Teacher notes:

The “Mobius”: Make sure the students are aware this circuit is different. It’s actually two interlocked circuits. When they finish there will be either 2, 3, 4, or 5 cells they haven’t yet used. They may pick anyone they wish and work it (labeling these cells A, B, C, D, and E as necessary). If they’ve done the primary circuit correctly these remaining cells should also form a circuit and finish the page.

The reason for this twist is that as students have become familiar with circuits it doesn’t take long for them to realize they don’t actually have to work the last two problems. This way, they’re not sure until the verification circuit how many are left and even then they need to be careful to insure they left the correct boxes. It’s an experiment. We’ll see how it goes.

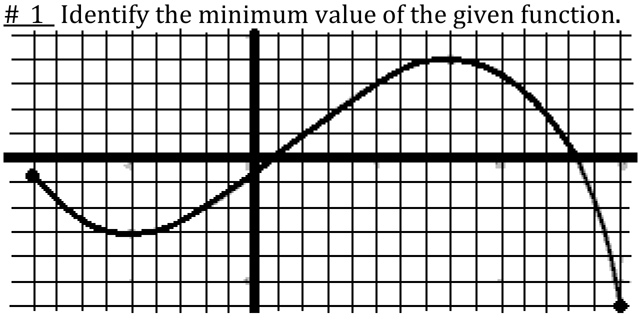
Calculator use: I expect the students to use their calculators during this circuit, but to do so appropriately. There is a problem that requires them to use their calculators to solve an equation. There are also a couple of decimal approximations to find. For the most part they should not be graphing the given functions. They might in order to solve the aforementioned problem, but they should be made aware that finding minima and maxima without using calculus isn’t going to be accepted in AP courses or in most of their future college math courses.

Mobius - Circuit with a twist – Related Rate/First and Second Derivatives Name______________________

Directions: Beginning in the first cell marked #1, find the requested information. To advance in the circuit, hunt for your answer and mark that cell #2. Continue working in this manner until you complete the circuit. Then verify your results by picking one of the remaining cells. The remaining cells (there will be 2, 3, 4, or 5 cells) will complete a second circuit.

Ans: 3.5809

1 Identify the minimum value of the given function.



Ans: 27

#____ A spherical balloon is being filled with a gas at a rate of 12 cubic feet per minute. Find the rate of change of its surface area, A, when the radius is 5 feet long.

What is the value in feet/min of $\frac{dr}{dt}$?

Ans: -4

#____ A spherical balloon is being filled with a gas at a rate of 12 cubic feet per minute. Find the rate of change of its surface area, A, when the radius is 5 feet long.

What is the value in square feet/min of $\frac{dA}{dt}$?

Ans: -6

#____ Find both critical numbers. Identify the leftmost critical number. $f(x) = x^3 + 6x^2 - 15x + 18$

Ans: 1.1905

#____A conical pile of sand is being added to at a rate of 15 cubic yards per hour. The sand is piling in such a way that the diameter of the pile is always twice its height. Find the rate of change of the height in ft/hour when the pile is 6' high.

Find the value (in cubic ft/hour) of $\frac{dV}{dt}$.

Ans: 2

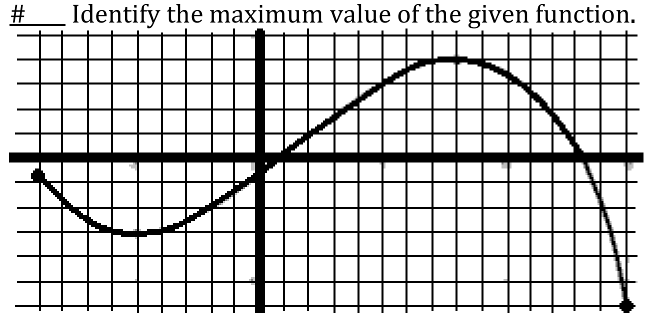
#____Apply the Mean Value Theorem to the function on the interval $[0, 2]$. Find the value of x where the guaranteed value of the derivative occurs. $f(x) = 3 + 12x^2 - x^3$.

Ans: $\frac{3}{25\pi}$

#____A particle is moving along the given curve with $\frac{dy}{dt} = \frac{1}{4}$. $y = \sqrt[3]{x}$. Find $\frac{dx}{dt}$ when $x = 2$.

Ans: -3

#____A particle is moving along the given curve with $\frac{dy}{dt} = -6$. $x^2 + y^2 = 25$. Find $\frac{dx}{dt}$ when $x = 3$ and $y = 4$.

Ans: -8 #____ $f(x) = 3x^4 - 8x^3 - 96x^2 + 384x - 110$. On the interval $[-5, 4]$ identify the value of x where the absolute maximum occurs.	Ans: 12 #____ $y = x^4 - 10x^3 - 12kx^2 + 4x - 7$ has a point of inflection at $x = 2$. Find the value of k.
Ans: $\frac{24}{5}$ #____ Find both critical numbers on the interval $[0,\ \pi]$. Identify the leftmost critical number on the interval. $f(x) = 3\cos(\frac{4}{3}x) + 2x$	Ans: 0.9449 #____ Identify the maximum value of the given function. 
Ans: 4 #____ $y = x^3 - 6x^2 + 2x + 4$ has exactly one point of inflection. Find the y-coordinate of the point of inflection.	Ans: 8 #____ A conical pile of sand is being added to at a rate of 15 cubic yards per hour. The sand is piling in such a way that the diameter of the pile is always twice its height. Find the rate of change of the height in ft/hour when the pile is 6' high. Convert cubic yards to cubic feet. 1 cubic yard = ? cubic feet
Ans: 405 #____ $f(x) = 3x^4 - 8x^3 - 96x^2 + 384x - 110$. On the interval $[-5, 4]$ identify the value of x where the absolute minimum occurs.	Ans: $\frac{\pi}{8}$ #____ A conical pile of sand is being added to at a rate of 15 cubic yards per hour. The sand is piling in such a way that the diameter of the pile is always twice its height. Find the rate of change of the height in ft/hour when the pile is 6' high. What is the value in feet/hour of $\frac{dh}{dt}$?
Ans: 20 #____ A spherical balloon is being filled with a gas at a rate of 12 cubic feet per minute. Find the rate of change of its surface area, A, when the radius is 5 feet long. What is the value (omitting units) of $\frac{dV}{dt}$?	Ans: -5 #____ Apply the Mean Value Theorem to the function on the interval $[0, 2]$. What is the average rate of change that is guaranteed by the theorem? $f(x) = 3 + 12x^2 - x^3$.