Entering AP Calculus BC Summer Assignment

Welcome to AP Calculus BC!!! I am so excited to spend our year together!!! .

Directions.

- This assignment will be collected on the 1st day of classes. Exact Date TBD.
- Your summer work this year is a series of AB topics which you will review through Circuits. We have done a lot of these…..sort of a seek and solve on paper. These are great because they are self - checking!!!
- Work must still be organized and labeled. You may work on this document or you may use your own paper. Organized work is very important on the AP Exam given each May. Please take extra care to make sure that your work is easy to follow and your answers are easy to read. I will be grading the work also not just the answers.
- This assignment will count as a Quiz Grade for Quarter 1.
- I do respond to email over the summer!!! If you every have a question or need a hint or two…please reach out…..I will respond in a timely manner.

I am really looking forward to working together next school year…..have a great summer.

Be safe and stay well.

♥ Mrs. Weber

AP Calculus -- Derivatives Circuit Training Name____________________________

Beginning in the first cell, find $\frac{dy}{dx}$. Hunt for your answer, mark that cell #2 and find the next derivative. Proceed in this manner until you complete the circuit. Make sure you truly understand how each equation connects to its derivative, and that you aren't just using process of elimination. ☺

Ans: 0 # __1__ $y = \frac{1}{2}x^4 + 3x^2 - x + e$	Ans: $\frac{dy}{dx} = x(2cosx - xsinx)$ # _____ $y = \cos(x^2)$
Ans: $\frac{dy}{dx} = sec^2xe^{tanx}$ # _____ $y = lnx + e^x$	Ans: $\frac{dy}{dx} = \frac{3}{2}sec^3\left(\frac{x}{2}\right)tan\left(\frac{x}{2}\right)$ # _____ $x^3 - y^3 = 3$
Ans: $\frac{dy}{dx} = \frac{1}{(3-x)^2}$ # _____ $y = x^2cosx$	Ans: $\frac{dy}{dx} = \frac{3-2x-y}{x+2y}$ # _____ $x^2y + y^2x - 2x = 7$

Ans: $\frac{dy}{dx} = \frac{1+xe^x}{x}$ # ______ $y = \ln(3x^2 - x)$	Ans: $\frac{dy}{dx} = 2x^3 + 6x - 1$ # ______ $y = -\frac{3}{4}x^4 - 4x^{-2} + \sqrt{x}$
Ans: $\frac{dy}{dx} = e^x - 2xe^{x^2}$ # ______ $y = e^{tanx}$	Ans: $\frac{dy}{dx} = \frac{2-y^2-2xy}{x^2+2xy}$ # ______ $siny + cosx = 1$
Ans: $\frac{dy}{dx} = -2xsin(x^2)$ # ______ $y = \sqrt{3x - x^2}$	Ans: $\frac{dy}{dx} = \frac{1}{x-1} - \frac{8x}{4x^2-3}$ # ______ $y = tan^{-1}x$

Ans: $\frac{dy}{dx} = -1$ # ______ $y = \frac{x}{3x - x^2}$	Ans: $\frac{dy}{dx} = cotx$ # ______ $y = lne^x$
Ans: $\frac{dy}{dx} = \frac{x^2}{y^2}$ # ______ $x^2 + xy + y^2 = 3x$	Ans: $\frac{dy}{dx} = \frac{-4x}{(x^2-1)^2}$ # ______ $y = (1 + sin^2x)^2$
Ans: $\frac{dy}{dx} = \frac{1}{1+x^2}$ # ______ $y = 4sin^2x + 4cos^2x$	Ans: $\frac{dy}{dx} = \frac{6x-1}{3x^2-x}$ # ______ $y = \ln(sinx)$

Ans: $\frac{dy}{dx} = -4cos^3 x sinx$ # ______ $y = sec^3\left(\frac{x}{2}\right)$	Ans: $\frac{dy}{dx} = \frac{3-2x}{2\sqrt{3x-x^2}}$ # ______ $y = \frac{x^2+1}{x^2-1}$
Ans: $\frac{dy}{dx} = \frac{sinx}{cosy}$ # ______ $y = e^x + e - e^{x^2}$	Ans: $\frac{dy}{dx} = -3x^3 + \frac{8}{x^3} + \frac{1}{2\sqrt{x}}$ # ______ $y = \frac{3x-x^2}{x}$
Ans: $\frac{dy}{dx} = 4sinxcosx + 4sin^3 xcosx$ # ______ $y = (1 - sin^2 x)^2$	Ans: $\frac{dy}{dx} = 1$ # ______ $y = ln\left(\frac{x-1}{4x^2-3}\right)$

Circuit Training – Implicit Differentiation Name_______________________________

Directions: Beginning in cell number 1, calculate either the first or second derivative as indicated. To advance in the circuit, locate your answer and call that cell number 2. Continue in this manner until you complete the circuit.

NOTE: Attach additional pages as necessary to clearly communicate the calculus. I expect to see a lot of work!

Answer: undefined # ___1___ Find $\frac{dy}{dx}$ for the circle $x^2 + y^2 = 25$. To advance in the circuit, evaluate $\frac{dy}{dx}$ for the point (3, - 4).	Answer: $-\frac{2}{\sqrt{3}}$ # _______ Find $\frac{d^2y}{dx^2}$ for the circle $x^2 + y^2 = 25$. To advance in the circuit, evaluate $\frac{d^2y}{dx^2}$ for the point (3, - 4).
Answer: $-\frac{25}{4}$ # _______ Find the slope of the tangent line to $\cos(\pi x) = x^7y^2$ at the point (-1, 1).	Answer: 1 # _______ For the circle centered at the origin with radius 4 and equation $x^2 + y^2 = 16$, find $\frac{dx}{dt}$ at the first quadrant point where $x = 2$ if $\frac{dy}{dt} = -3$ at that instant.
Answer: $\frac{16}{3}$ # _______ If $\sin y + x = \frac{7}{2}$, find the rate of change at the point $\left(3, \frac{\pi}{6}\right)$.	Answer: $\frac{1}{8}$ # _______ The relation $y^2(4 - x) = x^2$ has a slope of _____ when x= 3 and y = -3.
Answer: $\frac{1-3y}{3x+2y}$ # _______ Calculate the slope of the tangent line to $x^2 - xy + y^2 = 19$ at the point (2, 5).	Answer: $3\sqrt{3}$ # _______ Find $\frac{dy}{dx}$ for $3\sqrt[3]{x} - 12\sqrt[3]{y^4} = 9$

Answer: $\frac{1}{16\sqrt[3]{x^2y}}$ # ______ Find $\frac{dy}{dx}$ for $\tan(xy) = x + y$.	Answer: $\frac{3}{4}$ # _______ Calculate $\frac{dy}{dx}$ for the relation $3x + xy = y$. To advance in the circuit, find the instantaneous rate of change at the point $\left(\frac{1}{4}, 1\right)$.
Answer: $\frac{25}{64}$ # _______ Find $\frac{dy}{dx}$ for the hyperbola $x^2 - y^2 = 16$.	Answer: $\frac{7}{2}$ # _______ Find $\frac{dy}{dx}$ for $y^2 = \frac{1}{2x+5}$.
Answer: $-\frac{5}{2}$ # _______ For the relation $\sqrt{x+y} = 3x$, find the value of x for which $\frac{dy}{dx} = 17$ when $y = 8$.	Answer: $\frac{-1}{y(2x+5)^2}$ # _______ Find the slope of the tangent line to the ellipse $x^2 + 4y^2 = 16$ at the point (4, 0).
Answer: $\frac{1-y\sec^2(xy)}{x\sec^2(xy)-1}$ # _______ Write the equation of the line tangent to $x^2 + y^2 = 25$ at the third quadrant point where *x=-3.* To advance in the circuit, find the y-intercept of the tangent line.	Answer: $\frac{x}{y}$ # _______ Given the relation $x + 3xy + y^2 = 2x$, find $\frac{dy}{dx}$.

Circuit Training – What f' and f'' tell you about f. **Name ______________________**

Directions: Beginning in cell #1, answer the question based on your analysis of f' and/or f''. Understanding general graph behavior will be useful too. NO TECHNOLOGY is needed for any of these questions. Hunt for your answer; that becomes problem #2. Continue in this manner until you finish.

Answer: $(-\infty, -2) \cup (2, 3)$ # __1__ Given the function $f(x) = -x^2 + 7x + 6$. Find the interval(s) in which $f(x)$ is decreasing.
Answer: $(-2, 0)$ # ______ Find the interval(s) on which $h(x)$ is concave down if $h'(x) = \frac{2}{3}x^3 - \frac{3}{2}x^2 - 9x + 1$.
Answer: $\left(\frac{7}{2}, \infty\right)$ # ______ The maximum value for the function $f(x) = -2x^2 - 12x - 11$ is ______.
Answer: $(0, 2)$ # ______ Given the rational function $h(x) = \frac{1}{x^2-9}$; find the intervals on which $h(x)$ is increasing.

Answer: $\left(\frac{1}{2}, \infty\right)$

#______ If $f'(x) = 4x^3 - 2x^2$, then $f(x)$ is concave down on what interval(s)?

Answer: $(-\infty, -1)$

______ Find the interval on which $f(x) = x\sqrt{x+3}$ is increasing and concave up.

Answer: $(-\infty, -3) \cup (-3, 0)$

______ Find the y-value of the local maximum for $f(x) = x^3 + 4x^2 - 3x - 5$.

Answer: 7

______ If $f'(x) = 4x^3 - 2x^2$, then $f(x)$ is increasing on what interval(s)?

Answer: 1

#______ The graph of $g(x) = |x^2 - 4|$ is concave down and decreasing on the interval __________.

Answer: $\left(0,\ \frac{1}{3}\right)$

______ Find the x-coordinate of the inflection point (if any) of $f(x) = x^3 - \frac{1}{2}x^2 + 4x + 1$.

Answer: $(-2, \infty)$

______ Find the interval(s) on which $g(x) = x^2e^x$ is decreasing.

Answer: $\left(-\frac{3}{2},\ 3\right)$

______ Given $g(x) = x + \sin x$. Find the interval(s) on which $g(x)$ is decreasing.

Answer: $(-3,-2)$

#______ Find the interval on which $f(x) = \ln(x^2+1)$ is decreasing and concave down.

Answer: 13

______ Where is $f(x)$ concave up given that $f''(x) = -x^3 + 3x^2 + 4x - 12$?

Answer: none

______ The graph of $y = |\ln x|$ has an absolute minimum value where x = _______.

Answer: $\frac{1}{6}$

______ Find the interval(s) on which $f(x) = x\sqrt{x+3}$ is decreasing.

Circuit Training – U-Substitution (Indefinite Integrals) **Name ___________________________**

Directions: Beginning in cell #1, evaluate the indefinite integral. Search for your answer. When you find it, that cell becomes #2. Work that problem and then hunt for the answer. Continue in this manner until you complete the circuit. You should not need technology to evaluate these integrals! Do not guess at the end! Really work them out and then check for your answer!

Answer: $-\frac{1}{4}(4-x)^4+C$ # __1__ $\int 2x(x^2+3)^3dx$
Answer: $-\frac{1}{4}\cot^4 x+C$ # ______ $\int \frac{1}{\sqrt{1-4x^2}}dx$
Answer: $\ln(x^2+3)+C$ # ______ $\int \cos\left(\frac{x}{2}\right)dx$
Answer: $\frac{1}{4}(x^2+3)^4+C$ # ______ $\int (4x+3)\sqrt{2x^2+3x}\,dx$
Answer: $\frac{1}{2}\sin^2(2x)+C$ # ______ $\int \frac{\sin\sqrt{x}}{\sqrt{x}}dx$

Answer: $\frac{2}{3}(2x^2+3x)^{\frac{3}{2}}+C$

______ $\int \frac{2x}{x^2+3}dx$

Answer: $-e^{\cos x}+C$

______ $\int \frac{\ln(x+4)}{x+4}dx$

Answer: $\frac{1}{2}\sin^{-1}(2x)+\ C$

______ $\int \frac{1}{4+x^2}dx$

Answer: $-\ln|\cos x|+C$

______ $\int x\tan(x^2)dx$

Answer: $2\sqrt{2+e^x}+C$

______ $\int \sec^2\left(\frac{x}{4}\right)dx$

Answer: $-2\cos\sqrt{x} + C$

_______ $\int \frac{\tan^{-1}x}{1+x^2}dx$

Answer: $\frac{1}{2}\sec(2x)+C$

______ $\int xe^{x^2+1}dx$

Answer: $\frac{1}{2}tan^{-1}\left(\frac{x}{2}\right)+C$

______ $\int \frac{e^x}{\sqrt{2+e^x}}dx$

Answer: $\frac{1}{2}(\ln(x+4))^2+C$

______ $\int \frac{6x^2+4x+2}{x^3+x^2+x}dx$

Answer: $2\sin\left(\frac{x}{2}\right) + C$

______ $\int \sec(2x)\tan(2x)dx$

Answer: $2\ln|x^3 + x^2 + x| + C$

______ $\int (4-x)^3 dx$

Answer: $\frac{1}{2}(\tan^{-1}x)^2 + C$

______ $\int \cot^3 x \csc^2 x \, dx$

Answer: $-\frac{1}{2}\ln|\cos(x^2)| + C$

______ $\int 2\sin(2x)\cos(2x) dx$

Answer: $4\tan\left(\frac{x}{4}\right) + C$

______ $\int e^{\cos x} \sin x \, dx$

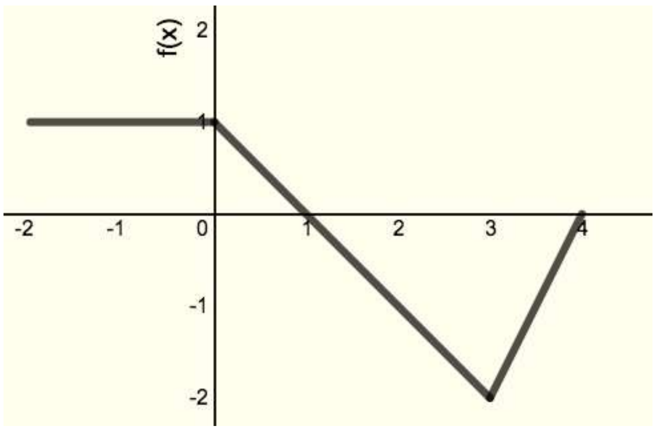
Answer: $\frac{1}{2}e^{x^2+1} + C$

______ $\int \frac{\sin x}{\cos x} dx$

Circuit Training – Fundamental Theorem of Calculus, Part I Name ___________________

Directions: Beginning in cell #1, use the Fundamental Theorem of Calculus Part I (and occasionally Part II) to answer the question. Search for your answer and that problem becomes #2. Continue in this manner until you complete the circuit.
NOTE: Any questions about the function $H(t)$ pertain to the following given information…

Let $H(t) = \int_1^t f(x)dx$ where $f(x)$ is the continuous function composed of three line segments with domain $[-2, 4]$ as graphed below:



Answer: $-\frac{5}{2}$ # __1__ Let $F(x) = \int_0^x 5dt$. Find $F(3)$.	Answer: $\frac{2}{3}$ # ______ Find $\frac{d}{dt}\int_{-1}^{\tan t} \frac{2}{1+x^2}dx$ and evaluate it for $t = -\frac{\pi}{4}$.
Answer: 1 # ______ Find $F'\left(\frac{3\pi}{2}\right)$ given $F(t) = \int_5^t \frac{2x}{\pi}e^{\cos x}dx$.	Answer: – 2 # ______ $H''(1) = ?$

Answer: – 1 # ______ $H(-2) = ?$	Answer: 4 # ________ $G(x) = \int_{-2}^{x} \cos\left(\theta + \frac{\pi}{2}\right) d\theta.$ $G'\left(-\frac{\pi}{2}\right) =$
Answer: 15 # ______ Let $G(x) = \int_{x}^{2} t dt.$ Find $G(4)$.	Answer: – 3 # ______ Given $W(t) = \int_{2}^{t} \ln(x-1)dx.$ Find $W''\left(\frac{5}{2}\right)$.
Answer: 3 # ______ The position function, $s(t)$, is defined as $s(t) = s(0) + \int_{0}^{t}\left(\frac{8}{\pi}+\sec^2\beta\right)d\beta$ where $s(0) = -6.$ Find $s\left(\frac{\pi}{4}\right)$.	Answer: 0 # ______ Now evaluate $H'(3)$.
Answer: 2 # ______ The next questions are about $H(x)$. Evaluate $H(1)$.	Answer: – 6 # ______ Let $F(x) = \int_{3}^{x} \sqrt{1+t}dt.$ Find $F'(15)$.