

5. Trig Functions and Graphs

5. Trig Functions and Graphs Outline

5.1A	Graphing Sine and Cosine Functions Graphs of Sine and Cosine and characteristics vocabulary
5.1B	Graphing Sine and Cosine Functions Parameters a and b
5.2	Transformations of Sinusoidal Functions
5.3	The Tangent Function
	5.1 – 5.3 Performance Task Ferris Wheel
5.4	Equations and Graphs of Trigonometric Functions
	Review
	5. Trig Functions and Graphs Exam

During the Sept 2013 - Jan 2014 Semester I decided to teach the Sine curve with all of the transformations in two days. After students had a good grasp of the vocabulary and graphing sine curves, I then taught the cosine curve with all of the transformations. This grouping seemed to have worked better with my students as it allowed for repeated use of vocabulary such as amplitude, phase shift, displacement, and period.

Graphing Notes

[Interactive Notes for Students](#)

5.1 Graphing Sine and Cosine Functions

Class Notes

The McGraw-Hill Ryerson PreCalculus 12 Text is used as the Main Resource.

Assignments in the Powerpoint Lesson Plans refer to pages and questions in the PreCalculus 12 text.

[5.1 Graphing Sine and Cosine Functions](#)

[5.1 Formative Assessment Amplitude and Period](#)

Digital Resources

[5.1 Sin and Cos curves 2](#)

[Unwrapping the Circle: 5.1 Deroulecercle.ggb](#)

[5.1 Unwrapping Unit Circle.wmv](#)

[Graphing Point on Circle \(Nspire File\)](#)

[Unit Circle Graphing Sine and Cosine \(Nspire File\)](#)

[Unit Circle and Graphing Sine and Cosine.wmv](#)

Pedagogical Shifts: TRANSFORM, Moving from Traditional to Student-Centered

Shifting from Student as Knowledge Recipient to Student as Inquirer and Creator

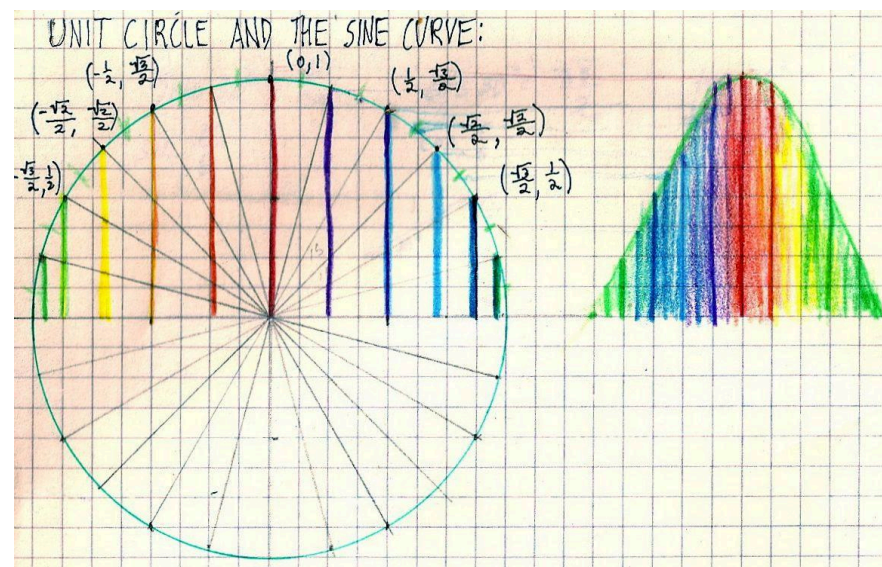
Shifting from Memorization to Higher-level Thinking

Desmos pre-created interactive graphs for trig functions are available online. Follow this link: <https://www.desmos.com/calculator> - Click on the bars in the upper left corner to view all pre-created interactive graphs.

Building a Sine Curve and Making Connections to the Unit Circle.

This is a nice idea to make connections between the unit circle and the graph of the sine function. Students can trace the heights of the curve to build half a period of a sine curve. Possible follow up questions include "What would the other half of the graph look like?" Connections could also be made to characteristics of a sine function graph such as amplitude and period.

[Template for Building the sine function graph](#)



5.2 Transformations of Sinusoidal Functions

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Assignments in the Powerpoint Lesson Plans refer to pages and questions in the PreCalculus 12 text.

[5.2 Transformations of Sinusoidal Functions](#)

[5.2 Formative Assessment Graphing Phase Shift and Displacement](#)

Digital Resources to Enhance Learning and Differentiate Instruction

[5.2 Transformations abcd \(Nspire File\)](#)

[Transformations of Sine and Cosine Curves.wmv](#)

[Sine Cosine Tracer \(GSP File\)](#)

Pedagogical Shifts: TRANSFORM, Moving from Traditional to Student-Centered

Shifting from Student as Knowledge Recipient to Student as Inquirer and Creator

Shifting from Memorization to Higher-level Thinking

Shifting from competitive to collaborative learning.



[Matching Sinusoidal Equations with Graphs and Properties](#)

In this activity, students worked in pairs to match the graph with the function equation and function table. They also had to list the features of the graph including amplitude, period, and principal axis.

Desmos Sinusoidal Transformations Investigation (Download: [SineTransformationsInv.docx](#))

This investigation assumes that students understand the basic properties of $y = \sin x$ and $y = \cos x$ and the transformations related to $y = a[f(b(x - c))] + d$. Students will explore how the parameters a , b , c , and d affect sinusoidal functions.

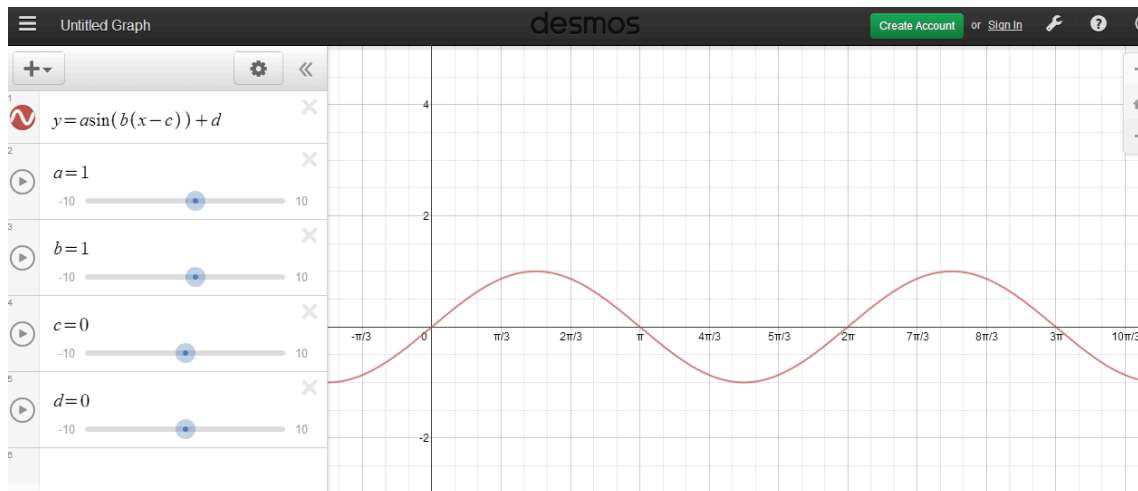
The investigation involves three steps:

1. Use Visualization to predict what characteristics will change when each of the parameters are adjusted.

Characteristics

	amplitude	period	midline	x-intercepts	y-intercept	domain	range
<i>a</i>							
<i>b</i>							
<i>c</i>							
<i>d</i>							

2. Verify the predictions from step 1 by using Desmos and sliders for each parameter.



3. Explore in more detail the relationship between the parameters and the characteristics of the graph

Step 3: Explore Parameters

Use [Desmos](#) to explore in more detail the relationship between the parameters and the characteristics of the graph.

Explore a : Begin with $y = \sin(x)$ ($a = 1, b = 1, c = 0$ and $d = 0$)

- When $a = 1$, the amplitude of the graph is _____.
- When $a = 2$, the amplitude of the graph is _____.
- When $a = 4$, the amplitude of the graph is _____.
- When $a = 0.5$, the amplitude of the graph is _____.
- When $a = -3$, the amplitude of the graph is _____.

Note: amplitude = $(\max - \min) / 2$

Conclusion:

Explore d : Begin with $y = \sin(x)$ ($a = 1, b = 1, c = 0$ and $d = 0$)

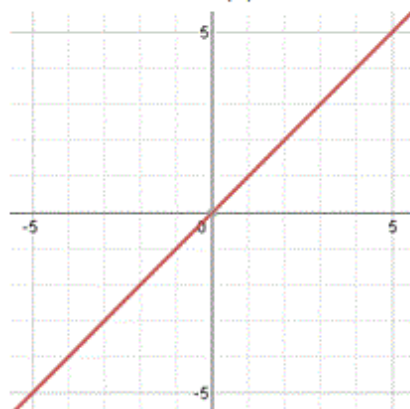
- When $d = 0$, the midline of the graph is _____.
- When $d = 2$, the midline of the graph is _____.
- When $d = -4$, the midline of the graph is _____.

Note: midline = $(\max + \min) / 2$

Investigation - Transformations Connections (Download: [TransformationsConnections.docx](#))

This activity asks students to review a transformation on a function they are already familiar with and then apply the same type of transformation to a sinusoidal function.

1. Linear function, $f(x) = x$ becomes $y = 2x$



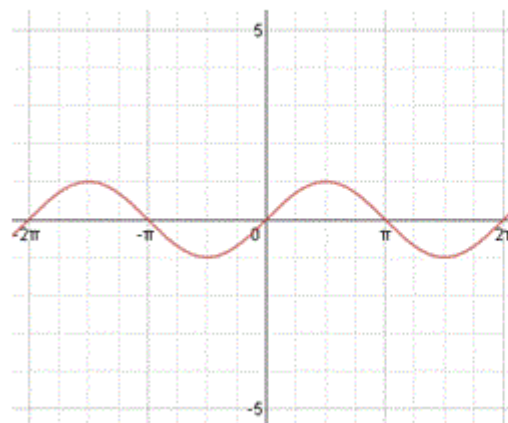
mapping notation

$(x,y) \rightarrow$

equation in $y = af[b(x-c)] + d$

describe the transformation.

2. Sinusoidal function, $f(x) = \sin x$ becomes $y = 2\sin x$



mapping notation

$(x,y) \rightarrow$

equation in $y = af[b(x-c)] + d$

describe the transformation.

5.3 Tangent Function

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[5.3 Tangent Function](#)

[5.3 Graphing Tangent Functions Formative Assessment](#)

Digital Resources

[Interactive Unit Circle Applet](#)

5.4 Equations and Graphs of Trigonometric Functions

Class Notes

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[5.4 Equations and Graphs of Trigonometric Functions](#)

[5. Graphing Trig Functions Performance](#)

[5.4 Formative Assessment Graphing Trig Functions](#)

Digital Resources

[Ferris Wheel Unit Circle \(GGB File\)](#)

Pedagogical Shifts: TRANSFORM, Moving from Traditional to Student-Centered

Shifting from Content-based to Competencies-based

Shifting from Student as Knowledge Recipient to Student as Inquirer and Creator

Shifting from Print-based to Multimodal

[Ferris_wheel.mov](#)

I used this short video to allow students to create the equation of the function of the height of a car on a ferris wheel to time. Students had to ask questions and relate the features of the ferris wheel to the values on the graph and the parameters of the sinusoidal function equation. They had to discover how to change the horizontal axis from radians to time and the effect that would have in the function equation. Students were able to discover that the best function equation (in their opinion) was a negative cosine function.

[Ferris Wheel Matching Activity](#)



In this activity, students must solve problems involving ferris wheels. In the first problem, students are given dimensions and features of a ferris wheel and need to graph the height of a car over time. In the middle portion of the activity, students must match graphs, equations, and features of different ferris wheels. Students then finish the activity with a problem similar to the first problem.

5. Trig Graphing Review

[5. Trig Functions and Graphs Review DK](#)

[5. Trig Graphing Review](#)