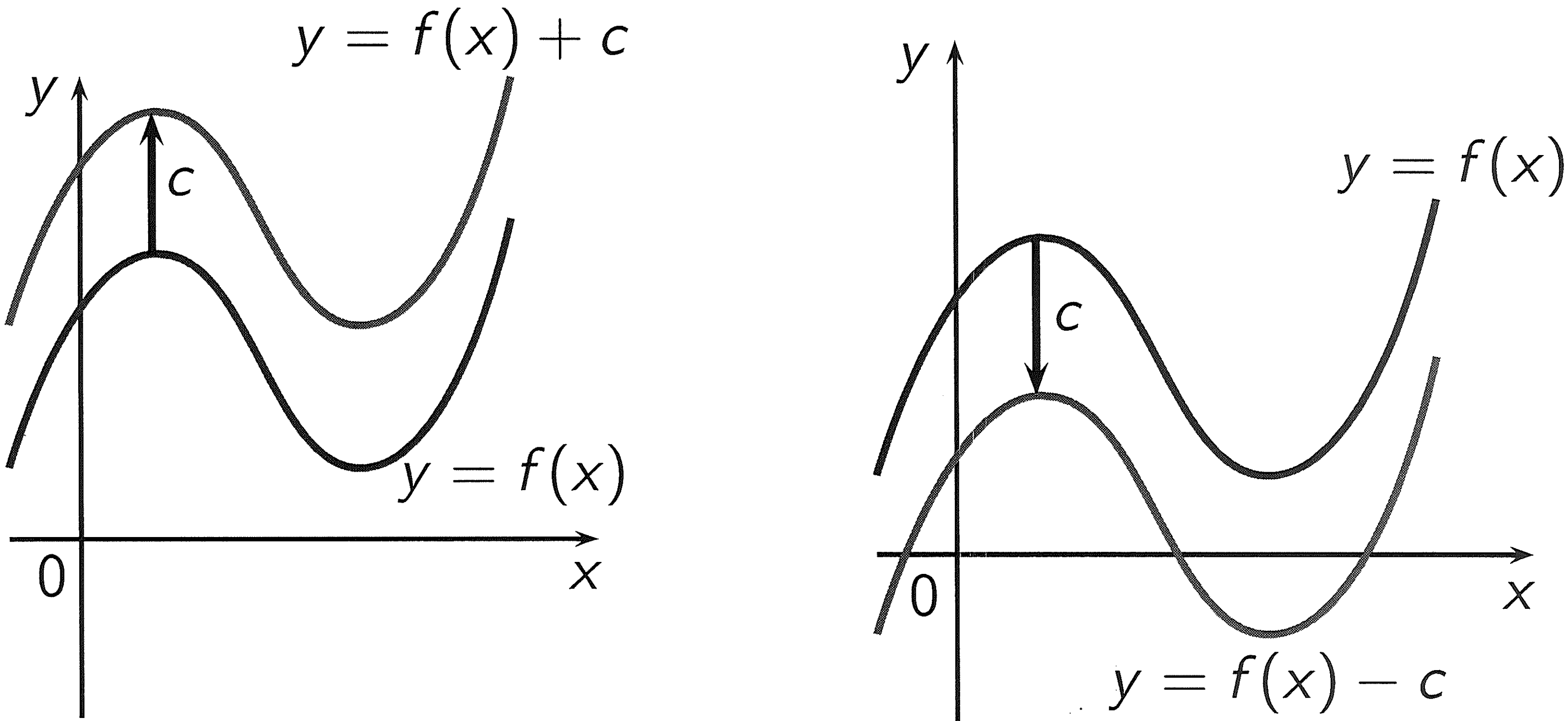


Vertical Shifting

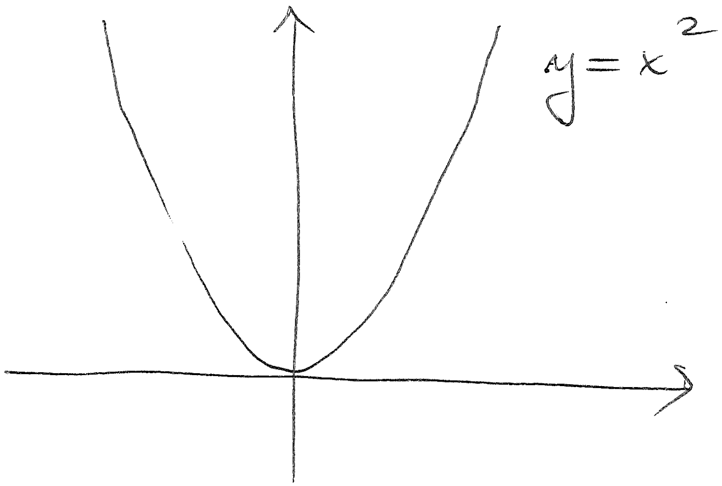
Suppose $c > 0$.

To graph $y = f(x) + c$, shift the graph of $y = f(x)$ upward c units.

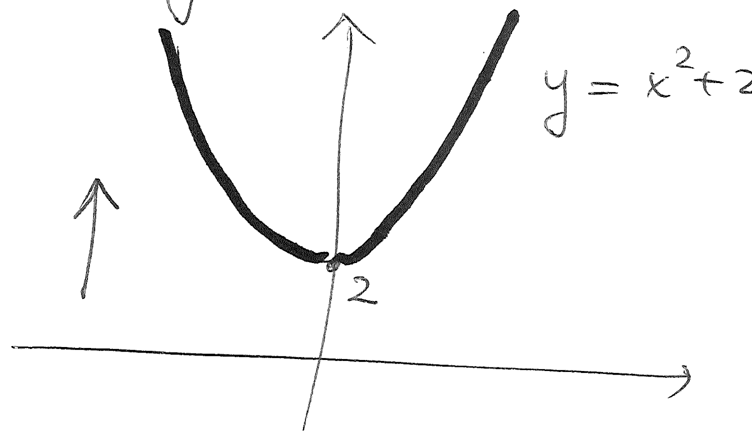
To graph $y = f(x) - c$, shift the graph of $y = f(x)$ downward c units.



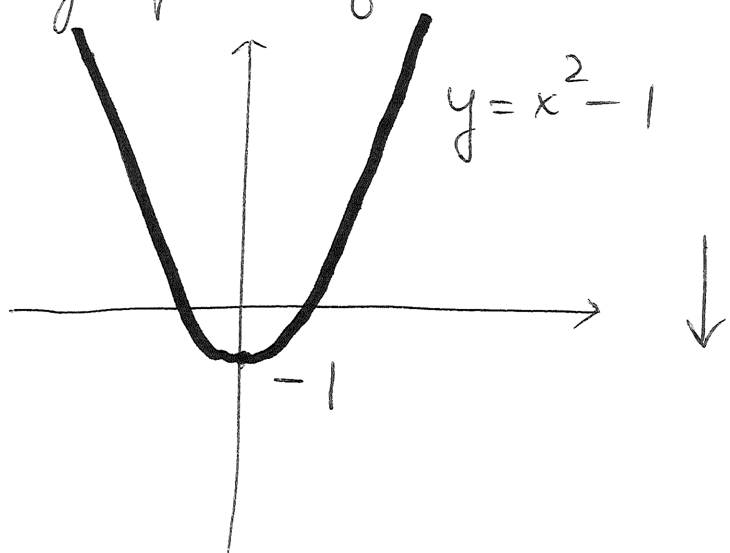
Consider for example the parabola $y=x^2$ whose graph is



Then the graph of $y=x^2+2$ is



whereas the graph of $y=x^2-1$ is

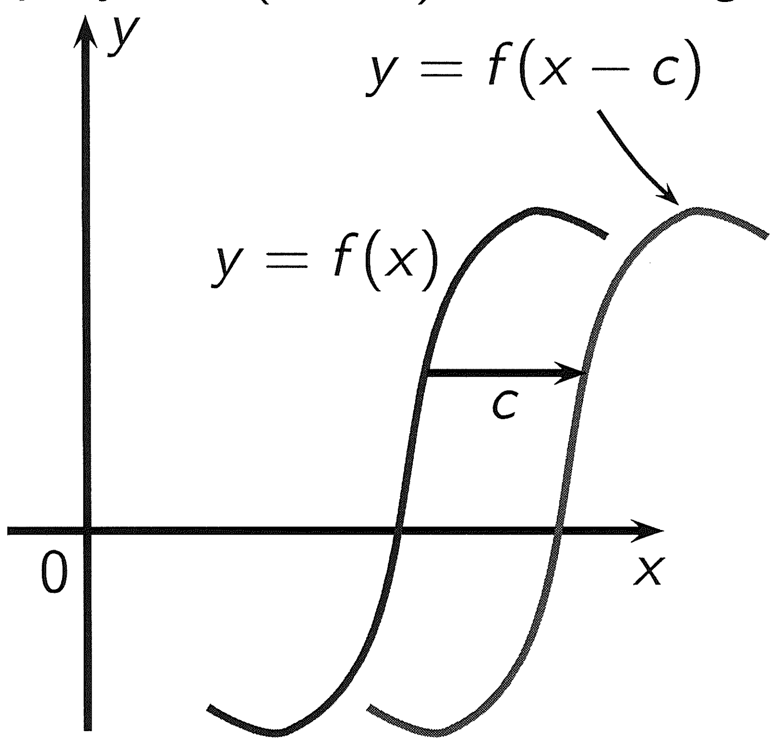


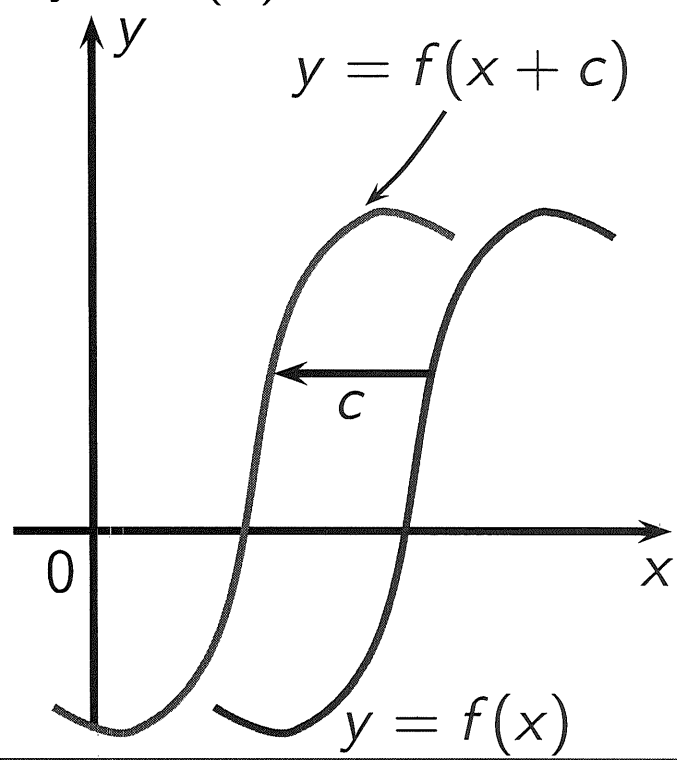
Horizontal Shifting

Suppose $c > 0$.

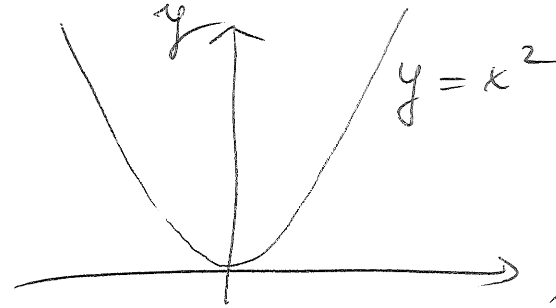
To graph $y = f(x - c)$, shift the graph of $y = f(x)$ to the right c units.

To graph $y = f(x + c)$, shift the graph of $y = f(x)$ to the left c units.

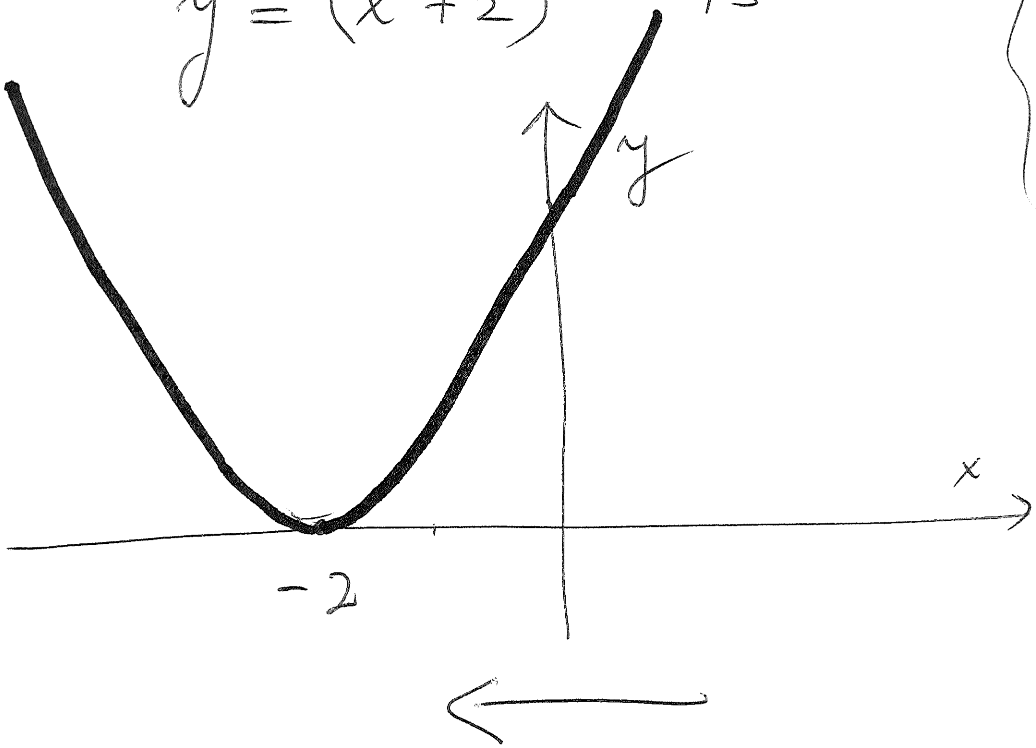




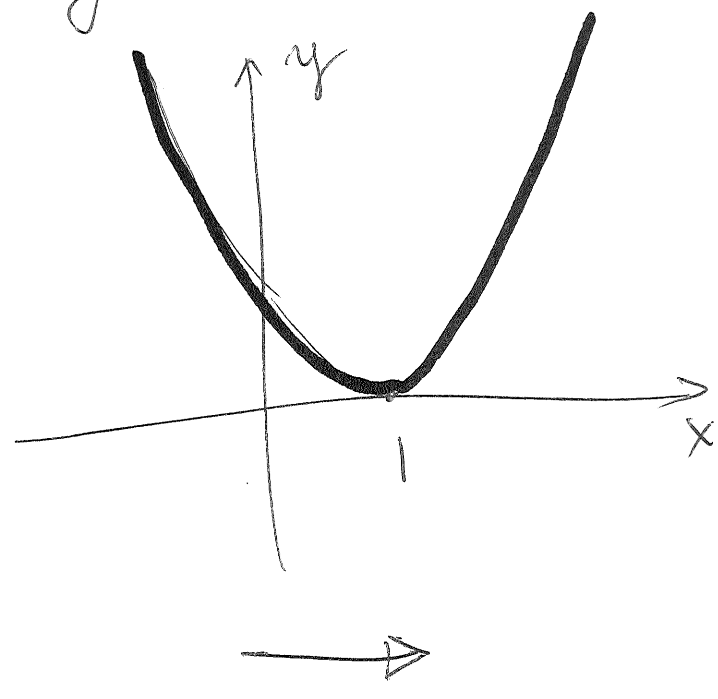
Consider again $y = x^2$



Then the graph of $y = (x+2)^2$ is



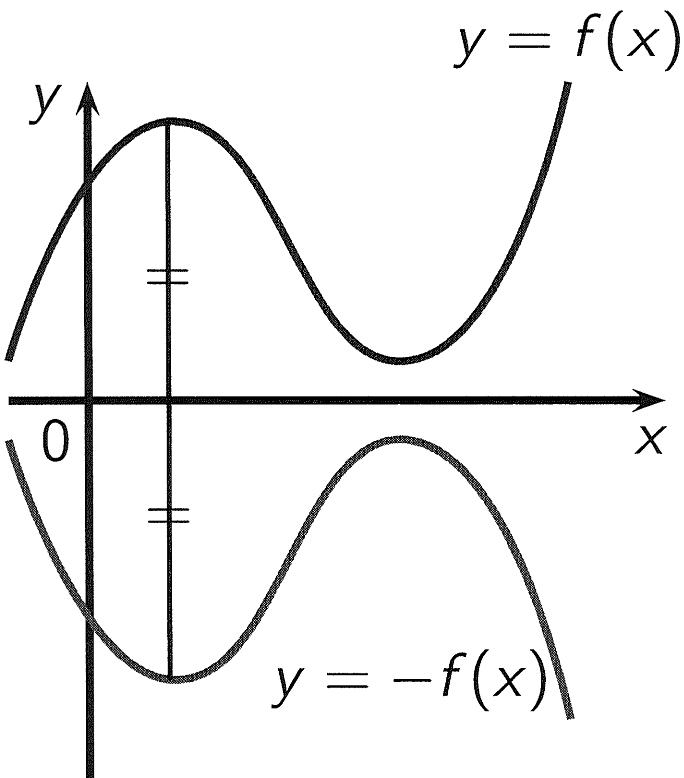
The graph of $y = (x-1)^2$ is

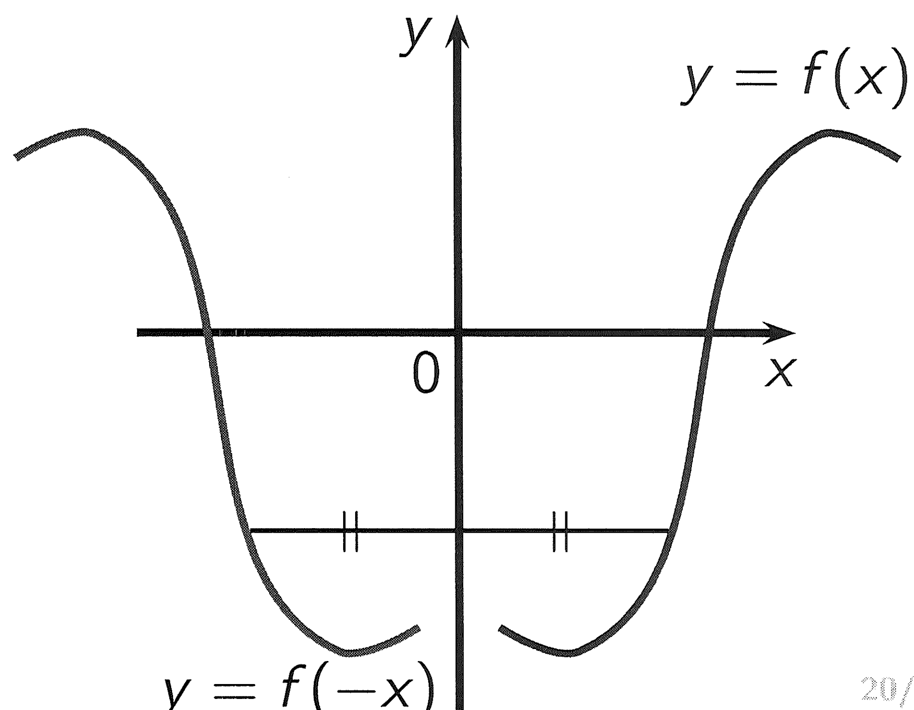


Reflecting Graphs

To graph $y = -f(x)$, reflect the graph of $y = f(x)$ in the x-axis.

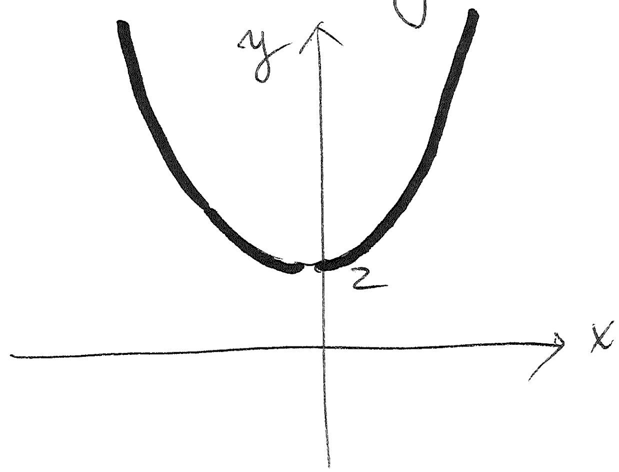
To graph $y = f(-x)$, reflect the graph of $y = f(x)$ in the y-axis.



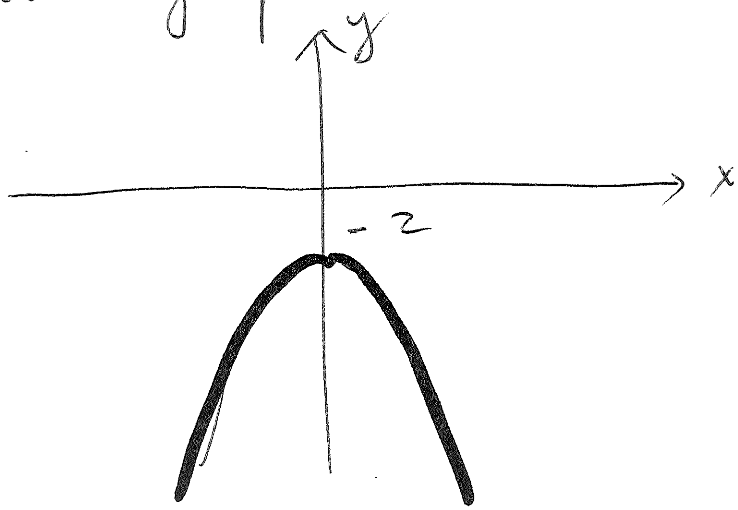


Reflection with respect to the x-axis

Consider $y = x^2 + 2$

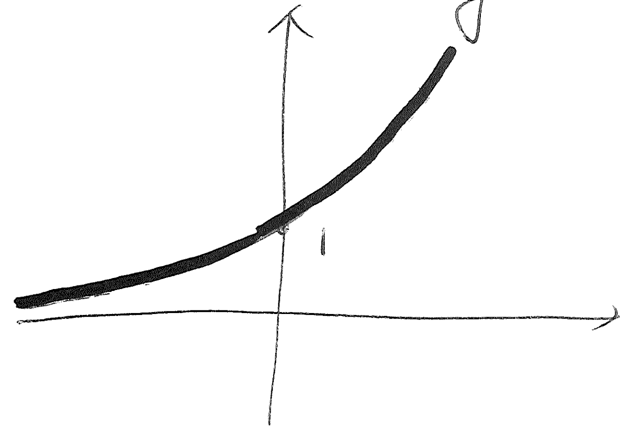


Then $y = -(x^2+2)$ has graph

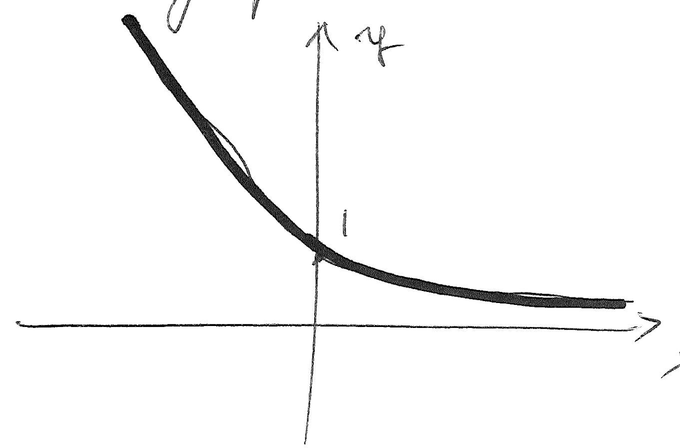


Reflection with respect to the y-axis

Consider $y = e^x$



Then $y = e^{(-x)}$ has graph

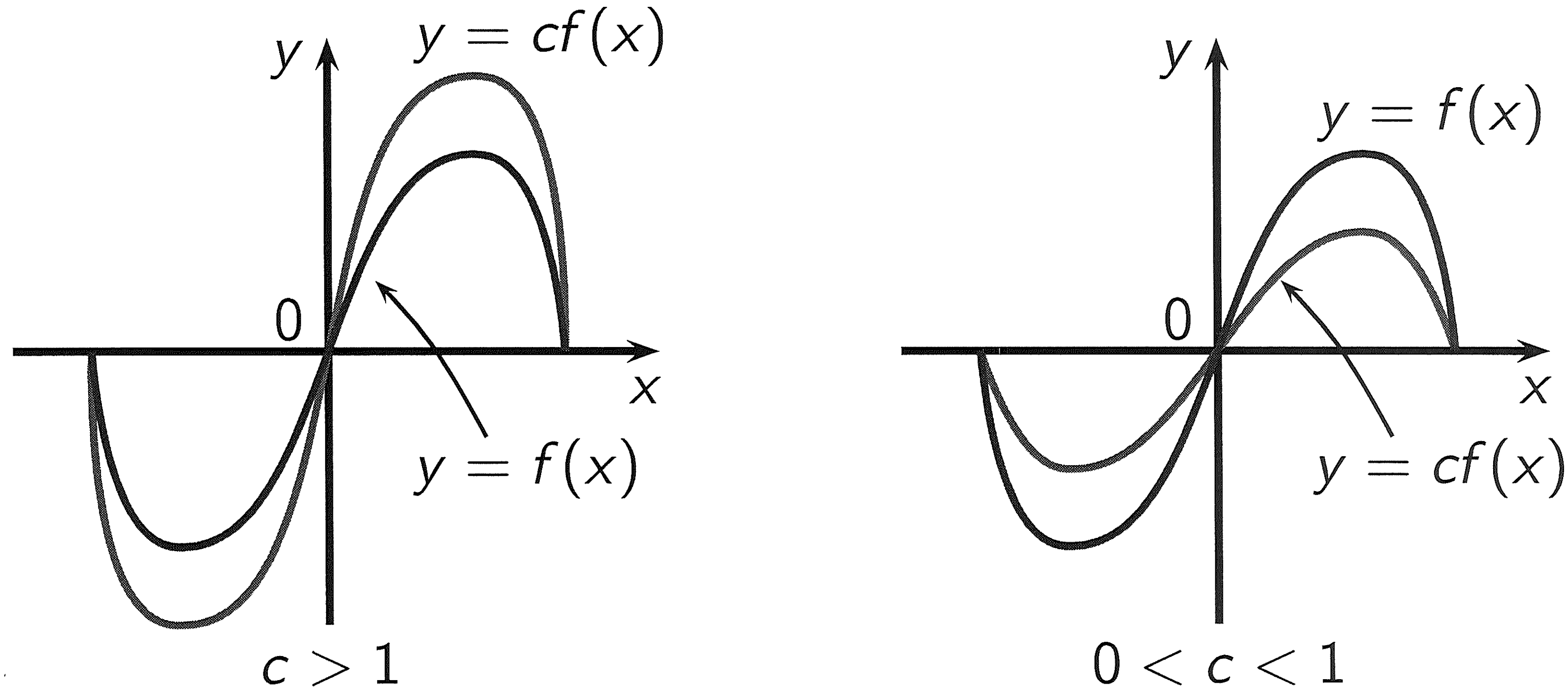


Vertical Stretching and Shrinking

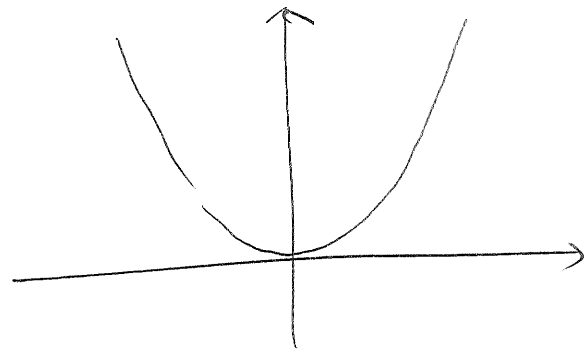
To graph $y = cf(x)$:

If $c > 1$, STRETCH the graph of $y = f(x)$ vertically by a factor of c.

If $0 < c < 1$, SHRINK the graph of $y = f(x)$ vertically by a factor of c.

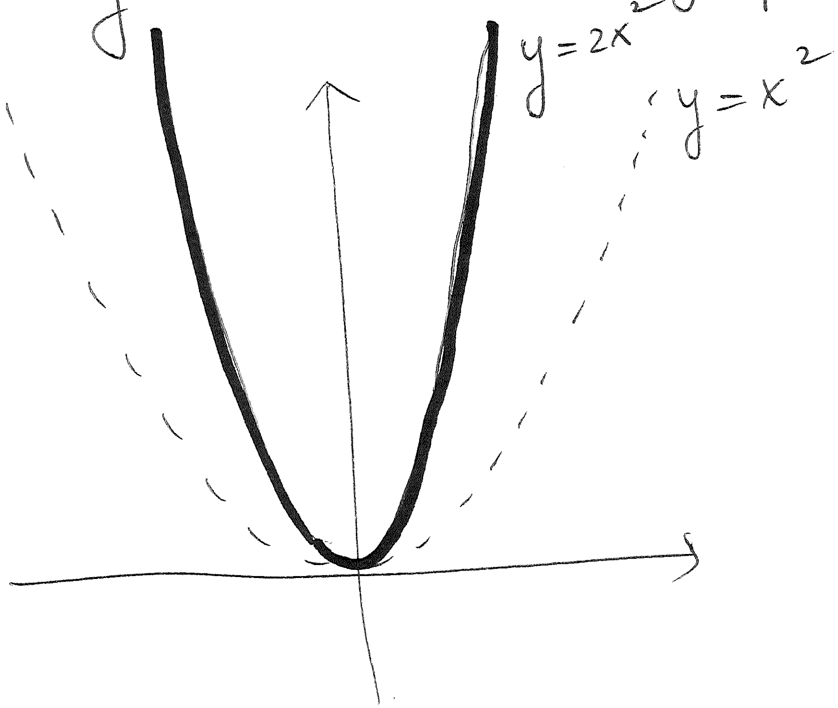


Consider $y = x^2$

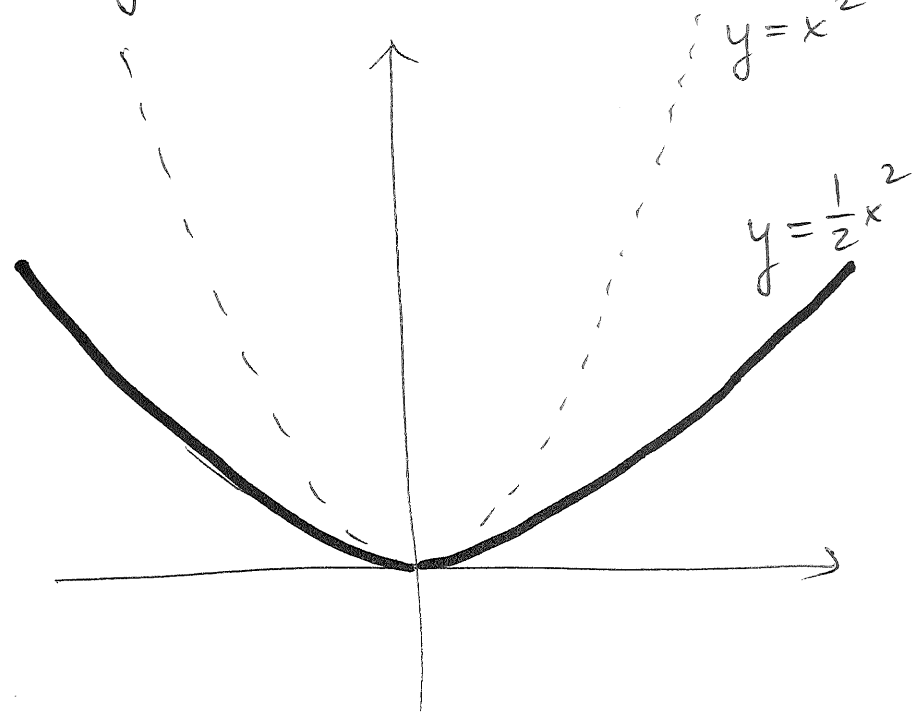


Then we have that:

$y = 2x^2$ has graph



$y = \frac{1}{2}x^2$ has graph

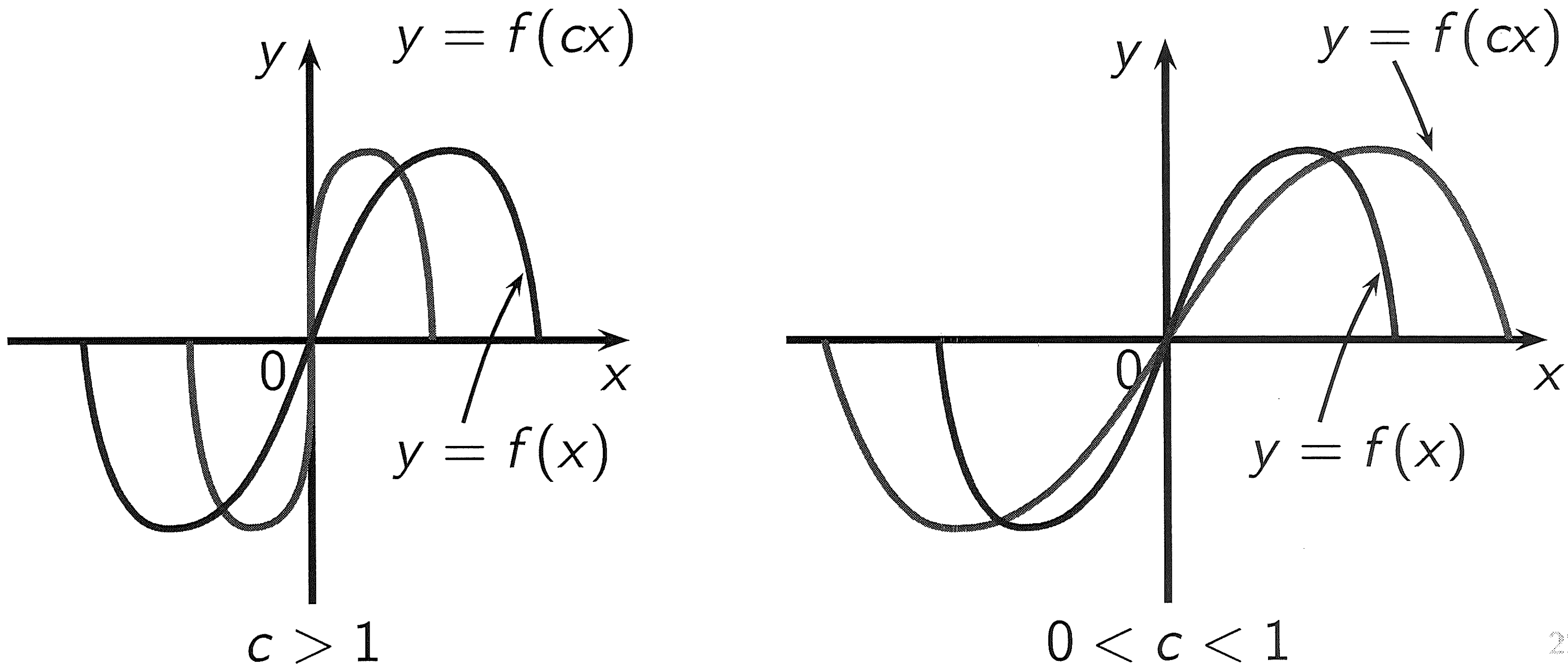


Horizontal Shrinking and Stretching

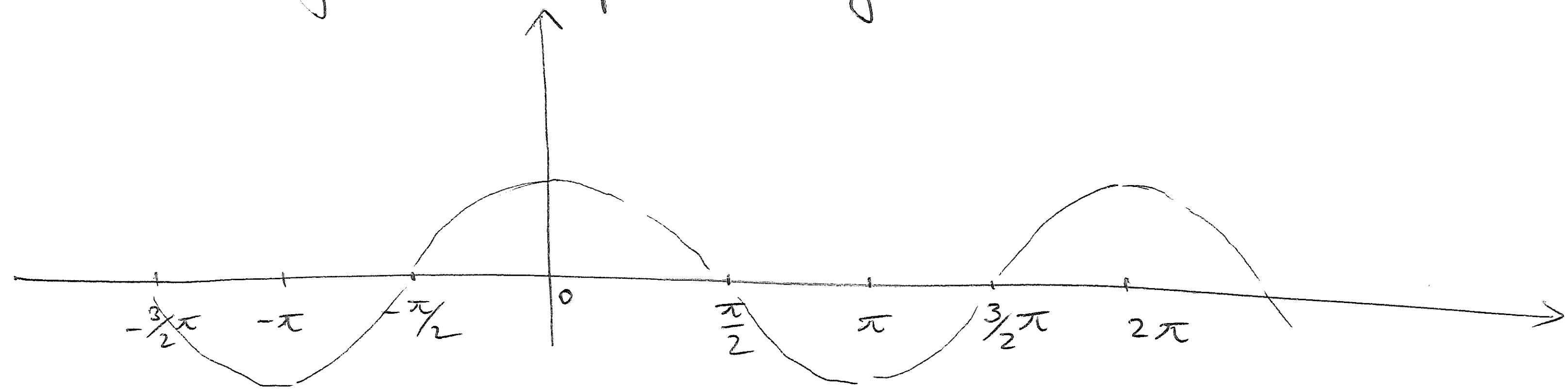
To graph $y = f(cx)$:

If $c > 1$, shrink the graph of $y = f(x)$ horizontally by a factor of $1/c$.

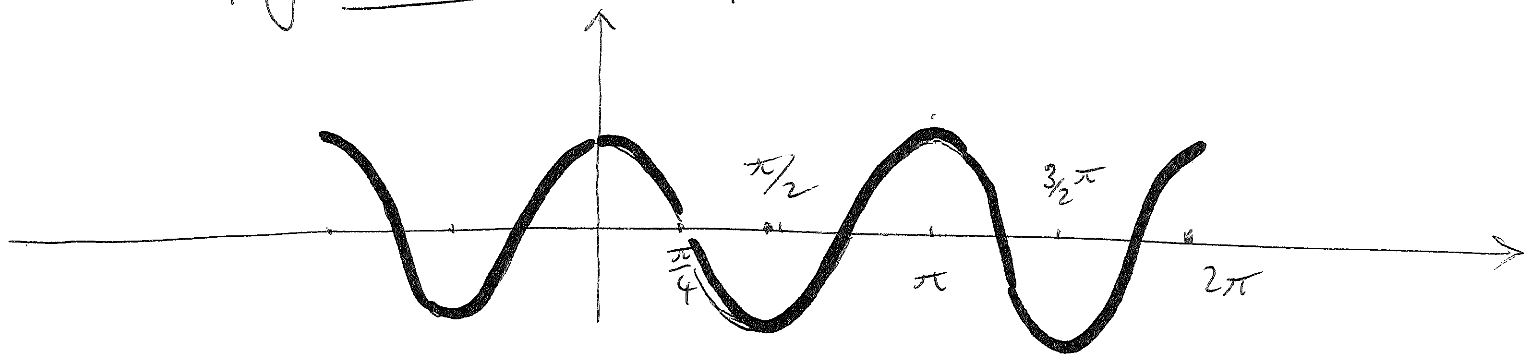
If $0 < c < 1$, stretch the graph of $y = f(x)$ horizontally by a factor of $1/c$.



Consider for example $y = \cos(x)$



Then $y = \cos(2x)$ has graph:



Then $y = \cos(\frac{1}{2}x)$ has graph