

The Department of Mathematical Sciences Information Regarding Math 124 Final Exam

Revised 3.8.2018

While all material covered in the syllabus is essential for success in the course, the following material will be stressed on the final exam. Chapter/Section taken from the class text: *College Algebra* (custom 5th edition) by Beecher, Penna and Bittinger.

The Final Exam consists of a random selection of 25 out of the following 37 questions.

Some objectives have more than one sample problem, as indicated.

Questions are phrased similar to the actual exam question.

Your instructor is **NOT PERMITTED** to provide students with solutions, even in lecture format.

Chapter 1

1. *Objective: Given the endpoints of a line segment, find the length of the segment and its midpoint.*

Material: Chapter 1, Section 1

Corresponding Textbook Exercises: 1.1 (41-56, 61-74)

Sample Problem: Find the midpoint of the line segment with endpoints $(-4,9)$ and $(5,11)$ and the distance between the two endpoints.

2. *Objective: Find the domain of a function including rational expressions, square roots, or their composition.*

Material: Chapters 1, 2 and 4, Sections 2 and 6, 3 and 6 (respectively)

Corresponding Textbook Exercises: 1.2 (33, 52-62, 81, 82, 97-98), 1.6 (17-22), 2.3 (27-34), and 4.6 (95, 96)

Sample Problems: Find the domain of the function

a) $y = \sqrt{x-3}$

b) $y = \sqrt{5-3x}$

c) $y = \sqrt{x^2 - 3x + 2}$

d) $f(s) = \frac{s^2 - 5s - 1}{s^3 - 5s^2 - 24s}$

e) $y = \frac{\sqrt{x-5}}{x-7}$

f) $y = \frac{x^2 - 2x + 3}{\sqrt{3x+4}}$

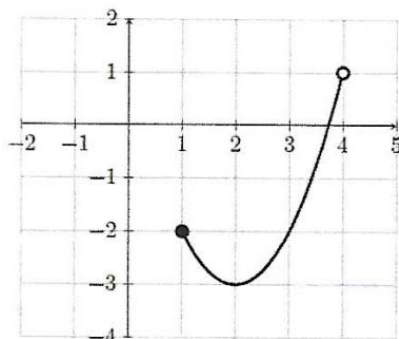
g) $y = \frac{x^2 - 5x + 6}{\sqrt{-x^2 + 5x - 4}}$

3. *Objective: Given the graph of a function, find the domain and range.*

Material: Chapter 1, Section 2

Corresponding Textbook Exercises: 1.2 (65-72)

Sample Problem: From the graph, find the domain, range, increasing and decreasing intervals of the function.



4. *Objective: Graph a line given its equation (equation may or may not be in slope intercept form).*

Material: Chapter 1, Sections 3 and 4

Corresponding Textbook Exercises: 1.3 (63-70), 1.4 (7-26 and 31-34)

Sample Problem: Put the following equation for a line into slope intercept form, and graph the line (choose and label and appropriate scale): $7x = 2 - 3y$

5. *Objective: Find the equation of a line given two points.*

Material: Chapter 1, Section 4

Corresponding Textbook Exercises: 1.4 (19-26)

Sample Problem: Find the equation of the line passing through the two points (3, 7) and (-2, 5)

6. *Objective: Find the equation of a line that is parallel [[or perpendicular]] to another through a given point.*

Material: Chapter 1, Section 4

Corresponding Textbook Exercises: 1.4 (43-50, 72)

Sample Problem: Find the equation of the line that goes through the given point and is perpendicular [[or parallel]] to the given line (state in slope-intercept form): $3x - 4y = 12$, (4, 2)

7. *Objective: Solve a linear equation (problem may be algebraic only, or given in the context of an application problem).*

Material: Chapter 1, Section 6

Corresponding Textbook Exercises: 1.6 (1-52)

Sample Problem:

a) Solve for x . $(5x - 17) - 2x = 6x - (1 - x)$

b) An airplane that travels 450 mph in still air encounters a 30 mph headwind. How long will it take the airplane to travel 1050 miles into the wind?

8. *Objective: Solve a linear inequality (problem may be algebraic only, or given in the context of an application problem).*

Material: Chapter 1, Section 6

Corresponding Textbook Exercises: 1.6 (1-52)

Sample Problem:

- Solve for x , show solution in interval notation. $-4 < 5 - 2x \leq 7$
- Jessica can be paid one of two ways for selling insurance policies:
 Plan A: \$750 per month, plus 10% of sales.
 Plan B: \$1000 per month, plus 8% of sales in excess of \$2000.
 For what amount of monthly sales is Plan A better for Jessica?

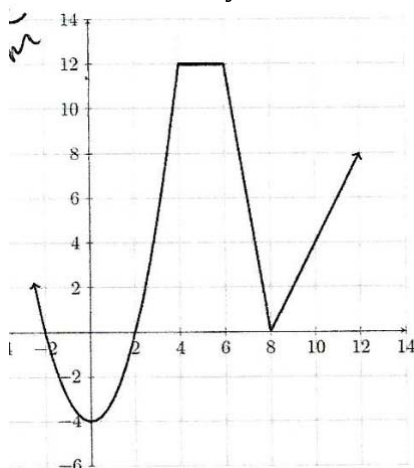
Chapter 2

9. *Objective: From a graph, determine the intervals where the function is increasing, decreasing or constant. Identify relative maximum(s) or relative minimum(s).*

Material: Chapter 2, Section 1

Corresponding Textbook Exercises: 2.1 (1-22)

Sample Problem: From the graph, find the intervals where the function is increasing, decreasing or constant. Identify relative maximum(s) or relative minimum(s).



10. *Objective: Evaluate a piecewise function for given inputs*

Material: Chapter 2, Section 1

Corresponding Textbook Exercises: 2.1 (35-48)

Sample Problem: Evaluate $g(-4)$, $g(-2)$ and $g(3)$ for the function
$$g(x) = \begin{cases} 3x - 2 & x \leq -2 \\ 3 & -2 < x < 3 \\ 7 - x & x \geq 3 \end{cases}$$

11. *Objective: Find the average rate of change of a function on a given interval.*

Material: Chapter 1, Section 3 and Chapter 2, Section 2

Corresponding Textbook Exercises: 1.3 (41-48), 2.2 (49-70)

Sample Problem: Construct and simplify the difference quotient $\frac{f(x+h) - f(x)}{h}$ for the function

$$f(x) = y = x^2 - 2.$$

12. *Objective: Find the composition of two or more functions.*
 Material: Chapter 2, Section 3
 Corresponding Textbook Exercises: 2.3 (17-38)
 Sample Problem: Given $f(x) = x^2 - 5$ and $g(x) = \sqrt{5 - x}$, find $f(g(x))$, or $(f \circ g)(x)$.
13. *Objective: Identify a given function is even, odd or neither*
 Material: Chapter 2, Section 4
 Corresponding Textbook Exercises: 2.4 (39-48)
 Sample Problem: Classify the function $f(x) = 3x^3 - 2x$ as even, odd or neither. Show your work to justify your answer.
14. *Objective: Describe how the graph of the function can be obtained from one of the basic graphs.*
 Material: Chapter 2, Section 5
 Corresponding Textbook Exercises: 2.5 (1-36)
 Sample Problem: Describe how the graph of $g(x) = y = -(x-1)^2 + 2$ can be obtained from $y = x^2$

Chapter 3

15. *Objective: Find the roots of a quadratic equation.*
 Material: Chapter 3, Section 2
 Corresponding Textbook Exercises: 3.2 (1-16, 29-56, 63-78)
 Sample Problem: Solve the quadratic equation $3x^2 - 5 = 4x$
16. *Objective: Solve equations that are (or easily become) quadratic in form – 2 questions.*
 Type 1, a quadratic
 Material: Chapter 3, Section 2
 Corresponding Textbook Exercises: 3.2 (79-94)
 Sample Problem: Solve for x : $(x-4)^4 + 5(x-4)^2 = 6$
 Type 2, quadratic in form
 Material: Chapter 5, Section 5
 Corresponding Textbook Exercises: 5.5 (25, 26, 29, 30, 61)
 Sample Problems: Solve for x :
 a) $e^{2x} - 3e^x = 4$
 b) $x - \frac{5}{x} = 4$
17. *Objective: Determine the characteristics of the graph of a quadratic (direction of opening, axis of symmetry, vertex, roots, y intercept) and use this information to graph it*
 Material: Chapter 3, Section 3
 Corresponding Textbook Exercises: 3.3 (3-16)
 Sample Problem: Graph the function $f(x) = x^2 - 8x - 20$. Label the vertex and x-intercepts.
18. *Objective: Find the maximum or minimum values given a quadratic application problem.*
 Material: Chapter 3, Section 3
 Corresponding Textbook Exercises: 3.3 (41-53)
 Sample Problem: A ball is thrown upward with an initial velocity of 20 ft/sec from a height of six feet. The function $s(t) = -16t^2 + 20t + 6$ gives the height of the ball t seconds after release. Determine the time when the ball is at maximum height, and find that height

19. *Objective: Solve rational equations.*

Material: Chapter 3, Section 4

Corresponding Textbook Exercises: 3.4 (1-30)

Sample Problems: Solve for x :

a) $\frac{5}{2x+3} + \frac{1}{x-6} = 0$

b) $\frac{3}{8x+1} + \frac{8}{2x+5} = 1$

20. *Objective: Solve radical equations.*

Material: Chapter 3, Section 4

Textbook Exercises: 3.4 (31-76, 97)

Sample Problems: Solve for x :

a) $\sqrt{2x+1} - 3 = 3$

b) $\sqrt{x-1} - \sqrt{x-4} = 1$

21. *Objective: Given a formula, solve for a specific variable.*

Material: Chapter 3, Section 4

Corresponding Textbook Exercises: 3.4 (81-90)

Sample Problem: Given the following formula, solve for w : $A = 2lw + 2hl + 2hw$

22. *Objective: Solve linear inequalities with absolute value.*

Material: Chapter 3, Section 5

Corresponding Textbook Exercises: 3.5 (33-64)

Sample Problem: Solve for x : $|1 - 6x| < 5$

Chapter 4

23. *Objective: Use the leading term test to determine the end behavior of a given polynomial*

Material: Chapter 4, Section 1

Corresponding Textbook Exercises: 4.1 (11-22)

Sample Problem: Describe the end behavior (by sketching or otherwise) of $g(x) = x^3 - 17x^2 + 5$

24. *Objective: Sketch the graph of a polynomial function. Show the general shape of the graph, the zero(s) of the function, y -intercept, intervals where the function is positive/negative, and the end behavior.*

Material: Chapter 4, Section 2

Corresponding Textbook Exercises: 4.2 (13-36)

Sample Problem: Sketch the graph of the function $h(x) = y = (x-3)(x+1)(x-2)^2$

25. *Objective: Use long or synthetic division to find the result of a polynomial divided by $x - c$.*

Material: Chapter 4, Section 3

Corresponding Textbook Exercises: 4.3 (11-22)

Sample Problem: Use long or synthetic division to find the quotient and remainder of the expression

$(x^3 - 13x + 15) \div (x - 5)$

26. *Objective: Solve a polynomial inequality.*

Material: Chapter 4, Section 6

Corresponding Textbook Exercises: 4.6 (25-52)

Sample Problem: Solve the following for x , and put the solution in interval notation:

$$2x^2 + 6 \leq 5x^2 + x$$

27. *Objective: Solve a rational inequality.*

Material: Chapter 4, Section 6

Corresponding Textbook Exercises: 4.6 (53-76)

Sample Problem: Solve the following for x , and put the solution in interval notation: $\frac{4}{x^2 - 9} < \frac{7}{x - 3}$

Chapter 5

28. *Objective: Find the inverse of a given function or relation and specify the domain of the inverse.*

NOTE: You can find the domain of the inverse by finding the range of the original function, or you can see Chapter X, Section X to determine domain.

Material: Chapter 5, Section 1 (domain is also referenced in Chapter 1, Sections 2 and 6)

Corresponding Textbook Exercises: 5.1 (45-60, 79-86)

Sample Problem: Given the function $f(x) = (x + 5)^3$, find a formula for the inverse $f^{-1}(x)$. Find the domain of $f^{-1}(x)$

29. *Objective: Convert an exponential equation to its equivalent logarithmic form, or visa-versa.*

Material: Chapter 5, Section 3

Corresponding Textbook Exercises: 5.3 (35-54)

Sample Problems:

a) Convert to an equivalent logarithmic equation. $e^{x+1} = 5$

b) Convert to an equivalent exponential equation. $\log_7(5 - x) = 2$

30. *Objective: Solve an exponential equation.*

Material: Chapter 5, Section 5

Corresponding Textbook Exercises: 5.5 (1-28)

Sample Problem: Solve for x :

a) $7^{3x-5} = 49$

b) $4^{2x-1} = 3^x$

31. *Objective: Solve a log equation.*

Material: Chapter 5, Section 5

Corresponding Textbook Exercises: 5.5 (31-56)

Sample Problem: Solve for x :

a) $\log_3 x = 2 - \log_3(x + 8)$

b) $\log x + \log(x - 4) = \log 12$

32. *Objective: Given an application problem, state the applicable function.*

Material: Chapter 5, Section 2

Corresponding Textbook Exercises: 5.2 (51-54), 5.6 (1, 2 and 7)

Sample Problems:

- a) Diantha has access to a \$10,000 investment that pays 6% compounded quarterly. Find the function that describes the current value of her investment.
- b) Jessica has access to an investment that returns approximately 5.8% compounded continuously, and she initially invests \$11,000. Find the function that describes the value of her investment.

33. *Objective: Given equation, find half life or doubling time.*

Material: Chapter 5, Section 6

Corresponding Textbook Exercises: None

Sample Problems: The number of bacteria cells at any time, t , can be expressed by the given equation. Find the half-life or doubling time, whichever is appropriate.

a) $P(t) = P_0 e^{\frac{-\ln 2}{2}t}$ Ans: half-life is 2

b) $P(t) = 300 e^{0.5t}$ Ans: double time of $\frac{\ln 2}{0.5}$

c) $P(t) = 300 e^{-0.7t}$ Ans: half life is $\frac{\ln 2}{0.7}$

Chapter 6

34. *Objective: Solve a system of two [[or three]] linear equations with two [[or three]] unknowns.*

Material: Chapter 6, Sections 1 and 2

Corresponding Textbook Exercises: 6.1 (17-44), 6.2 (1-16)

Sample Problem: Solve the given system:

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

b)
$$\begin{cases} x - 2y + 3z = -4 \\ 3x + y - z = 0 \\ 2x + 3y - 5z = 1 \end{cases}$$

35. *Objective: Identify the solution(s) for an augmented matrix in row-echelon form.*

Material: Chapter 6, Section 3

Corresponding Textbook Exercises: None

Sample Problems: Write out the solution (x, y, z) of the system of equations that correspond to the augmented matrix given by

a)
$$\left[\begin{array}{ccc|c} 1 & 0 & 0 & 4 \\ 0 & 1 & 0 & 7 \\ 0 & 0 & 1 & 2 \end{array} \right]$$

b)
$$\left[\begin{array}{ccc|c} 1 & 0 & 0 & 4 \\ 0 & 1 & 0 & 7 \\ 0 & 0 & 0 & 2 \end{array} \right]$$

c)
$$\left[\begin{array}{ccc|c} 1 & 0 & 0 & 4 \\ 0 & 1 & 2 & 7 \\ 0 & 0 & 0 & 0 \end{array} \right]$$

Chapter 7

36. *Objective: Solve a nonlinear system of equations.*

Material: Chapter 7, Section 4

Corresponding Textbook Exercises: 7.4 (7-54)

Sample Problem: Solve the given system (find only real valued solutions):
$$\begin{cases} 2y^2 + xy = 5 \\ 4y + x = 7 \end{cases}$$

Chapter 8

37. *Objective: Write the terms of a recursive sequence given as a formula.*

Material: Chapter 8, Section 1

Corresponding Textbook Exercises: 8.1 (61-66)

Sample Problem: For the given recursive sequence, find b_3 : $b_1 = 3$, $b_{n+1} = 2 + \frac{1}{b_n}$