

Math 105 Final Exam December 12, 2007
Chapters P3 – 4.5

Name _____ Instructor name or section # _____

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Given

QF: $ax^2 + bx + c = 0$, then $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ Standard form for a circle: $(x - h)^2 + (y - k)^2 = r^2$

midpoint of a line $\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$ distance formula $d = \sqrt{(y_2 - y_1)^2 + (x_2 - x_1)^2}$

point-slope form: $y = m(x - x_1) + y_1$ average rate of change: $\frac{f(x_2) - f(x_1)}{x_2 - x_1}$ Odd: $f(-x) = -f(x)$

periodic compounding $A = P \left(1 + \frac{r}{n} \right)^{nt}$ continuous compounding $A = Pe^{rt}$ Even: $f(x) = f(-x)$

Properties of logs: $\ln(a \cdot b) = \ln a + \ln b$, $\ln \frac{a}{b} = \ln a - \ln b$, $\ln a^p = p \ln a$

Show All Work for Full Credit!! On all graphs, tic marks are one unit.

New Stuff (Ch 3.6 to 4.5) #1 – 6.

1. (2 pts ea) Find the exact value of the logarithm without using a calculator.

- a.) $\log_7 1 =$ b.) $\log_3 9 =$
- c.) $\log_2 2 =$ d.) $\log(10^4) =$

2. (2 pts ea) Use properties of logarithms to expand (a, b, c) or condense (d, e) the logarithmic expression as much as possible. Do NOT solve for x or y.

- a.) $\ln x^2 y$ b.) $\ln \frac{e^2}{5}$ c.) $\ln \sqrt[5]{x}$

- d.) $2\log_b x + 3\log_b y$ e.) $4\ln(x + 6) - 3\ln x$

3. (3 pts ea) Solve for x. Express the answer to 2 decimals or in terms of logarithms or exponentials.

- a.) $10^x = 3.91$ b.) $2 + 3\ln x = 20$

4. (3 pts ea) The half-life of Kr-90 is 32 seconds. If 16 grams of Kr-90 are initially present, how many grams are present after 32 seconds? 40 seconds? Use the decay model $A = 16e^{-0.0217t}$

after 32 sec _____ gr

after 40 sec _____ gr

5. (3 pts ea) If the logistic growth function for Tribbles on the Enterprise is $f(t) = \frac{130,000}{1 + 999e^{-0.5t}}$.

a. How many Tribbles are there on the Enterprise at $t = 0$? _____

b. What is the limiting size of Tribbles on the Enterprise (after a very long time)? _____

6. (3 pts ea) Express the solution set in interval notation. A number line with boundary and test points maybe helpful.

a. $200x(x + 100) < 0$

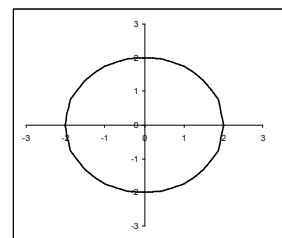
b. $\frac{110(x - 40)}{(x + 50)} > 0$

7. (2 pts ea) Determine whether the following relations, equations or graphs define y as a function of x .

a. $\{(1,5), (1, 8), (6, 5), (6, 8)\}$ Yes No

b. graph at right Yes No

c. $y = \sqrt{x}$ Yes No



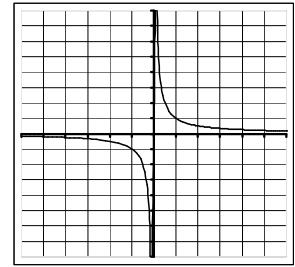
8. (4 pts) Find and simplify the difference quotient $\frac{f(x+h) - f(x)}{h}$, $h \neq 0$ for $f(x) = 2x + 1$

9. (2 pts ea) Are the following functions odd, even or neither?

a. $f(x) = x^9 - 1$ _____

b. $g(r) = r^6 - 1$ _____

c. graph at right _____ \longrightarrow



10. (2 pts ea) Given the piecewise function $g(x)$, evaluate at three points given below.

$$g(x) = \begin{cases} -x - 1 & x \geq 0 \\ x + 1 & x < 0 \end{cases} \quad g(-1) = \underline{\hspace{2cm}} \quad g(0) = \underline{\hspace{2cm}} \quad g(1) = \underline{\hspace{2cm}}$$

11. (2 pts ea) Use the given conditions to write an equation for the line in point-slope form and slope-intercept form:

Passing through (1, 1) perpendicular to $y = -2x + 1$

Point-slope form: _____

Slope-intercept form: _____

12. (4 pts ea) Perform indicated operation. Do NOT try to solve for x . Answers must be fully factored.

a. $\frac{3x^3 - 12x}{x - 7} \cdot \frac{x^2 - 14x + 49}{x^3 + 2x^2 - 4x - 8}$

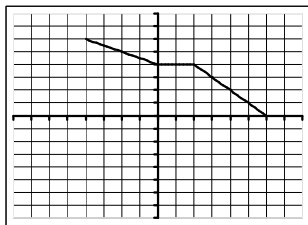
b. $\frac{x + 1}{x + 4} - \frac{x^2 - 2x - 6}{x^2 + 2x - 8}$

13. (2 pts ea) What is the domain of each of the following? Use either interval notation, set notation or an inequality.

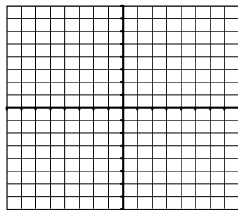
a. $\ln(x + 2)$ _____ b. $\sqrt{x + 2}$ _____ c. $\frac{x + 2}{x(x - 2)}$ _____

14 (2 pts ea) Use the graph of $y = f(x)$ below to graph the following functions. Tic marks are one unit.

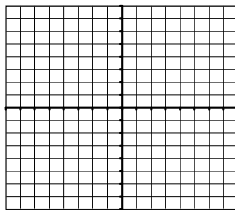
$y = f(x)$



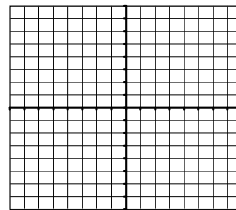
$y = f(-x)$



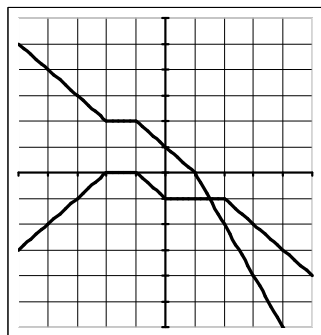
$7 = f(2x)$



$y = f(x - 2) + 2$



15. (2 pts ea) Use the graph of f (top) and g (bottom) to evaluate the functions below. Tic marks are one unit.



a. $f(-4) =$ _____

b. $(g - f)(-2) =$ _____

c. $\left(\frac{g}{f}\right)(0) =$ _____

d. $(f \circ g)(3) =$ _____

16. (3 pts ea) Find all values of x satisfying the following conditions. Describe any restrictions on the variable.

a. $f(x) = \frac{2x}{3}$ $g(x) = x$ and $(f - g)(x) = -2$

b. $\frac{1}{x} - 8 = \frac{1 - 8x^2}{x^2}$

17. The distance between endpoints of a diameter of a circle is 16. a. (3 pts) Write the standard form of the equation of the circle if the coordinates of its center are $(2, -3)$.

b. (3 pts) Complete the square and write the equation of the circle in standard form if $x^2 + y^2 - 2y - 2 = 0$.

18. (3 pts) The function $f(x) = 2x + 2$ is one-to-one. Find an equation for $f^{-1}(x)$.

19. (3 pts) Given that $h(x) = (f \circ g)(x)$. Identify f and g .

$$h(x) = (x + 3)^2 \quad f(x) = \underline{\hspace{2cm}} \quad g(x) = \underline{\hspace{2cm}}$$

20. (3 pts ea) Solve the following equations. Check all solutions.

a.) $2x^3 - 8x = 0$

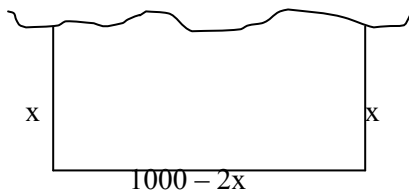
b.) $\sqrt{20 - 8x} = x$

Use interval notation to express the solution set.

c.) $5x + 11 < 26$

d.) $-2|x + 1| > -18$

21. (3 pts) You have 1000 feet of fencing to enclose a rectangular plot of land that borders a swamp. Since your emus fear mud you don't need a fence there. Find the width (x) of the plot to maximize the area. Once again, guess and check will yield no points.



22. (3 pts) Use the Intermediate Value Theorem to determine if the polynomial function $f(x) = 2x^4 - 1$ has a zero between 0 and 1?

Find $f(0) = \underline{\hspace{1cm}}$ Find $f(1) = \underline{\hspace{1cm}}$ Does a zero exist? Yes No

23. (2 pts ea) What is the end behavior of the functions? Indicate rises or falls left, rises or falls right.

a. $f(x) = x - 197x^7$ _____ left _____ right b. $g(x) = 15x^{10} + 180x$ _____ left _____ right

24. (3 pts) Given $f(x) = 2(x + 2)^2(x - 1)$

a.) What are the zeros? _____

b.) At which zero/s does the graph cross the x-axis? _____

c.) Which zero/s cause the graph to touch and turn? _____

25. (4 pts) Use **division** and the factor theorem to confirm $x - 1$ is a factor of $x^3 - 2x^2 - 5x + 6 = 0$. Show any remaining factors in fully factored form.

Remaining factors _____

26. (2 pts ea) Given $f(x) = \frac{-x+1}{x+1}$ Identify the following:

a. x-intercept/s if any: _____,

b. y-intercept(s), if any: _____

c. vertical asymptote(s) if any, $x =$ _____,