Check Out this App:
*Using WeBWorK with Applets in a Calculus Class*

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11/11/11
Overview

• My experience using WeBWorK with Flash
• The assignments and Apps
• Student feedback
Online Homework

• How many have used online homework in their classes (MyMathLab, WebAssign, WileyPlus, Hawkes, etc.)?

• How many have used WeBWorK?
What is WeBWorK?

- WeBWorK is an open-source online homework system for math and sciences courses.
- WeBWorK was originally created and run through the University of Rochester but is currently supported by the MAA and the NSF.
- National Problem Library (NPL) of over 20,000 homework problems.
- Wiki for support and collaboration http://webwork.maa.org/wiki/Main_Page

* http://webwork.maa.org/
How I got involved

• Barbara Margolius at Cleveland state recruited faculty to pilot Applets based homework.

• I piloted some Apps in Fall 2010 then more in Fall 2011.

*NSF grant (DUE 0941388 Flash applets for WeBWorK online homework system)
The Flash Applets
The Unit Circle

**TrigWidget**
Place the sine, cosine and tangent cards on the table so that the card value in each column shows the trigonometric function value of the angle given at the top of the column. Clicking the down arrow while the mouse is over a card will toggle between the decimal approximation and the exact value.

**Goals:** Understand relationship between cosine and sine function graphs and unit circle. Learn values of sine, cosine and tangent functions for standard angles.

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<tr>
<th>$\phi$</th>
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<th>$7\pi$</th>
<th>$7\pi$</th>
<th>$8\pi$</th>
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<tr>
<td>cos((\phi))</td>
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<td>sin((\phi))</td>
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<td>tan((\phi))</td>
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</tbody>
</table>

This work is supported in part by the National Science Foundation under the grant DUE-0941388.
Implicit graphing

**Implicit Plotter**

In the box below, enter an equation in terms of x and y of the form:

\[ f(x,y) = g(x,y) \]

For example:

\[ x^2/9 + y^2/4 = 1 \]

Use ordinary calculator syntax when entering sides of the equation. Always use * for multiplication and parentheses around functions’ arguments.

Mouse over the SYNTAX button below for a complete list of functions and syntax rules.

Enter your equation and x and y ranges in the range boxes. Then click the GRAPH button.

Enter an equation of the form \( f(x,y) = g(x,y) \):

\[ x^2 - 5y^2 = 1 \]

Click the RESET button to reset the ranges and erase the graph. Mouse over the SYNTAX button for syntax rules.

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Math Applet by Doug Ensley and Barbara Kaskosz

www.flashandmath.com
Sketching Derivatives

Derivative Sketching
By Dan Gries

Instructions: A function f(x) is shown in the upper graph. Sketch an accurate graph of the derivative of this function on the axes below. When you are satisfied with your sketch, click on the "Check Answer" button below.

Press and hold the "smooth" button to gradually smooth out your graph. Click on the "auto" button to turn on or off automatic smoothing.

Score:
- signs (pos/neg): 88%
- accuracy: 53%

Check Answer
New function

This applet makes use of graphing classes developed by B. Kaskosz and D. Ensley, published at flashandmath.com. This work was supported in part by the National Science Foundation under grant DUE-0941388.
Antiderivative Sketching

Directions: Sketch a function $F$ on the axes below which is an antiderivative of the function $f$ shown above, and which satisfies the condition $F(1.5) = 0.5$.

(This point is already fixed in the graph below.)

This applet makes use of graphing classes developed by B. Kaskoez and D. Ensley, published at flashandmath.com. This work was supported in part by the National Science Foundation under grant DUE-0941388.
The graph shown is for the function $f(x)$. Compute the following quantities:

a) $f(-8) = \phantom{\text{---}}$

b) $\lim_{x \to -3^+} f(x) = \phantom{\text{---}}$

c) $\lim_{x \to -3^-} f(x) = \phantom{\text{---}}$

d) $\lim_{x \to -4} f(x) = \phantom{\text{---}}$

The value of the function $f(x)$ at $x = -3$ is 2, but this is neither a left nor right-hand limit.
Continuity

This work is supported in part by the National Science Foundation under the grant DUE-0941388.

list all intervals for which

a) $f''(x) > 0$

b) $f''(x) < 0$

c) $f''(x) = 0$
Derivatives

Drag the graph tile into position so that the top graph in the column shows the function, the middle graph the first derivative and the bottom graph the second derivative. Pressing the appropriate button will allow you to shade the graph so that it is easy to compare with other graphs where it is positive, negative, increasing, decreasing, concave up or down.
u-substitution

This graph shows the integrand after the u-substitution. The area of the shaded region gives the value of the integral with the area below the u-axis considered negative. If your u-substitution is correct, the areas in the two graphs will be equal.

Let $u = 2^x$.

\[
\int_{0}^{2} (\sin(2^x)) \, dx = \int_{\text{[ ]}}^{\text{[ ]}} (\text{[ ]}) \, du = \text{[ ]}
\]

This work is supported in part by the National Science Foundation under the grant DUE-0041388.

Complete the indicated blanks in the applet. When done click ‘submit answers’.

If you click ‘submit answers’ before you are done, WeBWorK will save your work for when you log back on.
Volumes of Revolution

This is the graph formed by the intersection of the solid with the plane perpendicular to the cross-section plane through the x-axis. The positive axis only is shown.

This work is supported in part by the National Science Foundation under the grant DUE-0941388

Find the volume of the solid of revolution formed by rotating the curve

\[ y = 3 \sin \left( \frac{\pi x}{8} \right) \]

for \( x = 0 \) to \( 8 \) about the y-axis.
Volumes of Revolution

This graphing board displays the three-dimensional solid with the cross-section shown in the cross-section graphing board and the profile shown in the profile graphing board.

This work is supported in part by the National Science Foundation under the grant DUE-0941388.

Find the volume of the solid of revolution formed by rotating the curve

\[ x = \begin{cases} 
5 \sin \left( \frac{\pi y}{8} \right) + 2 & y \leq 8 \\
8 \sin \left( \frac{\pi y}{2} \right) + 2 & 8 < y \leq 10
\end{cases} \]

about the y-axis.
Find the volume of the figure shown. The cross-section of the figure is a regular 5-sided polygon. The area of the polygon can be computed as a function of the length of a line segment from the center of the 5-sided polygon to the midpoint of one of its sides and is given by \(5x^2 \tan \left( \frac{\pi}{5} \right)\) where \(x\) is the length of the bisector of one of the sides (shown in black on the cross-section graph). A formula similar to the cylindrical shells formula will then provide the volume of the figure. Simply replace \(\pi\) in the formula

\[
V = 2\pi \int x f(x) \, dx
\]

with \(5 \tan \left( \frac{\pi}{5} \right)\) to find the volume of the solid shown where for this solid

\[
f(x) = \begin{cases} 
    x & \text{if } x \leq 4 \\
    8-x & \text{if } 4 < x \leq 8 
\end{cases}
\]

for \(x = 0\) to \(8\).
Student feedback
How much did they complete?

I completed:
- a. all of the WeBWorK assignments - 8
- b. more than half of the WeBWorK assignments - 9
- c. less than half of the WeBWorK assignments - 2
- d. none of the WeBWorK assignments - 1

<table>
<thead>
<tr>
<th>Number of assignments completed</th>
<th>All 7</th>
<th>6</th>
<th>5</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Students</td>
<td>12</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>
Compared to traditional paper and pencil homework, the WeBWorK assignment made it:

a. More likely that I would complete the assignment – 6

b. Equally likely that I would complete the assignment – 7

c. Less likely that I would complete the assignment - 7
The orientation assignment at the beginning of the semester helped me learn how to use the program:

a. Strongly agree -1
b. Agree - 15
c. Disagree - 4
d. Strongly disagree - 0
I liked that WeBWorK checked my answers immediately:

a. Strongly agree -13
b. Agree - 6
c. Disagree - 0
d. Strongly disagree - 1
I found the program:

a. Very easy to use - 3
b. Reasonably easy to use - 7
c. Reasonably difficult to use - 9
d. Very difficult to use - 1
The WeBWorK assignments helped me practice the course material until I got it correct:

a. Strongly agree -9
b. Agree - 7
c. Disagree - 3
d. Strongly disagree - 1
If I got a WeBWorK question wrong (circle all that apply):

<table>
<thead>
<tr>
<th>Question</th>
<th>WeBWorK</th>
<th>Paper and Pencil</th>
</tr>
</thead>
<tbody>
<tr>
<td>I checked my work to see if I made a minor mistake</td>
<td>18</td>
<td>14</td>
</tr>
<tr>
<td>I contacted the teacher (with the email feature in WeBWorK)</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>I went to tutoring</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>I looked through the book and my notes to see if I was doing the correct procedure</td>
<td>7</td>
<td>16</td>
</tr>
<tr>
<td>I asked a friend for help</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>I gave up and did nothing</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>I completed</td>
<td>If given the option I prefer</td>
<td>Total</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>-----------------------------</td>
<td>-------</td>
</tr>
<tr>
<td></td>
<td>Paper and Pencil</td>
<td>WeBWorK</td>
</tr>
<tr>
<td>All the WeBWorK Assignments</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>More than half the WeBWorK</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Assignments</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than Half the WeBWorK</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Assignments</td>
<td></td>
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<tr>
<td>None of the WeBWorK Assignments</td>
<td>1</td>
<td>0</td>
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<tr>
<td></td>
<td>Total</td>
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</tbody>
</table>
Student Comments

- If I couldn’t get the correct answers I got frustrated and gave up because I wasn’t sure if the answer was wrong or I was just inputting it wrong.
- I was upset because I only got points for right answers.
- There are benefits for both types (of homework assignments).
Useful Websites

• www.flashandmath.com

• webwork.maa.org

• webwork.maa.org/wiki/Main_Page
Thank you for coming!

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