Math Maintenance Assignment

Welcome to Calculus! In order to ensure success in this course, there is a mandatory summer assignment packet. This packet is due on the first day of your math class whether it occurs in first or second semester. While it is best to not put the assignment off to the last minute, you want to complete the assignment close enough to the start of your course so that the ideas are fresh. There will be an assessment on this material the first week of class, after the packet has been reviewed.

All topics in this assignment should be a review. You should not only be familiar with the topics but you should know them well enough to be tested on them. This is material that will not be taught in the course. It is expected that you come in with a strong understanding of these topics. If you are unsure of how to do these problems, feel free to seek help with them. There are many websites with helpful videos including Khan Academy, YouTube, Math is fun.com, Purple Math.com, shmoop.com, and Algebrahelp.com.

Give us your best work while giving yourself the opportunity to get off to a great start! We look forward to having you in class!

Sincerely,
The Math Department

Directions: Complete the following problems neatly on loose-leaf paper. You must show ALL work to receive full credit. Do NOT rely on your calculator for calculations and graph analysis. Circle your final answers.

Linear Functions

Write the equation of the line that fits the specified condition. Your answers may be in slope-intercept form or point-slope form.

1. Through $(2, -5)$ with slope 6

2. The vertical line and horizontal line through $(-3, 7)$ (label which one is which)

3. Through $(-3, 7)$ and $(0, -2)$

4. With slope $\frac{3}{4}$ and y-intercept 7

5. Through $(3, 1)$ and parallel to $2x - y = -2$

6. Through $(-2, -3)$ and perpendicular to $3x - 5y = 1$

7. The line $y = f(x)$ where f has the following values:

x	-2	2	4
$f(x)$	4	2	1

8. Sketch a graph of $2x + 4y = 10$. State the domain and range of the graph.

Parent Functions

9. List the 12 Basic Parent Functions that you studied in your Pre-Calculus class. Provide the following for each one: name, equation, sketch of the graph, domain and range, and state any asymptotes (if applicable).

Transformations of Functions

For each of the following functions: a) State the parent function, **b)** Describe the transformation(s) **in words** made on the "parent" function (i.e. shift left, right, up, down, reflect over x- or y-axis, vertical or horizontal stretch or shrink), **c)** Graph the function, and **d)** State the domain and range. **Be able to do ALL of parts a through d **without** a calculator.****

10. $f(x) = 6 - x^2$

11. $g(x) = |x| + 2$

12. $h(x) = 2e^{-x} - 3$

13. $f(x) = 2x^2 - 1$

14. $g(x) = \ln(x + 3) + 1$

15. $h(x) = 3\sqrt{x + 2} - 1$

16. $f(x) = (x - 1)^3 + 3$

Rational Functions

Given the following rational functions: a) Identify all x and y intercepts using proper notation, **b)** Identify any vertical and/or horizontal asymptotes using proper notation, **c)** Sketch the graph, including at least 3 additional points and asymptotes, **d)** State the domain and range of the function.

17. $f(x) = \dfrac{2x^2}{x^2 - 9}$

18. $g(x) = \dfrac{1}{x + 4}$

19. $h(x) = \dfrac{2}{x}$

Piecewise Functions

Sketch the piecewise-defined functions.

20. $f(x) = \begin{cases} 3x + 2, & x \leq 1 \\ -2x + 4, & x > 1 \end{cases}$

21. $g(x) = \begin{cases} x^2, & x < 0 \\ \frac{1}{2}x, & x \geq 0 \end{cases}$

Inverse Functions

Find the inverse of the given function using proper function notation.

22. $y = x^3 - 1$

23. $y = x^{\frac{2}{3}}$

24. $y = \dfrac{2x + 1}{x - 3}$

Exponential Functions

25. If John invests $2700 in a savings account with 6.2% interest rate compounded monthly, how long will it take until John's account has a balance of $4150? Do not round the values in your "in-between" steps, but round your final answer to three decimal places and include units.

26. If Mary invests $3500 in a savings account that is compounded continuously at a rate of 2.4%, how much money will she have after 5 years?

27. The number of bacteria in a petri dish culture after t hours is modeled by $B = 100e^{0.0693t}$. Answer the following questions:

a) What was the initial number of bacteria present?

b) How many bacteria are present after 6 hours?

c) Approximately when will the number of bacteria be 200? Round to three decimal places and include units.

Rules for Exponents

Simplify and make sure all terms have positive exponents.

28. $\left(\frac{1}{2}x\right)^2 \cdot 16(x^3)^{-2}$

29. $\left(\frac{x^{-3}y^2}{x^{-4}y^{3/2}}\right)^2$

Common Formulas

State the following formulas and then evaluate the formula with the given value or expression. Simplify answers completely (do not leave in factored form). When applicable, leave answers in terms of π.

30. Area of a circle; $r = 5$

31. Area of a square; $s = 11$

32. Area of a square; $s = x + 2$

33. Area of a rectangle; length l is equal to four more than twice the width w

34. Area of a triangle; base $= x$ and height $= \frac{1}{2}x + 7$

Simplifying Expressions

Factor the expression. If possible, simplify the factored expression and state any excluded values.

35. $6x^2 + 37x - 35$

36. $\frac{x^2-2x+1}{x-1}$

37. $4x^2 - 81$

38. $\frac{2x^2+x-6}{3x^2+x-10}$

Expand and simplify the expression.

39. $(x + 3)^2 + 7$

40. $\frac{(2+h)^2-(2)^2}{h}$

41. $\frac{(x+h)^3-x^3}{h}$

Solving Equations

Solve for x. Show answers in both exact form and decimal form rounded to three decimal places (if needed).

42. $3x^2 + 23x + 14 = 0$

43. $2x^3 = 9x$

44. $2x^2 - 11x = -6$

45. $\frac{1}{\sqrt{x+5}} = 4$

46. $\frac{4x-15}{x+3} = 0$

47. $(1.045)^x = 2$

48. $3e^{2x} - 4 = 1$

49. $\log_2(x + 1) = 3$

50. $2\ln(3 - x) - 4 = 0$

Trigonometric Functions

For the given trig function, determine the period, amplitude, phase shift, and vertical shift (include the words "left, right, up, or down" when stating the phase shift and vertical shift). Also state the domain and range. If it helps, you may sketch the function using methods you learned in Pre-Calc.

51. $f(x) = 2\cos(x + \pi) - 3$

52. $g(x) = 3\sin x - 2$

Use reference angles and "All Student Take Calculus" to solve the equation for x in the given interval. Keep your answer in exact form (answers with π), not decimal form.

53. $\sin x = -\frac{\sqrt{2}}{2}, \ 0 \le x < 2\pi$

54. $\tan x = \sqrt{3}, \ 0 \le x < 2\pi$

55. $\cos^2 x = \frac{3}{4}, \ 0 \le x < 2\pi$

Use triangle relationships and "All Student Take Calculus" to find all six trigonometric ratios. Keep your answer in exact form (in rationalized radical form), not decimal form.

56. $\cos x = -\frac{2}{3}$ and $\sin x < 0$

57. $\tan x = -\frac{5}{12}$ and $\cos x > 0$

Short Answer Questions

In a few sentences, answer the following short answer questions. Be thorough and make sure to answer the question completely.

58. What is the domain of a function? What is a range? Describe domain and range of functions in your own words.

59. What types of functions have vertical asymptotes, and how do you determine the vertical asymptote of a function?

60. What does it mean to absolute value a function's graph? Describe what happens.