2024 – 2025

AP Calculus BC Summer Assignment (students moving from Calc AB to Calc BC)

Resources Needed: Graphing Calculator

As you already know from your time in Calculus AB, Calculus is the mathematical study of continuous change. You already know a lot about the two traditional branches – differential calculus and integral calculus. During this course we will explore these two areas in more depth and, later in the year, apply calculus concepts to less familiar types of functions including parametric and polar, as well as to infinite series.

If you feel you might need a quick refresher on Calc I concepts, here is a video to get you back in the swing…

https://www.youtube.com/watch?v=SOkMGWCLqoc

Your summer assignment is twofold. First, take a break this summer! Everyone needs one – relax, enjoy, and recharge. Second, try out the attached problem sets to review and sharpen your skills. If you would like to get the assignment out of the way first, and then relax, do so – just review your work at the end of August to remind yourself. Alternately, pretend you are not allowed to work on it until the last 2 weeks of break and forget about it for now.

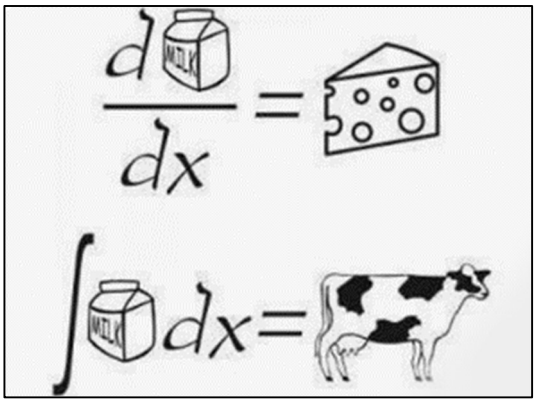
The attached problem sets will be the start of our class Calculus crossword we will work on throughout the year. In September, you will get a change to review with classmates and get us started off strong! You are welcome to work with a friend on this assignment, but you must show your own work.

If you are stuck or have questions, reach out. I look forward to working with you next school year!

Mrs. Meyers

Katherine.meyers@sno.wednet.edu

Summary of Calculus



Across and Down

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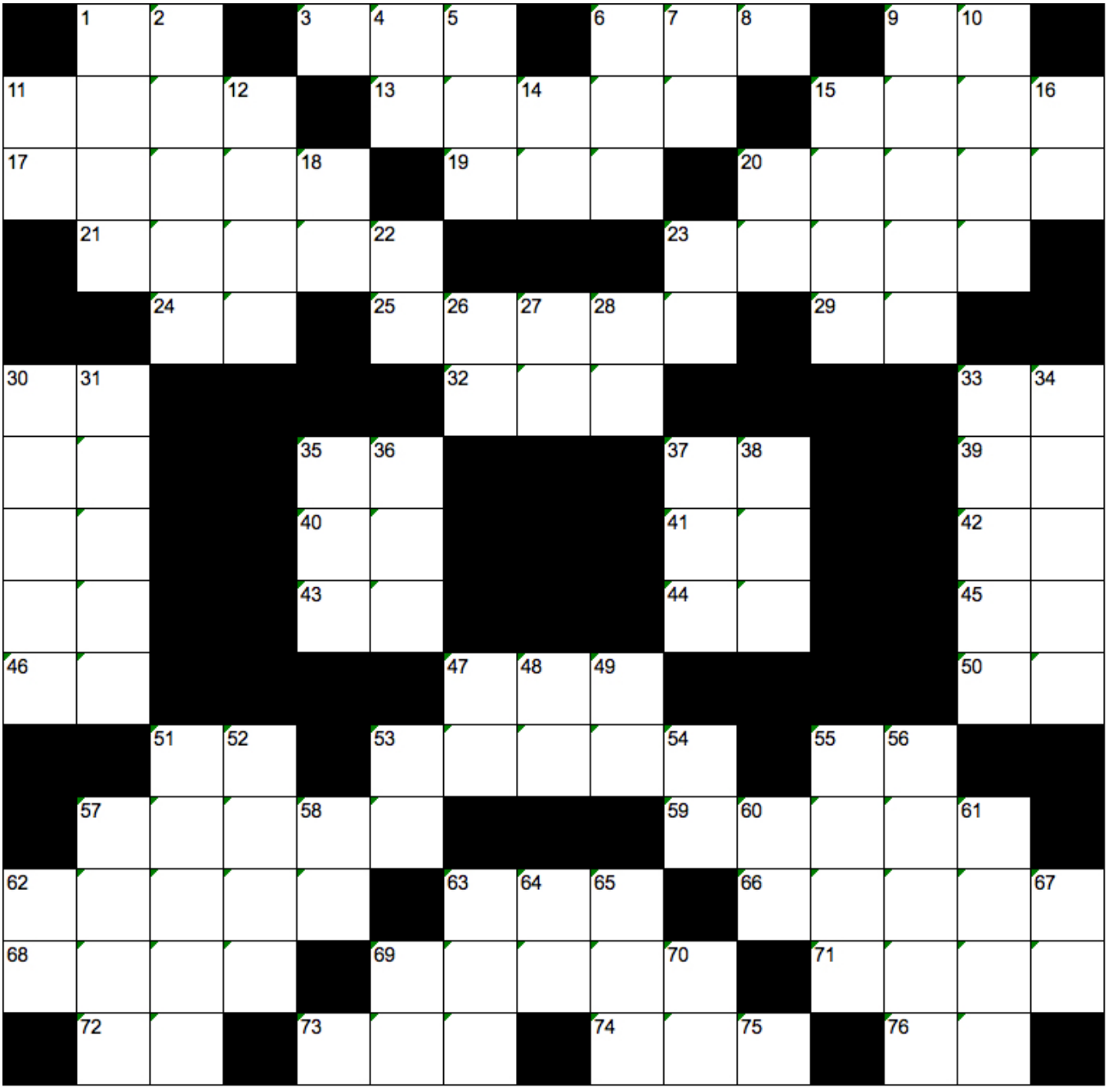

AP Calculus – Across and Down

Clue Set: #1

Topic: Limits

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Across

None

Down

D8. Find $\lim_{x\to 0}\left(e^x-\cos x\right)\left(e^x-\sin x\right)$.

D20. Find $\lim_{x\to-\infty}\dfrac{3x^3}{\sqrt{x^6-x^3+15}}$. Enter 99 if you believe the answer to be undefined.

D33. Find $\lim_{x\to 3}\dfrac{-x^3+1.62x^2+4.14x}{x-3}$.

D48. Find $\lim_{x\to\infty}\dfrac{6x}{\sqrt{1600x^2-8x+50}}-\lim_{x\to-\infty}\dfrac{6x}{\sqrt{1600x^2+8x-50}}$ (one decimal place).

D69. The whole numbers a and b each have one digit. If $\lim_{x\to 3} f(x)$ and $\lim_{x\to 1} g(x)$ both exist and

$$f(x)=\begin{cases} bx^2, x\ge 3 \\ ax+6,\ x<3 \end{cases} \text{ and } g(x)=\begin{cases} -a\cos(\pi x), x\ge 1 \\ b\sec^2\left(\dfrac{\pi x}{4}\right), x<1 \end{cases}, \text{ write } a \text{ then } b.$$

AP Calculus – Across and Down

Clue Set: #2

Topic: Basic Derivatives

Only digits (0 – 9) and negative signs are allowed. If an answer is an integer, use leading zeros to make the answer fit. (Ex: If 4 digits are required and your answer is 46,enter 0046.) If an answer has decimal places, the decimal point is dropped and trailing zeros are used to make the answer fit to the required number of decimal places which is specified in the problem. (Ex: If 2 decimal places are required and your answer is 12.4682, round to 12.47 and enter 1247. If one decimal place is required and your answer is 15, write 15.0 and enter 150.

Across

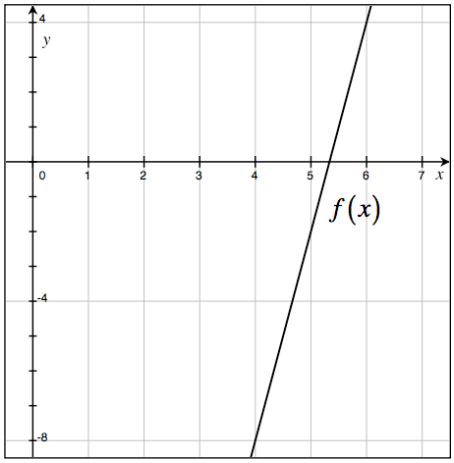
A39. If $f(x)=\dfrac{-45}{2x^2+x-4}$, find $\lim\limits_{h\to 0}\dfrac{f\left(\frac{1}{2}+h\right)-f\left(\frac{1}{2}\right)}{h}$.

A73. If $f(x)=\dfrac{14x^2-4x-1}{2x}$, find $f'\left(\frac{1}{4}\right)\cdot f'\left(-\frac{1}{4}\right)$.

Down

D18. The tangent line to $y=12.75+7x-x^2$ has x-intercept 10.75 and y-intercept 43. At what value of x does the tangent line intercept the curve? (One decimal place)

D47. If f is the function whose graph is shown and $g(x)=\sqrt{x}f(x)$, find $g'(4)$.



AP Calculus – Across and Down

Clue Set: #3

Topic: Derivatives – Chain Rule

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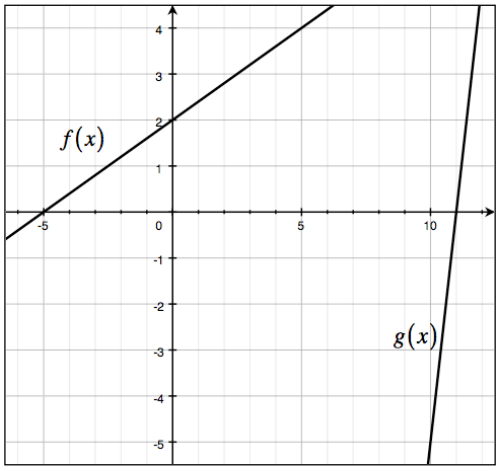
Across

A1. If $h(x)=f\left(g\left(\frac{x}{2}\right)\right)$ and $g(0)=4$, $g'(0)=5$, $f'(4)=16$, find $h'(0)$,

A35. If $f(6)=9$ and $f'(6)=-6$, and $g(x)=x\sqrt{f(2x)}$, find $g'(3)$.

A44. Using the graph to the right, if $h(x)=5f(g(5x))$, find $h'(2)$.



Down

D67. **(Sci. Calc.)** If $f(x)=100\left(\frac{x-3}{x+4}\right)^3$, find $\lim_{x\to 1/2}\frac{f(x)-f(1/2)}{x-1/2}$ to the nearest integer.

AP Calculus – Across and Down

Clue Set: #4

Topic: Derivatives – Trig Derivatives

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Across

A37. Find the slope of the line tangent to $y = \dfrac{\sin x}{10\cos 2x}$ at $x = \dfrac{5\pi}{3}$.

A55. If $y = -x\cos x$, find $\left.\dfrac{d^9 y}{dx^9}\right|_{x=0}$

A74. Let $f(x) = 3\cos x - 6\sin x$. If $a = \left|f'\left(\dfrac{3\pi}{2}\right)\right|$, $b = \left|f''\left(\dfrac{3\pi}{2}\right)\right|$, $c = \left|f^{(4)}\left(\dfrac{3\pi}{2}\right) - f\left(\dfrac{3\pi}{2}\right)\right|$, write a, then b, then c as a three-digit number.

Down

D49. **(Sci. Calc.)** The slope of the line normal to $y = \dfrac{10\sin x}{x}$ at $x = \dfrac{\pi}{4}$, accurate to one decimal place is

AP Calculus – Across and Down

Clue Set: #5

Topic: Derivatives –Implicit Differentiation

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Across

A20. For $y^4 - 3y = \frac{x^4}{2} - 5002$, find the value of $\frac{dy}{dx}$ at $(-10,1)$.

A46. For $x^2 - y^2 = 80$, find $\frac{d^2y}{dx^2}$ at $y = -1$.

A76. If $x^2 + y^2 = 34$, $\left|\frac{dy}{dx}\right|$ at $x = 3$ can be expressed as a fraction $\frac{a}{b}$ in lowest terms. Write a then b as a two-digit number.

Down

None

AP Calculus – Across and Down

Clue Set: #6

Topic: Derivatives –Transcendentals

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Across

A3. **(Sci. Calc.)** If $f(x) = -\pi x \ln\left[x^2 + \sin(\pi x)\right]$, find $f'(8)$ to the nearest integer.

A13. **(Sci. Calc.)** Find the slope of the tangent line to $y = \frac{292}{3} e^{\sin^3 x}$ at $x = 1$ to the nearest whole number.

A53. **(Sci. Calc.)** If $x = \ln(2y+1)$, find $\frac{dy}{dx}$ at $x = 3.706$, accurate to 3 decimal places.

A63. **(Sci. Calc.)** If $f(x) = \frac{5x + 6e}{5\ln x}$, find $f'\left(\sqrt{e}\right)$, accurate to one decimal place.

A71. **(Sci. Calc.)** If $f(x) = \ln\left(e^{5x} - 6\right)$, find $f'(0.793)$ (3 decimal places)

Down

D35. Using the table to the right, find $g''(1)$ if $g(x) = e^{f(x)}$.

x	$f(x)$	$f'(x)$	$f''(x)$
1	$\ln 3$	4	–25

AP Calculus – Across and Down

Clue Set: #7

Topic: Derivatives –Derivatives of Inverses, Linear Approximation

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Across

A9. If $f(x)=\sin 2x$, find the linear approximation for $f(\pi+0.075)$ using the tangent line to f at $x=\pi$.

A24. The function f is differentiable for all real numbers. The table to the right gives values of the function and its derivatives at $x=-2$ and $x=4$. If f^{-1} is the inverse function of f, and $y=xf^{-1}(x)$, find $\frac{dy}{dx}$ at $x=-2$.

x	$f(x)$	$f'(x)$
–2	3	–1/3
4	–2	–2/7

Down

D27. **(Gr. Calc.)** If $f(x)=\frac{x}{20}+\frac{\sin^2 x}{10}$ and $g(x)=f^{-1}(x)$, find $g'(0.3)$ accurate to one decimal place.

D51. For the function f, $f(10)=-54$ and $f'(x)=18-4x$. What is the approximation for $f(9.98)$ found by using the tangent line to the graph of f at $x=10$? (2 decimal place accuracy)

D60. **(Sci. Calc.)** If $f(x)=(2-3x)^3$, find the positive difference between $f(2)$ and the approximation to $f(2.04)$ using the linear approximation to f at $x=2$ (one decimal place).

AP Calculus – Across and Down

Clue Set: #8

Topic: Derivatives –Continuity & Differentiability, Related Rates

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Across

A6. If $y=\begin{cases} x^2+ax+b,\ x\ge 2 \\ -ax^2+504x-b,\ x<2 \end{cases}$, for what value of a is the function differentiable? Enter 000 if there is no such value.

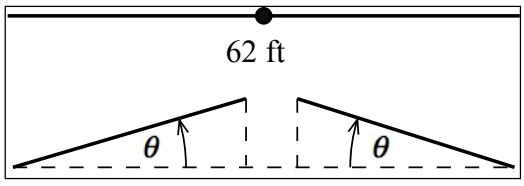
A15. **(Sci. Calc.)** A particle is moving along the curve $y=9-x^2$. How fast is its distance from the point (0, 9) changing at $x = 2.3$ if its x-coordinate is changing at the rate of 1.8 units/sec? (3 decimal place accuracy)

A57. **(Sci. Calc.)** A reservoir in the shape of an inverted cone has top diameter 200 feet and height 50 feet. Due to a drought, water is evaporating from the reservoir. When the height of the water is 42 feet high, the height of the water is lowering at the rate of 2.03 feet/week. How fast (to the nearest 10 feet) is the volume of the water decreasing at that moment, measured in ft^3/week?

A62. **(Sci. Calc.)** Train *S,* 50 miles north of a train station is traveling towards the station at 80 mph. Train *W*, is 20 miles west of the station and is traveling west at 30.15 mph from the station. How fast is the distance between the two trains changing at that instance? (2 decimal place accuracy)

Down

D6. **(Sci. Calc.)** A 62 ft. drawbridge opens in the center as shown by the figure to the right. The bridge opens at the rate of $\frac{2°}{\text{sec}}$. When $\theta = 19°$, find how fast the center of the bridge is rising. (2 decimal places).



D22. Let $f(x)=\begin{cases} e^{ax}+b, x\ge 0 \\ a(x+b)-17, x<0 \end{cases}$ with $b > a$, and a and b are whole numbers. If f is differentiable at $x = 0$, what is the smallest possible value of $a + b$?

AP Calculus – Across and Down

Clue Set: #9

Topic: Motion w/derivatives, Mean-Value Theorem

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Across

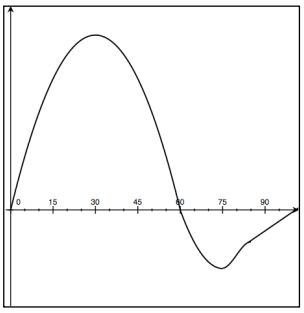
A47. Determine how many times Rolles Theorem is satisfied for the function $f(x) = e^{\sin(\pi x)\cos(\pi x)}$ on the interval [0, 50].

Down

D9. A model rocket has two stages. When it is launched, it travels upwards until it has no upward acceleration. At that time, the second stage ignites. How high is the rocket when the 2nd stage ignites (2 decimal places) if the rocket's height is described by $y(t) = t^3 - 15t^2 + 75t + 5.2$?

D26. Suppose $f(x)$ is differentiable everywhere and $f(-4) = 3$ and $f'(x) \le 4$ for all values of x. Using the Mean-Value Theorem, what is the largest possible value of $f(7)$?

D28. The graph to the right shows the velocity $v(t)$ of a particle over a 100-second period of time. For how many seconds was the particle speeding up?



D34. A particle subjected to huge forces is at the positions and has the velocities at $t = 1.5$ and $t = 2$ as shown in the table to the right. Find its average speed over that time interval. (2 decimal places).

t	$x(t)$	$v(t)$
1.5	14.82	41.27
2.0	–61.40	–32.35

D65. The function $f(x) = \sqrt{x} + 10$ passes through the points (1,11) and (a,b). If the value of c satisfying the Mean-Value Theorem for f on the interval $[1,a]$ occurs at $c = 4$, find the values of a and b that fit this situation. Write the answer as a, then b.

AP Calculus – Across and Down

Clue Set: #10

Topic: Function Analysis

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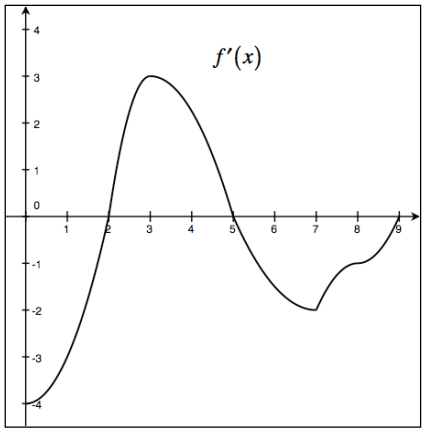
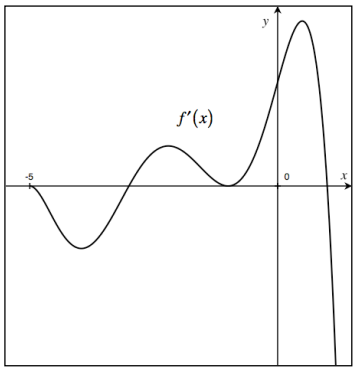
Across

A40. The graph of $f'(x)$, defined on [0, 9] is on the right. The graph of $f(x)$ is increasing and concave up on the interval $[a,b]$. Write a then b as a two-digit number.



A68. The function $f(x)=90x^2-x^3-1500x$ is increasing on the interval $[a,b]$ where a and b are two-digit numbers. Write a, then b as a four-digit number.

D14. The continuous graph to the right is $f'(x)$, defined on the interval $[-5,\infty)$. Find the two-digit number EI representing the number of relative extrema and number of inflection points of (for instance, 3 relative extrema and 2 inflection points would have an answer of 32).



D55. Let $f'(x)$ be the product of 21 terms defined by:

$$f'(x)=(x+4)(x+3)(x+2)\ldots(x)(x-1)\ \ldots\ (x-14)(x-15)(x-16).$$

If $x = a$ is the location of the leftmost relative maximum to f and $x = b$ is the location of the rightmost relative maximum to f, write a then b. For instance, if you think that $a = -1$ and $b = 10$, then your answer would be –110.