Circuit Training – Calculus First Half Review **Name _____**

Directions: Begin in cell #1. Do the work necessary to solve the problem. Search for your answer. Call the cell #2 and proceed in this manner until you complete the circuit. In some cases, you will have to attach separate paper to showcase your best work. *If you see the icon you may use a calculator, though you may not need to*. If the problem refers to a **TABLE**, use the table below. Otherwise, each problem uses only the given information in its cell.

Select function values and first derivative values of the twice differentiable functions f and g are shown.

x	$f(x)$	$g(x)$	$f'(x)$	$g'(x)$
0	3	– 2	1/2	3
1	4	– 4	1/4	1/3
2	5	– 8	1/8	-5

Answer: $\frac{7}{9}$

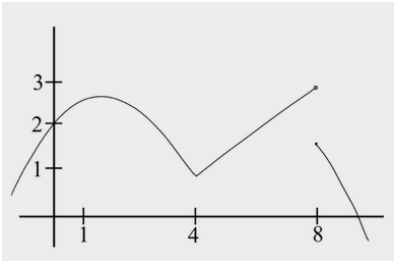
___1____ $\lim_{x\to -6} \frac{2x^2+12x}{x+6}$

Answer: 2

_____ $\lim_{x\to -\infty} \frac{\sqrt{ax^2+bx+c}}{d-ax} = 2$ if a =?

Answer: 17

_____ Where does the function appear to be continuous but not differentiable?



Answer: $-\infty$

_____ For piecewise function, $f(x)$, consider the statement $\lim_{x\to 6^-} f(x) = \lim_{x\to 6^+} f(x) = f(6)$.

$$f(x) = \begin{cases} \frac{1}{6}x - 4\,, x < 6 \\ -\frac{x}{2}\,, \quad x = 6 \\ 3 - x\,, \qquad x > 6 \end{cases}$$

If TRUE, go to answer – 3, if FALSE, go to answer – 2.

Answer: – 12

_____

Evaluate the limit: $\lim_{x\to 0} \frac{\sqrt{x+36}-6}{x}$

Answer: 1

_____

Evaluate the limit: $\lim_{x\to \frac{\pi}{4}} \frac{\tan x - 1}{x - \frac{\pi}{4}}$

Answer: -2

_____ Given $y = e^{x-e} + \ln x - \frac{x}{e}$; $y'(e) = ?$

Answer: $-\frac{24}{25}$

_____

$y = \tan^{-1}(3x)$ $y'(1) = ?$

Answer: $-\frac{63}{2}$

_____. **TABLE** $\lim_{x \to 2} \frac{3f(x) - 15}{x-2} = ?$

Answer: $\frac{1}{12}$

_____ $\lim_{x \to 6^-} \frac{2x}{x^2-36} = ?$

Answer: -3

_____ Find the instantaneous rate of change of the function

$h(x) = \frac{2}{3}x^3 - 4x^2 + 7x + 1$ at $x = -1$.

Answer: 7

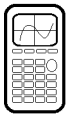
_____ **TABLE**

$w(x) = 3f(x)g(x)$ $w'(0) = ?$

Answer: $-\frac{3}{4}$

_____

Where do the graphs of $y = e^{\frac{x}{2}}$ and $y = -x^2 + 2x + 1$ have parallel tangents?



Answer: 8

_____ Evaluate $\frac{dy}{dx}$ at the second quadrant point where $x = -1$ for the relation $x^3 - x^2y + y^2 = 11$.

Answer: $-\frac{1}{3}$

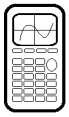
_____ Find $\frac{d^2y}{dx^2}$ at $x = -3$ for $y = \frac{x+5}{x-2}$.

Answer: 4

_____ What is the slope of the tangent line to $y = 2\sin x$ at $x = \pi$?

Answer: 0.653

_____ What is the 47th derivative of $y = \sin x$ evaluated at $x = \frac{\pi}{3}$?



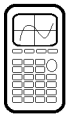
Answer: ¼

_____

The equation of the tangent line to $y = \sqrt[3]{x}$ at $x = 8$ is $y = ax + b$. What is b?

Answer: $\frac{3}{8}$

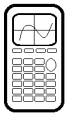
_____ Where is the tangent line to $y = \frac{\csc^2\left(\frac{x}{2}\right)}{3x+4}$ horizontal on the interval $0 \le x \le 2\pi$?



Answer: $\frac{5}{2}$

_____

Let $R(t)$ be the rate, in gallons per hour, at which water enters a tank. What are the units of $R'(t)$?



gallons……go to……answer……$-\frac{1}{2}$

gallons/hour……go to……answer….0.653

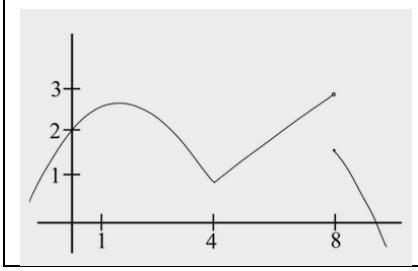
gallons^2/hour……go to……answer…….$\frac{3}{8}$

gallons/hour^2……go to……answer…….$-\frac{3}{4}$

Answer: $\sqrt{\frac{13}{3}}$

_____ Assume the graph is $p(x)$.

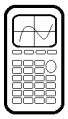
$$\lim_{x \to 8^-} \frac{3p(x) - 2x}{15 - 3x} = ?$$



Answer: $-\frac{1}{2}$

_____ **TABLE**

Write the equation of the tangent line to $g(x)$ at $x = 1$ and use it to approximate $g(0.8)$.



Answer: $\frac{4}{3}$

_____ **TABLE**

$h(x) = 16f(x) - g(x) \qquad h'(2) = ?$

Answer: $-\frac{14}{125}$

_____ **TABLE**

$p(x) = \sqrt{f(x)} \qquad p'(1) = ?$

Answer: $\frac{3}{10}$

_____ **TABLE**

Let $f^{-1}(x)$ be the inverse of $f(x)$. Find $(f^{-1})'(5)$.

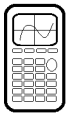
Answer: $-\frac{1}{8}$

_____ **TABLE**

$m(x) = \frac{g(x)}{f(x)} \qquad m'(2) = ?$

Answer: $-\frac{11}{7}$

_____ The velocity of a particle moving horizontally along the x −axis is given by $v(t) = t\sin^3(5t)$ for $t \geq 0$.
At $t = 2$ is the particle speeding up or slowing down? Explain.



Speeding up …. go to…. answer $\frac{3}{2}$.

Slowing down…. go to answer $\frac{5}{2}$.

Answer: 24

_____ **TABLE**

For some value of $x = c, 0 < c < 2,\ g(c) = -\pi$.

What condition(s) must be met for the proof?

Continuity…….. go to ….. answer $-\frac{1}{3}$.

Differentiability….. go to ….. answer $-\frac{1}{4}$.

Differentiability and continuity.. go to.. answer $-\frac{24}{25}$.

Answer: -4.066

_____ Let $z = \frac{xy}{2}$. If $\frac{dz}{dt} = -12$ and $\frac{dx}{dt} = 3$ when $z = 4$ and $y = 6$, find $\frac{dy}{dt}$.

Answer: $\frac{1}{16}$

_____ Use the data in the **TABLE** to estimate $f''(1.5)$.

Answer: 3.545

_____ Given $h(x) = x^3 - x$.
Determine $c, 1 < c < 3$, for which $h'(c) = \frac{h(3) - h(1)}{3 - 1}$.

Answer: $\frac{3}{2}$

_____ $\frac{dh}{dt} = -\sqrt{5h}$ Determine $\frac{d^2h}{dt^2}$ at $h = 16$.