Math 110 **Final Exam** **Do not write on this exam.**

Fall, 2018 Sections 1-17, including SL Center
Instructors: Jeppsen, McGhie, Lewis, Riddle, Robertson, Ross, Woller

1. Let $f(x)$ be a polynomial with real coefficients, for which both $2+i$ and $3-5i$ are zeros. In addition to these two zeros, what other zeros do we know that $f(x)$ has?

   (a) $\sqrt{5}$ and $\sqrt{34}$ (b) $2-i$ and $3+5i$ (c) $-2-i$ and $-3+5i$ (d) $-2+i$ and $-3-5i$
   (e) 5 and 34 (f) $2+5i$ and 3−i (g) $3+i$ and $2-5i$ (h) $1+2i$ and $5-3i$
   (i) $\frac{1}{2}+i$ and $\frac{1}{3}-\frac{1}{5}i$ (j) None of the above

2. Solve the inequality: $\dfrac{(x-3)(x+2)}{x+4} \leq 0$

   (a) $(-3,2)\cup[4,\infty)$ (b) $(-\infty,-3)\cup(2,4]$
   (c) $[-3,2]\cup(4,\infty)$ (d) $(-\infty,-3]\cup[2,4)$
   (e) $[-4,-2)\cup(3,\infty)$ (f) $(-\infty,-4]\cup(-2,3)$
   (g) $(-4,-2]\cup[3,\infty)$ (h) $(-\infty,-4)\cup[-2,3]$
   (i) $(-\infty,-4)\cup(-4,-2]\cup[3,\infty)$ (j) None of the above

3. Sam likes to change the decorations in his office. He owns 3 paintings, 4 vases and 5 clocks. In how many different ways can he choose 2 paintings, 2 vases and 1 clock to put in his office?

   (a) 4 (b) 5 (c) 14 (d) 23 (e) 60 (f) 90 (g) 150 (h) 360 (i) 17,280
   (j) None of the above

4. Consider the polynomial x^3+4x^2+x-6. Find all of its real zeros, and add them up. The sum is:

   (a) −4 or less (b) −3 (c) −2 (d) −1 (e) 0 (f) 1 (g) 2 (h) 3 (i) 4 or more
   (j) The equation has no real zeros.

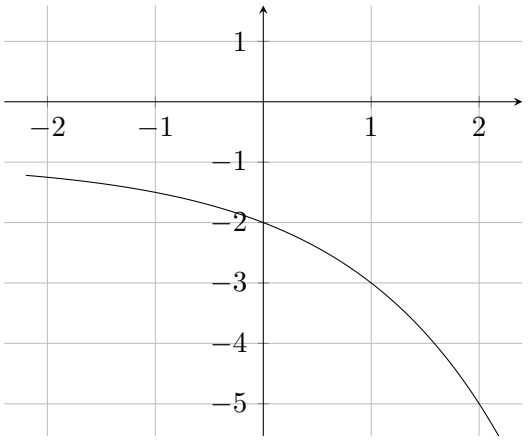
5. Find the domain of the function $f(x)=\sqrt{\log_3(-4x)}$.

   (a) $(-\infty,0)$ (b) $(0,\infty)$ (c) $(4,\infty)$ (d) $(-\infty,-4)$ (e) $(-\infty,-\frac{1}{4})$
   (f) $(\frac{3}{4},\infty)$ (g) $(-\infty,-\frac{3}{4})$ (h) $(3^4,\infty)$ (i) $(3^{-4},\infty)$ (j) None of the above

6. If x is the solution to $\left(\frac{1}{2}\right)^{3-x}=4^{x-1}$, then x is:

   (a) $\frac{7}{3}$ (b) $\frac{11}{9}$ (c) $\frac{5}{2}$ (d) $\frac{5}{3}$ (e) $-\frac{5}{3}$ (f) −1 (g) $\frac{15}{4}$ (h) −2 (i) 2
   (j) None of the above

7. Select the function that best describes the given graph.

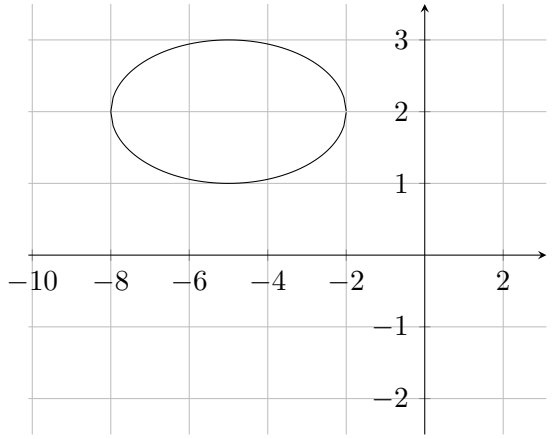


(a) $f(x) = -1 - 3^x$ (b) $f(x) = 1 - 2^{-x}$ (c) $f(x) = -1 + 2^{-x}$
(d) $f(x) = -1 - 3^{-x}$ (e) $f(x) = -1 - 2^x$ (f) $f(x) = -1 - 2^{-x}$
(g) $f(x) = 1 + 3^x$ (h) $f(x) = 1 - 3^{-x}$ (i) $f(x) = 1 - 2^x$
(j) None of the above

8. The equation $\log_3(x) + \log_3(x-2) = \log_3(2x-3)$ has some number of solutions. Of the solutions, the *largest* one is:

(a) -3 or less (b) -2 (c) -1 (d) 0 (e) 1 (f) 2 (g) 3 (h) 4 (i) 5 or more
(j) The equation has no solutions

9. Find the equation of the ellipse shown in the graph.



(a) $(x-5)^2 + 3(y+2)^2 = 3$ (b) $9(x-5)^2 + (y+2)^2 = 9$
(c) $(x+5)^2 + 3(y-2)^2 = 3$ (d) $9(x+5)^2 + (y-2)^2 = 1$
(e) $9(x-5)^2 + (y+2)^2 = 1$ (f) $(x-2)^2 + 3(y+5)^2 = 3$
(g) $3(x+5)^2 + (y-2)^2 = 3$ (h) $(x+5)^2 + 9(y-2)^2 = 9$
(i) $(x-2)^2 + 9(y+5)^2 = 9$ (j) None of the above

10. Susan is depositing \$9 into a savings account. The account pays an interest rate of 5%, compounded quarterly. In 7 years, how much money will be in the savings account?

    (a) $9 \,/\, \left(1+\frac{5}{4}\right)^{28}$ (b) $9\left(1+\frac{0.05}{4}\right)^{28}$ (c) $9\,(1+0.05)^{7}$ (d) $9 \,/\, (1+5)^{7}$
    (e) $9 \,/\, (1+0.05)^{28}$ (f) $9\left(1+\frac{5}{4}\right)^{28}$ (g) $9 \,/\, \left(1+\frac{0.05}{4}\right)^{7}$ (h) $9\left(1+\frac{0.05}{4}\right)^{7}$
    (i) $9 \,/\, (1+0.35)^{4}$ (j) None of the above

11. Which of the following types of figures is represented by the equation $4x^2 - 3y + 8x = 1$?

    (a) Ellipse (b) Hyperbola (c) Line (d) Parabola (e) None of these

12. Consider the hyperbola $y^2/9 - x^2/4 = 1$. Which of the following is a correct description of its asymptote(s)?

    (a) $(0,3)$ and $(0,-3)$ (b) $(2,0)$ and $(-2,0)$ (c) $(0,0)$ (d) $(0,\sqrt{13})$ and $(0,-\sqrt{13})$
    (e) $y = \pm\frac{3}{2}x$ (f) $y = \pm\frac{2}{3}x$ (g) $y = \pm\frac{9}{4}x$ (h) $y = \pm\frac{4}{9}x$
    (i) None of the above

13. Riley rolls a die. The probability that the die shows either a 3, or an even number, is:

    (a) 0 (b) 1/6 (c) 1/3 (d) 1/3 (e) 2/3 (f) 5/6 (g) 1 (h) None of the above

14. Thomas tosses a coin on Monday, rolls a die on Tuesday, and tosses a coin on Wednesday. The probability that he gets 'heads' on Monday, either a 1 or a 6 on Tuesday, and 'tails' on Wednesday, is:

    (a) 1/24 (b) 1/16 (c) 1/12 (d) 1/8 (e) 1/6 (f) 3/16 (g) 1/4 (h) 3/8
    (i) 3/7 (j) None of the above

15. Solve the system of equations below.

$$\begin{aligned} 3x + 2y &= -3 \\ 2x - y &= 5 \end{aligned}$$

    The correct value of y is:

    (a) -4 or less (b) -3 (c) -2 (d) -1 (e) 0 (f) 1 (g) 2 (h) 3 (i) 4 (j) 5 or more

16. Let $H(x) = \dfrac{x^2 + 3x - 1}{x + 2}$. Then H has an oblique asymptote at:

    (a) $y = x + \frac{3}{2}$ (b) $y = x - 1$ (c) $y = x + 1$ (d) $y = x + 2$ (e) $y = -3$ (f) $y = x$
    (g) $y = x + 3$ (h) $y = 1$ (i) $H(x)$ does not have an oblique asymptote
    (j) $H(x)$ has an oblique asymptote, but none of the above is correct

17. Consider the sequence $\{a_1, a_2, a_3, ...\} = \{3, 2, \frac{4}{3}, \frac{8}{9}, ...\}$. Find a formula for the n-th term of the sequence.

(a) $a_n = \frac{2n+1}{n}$ (b) $a_n = 2 + (n-2)^2$ (c) $a_n = 4 - n$ (d) $a_n = 3(\frac{2}{3})^{n-1}$
(e) $a_n = \frac{n+2}{n}$ (f) $a_n = 2 + (n-1)^2$ (g) $a_n = 3 - n$ (h) $a_n = 3(\frac{2}{3})^n$
(i) None of the above

18. Jill has an avocado, an apple, a banana, a pear and a peach. On Monday, on Tuesday and on Wednesday she will eat 1 piece of fruit for lunch. In how many ways can she choose a different piece of fruit for each day?

(a) 6 (b) 10 (c) 12 (d) 20 (e) 24 (f) 27 (g) 36 (h) 60 (i) 125
(j) None of the above

19. If $2^x - 7 + x = 0$ then x is in the interval: (*Hint: Use the Intermediate Value Theorem*)

(a) $[-2, -1]$ (b) $[-1, 0]$ (c) $[0, 1]$ (d) $[1, 2]$ (e) $[2, 3]$
(f) $[3, 4]$ (g) $[4, 5]$

20. Let $37 = 4^a$. An equivalent algebraic expression is:

(a) $a = \log_4(37)$ (b) $4 = \log_{37}(a)$ (c) $37 = \log_a(4)$
(d) $a = \log_{37}(4)$ (e) $37 = \log_4(a)$ (f) $4 = \log_a(37)$ (g) None of the above

21. The population of bluefin tuna in a highly fished section of the Atlantic Ocean is currently 100 animals. It is decaying exponentially, with a decay rate of -4 per year. In other words, $N(t) = 100\, e^{-4t}$, where t is measured in years. How long will it take for the population of bluefin tuna in this section to reach 1/5 of its current population?

(a) $t = 4 \ln\left(\frac{1}{5}\right)$ (b) $t = \frac{1}{4} \ln\left(\frac{1}{5}\right)$ (c) $t = \ln\left(\frac{5}{4}\right)$ (d) $t = \frac{1}{5} \ln\left(\frac{1}{4}\right)$
(e) $t = \frac{1}{4} \ln(5)$ (f) $t = \frac{1}{5} \ln(4)$ (g) $t = 5 \ln(4)$ (h) $t = 4 \ln(5)$
(i) $t = 5 \ln\left(\frac{1}{4}\right)$ (j) None of the above

22. A parabola has vertex $(-3, 0)$ and focus $(-3, 5)$. The equation of the parabola is:

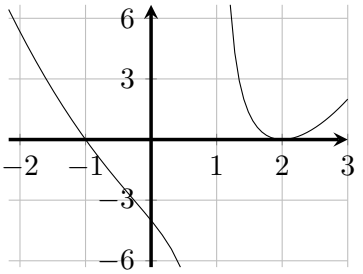
(a) $y = \frac{1}{20}(x+3)^2$ (b) $y = \frac{1}{5}(x-3)^2$ (c) $y = 4(x+3)^2$ (d) $y = \frac{4}{5}(x+3)^2$
(e) $y = 20(x-3)^2$ (f) $x = \frac{1}{20}y^2 + 3$ (g) $x = \frac{1}{20}y^2 - 3$ (h) $x = \frac{1}{5}y^2 + 3$
(i) $x = \frac{4}{5}y^2 - 3$ (j) None of the above

23. Find the sum of the series $5 + 4\frac{2}{3} + 4\frac{1}{3} + ... + 1 = \Sigma_{n=1}^{13} \left(5\frac{1}{3} - \frac{n}{3}\right)$.

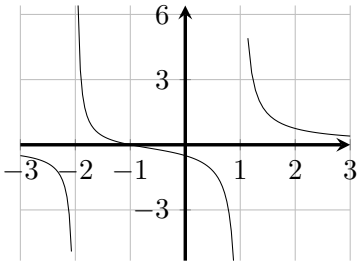
(a) 26 (b) $\frac{65}{2}$ (c) 36 (d) 39 (e) 42 (f) 52 (g) 60 (h) 78 (i) 84
(j) None of the above

24. Which of the following is the graph of $f(x) = \frac{(x-2)(x+1)}{x-1}$?

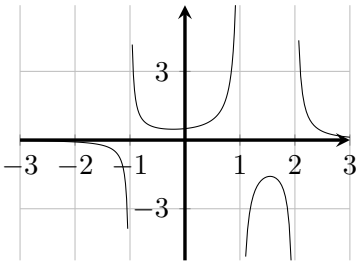
(a)



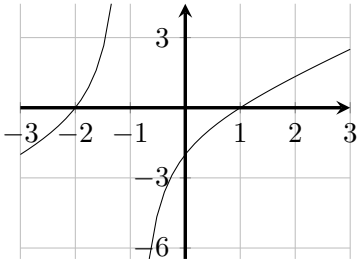
(b)



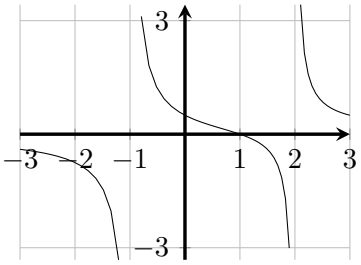
(c)



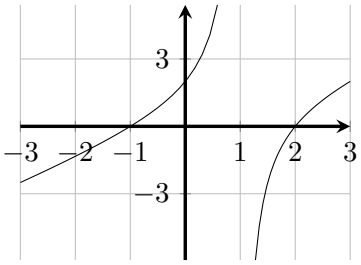
(d)



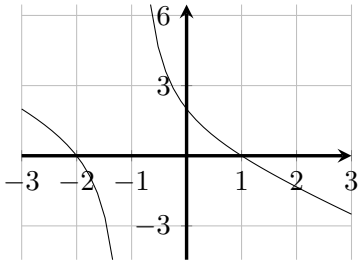
(e)



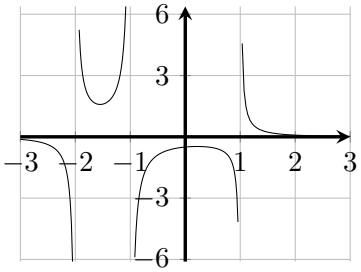
(f)



(g)



(h)



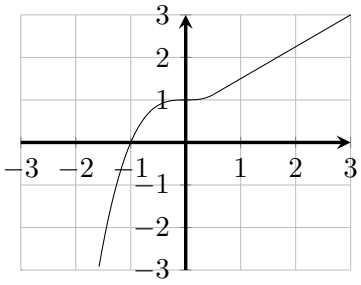
25. Let $A = \{1, 2, 3\}$, $B = \{2, 3, 4\}$, and $C = \{1, 3, 5\}$. The set $(A \cup B) \cap C$ is:

(a) $\{2, 4, 5\}$ (b) $\{1, 3\}$ (c) $\{3, 5\}$ (d) $\{1, 2, 3, 4, 5\}$

(e) $\{3\}$ (f) $\{1, 2, 3, 5\}$ (g) $\{2, 3, 4\}$ (h) $\{1, 2, 5\}$

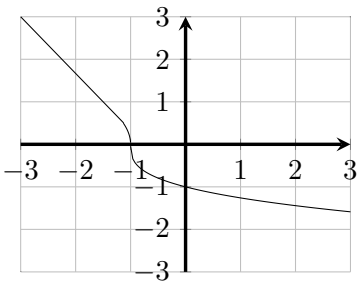
(i) $\{2, 3, 5\}$ (j) None of the above

26. Below is a graph of the function $y = f(x)$.

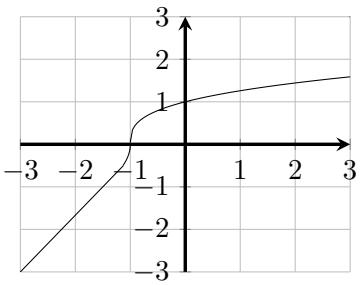


Which of the following is the graph of $y = f^{-1}(x)$, the inverse function of $f(x)$?

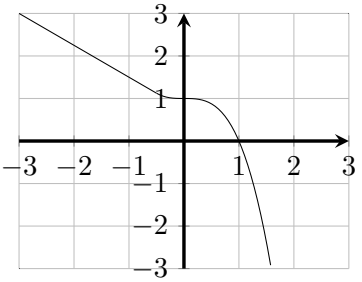
(a)



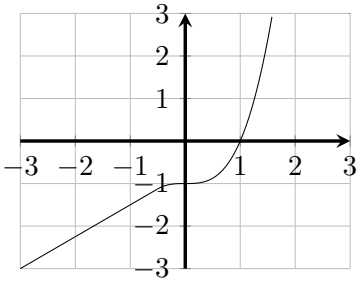
(b)



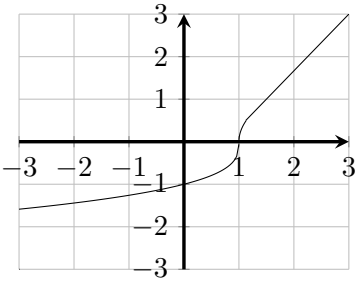
(c)



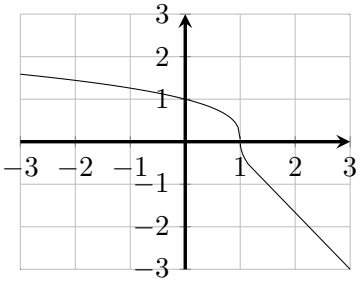
(d)



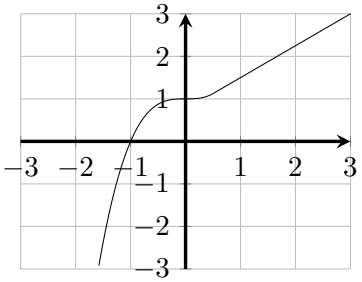
(e)



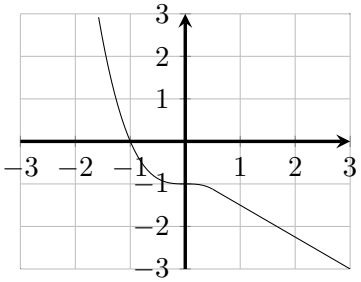
(f)



(g)



(h)



27. Solve the system of equations below.

$$\begin{aligned} x^2 + 2y &= -3 \\ 2x^2 - y^2 &= -2 \end{aligned}$$

This system of equations might have more than one solution. Among all of the solutions, the largest value of y that appears is:

(a) -3 or less (b) -2 (c) -1 (d) 0 (e) 1 (f) 2 (g) 3 (h) 4 (i) 5 or more
(j) The equation has no solutions

28. Consider the function $f(x) = \sqrt[3]{1/x + 1}$. The inverse function of $f(x)$ is $f^{-1}(x) =$

(a) $1/(x+1)^3$ (b) $1/(x-1)^3$ (c) $1/(x^3+1)$ (d) $1/(x^3-1)$
(e) $1/x^3 - 1$ (f) $1/x^3 + 1$ (g) $1/(\sqrt[3]{x} - 1)$ (h) $1/(\sqrt[3]{x} + 1)$
(i) $2/x^3$ (j) None of the above

29. The functions $f(x)$ and $g(x)$ are defined by the following table:

x	-3	-2	-1	0	1	2	3
$f(x)$	-1	0	-3	3	-2	2	1
$g(x)$	1	3	-3	-1	0	2	-2

Evaluate $(f \circ g)(-2)$.

(a) -3 (b) -2 (c) -1 (d) 0 (e) 1 (f) 2 (g) 3

30. The polynomial $f(x)$ has real coefficients and has zeros -2 and $1 + 3i$. Then $f(x) =$

(a) $x^2 + 5x + 6$ (b) $x^2 + x - 2$ (c) $x^2 - x - 6$ (d) $x^2 - 2x + 10$
(e) $x^3 - x^2 + 8x + 10$ (f) $x^3 + 6x + 20$ (g) $x^3 + 2x^2 - 9x - 18$ (h) $x^3 + 5x + 18$
(i) $x^3 - x^2 + 7x + 9$ (j) None of the above

Answers

1. b
2. h
3. f
4. a
5. e
6. f
7. e
8. g
9. h
10. b
11. d
12. e
13. e
14. c
15. b
16. c
17. d
18. h
19. e
20. a
21. e
22. a
23. d
24. f
25. b
26. e
27. b
28. d
29. e
30. f