MATH 121 Final Exam Practice Problems for ALEKS-trained students

Multiple Choice Section. Write the letter of your answer in the box provided.

1. Solve the equation $x^2 - x - 2 = 0$ for $x$.
   (a) $x = 2, 1$  (b) $x = -2, 1$  (c) $x = 2, -1$  (d) $x = -2, -1$  (e) None of the above

2. Write the solution to the inequality $|x| < 12$ using interval notation.
   (a) $(-12, 12)$  (b) $(-\infty, 12)$  (c) $(12, \infty)$  (d) $(-\infty, -12) \cup (12, \infty)$  (e) None of the above

3. Find the distance between the points $(-1, -3)$ and $(2, 3)$.
   (a) 9  (b) $\sqrt{36}$  (c) $\sqrt{45}$  (d) $(-3, 0)$  (e) None of the above

4. The x-intercepts of $x^2 + y^2 = 16$ are
   (a) $(-4, 0), (4, 0)$  (b) $(4, 0)$  (c) $(-16, 0), (16, 0)$  (d) $(0, -4), (0, 4)$

5. Find the slope of the line that is perpendicular to $2x - 5y = 7$.
   (a) $\frac{2}{5}$  (b) $\frac{-5}{2}$  (c) $\frac{5}{2}$  (d) -5  (e) None of the above

6. Find the midpoint of the line segment joining the points $\left(\frac{2}{3}, 3\right)$ and $\left(\frac{4}{3}, -9\right)$.
   (a) $(1, -3)$  (b) $\left(\frac{2}{3}, -12\right)$  (c) $\sqrt{32}$  (d) $(2, -6)$  (e) None of the above

7. Find the equation of the circle in standard form that has center $(1, -3)$ and radius of $\sqrt{5}$.
   (a) $(x + 1)^2 + (y - 3)^2 = \sqrt{5}$  (b) $(x - 1)^2 + (y + 3)^2 = \sqrt{5}$
   (c) $(x + 1)^2 + (y - 3)^2 = 5$  (d) $(x - 1)^2 + (y + 3)^2 = 5$  (e) None of the above

Answer:
8. Find the average rate of change of \( f(x) = 3^x \) from \( x = 1 \) to \( x = 2 \).
(a) 4.5  (b) -6  (c) 6  (d) 9  (e) None of the above

Use the given graph of the function \( f \) at the right to answer problems #9-12

9. Determine the absolute maximum value of \( f \).
(a) 3  (b) 4  (c) -2  (d) -1  (e) None of the above

Answer:

10. Find a value of \( x \) for which \( f(x) = 0 \)
(a) \( x = 2 \)  (b) \( x = 1 \)  (c) \( x = -2 \)
(d) \( x = 3 \)  (e) None of the above

Answer:

11. Find the coordinates of the relative (local) maximum.
(a) \((6,1)\)  (b) \((1,0)\)  (c) \((-1,4)\)
(d) \((-3,-3)\)  (e) None of the above

Answer:
12. Find all of the x-intervals where the graph is increasing.
(a) (−3, 4) ∪ (−2, 3)  (b) (3, 6)  (c) (−5, −1) ∪ (3, 6)
(d) (−1, 3)  (e) None of the above.

Answer:  

13. Choose the only function which is one-to-one.
(a) 𝑓(𝑥) = 𝑥²  (b) 𝑓(𝑥) = −3  (c) 𝑓(𝑥) = 2 − 𝑥²  (d) 𝑓(𝑥) = 𝑒^{−3𝑥}

Answer:  

14. Determine the vertex of 𝑓(𝑥) = −2(𝑥 − 1)² − 2
(a) (−1, −2)  (b) (1, −2)  (c) (−2, −2)  (d) (−2, 7)

Answer:  

15. The zeroes of the polynomial function 𝑓(𝑥) = 4𝑥⁴(𝑥 − 3)(𝑥 + 1) are
(a) {0, −3, 1}  (b) {0, 3, −1}  (c) {4, 0, 1, −1}  (d) {0, 1, −1}

Answer:  

16. Given that the function 𝑓(𝑥) = √𝑥 + 3 is one-to-one, what is the range of 𝑓⁻¹(𝑥)?
(a) Not enough information is given  (b) (−∞, ∞)  (c) (−3, ∞)
(d) (0, ∞)  (e) [−3, ∞)

Answer:  

17. The range of 𝑓(𝑥) = ln(𝑥 − 1) is
(a) (1, ∞)  (b) (7, ∞)  (c) All real numbers
(d) (−∞, 1)  (e) None of the above

Answer:  

18. Convert the logarithmic equation \( \log_4 x = \frac{1}{2} \) into exponential form.

(a) \( 4^{1/2} = x \)  
(b) \( x^{1/2} = 4 \)  
(c) \( 4^x = 1/2 \)  
(d) \( x^2 = 4 \)  
(e) None of the above

Answer: 

19. Find the exact value of the expression: \( e^{2\ln(3)} \)

(a) 6  
(b) \( e^{\ln(10)} \)  
(c) 16  
(d) 9  
(e) None of the above

Answer: 

20. If \( e^{-2} \) is evaluated, the result is:

(a) \( \ln \left( \frac{1}{5} \right) \)  
(b) 1.001  
(c) negative  
(d) positive  
(e) None of the above

Answer: 

Written problems (show all steps used clearly):

21. For the circle \( x^2 + (y-1)^2 = 9 \) (a) state the center and radius. Graph the circle. Place the circle correctly on the axes. (b) Find the x and y intercepts and label them on your graph.

22. Find the distance between the two points (3,-5) and (1,7).

23. Find the midpoint between the two points (3,-5) and (1,7). All three points on the same grid to verify that the midpoint you found lies between the two given points.

24. Graph \( f(x) = -\sqrt{x - 2} \) (a) Label at least two points (b) What is the domain of \( f(x) \) and its range

25. For the function \( f(x) = 1 - 2x^2 \), find the average rate of change from \( x=1 \) to \( x=3 \)

26. For the function in problem 25, compute the difference quotient \( \frac{f(x + h) - f(x)}{h} \)

27. Given the functions \( f(x) = x^2 + 2 \) and \( g(x) = \sqrt{x - 2} \), find and simplify \( (f \circ g)(x) \)

28. Given \( y = x^2 + 2x + 3 \)
a. Determine the vertex and axis of symmetry.

Vertex: Axis of Symmetry:

b. Determine the $x$ and $y$ intercepts (if they exist).

$x$-intercept(s): 

29. Given the function $g(x) = \frac{1}{x+2} + 1$, determine the following and sketch a graph:

(a) The equation of the vertical asymptote.

(b) The equation of the horizontal asymptote.

(c) The $y$-intercept(s)

(d) The $x$-intercept(s)
30. Graph the function \( f(x) = e^{-x} - 1 \). State the domain, range, and asymptote of \( f(x) \).

Domain: __________

Range: __________

Asymptote: __________

y-intercept: __________

31. Given that \( x^2 + y^2 + 4x - 5y = 2 \) is the equation of a circle, determine the center and radius (hint: complete the squares).

Center: __________

Radius: __________

32. Find the inverse of the function: \( f(x) = \frac{2x}{x-8} \)

33. Solve the equation:

\[ 8e^{-3x} = 40 \]
34. Solve the equation:
\[ \log_2(x - 2) + \log_2(x + 2) = 5 \]

35. Graph \( f(x) = \ln(x+2) \). Determine (a) domain, (b) range (c) asymptotes, and (d) x- and y-intercepts.

36. Solve \( \log_6(x - 1) + \log_6(x - 2) = 1 \)

37. Solve \( 7^{x^{-1}} = 3^x \)

38. Solve \( 3\ln(x-5) = 1 \)

39. The function \( f(x) = \frac{3x}{x+8} \) is one-to-one. (a) What is the domain of \( f(x) \) (b) What is the range of \( f^{-1} \)?

40. What is \( f^{-1} \) for the function in problem 39 above? What is the domain of the inverse? What is the range of \( f(x) \)?

41. Moth balls let outside quickly lose their mass due to sublimation into the surrounding air. Suppose that the mass of the moth balls \( A \) in ounces varies with time following the equation \( A = A_0 e^{-0.03t} \) where \( A_0 \) is the initial mass in ounces and \( t \) is the time in days.

(a) If we start with 6 ounces of moth balls, how many ounces will be there after 10 days?
(b) How many days will it take for there to be only 3 ounces of moth balls?

42. For the polynomial function \( f(x) = (x - 2)^2(x + 1) \) (a) what are its zeros and associated multiplicities? (b) Does it cross or touch the x-axis at each of the zeros (c) Determine the end behavior of the graph (example: does it rise/fall on the left and does it rise/fall on the right?)

43. Graph \( f(x) = \ln(x + 2) \). What is the domain, range, intercepts and asymptotes?

44. Graph \( f(x) = x^2 - 4x + 3 \). (a) Find the domain and range, (b) What is the vertex and axis of symmetry (c) What are the x-intercepts? (d) Graph the function and label clearly the vertex and intercepts

45. For the rational function \( f(x) = \frac{3x^2+2x-8}{x^3-2x^2-3x} \) (a) What is the domain (b) Where are the asymptotes?

46. Graph \( f(x) = (x - 3)^3 \). (a) Label at least two points (b) What is the domain and range (c) Find all intercepts

47. Graph \( f(x) = |x| + 3 \) (a) Label at least three points (b) What is the domain and range (c) Is the function odd, even or neither?

48. Write \( \log(x - 11) = 1 \) in exponential form and solve for \( x \)

49. Given \( f(x) = 2x^2 + 3 \) and \( g(x) = \sqrt{x - 1} \), (a) find \((f \circ g)(x)\) and simplify, (b) find \((f \circ g)(1)\)
(c) What is the domain of \((f \circ g)(x)\)

50. Solve the inequality \( x^3 + 12x > -8x^2 \) Write your answer in interval notation or union of intervals