

MATH 140 Final Exam
Fall 2016
Practice Final

Name _____

ID# _____

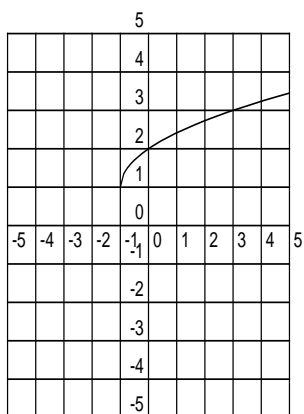
Instructor _____

Section _____

Do not open this booklet until told to do so.

On the separate answer sheet, fill in your name and identification number and code the appropriate spaces with a #2 pencil. Use the spaces marked "Year" under Birth Date to code the version of the exam you are taking. There are 50 multiple choice questions on this exam. Select the one best answer for each problem. Mark all answers on the separate answer sheet with a #2 pencil. Make your marks heavy and black. Mark only one answer for each question. If you make a mistake or wish to change an answer, be sure to erase your first choice completely. Answer all questions. There is no penalty for guessing. In the test booklet, do all of the work in the space provided and circle the letter of the answer for each problem. When you finish the exam, return your answer sheet and the test booklet to your instructor.

1. Find the domain of the function whose graph is shown.

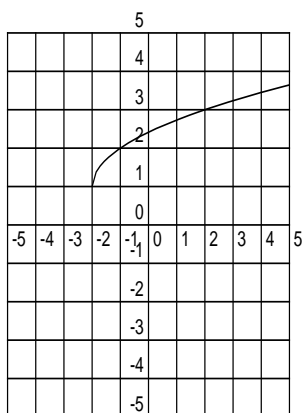


- (a) $[-1, \infty)$ (b) $(-\infty, \infty)$ (c) $[1, \infty)$ (d) $[1, \infty)$

2. Let $g(x) = \frac{2}{x+5}$. Find the domain of g .

- (a) $[-5, \infty)$ (b) $(-\infty, -5) \cup (-5, \infty)$ (c) $(-\infty, 5) \cup (5, \infty)$ (d) $(-\infty, \infty)$

3. The graph of a function f is shown. Find the range of f .



- (a) $(-\infty, \infty)$ (b) $[-1, \infty)$ (c) $[1, \infty)$ (d) $(-\infty, -1)$

4. What is the domain of $f(x)$ specified below?

$$f(x) = \{(2, -1), (3, -6), (4, -4), (5, 4)\}$$

- (a) $\{-1, -6, -4, 4\}$ (b) $\{-6, -4, -1, 2, 3, 4, 5\}$ (c) $\{2, 3, 4, 5\}$ (d) $(-\infty, \infty)$

5. Suppose $f(x) = 2x^2 + 2$ and $g(x) = 7x + 5$. Which of the following is a formula for $(f - g)(x)$?

- (a) $(f - g)(x) = 98x^2 + 140x + 52$
(b) $(f - g)(x) = 2x^2 - 7x - 3$
(c) $(f - g)(x) = 2x^2 + 7x + 3$
(d) $(f - g)(x) = 2x^2 + 2x - 3$

6. Suppose $f(x) = 8x^2$ and $g(x) = \sqrt{4x + 9}$. Which of the following is a formula for $(f \cdot g)(x)$?

- (a) $(f \cdot g)(x) = \sqrt{32x^2 + 9}$
(b) $(f \cdot g)(x) = 8x^2\sqrt{4x + 9}$
(c) $(f \cdot g)(x) = 32x + 72$
(d) $(f \cdot g)(x) = \frac{8x^2}{\sqrt{4x + 9}}$

7. Suppose $f(x) = x + 3$ and $g(x) = \sqrt{x - 3}$. Find a formula for $(f + g)(x)$ and its domain.

- (a) $(f + g)(x) = x + \sqrt{x}$, Domain is $[0, \infty)$
(b) $(f + g)(x) = x + 3 + \sqrt{x - 3}$, Domain is $(-\infty, \infty)$
(c) $(f + g)(x) = x + 3 + \sqrt{x - 3}$, Domain is $[3, \infty)$
(d) $(f + g)(x) = \sqrt{x}$, Domain is $[0, \infty)$

8. Suppose $f(x) = \log(x - 1)$ and $g(x) = x + 5$. Find the domain of $(f \circ g)(x)$.

- (a) $(-4, \infty)$ (b) $(-\infty, 1)$ (c) $(1, \infty)$ (d) $[-4, \infty)$

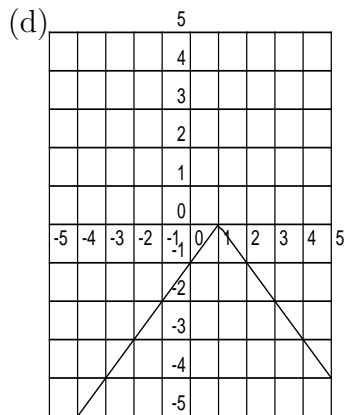
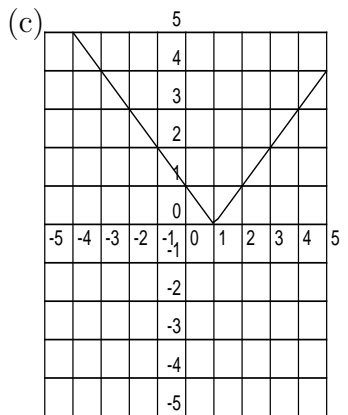
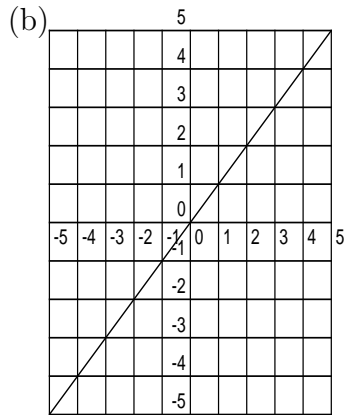
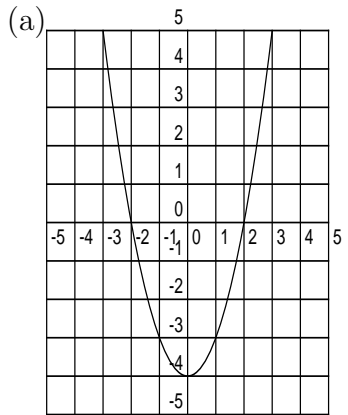
9. Suppose $f(x) = \sqrt{x - 9}$ and $g(x) = x^2 + 11$. Which of the following is a formula for $(f \circ g)(x)$?

- (a) $(f \circ g)(x) = x + \sqrt{2}$
(b) $(f \circ g)(x) = x + 2$
(c) $(f \circ g)(x) = \sqrt{x^2 + 2}$
(d) $(f \circ g)(x) = x^2 + 9 + \sqrt{x - 11}$

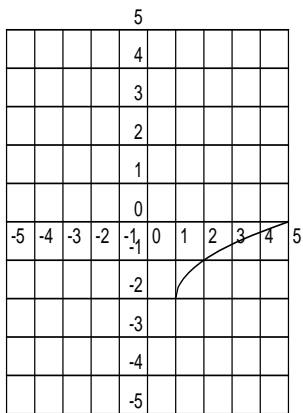
10. Suppose $f(x) = 3x + 8$ and $g(x) = \sqrt{x - 4}$. Find $(f \circ g)(9)$.

- (a) $3\sqrt{5} + 8$ (b) 0 (c) $\sqrt{31}$ (d) $35\sqrt{5}$

11. Which graph shows a function which has an inverse?



12. The graph of a one-to-one function f is shown. Find $f^{-1}(-1)$.



- (a) 2 (b) 1 (c) -0.59 (d) -1

13. Let $f(x) = \frac{1}{13x + 20}$. Which of the following is a formula for $f^{-1}(x)$?

- (a) $f^{-1}(x) = \frac{1}{13x + 20}$ (b) $f^{-1}(x) = \frac{1}{13x} - \frac{20}{13}$ (c) $f^{-1}(x) = 13x + 20$ (d) No inverse

14. Let f be the one-to-one function defined by the following set of ordered pairs. Find $f^{-1}(9)$.

$$f(x) = \{(-2, -1), (9, 13), (11, 9), (12, 19)\}$$

- (a) $\frac{1}{9}$ (b) 11 (c) $\frac{1}{13}$ (d) 13

15. Lagoon Energy provides natural gas to residential customers. They charge a monthly service fee of \$15.00. In addition, customers pay \$0.321 per therm for the first 60 therms of gas used, and \$0.145 per therm for the amount of gas over 60 therms. These fees include any applicable taxes. What is the monthly charge for a customer who uses 80 therms?

- (a) \$37.16 (b) \$19.26 (c) \$34.26 (d) \$25.68

16. Which of the following functions is even?

(a) $f(x) = 9x^3 + 14x^2 + 5$

(b) $g(x) = 9x^2 - 14x + 5$

(c) $h(x) = 9e^{x-14} + 5$

(d) $k(x) = \frac{9}{14x^2}$

17. Let f be the function defined below. Find $f(15)$.

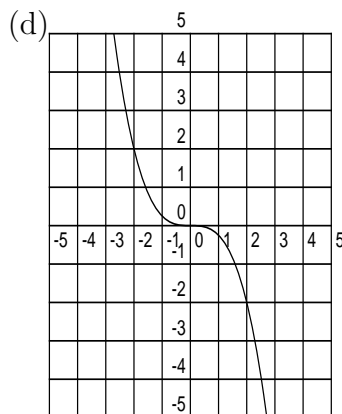
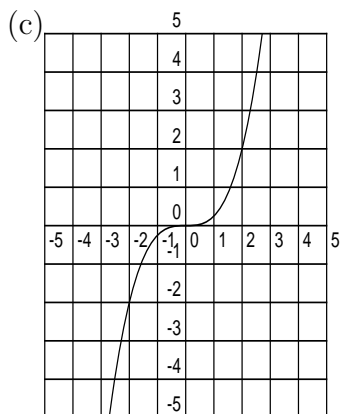
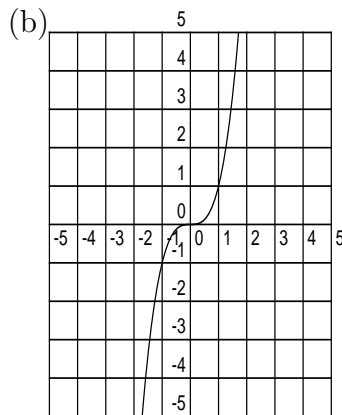
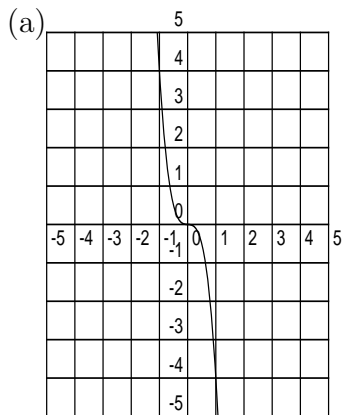
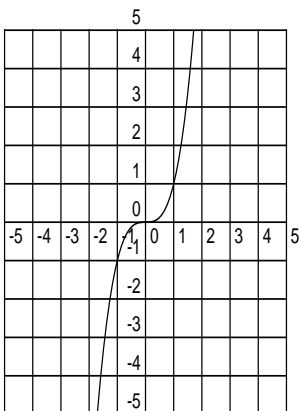
$$f(x) = \{(13, 14), (14, 15), (15, 16), (16, 13)\}$$

- (a) 16 (b) 13 (c) 14 (d) 15

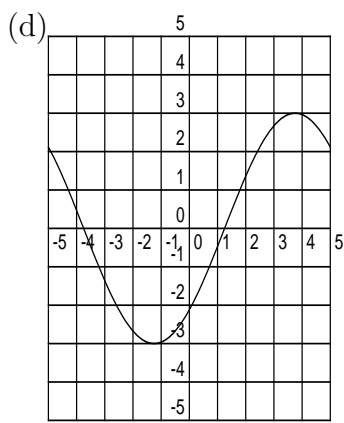
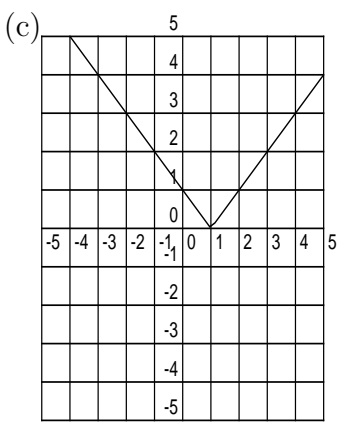
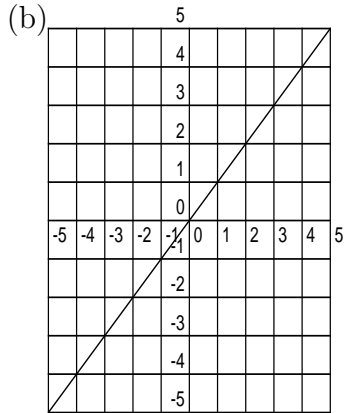
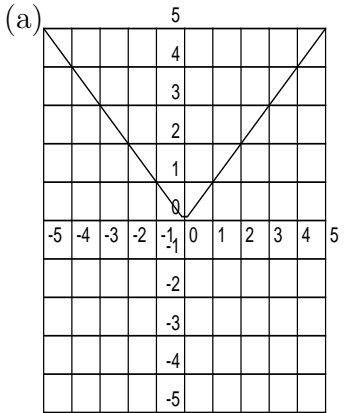
18. Let $f(x) = \begin{cases} 4x + 10 & \text{if } x < -1 \\ 8x + 7 & \text{if } -1 \leq x \leq 5 \\ 12x + 7 & \text{if } x > 5 \end{cases}$
- Find $f(3)$.

(a) 3 (b) 31 (c) 22 (d) 43

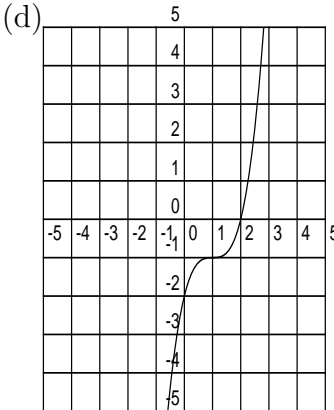
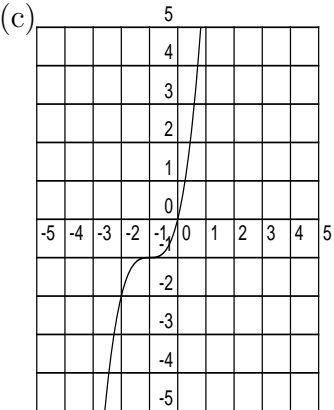
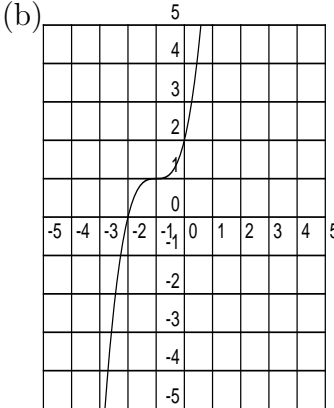
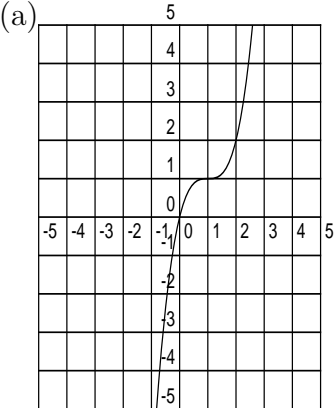
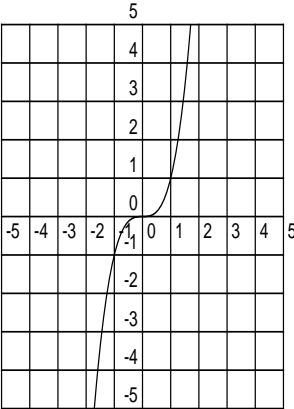
19. The graph of $f(x)$ is shown. Choose the graph of $-4f(x)$.



20. Which of the following functions is odd?



21. The graph of $f(x)$ is shown. Choose the graph of $f(x - 1) + 1$.



22. The following table shows the length in inches, x , and weight in pounds, w , for core samples of a certain type of rock. Assume that the relationship between x and w is linear and use a graphing utility to find the regression line. Then, use the model to find the expected weight for a core sample of this type of rock with a length of 31.15 inches.

x	11.0	15.0	19.0	23.0	27.0	31.0	35.0
w	16.49	21.63	24.25	29.87	32.01	38.11	39.77

- (a) 36.94 (b) 36.90 (c) 36.92 (d) 36.96
23. Solve the equation: $9 = 3^{5x-48}$.
- (a) $\frac{51}{5}$ (b) $\frac{49}{5}$ (c) 10 (d) $\frac{242}{5}$
24. Evaluate the expression $\log_3 674$. Round your answer to the nearest hundredth.
- (a) 2.83 (b) 0.48 (c) 8.49 (d) 5.93
25. Solve the equation: $\log_2(x+2) - \log_2 x = 2$
- (a) $\frac{3}{2}$ (b) -2 (c) $\frac{1}{4}$ (d) $\frac{2}{3}$
26. Find the balance for \$287 invested at a rate of 4% for 7 years if the interest is compounded monthly.
- (a) \$298.69 (b) \$379.21 (c) \$379.56 (d) \$2089.36

27. The number of bacteria N in a culture is given by the model $N(t) = 247e^{0.044t}$, where t is the time in hours. Find how many hours it takes for the original population to double. Round your answer to the nearest hundredth of an hour.

- (a) 16.75 hours (b) 15.75 hours (c) 14.75 hours (d) 15.85 hours

28. The magnitude of an earthquake, M , is related to its intensity, I , according to $M = \log \frac{I}{I_0}$ where I_0 is a reference intensity. How much more intense is an earthquake of magnitude 3.9 compared to an earthquake of magnitude 2.8? Round your answer to the nearest hundredth.

- (a) 1.39 (b) 1.10 (c) 12.59 (d) 24.71

29. Divide the polynomial $p(x) = x^3 + 2x^2 + 2x + 3$ by $x - 5$.

- (a) $x^2 + 7x + 37 + \frac{188}{x - 5}$
(b) $x^3 + 7x^2 + 37x + 188$
(c) $x^2 - 3x + 17 - \frac{82}{x - 5}$
(d) $x^3 - 3x^2 + 17x - 82$

30. According to the rational zeros theorem, which of the following is a possible rational zero of $p(x) = 11x^3 + 10x^2 + 15x + 336$?

- (a) $\frac{11}{12}$ (b) 0 (c) $\frac{15}{11}$ (d) $\frac{12}{11}$

31. Find all the zeros of the polynomial $p(x) = x^3 - 6x^2 - 2x + 12$.

- (a) 6 (b) $-6, \sqrt{2}, -\sqrt{2}$ (c) $6, \sqrt{2}, -\sqrt{2}$ (d) $6, 2, -2$

32. Suppose that when the polynomial $p(x)$ is divided by $x - 4$, the quotient is $2x^4 - 3x^2 + 8x - 12$ with a remainder of 2. We may conclude that ...

- (a) $x + 2$ is not a factor of $p(x)$, and 2 is not a zero of $p(x)$.
(b) $x - 4$ is a factor of $p(x)$, and 4 is a zero of $p(x)$.
(c) $x - 4$ is not a factor of $p(x)$, and 4 is not a zero of $p(x)$.
(d) $x - 4$ is not a factor of $p(x)$, and 2 is not a zero of $p(x)$.

33. Find all the zeros of the polynomial $p(x) = 12x^3 - 104x^2 + 228x - 136$.

- (a) $-1, 2, \frac{17}{3}$ (b) $1, 2, \frac{17}{3}$ (c) $1, \frac{1}{2}, \frac{3}{17}$ (d) $-1, \frac{1}{2}, \frac{3}{17}$

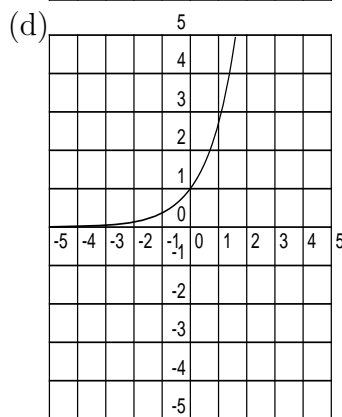
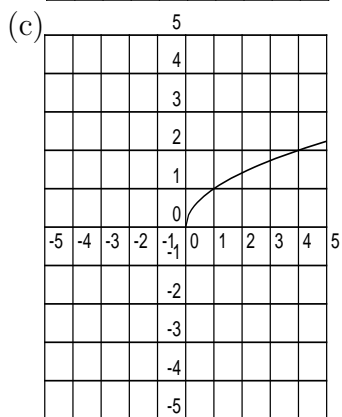
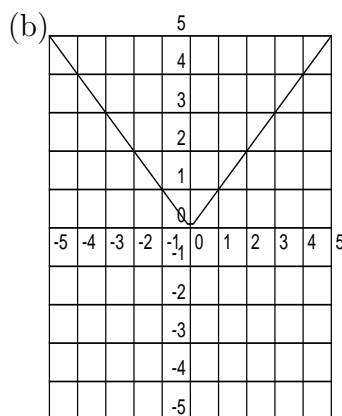
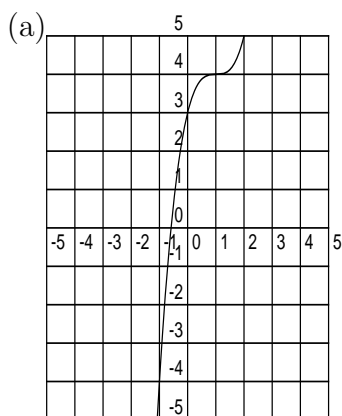
34. Write the polynomial $f(x) = 4x^3 - 8x^2 - 132x + 360$ in factored form.

- (a) $f(x) = 4(x - 3)(x - 5)(x + 6)$
(b) $f(x) = (x - 3)(x - 5)(x + 6)$
(c) $f(x) = 4(x + 3)(x + 5)(x - 6)$
(d) $f(x) = (x + 3)(x + 5)(x - 6)$

35. Describe the end behavior of the graph of the polynomial function $q(x) = -9x^4 + 7x^3 + 10$.

- (a) Up to the left; Up to the right.
- (b) Up to the left; Down to the right.
- (c) Down to the left; Up to the right.
- (d) Down to the left; Down to the right.

36. Each of the following images shows the graph of a function. Each image is at an appropriate scale to accurately suggest the end behavior and any other important characteristics of the graph. Which could be the graph of a polynomial function?



37. Use a graphing utility to approximate the real zero of the polynomial $p(x) = x^3 + x^2 + 3x + 2$ to the nearest ten-thousandth.

- (a) -0.7052 (b) -0.7252 (c) -0.6383 (d) -0.7152

38. Solve the system of equations.
$$\begin{cases} y = x^2 + 8x + 107 \\ 12x + y = 8 \end{cases}$$

- (a) $(-9, -11)$, $(116, 140)$ (b) $(-9, -11)$ (c) $(-9, 116)$, $(-11, 140)$ (d) $(-11, -9)$, $(116, 140)$

39. Pamela requires 1.5 hours to row 7.0 miles downstream on the Chattahoochee River. Her return trip upstream requires 3.5 hours. Assuming that Pamela rows with constant effort throughout the trip, find Pamela's speed in still water, in miles per hour, to the nearest tenth.

- (a) 3.3 (b) 1.3 (c) 1.7 (d) 4.7

40. Solve the system of equations.
$$\begin{cases} x + 7y + 6z = -63 \\ 4x + 29y + 4z = -53 \\ 6x + 43y + 16z = -179 \end{cases}$$

- (a) $(4, -1, -10)$ (b) $(1, 4, 6)$ (c) $(-1456 - 146z, 199 + 20z, z)$ (d) No solution.

41. Let $f(x) = \frac{x^3 + 5x^2 + 5x + 5}{2x^2 + 2x + 1}$. Find $f(5)$.

- (a) $\frac{280}{61}$ (b) $\frac{1}{2}$ (c) 5 (d) $\frac{60}{13}$

42. Let $f(x) = \frac{10x^3 + 3x^2 + 7x + 15}{14x^3 + 10x^2 + 13x + 10}$. Find any horizontal asymptote of the graph of $f(x)$.

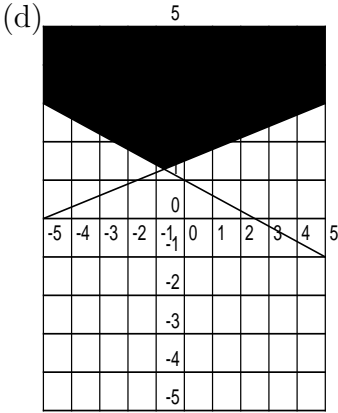
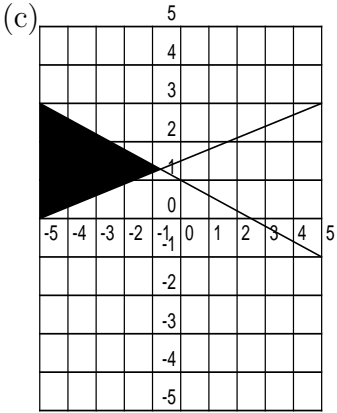
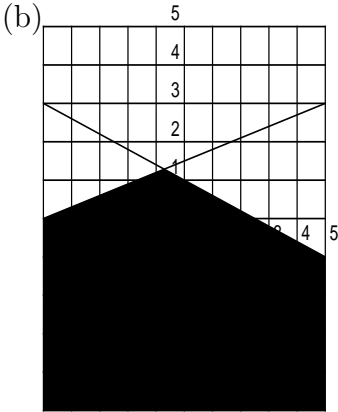
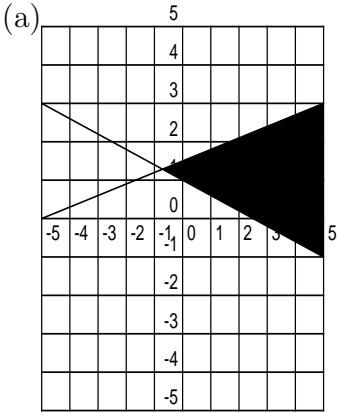
- (a) $y = 10$ (b) $y = 0$ (c) $y = \frac{10}{14}$ (d) No horizontal asymptote

43. Let $f(x) = \frac{12x^2 + 1}{(x - 6)(x - 17)}$. Find any vertical asymptote(s) of the graph of f .

- (a) $x = 6, x = 17$ (b) $x = -6, x = -17$ (c) $x = 1$ (d) $x = -\frac{1}{\sqrt{12}}i, x = \frac{1}{\sqrt{12}}i$

44. Shade the solution set of the system of inequalities:

$$\begin{cases} 4x + 10y \geq 10 \\ -3x + 10y \leq 15 \end{cases}$$



45. Let h represent a number of hammers, and let p represent a number of pliers. Find the inequalities which define the feasible region for the following linear programming problem:

Final XM Industries manufactures two products, hammers and pliers. A hammer requires 9 ounces of plastic, 9 pounds of steel, and takes 7 minutes of labor to produce. A pair of pliers requires 4 ounces of plastic, 1.2 pounds of steel, and takes 8 minutes of labor to produce. Each week the company has 17000 ounces of plastic, 14500 pounds of steel, and 16100 minutes of labor available. The company can sell as many tools as it can produce, getting \$8.00 per hammer and \$6 per pair of pliers. How many of each tool should they make to maximize their revenue?

$$(a) \begin{cases} h & \geq 0 \\ p & \geq 0 \\ 9h + 4p & \leq 17000 \\ 9h + 1.2p & \leq 14500 \\ 7h + 8p & \leq 16100 \end{cases}$$

$$(b) \begin{cases} 9h + 4p & \leq 17000 \\ 9h + 1.2p & \leq 14500 \\ 7h + 8p & \leq 16100 \end{cases}$$

$$(c) \begin{cases} h & \geq 0 \\ p & \geq 0 \\ 9h + 4p & \leq 14500 \\ 9h + 1.2p & \leq 16100 \\ 7h + 8p & \leq 17000 \end{cases}$$

$$(d) \begin{cases} h & \geq 0 \\ p & \geq 0 \\ 9h + 4p & \geq 17000 \\ 9h + 1.2p & \geq 14500 \\ 7h + 8p & \geq 16100 \end{cases}$$

46. Let $A = \begin{bmatrix} -1 & 9 & -8 \\ -10 & -2 & 4 \\ -4 & 3 & 10 \end{bmatrix}$ and let $B = \begin{bmatrix} -6 & -1 & -2 \\ 8 & 6 & 1 \\ 2 & -10 & 0 \end{bmatrix}$. What is $A + B$?

(a) $\begin{bmatrix} -7 & 8 & -10 \\ -2 & 4 & 5 \\ -2 & -7 & 10 \end{bmatrix}$ (b) $\begin{bmatrix} 5 & 10 & -6 \\ -18 & -8 & 3 \\ -6 & 13 & 10 \end{bmatrix}$ (c) $\begin{bmatrix} -5 & -10 & 6 \\ 18 & 8 & -3 \\ 6 & -13 & -10 \end{bmatrix}$ (d) None of these.

47. Let $A = \begin{bmatrix} -9 & -10 & -9 \\ 4 & 0 & -10 \\ 1 & 5 & -1 \end{bmatrix}$ and let $B = \begin{bmatrix} 6 & 4 & 9 \\ 0 & 5 & 5 \\ -8 & 5 & 1 \end{bmatrix}$. What is AB ?

(a) $\begin{bmatrix} 18 & -131 & -140 \\ 104 & -34 & 26 \\ 14 & 24 & 33 \end{bmatrix}$

(b) $\begin{bmatrix} -29 & -15 & -103 \\ 25 & 25 & -55 \\ 93 & 85 & 21 \end{bmatrix}$

(c) $\begin{bmatrix} -54 & -40 & -81 \\ 0 & 0 & -50 \\ -8 & 25 & -1 \end{bmatrix}$

(d) The product does not exist.

48. Let $A = \begin{bmatrix} -1 & -1 & 1 \\ 5 & 5 & -9 \\ -3 & 8 & 4 \end{bmatrix}$. What is $2A$?

(a) $\begin{bmatrix} -2 & -2 & 2 \\ 10 & 10 & -18 \\ -6 & 16 & 8 \end{bmatrix}$ (b) $\begin{bmatrix} -1 & -1 & 1 \\ 5 & 5 & -9 \\ -3 & 8 & 4 \end{bmatrix}$ (c) $\begin{bmatrix} -2 & -2 & 2 \\ 5 & 5 & -9 \\ -3 & 8 & 4 \end{bmatrix}$ (d) None of these.

49. Let $A = \begin{bmatrix} 69 & 35 & -18 \\ -88 & -45 & 23 \\ -4 & -2 & 1 \end{bmatrix}$ and $b = \begin{bmatrix} -2 \\ -1 \\ -3 \end{bmatrix}$. The inverse matrix of A is $A^{-1} = \begin{bmatrix} 1 & 1 & -5 \\ -4 & -3 & -3 \\ -4 & -2 & -25 \end{bmatrix}$.

Use the inverse to solve the matrix equation $AX = b$.

(a) $\begin{bmatrix} -119 \\ 152 \\ 7 \end{bmatrix}$ (b) $\begin{bmatrix} -107 \\ 172 \\ 92 \end{bmatrix}$ (c) $\begin{bmatrix} 12 \\ 20 \\ 85 \end{bmatrix}$ (d) None of these.

50. Find the inverse of the matrix $\begin{bmatrix} -2 & 4 & 2 \\ 8 & 3 & 5 \\ 10 & 2 & 6 \end{bmatrix}$.

(a) $\begin{bmatrix} -2 & 8 & 10 \\ 4 & 3 & 2 \\ 2 & 5 & 6 \end{bmatrix}$

(b) $\begin{bmatrix} -2/9 & 5/9 & -7/18 \\ -1/18 & 8/9 & -13/18 \\ 7/18 & -11/9 & 19/18 \end{bmatrix}$

(c) $\begin{bmatrix} -1/2 & 1/4 & 1/2 \\ 1/8 & 1/3 & 1/5 \\ 1/10 & 1/2 & 1/6 \end{bmatrix}$

(d) No Inverse