Dear Future AP Calculus Student,

Congratulations! You have signed up for a truly rewarding mathematics course. This course is also very challenging and relies heavily on your background in pre-calculus. Because of this fact, I am asking you to complete a summer assignment in order to practice and perfect those skills. The Calculus is challenging enough without simple errors in pre-calculus topics getting in the way.

The summer assignment is 100 problems and due on the first full day of class next year. Please follow the instructions. Please utilize online resources like Khan Academy, Wolfram Alpha, or others to help you through this assignment. Please utilize each other to help you through this assignment. Form a study group, a group chat, or get together for a summer Calculus party. It is imperative that you know how to do ALL of these problems BEFORE starting Calculus. You must be absolutely fluent with exact values for Trigonometric functions (problems #40 - #55) on day one. We will take a quiz on these the first week of school.

For this assignment, I suggest that you procrastinate. Yes, I actually said that. It will serve you better to do these problems near the end of summer.

Please watch your email for reminders. If you lose the assignment, it should also be posted on the school website.

Have a relaxing summer and prepare yourself to have the best possible experience in AP Calculus AB next year.

Sincerely,

Mr. Bremel
Simplify the following:

1. \( \frac{3}{4x^2-25} + \frac{2}{2x+5} \)

2. \( \frac{8}{y-2} - \frac{3y}{2y^2-8} \)

3. \( \frac{30x^2+53x+22}{70x^2+17x-66} \)

Let \( f(x) = 2x + 1 \) and \( g(x) = 2x^2 - 1 \). Find each.

4. \( f(2) \)

5. \( g(-3) \)

6. \( f(h + 1) \)

7. \( f[g(-2)] \)

8. \( g[f(m + 2)] \)

9. \( [f(x)]^2 - 2g(x) \)
Let $f(x) = \sin(2x)$. Find each EXACT value.

10. $f\left(\frac{\pi}{4}\right)$
11. $f\left(\frac{2\pi}{3}\right)$
12. $f\left(-\frac{\pi}{6}\right)$

Let $f(x) = x^2$, $g(x) = 2x + 5$, and $h(x) = x^2 - 1$. Find each.

13. $h[f(-2)]$
14. $f[g(x - 1)]$
15. $g[h(x^3)]$

Find the $x$ and $y$ intercepts for each of the following functions:

16. $y = 2x - 5$
17. $y = x^2 + x - 2$

18. $y = x\sqrt{16 - x^2}$
19. $y^2 = x^3 - 4x$
Find the point(s) of intersection of the graphs for the given equations.

20. \( \frac{x+y=8}{4x-y=7} \)  
21. \( \frac{x^2+y=6}{x+y=4} \)  
22. \( \frac{x=3-y^2}{y=x-1} \)

Find the domain and range of the following functions. Write your answers in INTERVAL NOTATION.

23. \( f(x) = x^2 - 5 \)  
24. \( f(x) = -\sqrt{x + 3} \)

25. \( f(x) = 3 \sin x \)  
26. \( f(x) = \frac{2}{x-1} \)
Find the inverse for each function.

27. \( f(x) = 2x + 1 \)  
28. \( f(x) = \frac{x^2}{3} \)

29. \( g(x) = \frac{5}{x-2} \)  
30. \( y = \sqrt{4-x} + 1 \)

31. If the graph of \( f(x) \) has the point \((2, 7)\) then what is one point that will be on the graph of \( f^{-1}(x) \)?

32. Explain, in words, how the graphs of \( f(x) \) and \( f^{-1}(x) \) compare.
33. Determine the equation of a line passing through the point \((5, -3)\) with an undefined slope.

34. Determine the equation of a line passing through the point \((4, -2)\) with a slope of 0.

35. Use point-slope form to find the equation of the line passing through the point \((0, 5)\) with a slope of \(2/3\).

36. Use point-slope form to find a line passing through the point \((2, 8)\) and parallel to the line \(y = \frac{5}{6}x - 1\).

37. Use point-slope form to find a line perpendicular to \(y = -2x + 9\) passing through the point \((4, 7)\).
38. Find the equation of a line passing through the points (-3, 6) and (1, 2).

39. Find the equation of a line with an x-intercept of (2, 0) and a y-intercept of (0, 3).

Determine the exact value of the following. DO NOT use a calculator.

40. \( \sin \pi \)  
41. \( \cos \frac{3\pi}{2} \)  
42. \( \sin \left( -\frac{\pi}{2} \right) \)  
43. \( \sin \left( \frac{5\pi}{4} \right) \)

44. \( \cos \frac{\pi}{4} \)  
45. \( \cos(-\pi) \)  
46. \( \cos \left( \frac{\pi}{3} \right) \)  
47. \( \sin \frac{5\pi}{6} \)

48. \( \cos \frac{2\pi}{3} \)  
49. \( \tan \left( \frac{\pi}{4} \right) \)  
50. \( \tan \pi \)  
51. \( \tan \left( \frac{\pi}{3} \right) \)

52. \( \cos \frac{4\pi}{3} \)  
53. \( \sin \frac{11\pi}{6} \)  
54. \( \tan \frac{7\pi}{4} \)  
55. \( \sin \left( -\frac{\pi}{6} \right) \)
Solve each of the equations for \(0 \leq x \leq 2\pi\).

56. \(\sin x = -\frac{1}{2}\)  
57. \(2 \cos x = \sqrt{3}\)  
58. \(4 \sin^2 x = 3\)
   *Recall \(\sin^2 x = (\sin x)^2\)

59. \(2 \sin^2 x - 3 \sin x - 2 = 0\)  
60. \(\cos^2 x = 1 - \sin x\)  
61. \(\sin x - 2 \sin x \cos x = 0\)

62. Given \(f(x) = x^2\) and \(g(x) = (x - 3)^2 + 1\), how does the graph of \(g(x)\) differ from \(f(x)\) in terms of transformations of functions?

63. Write an equation for the function that has the shape of \(f(x) = x^3\) but moved six units to the left and reflected over the x-axis.
Find the vertical asymptotes for the following functions:

64. \( f(x) = \frac{1}{x^2} \)  \hspace{1cm} 65. \( f(x) = \frac{x^2}{x^4 - 4} \)  \hspace{1cm} 66. \( f(x) = \frac{2+x}{x^2(1-x)} \)

67. \( f(x) = \frac{4-x}{x^2 - 16} \)  \hspace{1cm} 68. \( f(x) = \frac{x-1}{x^2 + x - 2} \)  \hspace{1cm} 69. \( f(x) = \frac{5x+20}{x^2 - 16} \)

Find the horizontal asymptotes for the following functions:

70. \( f(x) = \frac{x^2 - 2x + 1}{x^3 + x - 7} \)  \hspace{1cm} 71. \( f(x) = \frac{5x^3 - 2x + 4}{4x - 3x^2 + 5} \)  \hspace{1cm} 72. \( f(x) = \frac{4x^2}{3x^3 - 7} \)

73. \( f(x) = \frac{(2x-5)^2}{x^2 - x} \)  \hspace{1cm} 74. \( f(x) = \frac{-3x + 1}{\sqrt{x^2} + x} \)

***Remember \( \sqrt{x^2} = \pm x \)
Solve the following equations to find the value of \( x \).

75. \( 3^{3x-5} = 9^{2x+1} \)  
76. \( \left( \frac{1}{9} \right)^x = 27^{2x+4} \)  
77. \( \left( \frac{1}{6} \right)^x = 216 \)

Evaluate the following logarithms. Use the exponential definition of a logarithm to help you.

78. \( \log_7 7 \)  
79. \( \log_3 27 \)  
80. \( \log_2 \frac{1}{32} \)

81. \( \log_{25} 5 \)  
82. \( \log_9 1 \)  
83. \( \log_4 8 \)

84. \( \ln \sqrt{e} \)  
85. \( \ln \frac{1}{e} \)  
86. \( \ln 0 \)
Solve each logarithmic or exponential equation below. Give exact answers.

87. \( \log_{20}(8 - 2x) = \log_{20}(-3x + 10) \)  
88. \( 5 \ln(b - 9) = 20 \)

89. \( 3 \log_4(4n - 5) + 4 = 7 \)  
90. \( \log(x + 21) + \log x = 2 \)

91. \( 5^{2x} = 20 \)  
92. \( 4 - 2e^{x+1} = -12 \)
State whether the following functions are even, odd, or neither. Show your work to explain your answer.

93. \( y = 2x^4 - 5x^2 \) 

94. \( g(x) = x^5 - 3x^3 + x \)

95. \( h(x) = 2x^2 - 5x + 3 \)

96. \( f(x) = 2 \cos x \)
Graph each of the following piecewise functions. Determine any points of discontinuity.

99. \[ f(x) = \begin{cases} x + 5; & x \leq 2 \\ -4; & x > 2 \end{cases} \]

100. \[ f(x) = \begin{cases} x - 1; & x \leq -2 \\ 2x - 1; & -2 < x \leq 4 \\ -3x + 8; & x > 4 \end{cases} \]