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Circle your section:

830 – 945 *MW*  
1110 – 001  
Graffeo

1000 – 1115 *TR*  
1110 – 002  
Nabity

400 – 515 *TR*  
1110 – 003  
Kurtz

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- No notes or calculator allowed, only pencil, eraser, and scrap paper
  - There is a 3 hour time limit on this exam. If the exam is not returned to the proctor in 3 hours the student will receive a zero
  - All scrap work must be collected with the exam or properly disposed of (it may not remain in the students possession)
  - Show all work and box all answers; no work shown or messy work = no credit
  - Reduce and simplify all answers to factored form with positive exponents
  - All domains, ranges, intervals, and inequalities must be answered using interval notation
  - Intercepts must be written as ordered pairs
  - Asymptotes must be written as equations of a line
  - Label at least 3 points and the function on all graphs which you sketch
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Point Totals

page 1 \_\_\_\_\_ /6      page 2 \_\_\_\_\_ /6      page 3 \_\_\_\_\_ /13

page 4 \_\_\_\_\_ /12      page 5 \_\_\_\_\_ /12      page 6 \_\_\_\_\_ /18

page 7 \_\_\_\_\_ /65      page 8 \_\_\_\_\_ /68

Total: \_\_\_\_\_ /200

Show All Work

In this section of the test you must show all work. Partial credit is possible in this section. **Make sure all of your answers are in the correct reduced form**

1. (6 pts) Let  $f(x) = -3|x - 1| + 3$ .

(a) State the basic function to which transformations are applied.

ans:  $y =$  \_\_\_\_\_

(b) State the transformations applied to the basic function in order (as per lecture notes).

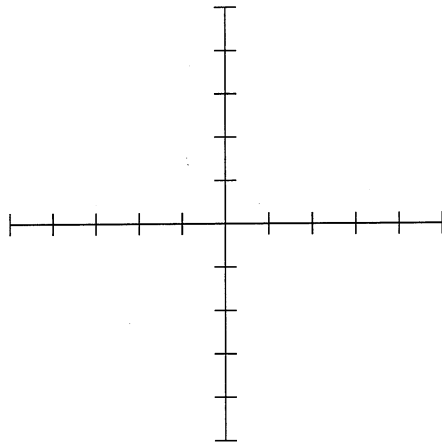
1.) \_\_\_\_\_

2.) \_\_\_\_\_

3.) \_\_\_\_\_

4.) \_\_\_\_\_

(c) Sketch a graph of  $f(x)$  and state the domain and range of  $f(x)$ .



Domain: \_\_\_\_\_

Range: \_\_\_\_\_

Show All Work

2. (6 pts) Let  $f(x) = -2^{x+1} - 2$ .

(a) State the basic function to which transformations are applied.

ans:  $y = \underline{\hspace{2cm}}$

(b) State the transformations applied to the basic function in order (as per lecture notes).

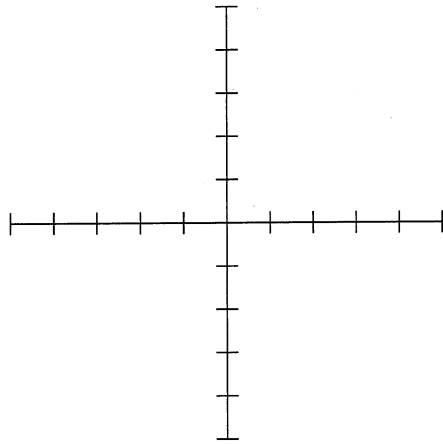
1.)  $\underline{\hspace{10cm}}$

2.)  $\underline{\hspace{10cm}}$

3.)  $\underline{\hspace{10cm}}$

4.)  $\underline{\hspace{10cm}}$

(c) Sketch a graph of  $f(x)$  and state the domain and range of  $f(x)$ .



Domain:  $\underline{\hspace{2cm}}$

Range:  $\underline{\hspace{2cm}}$

Show All Work

3. (13 pts) Answer the following questions given  $f(x) = -2x^2 - 2x + 4$ :

a) Does the graph of  $f(x)$  open up or down?

up                      down

(b) Find the x-intercepts and y-intercepts of  $f(x)$ .

x-int: \_\_\_\_\_

y-int: \_\_\_\_\_

(c) Find the vertex of  $f(x)$ .

ans: \_\_\_\_\_

(d) State the domain and range of  $f(x)$ .

Domain: \_\_\_\_\_

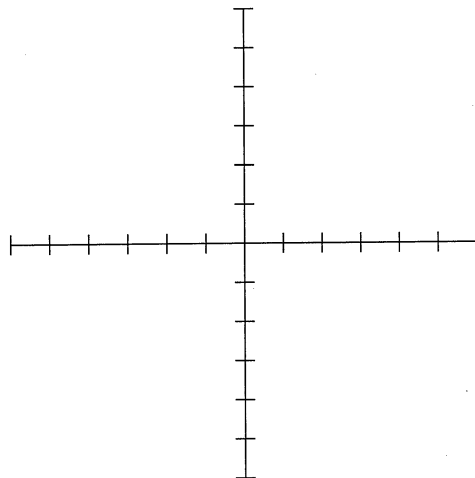
Range: \_\_\_\_\_

(e) State the intervals of increasing and decreasing of  $f(x)$ .

Increasing: \_\_\_\_\_

Decreasing: \_\_\_\_\_

(f) Sketch a graph of  $f(x)$



Show All Work

4. (12 pts) Given the function  $R(x) = \frac{x^2 - 16}{-3x^2 + 12}$  answer the following questions:

(a) State the domain of  $f(x)$ .

Domain: \_\_\_\_\_

(b) Find the x-intercepts and y-intercept of  $f(x)$ .

x-intercepts: \_\_\_\_\_

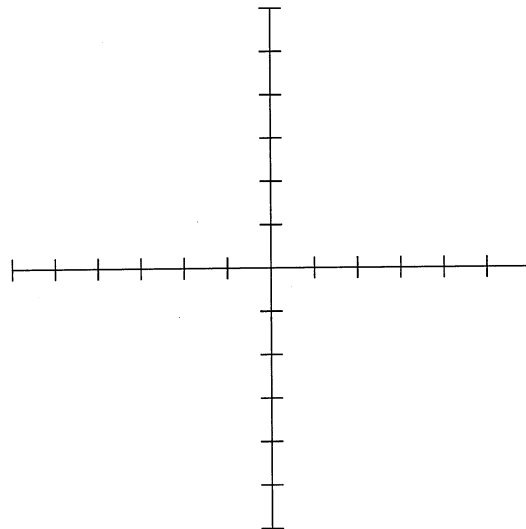
y-intercept: \_\_\_\_\_

(c) Find the horizontal asymptote and vertical asymptotes of  $f(x)$ .

H.A.: \_\_\_\_\_

V.A.: \_\_\_\_\_

(d) Sketch a graph of  $f(x)$ .



Show All Work

5. (6 pts) Solve the following inequality algebraically.

$$\frac{x-3}{x^2-4} < 0$$

Ans: \_\_\_\_\_

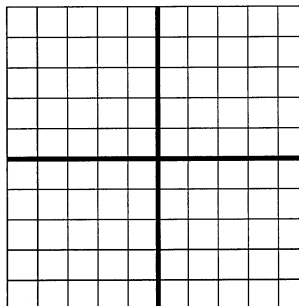
6. (6 pts) Find the real zeros of  $f(x) = x^3 - 2x^2 - 5x + 6$  and write  $f(x)$  in factored form.

Ans: \_\_\_\_\_

Show All Work

7. (6 pts) Graph the following piecewise function and label at least 3 points.

$$f(x) = \begin{cases} x + 5 & \text{if } x \leq -2 \\ x^2 - 1 & \text{if } -2 < x \leq 1 \\ -x + 1 & \text{if } x > 1 \end{cases}$$



8. (6 pts) The half life of a substance is found to be 1000 years. The substance decays by the law of exponential decay. If 1000 grams are present initially, how many grams will be present after 500 years? Leave your answer in terms of logarithms

Ans: \_\_\_\_\_

9. (6 pts) A movie theater sells adult tickets for \$10 each and child tickets for \$5 each. If one evening 500 customers came to the theater and the theater made \$3500, how many adults came and how many children came to the theater that evening?

Adults: \_\_\_\_\_

Children: \_\_\_\_\_

**Fill In The Blank**

For this portion of the test you are not required to show any work. Put your answers in the corresponding blanks. **Make sure your answers are in the correct reduced form.** No partial credit will be given on this section.

1. \_\_\_\_\_

2. \_\_\_\_\_

3. \_\_\_\_\_

4. \_\_\_\_\_

5. \_\_\_\_\_

6. \_\_\_\_\_

7. \_\_\_\_\_

8. \_\_\_\_\_

9. (a) \_\_\_\_\_ (b) \_\_\_\_\_

10. (a) \_\_\_\_\_ (b) \_\_\_\_\_

11. (a) \_\_\_\_\_

(b) \_\_\_\_\_

(c) \_\_\_\_\_

(d) \_\_\_\_\_

(e) \_\_\_\_\_

(f) \_\_\_\_\_

(g) \_\_\_\_\_

(h) \_\_\_\_\_

(i) \_\_\_\_\_

(j) \_\_\_\_\_

(k) \_\_\_\_\_

(l) \_\_\_\_\_

(m) \_\_\_\_\_

(n) \_\_\_\_\_

(o) \_\_\_\_\_

**Fill In The Blank**

12. \_\_\_\_\_
13. X-int: \_\_\_\_\_ Cross Touch  
X-int: \_\_\_\_\_ Cross Touch  
X-int: \_\_\_\_\_ Cross Touch
14. \_\_\_\_\_
15. \_\_\_\_\_
16. \_\_\_\_\_
17. \_\_\_\_\_
18. \_\_\_\_\_
19.  $f^{-1}(x) :=$  \_\_\_\_\_ D: \_\_\_\_\_ R: \_\_\_\_\_
20. (a) \_\_\_\_\_ (b) \_\_\_\_\_
21. (a) \_\_\_\_\_ (b) \_\_\_\_\_
22. (a) \_\_\_\_\_ (b) \_\_\_\_\_
23. (a) \_\_\_\_\_ (b) \_\_\_\_\_ (c) \_\_\_\_\_
24. (a) \_\_\_\_\_ (b) \_\_\_\_\_ (c) \_\_\_\_\_
25. (a) \_\_\_\_\_ (b) \_\_\_\_\_ (c) \_\_\_\_\_ (d) \_\_\_\_\_

### Fill In The Blank

1. (3 pts) **Fill in the blank:** Reduce, simplify, and express answers using positive exponents only. Place your answers in the appropriate blank space on the answer sheet of the exam.

$$\frac{2x + \frac{1}{x}}{x + \frac{3x}{2}}$$

2. (3 pts) **Fill in the blank:** Solve the following formula for  $t$ . Place your answers in the appropriate blank space on the answer sheet of the exam.

$$A = A_0 e^{kt}$$

3. (3 pts) **Fill in the blank:** Solve the following inequality. Place your answers in the appropriate blank space on the answer sheet of the exam.

$$\frac{3x + 1}{2} + 3 < \frac{1}{4} + \frac{x}{2}$$

4. (3 pts) **Fill in the blank:** Solve the following expression. Place your answers in the appropriate blank space on the answer sheet of the exam.

$$1 - \frac{10}{x^2} = \frac{3}{x}$$

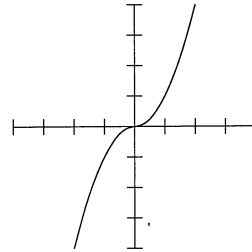
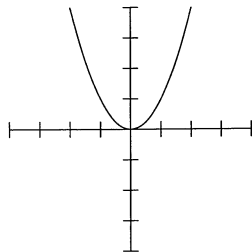
5. (3 pts) **Fill in the blank:** Find the slope-intercept form equation for a linear function parallel to the line  $y = 3x + 1$ ; containing the point  $(-1, 2)$ . Place your answers in the appropriate blank space on the answer sheet of the exam.

6. (3 pts) **Fill in the blank:** Find the real solutions of the equation  $\sqrt{x^2 + 3x} = 2$  Place your answers in the appropriate blank space on the answer sheet of the exam.

7. (3 pts) **Fill in the blank:** Given the equation of the circle in general form, complete the square and write the equation in standard form. Place your answers in the appropriate blank space on the answer sheet of the exam.

$$x^2 + y^2 + 4x - 6y + 9 = 0$$

8. (4 pts) **Fill in the blank:** Indicate whether each graph specifies a one-to-one function (yes or no). Place your answers in the appropriate blank space on the answer sheet of the exam.



### Fill In The Blank

9. (4 pts) **Fill in the blank:** If  $x$  is the independent variable, determine if the following equations specify functions (yes or no). Place your answers in the appropriate blank space on the answer sheet of the exam.

(a)  $\ln(y) = x$

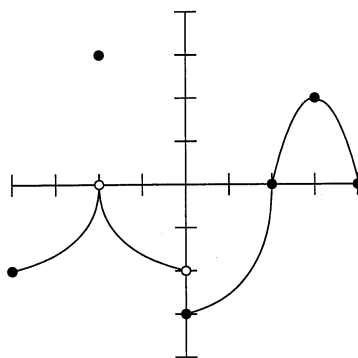
(b)  $(x - 2)^2 + (y + 3)^2 = 4$

10. (6 pts) **Fill in the blank:** Find the domain of each function. Place your answers in the appropriate blank space on the answer sheet of the exam.

(a)  $g(x) = \ln(x - 1) + 2$

(b)  $h(x) = \frac{3x + 2}{\sqrt{4x - 8}}$

11. (30 pts) **Fill in the blank:** Use the given graph of the function  $f$  to answer the following questions. Place your answers in the appropriate blank space on the answer sheet of the exam.



(a)  $f(-2) =$

(b) Is  $f(\frac{1}{2})$  positive or negative?

(c)  $f(x)$  is negative on:

(d)  $f(x)$  is positive on:

(e) Domain of  $f(x)$ :

(f) Range of  $f(x)$ :

(g)  $x$ -intercepts:

(h)  $y$ -intercept:

(i) For what values of  $x$  is  $f(x) = 2$ ?

(j) How often does the line  $y = 1$  intersect the graph?

(k)  $f(x)$  is increasing on:

(l)  $f(x)$  is decreasing on:

(m) State any local maximum of  $f(x)$ ?

(n) State any local minimum of  $f(x)$ ?

(o) Is this function even, odd, or neither?

### Fill In The Blank

12. (3 pts) **Fill in the blank:** What is the end behavior of  $f(x) = -2x^3(x+3)^2(x-2)$ ? Place your answers in the appropriate blank space on the answer sheet of the exam.
13. (3 pts) **Fill in the blank:** Determine the x-intercepts of  $f(x) = 2(2x-6)^3(x+4)^2$  and circle whether the graph crosses or touches at each x-intercept. Place your answers in the appropriate blank space on the answer sheet of the exam.
14. (3 pts) **Fill in the blank:** What is the maximum number of zeros of  $f(x)$  if  $f(x) = 10x^7 - 3x^2 + x$ . Place your answers in the appropriate blank space on the answer sheet of the exam.
15. (3 pts) **Fill in the blank:** Use the Rational roots theorem to state the possible zeros of  $f(x) = x^4 - 3x^2 + 2x - 6$ . Place your answers in the appropriate blank space on the answer sheet of the exam.
16. (3 pts) **Fill in the blank:** Determine whether  $x+3$  is a factor of  $f(x) = x^4 + 4x^3 - 13x^2 - 28x + 60$ . If it is, write  $f$  in factored form  $f(x)=(x+3)(\text{quotient})$ . Place your answers in the appropriate blank space on the answer sheet of the exam.
17. (3 pts) **Fill in the blank:** Given  $-3i$  is a zero of  $g(x) = x^4 - x^3 - 3x^2 - 9x - 108$  find the remaining zeros of  $g(x)$ . Place your answers in the appropriate blank space on the answer sheet of the exam.
18. (3 pts) **Fill in the blank:** If  $f(x) = \sqrt{2x-2}$  and  $g(x) = \frac{2x+4}{3x-1}$ , find  $f(g(1))$ . Place your answers in the appropriate blank space on the answer sheet of the exam.
19. (3 pts) **Fill in the blank:** Given  $f(x) = \frac{x-3}{6x}$  find its inverse and state the domain and range of  $f(x)$ . Place your answers in the appropriate blank space on the answer sheet of the exam.

### Fill In The Blank

20. (4 pts) **Fill in the blank:** Rewrite the logarithmic equations into exponential form and the exponential equations into logarithmic form. Place your answers in the appropriate blank space on the answer sheet of the exam.

(a)  $\log_3 27 = 3$

(b)  $10^{-2} = \frac{1}{100}$

21. (4 pts) **Fill in the blank:** Evaluate the following logarithmic expressions. Place your answers in the appropriate blank space on the answer sheet of the exam.

(a)  $\log_2(-4)$

(b)  $\log_5\left(\frac{1}{25}\right)$

22. (6 pts) **Fill in the blank:** Solve for x. Place your answers in the appropriate blank space on the answer sheet of the exam.

(a)  $3^{x+4} = \frac{1}{27}$

(b)  $2^{\log_2(3x+1)} = 7$

23. (9 pts) **Fill in the blank:** Solve for x. Place your answers in the appropriate blank space on the answer sheet of the exam.

(a)  $\log_b(x) = 2\log_b(3) + \frac{1}{3}\log_b(27) - \log_b(9)$

(b)  $\log_b(x) + \log_b(x+4) = \log_b(20)$

(c)  $\log_2(3x-4) - \log_2(x+5) = 1$

24. (9 pts) **Fill in the blank:** Solve the following system of equations

(a) 
$$\begin{cases} -5x - 2y = -4 \\ 3x + 5y = -9 \end{cases}$$

(b) 
$$\begin{cases} 3x + y = 3 \\ -2x + 4y = -2 \end{cases}$$

(c) 
$$\begin{cases} 2x - 3y = 5 \\ -6x + 9y = 1 \end{cases}$$

25. (12 pts) **Fill in the blank:** Given the following matrices perform the indicated operations. Place your answers in the appropriate blank space on the answer sheet of the exam.

$$A = \begin{bmatrix} 3 & 1 \\ -1 & 4 \end{bmatrix}, B = \begin{bmatrix} 2 & 4 \\ -2 & -4 \end{bmatrix}, C = \begin{bmatrix} 0 & 1 \\ 1 & 0 \\ 0 & 1 \end{bmatrix}, D = \begin{bmatrix} 3 & -1 & 0 \\ 2 & 1 & 0 \end{bmatrix}$$

(a) AC

(b) 2A-B

(c)  $B^2$

(d) DC