

MATH 126 SAMPLE EXAM QUESTIONS – SPRING 2018

This problem set has been designed to provide you with an understanding of the types of problems you should be able to perform in order to be successful in this class. Most of the problems are odd numbered problems taken from the textbook. The answers should be in the back of the book so that you can check your answer once completed. For the even problems or “extra” problems listed, check with your instructor for the solutions.

CHAPTER 1

Section 1.1

Perform the indicated operations:

25. $\frac{3}{10} + \frac{4}{15}$

29. a) $\frac{2}{\frac{2}{3}} - \frac{\frac{2}{3}}{2}$ b) $\frac{\frac{1}{12}}{\frac{1}{8} - \frac{1}{9}}$

Express the interval in terms of an inequality and graph:

45. $(-3, 0)$

47. $[2, 8)$

49. $[2, \infty)$

Graph the set:

59. $(-2, 0) \cup (-1, 1)$

61. $[-4, 6] \cap [0, 8)$

63. $(-\infty, -4) \cup (4, \infty)$

Section 1.2

Evaluate each expression:

19. a) $\sqrt{16}$ b) $\sqrt[4]{16}$ c) $\sqrt[4]{\frac{1}{16}}$

Simplify the expression:

29. $\sqrt{32} + \sqrt{18}$

31. $\sqrt[5]{96} + \sqrt[5]{3}$

33. $\sqrt{16x} + \sqrt{x^5}$

Simplify the expression and eliminate any negative exponents:

41. a) $(4x^2y^4)(2x^5y)$ b) $(8a^2z)(\frac{1}{2}a^3z^4)$

43. a) $(5x^2y^3)(3x^2y^5)^4$

49. a) $\frac{8a^3b^{-4}}{2a^{-5}b^5}$ b) $\left(\frac{y}{5x^{-2}}\right)^{-3}$

Simplify the expression and eliminate any negative exponents. Assume all letters represent positive numbers:

65. a) $(8a^6b^{\frac{3}{2}})^{\frac{2}{3}}$

68. a) $\left(\frac{x^8y^{-4}}{16y^{\frac{4}{3}}}\right)^{-\frac{1}{4}}$

73. a) $\sqrt{4st^3}\sqrt[6]{s^3t^2}$ b) $\frac{\sqrt[4]{x^7}}{\sqrt[4]{x^3}}$

Rationalize the denominator:

89. a) $\frac{1}{\sqrt{10}}$ b) $\sqrt{\frac{2}{x}}$ c) $\sqrt{\frac{x}{3}}$

Section 1.3

Find the sum, difference or product:

17. $(x^3 + 6x^2 - 4x + 7) - (3x^2 + 2x - 4)$

21. $2(2 - 5t) + t^2(t - 1) - (t^4 - 1)$

Multiply:

23. $(3t - 2)(7t - 4)$

25. $(3x + 5)(2x - 1)$

29. $(3x + 4)^2$

35. $(x + 5)(x - 5)$

39. $(\sqrt{x} + 2)(\sqrt{x} - 2)$

47. $(2x - 5)(x^2 - x + 1)$

Factor the common factor:

61. $-2x^3 + 16x$

65. $2x^2y - 6xy^2 + 3xy$

Factor:

67. $x^2 + 2x - 3$

71. $3x^2 - 16x + 5$

73. $(3x + 2)^2 + 8(3x + 2) + 12$

75. $9a^2 - 16$

77. $27x^3 + y^3$

83. $x^3 + 4x^2 + x + 4$

85. $2x^3 + x^2 - 6x - 3$

91. $x^{-\frac{3}{2}} + 2x^{-\frac{1}{2}} + x^{\frac{1}{2}}$

93. $(x^2 + 1)^{\frac{1}{2}} + 2(x^2 + 1)^{-\frac{1}{2}}$

121. $(x - 1)(x + 2)^2 - (x - 1)^2(x + 2)$

122. $y^4(y + 2)^3 + y^5(y + 2)^4$

128. $\frac{1}{2}x^{-\frac{1}{2}}(3x + 4)^{\frac{1}{2}} - \frac{3}{2}x^{\frac{1}{2}}(3x + 4)^{-\frac{1}{2}}$

Section 1.4

Find the domain:

5. $4x^2 - 10x + 3$

7. $\frac{2x+1}{x-4}$

9. $\sqrt{x+3}$

11. $\frac{x^2+1}{x^2-x-2}$

EXTRA (not from the book):

A. $\frac{\sqrt{x-4}}{x^2-2x-8}$

B. $\frac{1}{\sqrt{3-x}}$

Perform the multiplication or division and simplify:

25. $\frac{x^2-2x-15}{x^2-9} \cdot \frac{x+3}{x-5}$

33. $\frac{2x^2+3x+1}{x^2+2x-15} \div \frac{x^2+6x+5}{2x^2-7x+3}$

Simplify the compound expression:

59. $\frac{x+\frac{1}{x+2}}{x-\frac{1}{x+2}}$

63. $\frac{\frac{x}{y}-\frac{y}{x}}{\frac{1}{x^2}-\frac{1}{y^2}}$

Rationalize the denominator:

81. $\frac{1}{2-\sqrt{3}}$

83. $\frac{2}{\sqrt{2}+\sqrt{7}}$

86. $\frac{2(x-y)}{\sqrt{x}-\sqrt{y}}$

Section 1.5

Solve the equation:

43. $x^2 + x - 12 = 0$

49. $3x^2 + 5x = 2$

51. $2x^2 = 8$

55. $x^2 + 2x - 5 = 0$

67. $2x^2 + x - 3 = 0$

85. $\frac{1}{x-1} + \frac{1}{x+2} = \frac{5}{4}$

91. $\sqrt{2x+1} + 1 = x$

EXTRA (not from the book):

A. $x^2 - 2x - 5 = 0$

Section 1.6

Refer to WebAssign problems for sample problems from this section.

Section 1.7

Solve the inequality. Express your answer in interval notation.

19. $3x + 11 \leq 6x + 8$

31. $-2 < 8 - 2x \leq -1$

49. $(x + 2)(x - 1)(x - 3) \leq 0$

51. $(x - 4)(x + 2)^2 < 0$

57. $\frac{x-3}{x+1} \geq 0$

Section 1.8

Sketch the graph and find any x-intercepts or y-intercepts:

59. $2x - y = 6$

65. $y = x^2 - 9$

69. $y = \sqrt{4 - x^2}$

75. $y = 4 - |x|$

Show the equation represents a circle and find the center and radius of the circle:

103. $x^2 + y^2 - 4x + 10y + 13 = 0$

107. $2x^2 + 2y^2 - 3x = 0$

Section 1.10

Find the slope of the line thru P and Q:

9. P(2,4) Q(4,3)

11. P(1,-3) Q(-1,6)

Find the equation of the line that satisfies the given conditions:

23. Through (2,1) and (1,6)

31. Through (1,-6) parallel to $x + 2y = 6$

35. Through (-1, -2) perpendicular to $2x + 5y + 8 = 0$

CHAPTER 12

Section 12.6

Expand:

5. $(x + y)^6$

13. $(2x - 3y)^3$

25. $(x + 2y)^4$

Complete the following:

29. Find the first 3 terms in the expansion of $(x + 2y)^{20}$

39. Find the term containing x^4 in the expansion of $(x + 2y)^{10}$

CHAPTER 2

Section 2.1

Evaluate the function at the indicated values:

17. $f(x) = x^2 - 6$; $f(-3), f(3), f(0), f\left(\frac{1}{2}\right), f(10)$

21. $g(x) = \frac{1-x}{1+x}$; $g(2), g(-2), g\left(\frac{1}{2}\right), g(a), g(a-1), g(-1)$

27. $f(x) = \begin{cases} x^2 & \text{if } x < 0 \\ x + 1 & \text{if } x \geq 0 \end{cases}$ $f(-2), f(-1), f(0), f(1), f(2)$

Find $f(a)$, $f(a+h)$ and the difference quotient $\frac{f(a+h)-f(a)}{h}$, where $h \neq 0$:

35. $f(x) = 3x + 2$

41. $f(x) = 3 - 5x + 4x^2$

Find the domain of the function:

47. $f(x) = \frac{1}{x-3}$

$$51. \quad f(x) = \sqrt{x-5}$$

$$53. \quad f(x) = \sqrt[3]{t-1}$$

$$57. \quad f(x) = \frac{\sqrt{2+x}}{3-x}$$

Section 2.2

Sketch the graph of the function by making a table of values:

$$5. \quad f(x) = 2$$

$$11. \quad f(x) = -x^2$$

$$15. \quad g(x) = x^3 - 8$$

$$19. \quad f(x) = 1 + \sqrt{x}$$

$$27. \quad f(x) = |2x - 2|$$

Sketch the graph of the piecewise function:

$$37. \quad f(x) = \begin{cases} x & \text{if } x \leq 0 \\ x + 1 & \text{if } x > 0 \end{cases}$$

$$45. \quad f(x) = \begin{cases} 4 & \text{if } x < -2 \\ x^2 & \text{if } -2 \leq x \leq 2 \\ -x + 6 & \text{if } x > 2 \end{cases}$$

Section 2.3

As these problems relate to given graphs, please refer to WebAssign problems for this section or consult with your instructor.

Section 2.5

Sketch the graph of the function, not by plotting points, but by starting with the graphs of the standard function and applying transformations.

21. $f(x) = x^2 - 1$

23. $f(x) = \sqrt{x} + 1$

25. $f(x) = (x - 5)^2$

27. $f(x) = \sqrt{x + 4}$

28. $f(x) = |x - 3|$

37. $y = (x - 3)^2 + 5$

41. $y = |x + 2| + 2$

Section 2.6

Find $f+g$, $f-g$, fg and f/g and their domains:

5. $f(x) = x - 3$, $g(x) = x^2$

7. $f(x) = \sqrt{4 - x^2}$, $g(x) = \sqrt{1 + x}$

Use $f(x)=3x-5$ and $g(x)=2-x^2$ to evaluate the expression:

21. a) $f(g(0))$ b) $g(f(0))$

23. a) $(f \circ g)(-2)$ b) $(g \circ f)(-2)$

Find the functions $f(g(x))$, $g(f(x))$, $f(f(x))$ and $g(g(x))$ and their domains:

37. $f(x) = \frac{1}{x}$, $g(x) = 2x + 4$

41. $f(x) = \frac{x}{x+1}$, $g(x) = 2x - 1$

43. $f(x) = \frac{x}{x+1}$, $g(x) = \frac{1}{x}$

Section 2.7

Use the Inverse Function Property to show $f(x)$ and $g(x)$ are inverses of each other:

25. $f(x) = x - 6; \quad g(x) = x + 6$

27. $f(x) = 2x - 5; \quad g(x) = \frac{x+5}{2}$

Find the inverse of the function of f :

37. $f(x) = 2x + 1$

41. $f(x) = 5 - 4x^2$

45. $f(x) = \frac{x}{x+4}$

51. $f(x) = \sqrt{2 + 5x}$

CHAPTER 3

Section 3.1

Express in standard form. Find the vertex, x and y intercepts. Sketch the graph.

9. $f(x) = x^2 - 6x$

13. $f(x) = x^2 + 4x + 3$

17. $f(x) = 2x^2 + 4x + 3$

21. $f(x) = -4x^2 - 16x + 3$

Find the max or min value of the function:

33. $f(x) = x^2 + x + 1$

35. $f(t) = 100 - 49t - 7t^2$

Section 3.2

Sketch the graph of the polynomial function. List any intercepts.

15. $P(x) = (x - 1)(x + 2)$

17. $P(x) = x(x - 3)(x + 2)$

21. $P(x) = (x - 1)^2(x - 3)$

Factor the polynomial and use the factored form to find the zeroes. Sketch the graph.

27. $x^3 - x^2 - 6x$

33. $x^3 + x^2 - x - 1$

Section 3.3

Use either synthetic or long division to divide $P(x)$ by $D(x)$.

3. $P(x) = 3x^2 + 5x - 4$; $D(x) = x + 3$

5. $P(x) = 2x^3 - 3x^2 - 2x$; $D(x) = 2x - 3$

7. $P(x) = x^4 - x^3 + 4x + 2$; $D(x) = x^2 + 3$

9. $P(x) = x^2 + 4x - 8$; $D(x) = x + 3$

11. $P(x) = 4x^2 - 3x - 7$; $D(x) = 2x - 1$

Find the quotient and remainder using long division.

15.
$$\frac{x^2 - 6x - 8}{x - 4}$$

17.
$$\frac{4x^3 + 2x^2 - 2x - 3}{2x + 1}$$

Use synthetic division and the Remainder Theorem to evaluate $P(c)$.

39. $P(x) = 4x^2 + 12x + 5$; $c = -1$

43. $P(x) = x^3 + 2x^2 - 7$; $c = -2$

47. $P(x) = x^7 - 3x^2 - 1$; $c = 3$

Use the Factor Theorem to show that $x - c$ is a factor of $P(x)$ for the given values of c .

53. $P(x) = x^3 - 3x^2 + 3x - 1; \quad c = 1$

Find a polynomial of the specified degree that has the given zeros.

59. Degree: 3; zeros: -1, 1, 3

Section 3.4

Find all the rational zeros of the polynomial and write in factored form.

15. $P(x) = x^3 + 3x^2 - 4$

19. $P(x) = x^3 - 6x^2 + 12x - 8$

23. $P(x) = x^3 + 3x^2 - x - 3$

25. $P(x) = x^4 - 5x^2 + 4$

35. $P(x) = 4x^3 - 7x + 3$

41. $P(x) = 2x^4 - 7x^3 + 3x^2 + 8x - 4$

Use Descartes' Rule of Signs to determine how many positive and negative real zeros the polynomial can have. Then determine the possible total number of real zeros.

65. $P(x) = x^3 - x^2 - x - 3$

67. $P(x) = 2x^6 + 5x^4 - x^3 - 5x - 1$

Section 3.5

Find the real and imaginary parts of the complex number.

5. $5 - 7i$

7. $\frac{-2-5i}{3}$

9. 3

Evaluate the expression and write in a+bi form.

15. $(2 - 5i) + (3 + 4i)$

21. $(12 + 8i) - (7 + 4i)$

25. $(7 - i)(4 + 2i)$

33. i^{100}

37. $\frac{2-3i}{1-2i}$

41. $\frac{10i}{1-2i}$

Evaluate the radical expression and express in a+bi form.

47. $\sqrt{-25}$

49. $\sqrt{-3}\sqrt{-12}$

Find all solutions and express in a+bi form.

57. $x^2 + 49 = 0$

59. $x^2 - 4x + 5 = 0$

61. $x^2 + 2x + 5 = 0$

67. $t + 3 + \frac{3}{t} = 0$

Section 3.7

Find the x and y intercepts of the rational function.

11. $\frac{x-1}{x+4}$

13. $\frac{x^2-x-2}{x-6}$

Find all horizontal and vertical asymptotes (if any).

21. $\frac{5}{x-2}$

$$25. \frac{6x^2+1}{2x^2+x-1}$$

$$27. \frac{(5x-1)(x+1)}{(3x-1)(x+2)}$$

Find the intercepts and asymptotes and then sketch the graph of the rational function and state the domain and range.

$$41. \frac{4x-4}{x+2}$$

$$47. \frac{4x-8}{(x-4)(x+1)}$$

$$51. \frac{3x+6}{x^2+2x-8}$$

$$55. \frac{x^2-2x+1}{x^2+2x+1}$$

Find the slant asymptote, the vertical asymptote and sketch a graph of the function.

$$65. \frac{x^2}{x-2}$$

$$69. \frac{x^2+5x+4}{x-3}$$

CHAPTER 4

Section 4.1

Graph.

$$15. f(x) = 2^x \text{ and } g(x) = 2^{-x}$$

$$16. f(x) = 3^{-x} \text{ and } g(x) = \left(\frac{1}{3}\right)^x$$

Graph. State domain, range and asymptote.

$$27. f(x) = 2^x - 3$$

$$33. y = 5^{-x} - 1$$

Section 4.2

Graph. State the domain, range and asymptotes.

7. $f(x) = -e^x$

9. $y = e^{-x} - 1$

11. $f(x) = e^{x-2}$

Section 4.3

Express in exponential form.

7. $\log_5 25 = 2$

9. $\log_8 2 = \frac{1}{3}$

11. $\ln 5 = x$

Express in logarithmic form.

13. a) $5^3 = 125$

17. a) $e^x = 2$ b) $e^3 = y$

Evaluate the expression.

19. a) $\log_3 3$ b) $\log_3 1$ c) $\log_3 3^2$

21. a) $\log_6 36$ b) $\log_9 81$ c) $\log_7 7^{10}$

25. a) $2^{\log_2 37}$

Find x.

29. a) $\log_2 x = 5$ b) $\log_2 16 = x$

31. a) $\log_3 243 = x$ b) $\log_3 x = 3$

Sketch the graph by plotting points.

41. $f(x) = \log_3 x$

43. $f(x) = 2 \log x$

Section 4.4

Evaluate the expression.

7. $\log_3 \sqrt{27}$

9. $\log 4 + \log 25$

11. $\log_4 192 - \log_4 3$

13. $\log_2 6 - \log_2 15 + \log_2 20$

15. $\log_4 16^{100}$

Use Law of Logs to expand the expression.

19. $\log_2(2x)$

21. $\log_2(x(x-1))$

27. $\log_x(x\sqrt{y})$

31. $\ln \sqrt{ab}$

35. $\log_2 \left(\frac{x(x^2+1)}{\sqrt{x^2-1}} \right)$

Use Law of Logs to combine the expression.

45. $\log_3 5 + \log_3 2$

47. $\log_2 A + \log_2 B - 2 \log_2 C$

51. $\ln 5 + 2 \ln x + 3 \ln(x^2 + 5)$

Use Change of Base Formula and a calculator to evaluate the logarithm(round to 6 decimal places). Use either natural logs or common logs.

55. $\log_2 5$

57. $\log_3 16$

Section 4.5

Solve the equation.

29. $e^{2x} - 3e^x + 2 = 0$

37. $\ln x = 10$

41. $\log(3x + 5) = 2$

43. $4 - \log(3 - x) = 3$

49. $\log_5(x + 1) - \log_5(x - 1) = 2$

EXTRA:

A. $2^{x-3} = 4^{3x+1}$

B. $27^x = 3^{x+8}$

CHAPTER 10

Section 10.1

21. Solve the system:
$$\begin{cases} x + y = 4 \\ -x + y = 0 \end{cases}$$

23. Solve the system:
$$\begin{cases} 2x - 3y = 9 \\ 4x + 3y = 9 \end{cases}$$

27. Solve the system:
$$\begin{cases} -x + y = 2 \\ 4x - 3y = -3 \end{cases}$$

31. Solve the system:
$$\begin{cases} \frac{1}{2}x + \frac{1}{3}y = 2 \\ \frac{1}{5}x - \frac{2}{3}y = 8 \end{cases}$$

Section 10.2

17. Solve the system:
$$\begin{cases} x - y - z = 4 \\ 2y + z = -1 \\ -x + y - 2z = 5 \end{cases}$$

19. Solve the system:
$$\begin{cases} x + y + z = 4 \\ x + 3y + 3z = 10 \\ 2x + y - z = 3 \end{cases}$$

21. Solve the system:
$$\begin{cases} x - 4z = 1 \\ 2x - y - 6z = 4 \\ 2x + 3y - 2z = 8 \end{cases}$$

Section 10.3

State the dimension of the matrix:

5.
$$\begin{bmatrix} 2 & 7 \\ 0 & -1 \\ 5 & -3 \end{bmatrix}$$

7.
$$\begin{bmatrix} 12 \\ 35 \end{bmatrix}$$

9.
$$\begin{bmatrix} 1 & 4 & 7 \end{bmatrix}$$

Solve the following system using Gaussian Elimination or Gauss-Jordan Elimination:

19.
$$\begin{cases} x - 2y + z = 1 \\ y + 2z = 5 \\ x + y + 3z = 8 \end{cases}$$

21.
$$\begin{cases} x + y + z = 2 \\ 2x - 3y + 2z = 4 \\ 4x + y - 3z = 1 \end{cases}$$

23.
$$\begin{cases} x + 2y - z = -2 \\ x + z = 0 \\ 2x - y - z = -3 \end{cases}$$

Section 10.4

Perform the matrix operations if possible:

7.
$$\begin{bmatrix} 2 & 6 \\ -5 & 3 \end{bmatrix} + \begin{bmatrix} -1 & -3 \\ 6 & 2 \end{bmatrix}$$

$$9. \quad 3 \begin{bmatrix} 1 & 2 \\ 4 & -1 \\ 1 & 0 \end{bmatrix}$$

$$11. \quad \begin{bmatrix} 2 & 6 \\ 1 & 3 \\ 2 & 4 \end{bmatrix} \begin{bmatrix} 1 & -2 \\ 3 & 6 \\ -2 & 0 \end{bmatrix}$$

$$12. \quad \begin{bmatrix} 2 & 1 & 2 \\ 6 & 3 & 4 \end{bmatrix} \begin{bmatrix} 1 & -2 \\ 3 & 6 \\ -2 & 0 \end{bmatrix}$$

Section 10.5

Calculate the products AB and BA to show that B is the inverse of A :

$$3. \quad A = \begin{bmatrix} 4 & 1 \\ 7 & 2 \end{bmatrix} \quad B = \begin{bmatrix} 2 & -1 \\ -7 & 4 \end{bmatrix}$$

$$5. \quad A = \begin{bmatrix} 1 & 3 & -1 \\ 1 & 4 & 0 \\ -1 & -3 & 2 \end{bmatrix} \quad B = \begin{bmatrix} 8 & -3 & 4 \\ -2 & 1 & -1 \\ 1 & 0 & 1 \end{bmatrix}$$

Find the inverse of the matrix, if it exists:

$$9. \quad \begin{bmatrix} -3 & -5 \\ 2 & 3 \end{bmatrix}$$

$$13. \quad \begin{bmatrix} 6 & -3 \\ -8 & 4 \end{bmatrix}$$

$$17. \quad \begin{bmatrix} 2 & 4 & 1 \\ -1 & 1 & -1 \\ 1 & 4 & 0 \end{bmatrix}$$

$$19. \quad \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & -1 \\ 1 & -1 & 10 \end{bmatrix}$$

Section 10.6

Find the determinant, if it exists:

5. $\begin{bmatrix} 2 & 0 \\ 0 & 3 \end{bmatrix}$

9. $\begin{bmatrix} 2 & 5 \end{bmatrix}$

19. $\begin{bmatrix} 2 & 1 & 0 \\ 0 & -2 & 4 \\ 0 & 1 & -3 \end{bmatrix}$

23. $\begin{bmatrix} 1 & 3 & 7 \\ 2 & 0 & 8 \\ 0 & 2 & 2 \end{bmatrix}$

Use Cramer's Rule to solve the system:

33.
$$\begin{cases} 2x - y = -9 \\ x + 2y = 8 \end{cases}$$

39.
$$\begin{cases} x - y + 2z = 0 \\ 3x + z = 11 \\ -x + 2y = 0 \end{cases}$$

Section 10.7

Find the Partial Fraction Decomposition of the rational function:

13. $\frac{2}{(x-1)(x+1)}$

17. $\frac{12}{x^2-9}$

21. $\frac{x+14}{x^2-2x-8}$

27. $\frac{x^2+1}{x^3+x^2}$

33. $\frac{-10x^2+27x-14}{(x-1)^3(x+2)}$

Section 10.8

Find all solutions of the systems of equations:

$$19. \quad \begin{cases} y + x^2 = 4x \\ y + 4x = 16 \end{cases}$$

$$23. \quad \begin{cases} x - y = 4 \\ xy = 12 \end{cases}$$

$$27. \quad \begin{cases} x^2 + y^2 = 9 \\ x^2 - y^2 = 1 \end{cases}$$

Section 10.9

Graph the inequality:

$$3. \quad x < 3$$

$$7. \quad y \leq 2x + 2$$

$$15. \quad x^2 + y^2 \leq 25$$

Graph the solution of the system. Find all vertices. Determine if the solution set is bounded:

$$21. \quad \begin{cases} x + 4 \leq 4 \\ y \geq x \end{cases}$$

$$31. \quad \begin{cases} y < 9 - x^2 \\ y \geq x + 3 \end{cases}$$

$$33. \quad \begin{cases} x^2 + y^2 \leq 4 \\ x - y > 0 \end{cases}$$