

MATH 140 Practice Final
Semester XX
Version X

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.

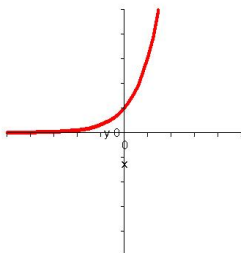
There are 50 multiple choice questions on this exam. Select the one best answer for each problem. Mark all answers on the separate answer sheet with a #2 pencil. Make your marks heavy and black. Mark only one answer for each question. If you make a mistake or wish to change an answer, be sure to erase your first choice completely. Answer all questions. There is no penalty for guessing.

In the test booklet, do all of the work on the back of the preceding page and circle the letter of the answer for each problem.

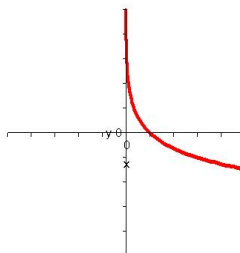
When you finish the exam, place your answer sheet inside the front cover of the test booklet and turn it in to your instructor.

1. If a is a real number greater than 1, which of the following might be the graph of $y = a^x$?

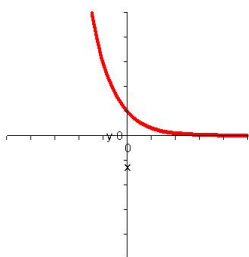
(a)



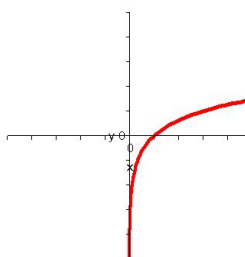
(b)



(c)



(d)



2. In chemistry, pH is used to measure the acidity of a substance. The pH is defined by $\text{pH} = -\log[H^+]$, where $[H^+]$ is the hydrogen ion concentration of the substance in moles per liter. To the nearest tenth, what is the pH of lemon juice, whose $[H^+]$ is 0.005 moles per liter?

- (a) 2.3 (b) -2.3 (c) 5.3 (d) -5.3

3. Let $f(x) = 2x + 2$ and let $g(x) = x - 4$. Find a formula for $f \circ g$.

- (a) $(f \circ g)(x) = 2x^2 - 6x - 8$
 (b) $(f \circ g)(x) = 2x - 6$
 (c) $(f \circ g)(x) = 2x - 2$
 (d) $(f \circ g)(x) = 3x - 2$

4. Let $g(x) = \sqrt{x-5}$. Find the domain of g .
 (a) $(-\infty, \infty)$ (b) $(-\infty, 5]$ (c) $[5, \infty)$ (d) $(-\infty, -5]$
5. Find any horizontal asymptote(s) of the graph of the function f .

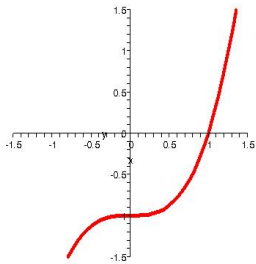
$$f(x) = \frac{3x^2 + 3}{x^2 - 5x + 4}$$

 (a) $y = 3$ (b) $y = 1$ (c) $y = 0$ (d) There is no horizontal asymptote.
6. Let $f(x) = x + 3$ and let $g(x) = x - 3$. Find a formula for $(fg)(x)$.
 (a) $(fg)(x) = x$
 (b) $(fg)(x) = x^2 - 9$
 (c) $(fg)(x) = (x + 3)(x - 3)(x)$
 (d) $(fg)(x) = \frac{x + 3}{x - 3}$
7. Let $f(x) = x^2 + 2x + 4$. Find the domain of f and the range of f .
 (a) Domain $(-\infty, \infty)$, Range $(-\infty, 3]$
 (b) Domain $(-\infty, \infty)$, Range $[3, \infty)$
 (c) Domain $(-\infty, \infty)$, Range $(-\infty, 4]$
 (d) Domain $(-\infty, \infty)$, Range $[4, \infty)$
8. The data in the table represent the estimated population, in millions, of the American colonies from 1740 to 1780. Use a graphing utility to find an exponential regression model for the population y in terms of the year x . Then use the model to estimate the population, to the nearest 100,000, of the United States upon the inauguration of George Washington in 1789.

x	1740	1750	1760	1770	1780
y	0.9	1.2	1.6	2.1	2.8

- (a) 3.3 million (b) 3.4 million (c) 3.5 million (d) 3.6 million

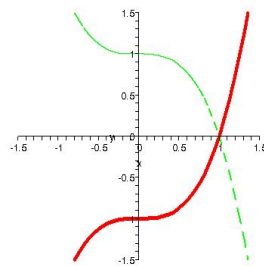
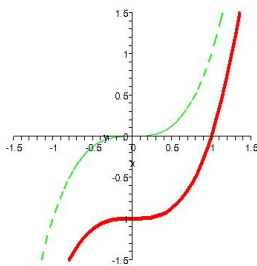
9. The graph of a one-to-one function f is given as a solid curve.



Which of the following images depicts the graph of f as a solid curve and f^{-1} as a dashed curve?

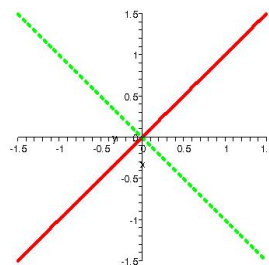
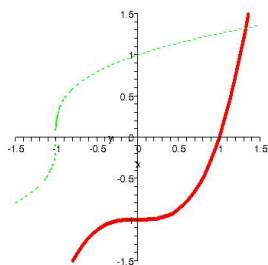
(a)

(b)



(c)

(d)



10. Approximate $\sin 56^\circ$ to the nearest hundredth.

- (a) 0.83 (b) 0.56 (c) -0.52 (d) 0.85

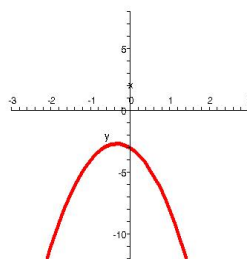
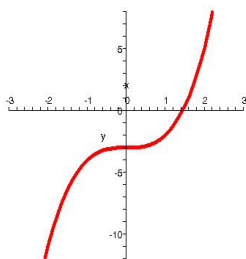
11. The table indicates five values of a continuous function f .

x	-2	-1	0	1	2
$f(x)$	-11	-4	-3	-2	5

Which of the following images might be the graph of f ?

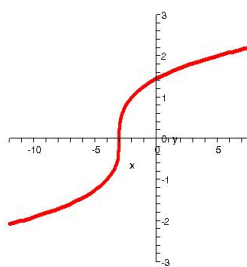
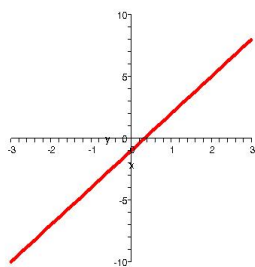
(a)

(b)



(c)

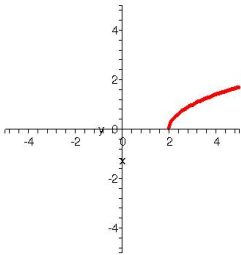
(d)



12. Solve the equation for x .
 $2^{x+5} = 16$

- (a) -2 (b) -1 (c) 0 (d) 1

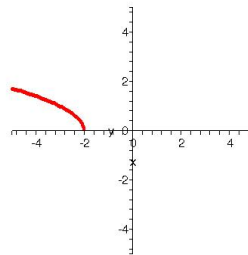
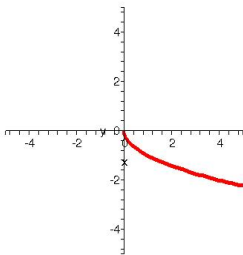
13. The graph of a function $y = f(x)$ is given.



Which of the following images depicts the graph of $y = -f(x + 2)$?

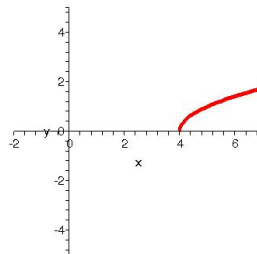
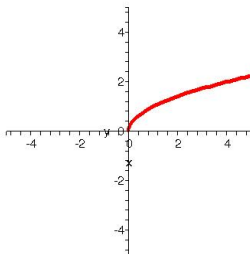
(a)

(b)



(c)

(d)



14. One zero of $f(x) = x^3 - 19x + 30$ is 3. Find the other zeros.

- (a) $-2, 5$ (b) $-2, -5$ (c) $2, 5$ (d) $-5, 2$

15. Let $f(x) = (x^2 + 4)(x - 3)^2(x + 5)$. Which of the following best completes this sentence:
“At $x = 3$ the graph of $f \dots$ ”

- (a) touches the x -axis and turns around.”
- (b) has a vertical asymptote.”
- (c) crosses the x -axis.”
- (d) has a discontinuity.”

16. Let $f(x) = \frac{3}{x - 4}$ and let $g(x) = \sqrt{x}$. Find the domain of $f \circ g$.

- (a) $(-\infty, \infty)$ (b) $[0, \infty)$ (c) $[0, 16) \cup (16, \infty)$ (d) $(4, \infty)$

17. Let $f(x) = x^4 + 3x^3 - 7x - 21$. Use a graphing utility to approximate the positive real zero of f to the nearest thousandth.

- (a) 2.083 (b) 2.000 (c) 1.913 (d) 1.915

18. Maximize the objective function $z = 3x + 2y$ subject to the constraints

$$\begin{cases} x & \geq 0 \\ y & \geq 0 \\ 3x + 4y & \leq 12 \end{cases}$$

The maximum value of z is

- (a) 0 (b) 6 (c) 9 (d) 12

19. Solve the equation for x .

$$\ln(x + 3) = 4$$

- (a) $e^4 + 3$ (b) $\ln(4) - 3$ (c) $e^4 - 3$ (d) 1

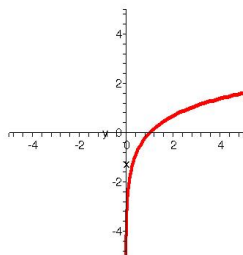
20. Solve the system of equations.

$$\begin{cases} x + 2y = 3 \\ 3x - y = 16 \end{cases}$$

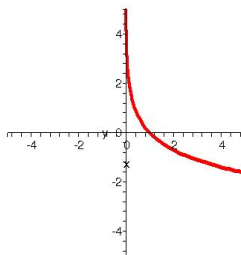
- (a) $(5, -1)$ (b) $(-1, 5)$ (c) $(-3, 4)$ (d) $(-3, -4)$

21. Which of the following is the graph of $y = \ln x$?

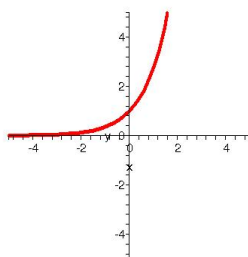
(a)



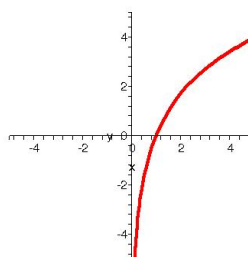
(b)



(c)



(d)



22. The number of bacteria in a culture is modeled by the law of exponential growth, $y = A_0 e^{kt}$. If the initial population of the culture is 2000 and the growth constant is 0.12 with time measured in hours, how long, to the nearest tenth of an hour, will it take for the population to reach 5000?

- (a) 7.5 hours (b) 7.6 hours (c) 7.7 hours (d) 7.8 hours

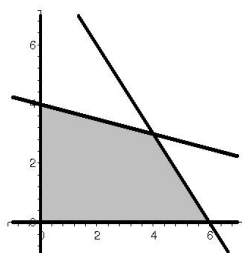
23. Use the inverse of the matrix A to solve the following matrix equation.

$$A = \begin{bmatrix} 5 & -3 & 2 \\ 2 & 1 & 4 \\ 1 & 0 & 3 \end{bmatrix} \quad \begin{bmatrix} 5 & -3 & 2 \\ 2 & 1 & 4 \\ 1 & 0 & 3 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 26 \\ 21 \\ 15 \end{bmatrix}$$

$$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \quad \text{(a)} \begin{bmatrix} 1 \\ 3 \\ 4 \end{bmatrix} \quad \text{(b)} \begin{bmatrix} 3 \\ -1 \\ 4 \end{bmatrix} \quad \text{(c)} \begin{bmatrix} 2 \\ -1 \\ 4 \end{bmatrix} \quad \text{(d)} \begin{bmatrix} -3 \\ 1 \\ -4 \end{bmatrix}$$

24. The graph of the feasible region for the indicated set of constraints is given. Find the vertices of this feasible region.

$$\begin{cases} x & \geq 0 \\ y & \geq 0 \\ x + 4y & \leq 16 \\ 3x + 2y & \leq 18 \end{cases}$$



- (a) $(0,0), (4,0), (0,6), (4,3)$
 (b) $(0,0), (0,4), (6,0), (4.1,2.9)$
 (c) $(0,0), (0,4), (6,0), (3.8,3.1)$
 (d) $(0,0), (0,4), (6,0), (4,3)$

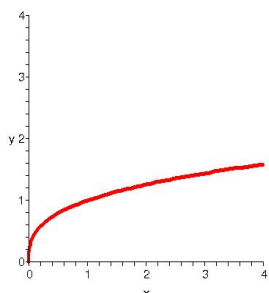
25. Divide $x^4 - 3x^3 + x^2 - 1$ by $x - 2$.

- (a) $x^2 - 5x + 11 \quad R - 22$
 (b) $x^3 - 5x^2 + 11x - 22 \quad R 43$
 (c) $x^3 - x^2 - x - 2 \quad R - 5$
 (d) $x^3 - x^2 - x - 3$

26. Let $g(x) = \frac{2x + 3}{x - 5}$. Find the domain of g .

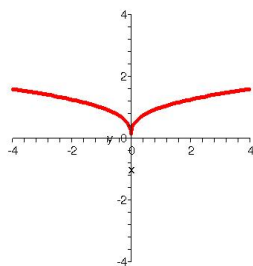
- (a) $(-\infty, \infty)$
 (b) $(-\infty, 0) \cup (0, \infty)$
 (c) $(-\infty, 5) \cup (5, \infty)$
 (d) $(-\infty, -\frac{3}{2}) \cup (-\frac{3}{2}, 5) \cup (5, \infty)$

27. The portion of the graph of a function $y = f(x)$ in the first quadrant is shown. If one knows that the function f is an *odd* function, which of the following is an accurate depiction of the graph of f ?

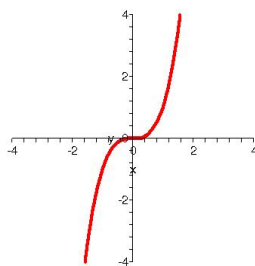


(a)

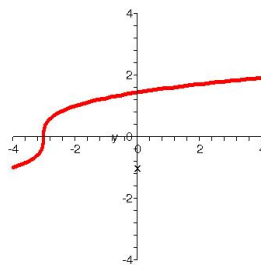
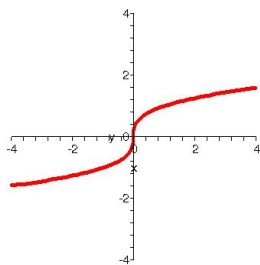
(b)



(c)



(d)



28. Let $f(x) = 2x^5 - 7x^4 + 3x^2 - 5$. List all possible rational zeros of f .

- (a) $\pm \frac{1}{2}, \pm 1, \pm \frac{5}{2}, \pm 5$ (b) $\pm 1, \pm 2$ (c) $\pm 1, \pm 5$ (d) $\pm \frac{1}{5}, \pm \frac{2}{5}, \pm 1, \pm 5$

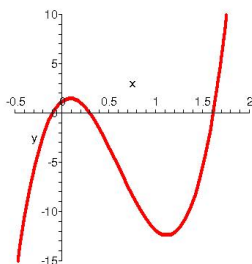
29. For the matrices A and B defined below, find their sum $A + B$, if possible.

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

$A + B =$

(a) Undefined (b) $\begin{bmatrix} 12 & 3 \\ -14 & 5 \end{bmatrix}$ (c) $\begin{bmatrix} 12 & 0 \\ 2 & 5 \end{bmatrix}$ (d) $\begin{bmatrix} 7 & 1 \\ -3 & 6 \end{bmatrix}$

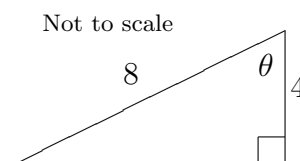
30. The graph of a polynomial of degree 3 is shown. Estimate the largest zero of the polynomial to the nearest tenth.



(a) 0.0 (b) 0.1 (c) 1.5 (d) 1.6

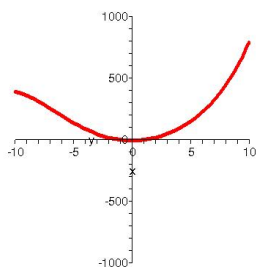
31. For the indicated right triangle, find the measure of θ .

(a) 30° (b) 60° (c) 90° (d) 120°

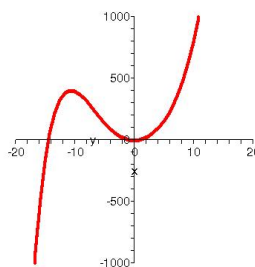


32. Let $f(x) = 0.002x^5 + 6x^2 - 5$. Which of the following images best portrays the graph of f ?

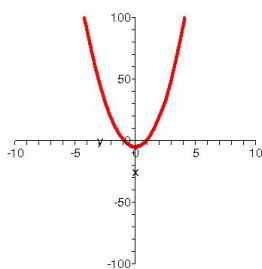
(a)



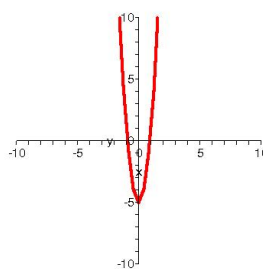
(b)



(c)



(d)



33. Assuming continuous compounding, how long, to the nearest tenth of a year, will it take an investment to double at an annual interest rate of 3%?

- (a) 0.2 years (b) 2.3 years (c) 23.1 years (d) 1.1 years

34. Let $g(x) = \frac{3x - 2}{4x + 1}$. Find $g(2)$.

- (a) $\frac{6x - 4}{4x + 1}$ (b) $\frac{4}{9}$ (c) $\frac{4}{5}$ (d) $\frac{-4}{5}$

35. Find the inverse of the matrix $A = \begin{bmatrix} 1 & 7 \\ 3 & 11 \end{bmatrix}$, if possible.

$A^{-1} =$

- (a) Undefined (b) $\begin{bmatrix} 11 & -7 \\ -3 & 1 \end{bmatrix}$ (c) $\begin{bmatrix} -1.1 & -0.7 \\ -0.3 & -0.1 \end{bmatrix}$ (d) $\begin{bmatrix} -1.1 & 0.7 \\ 0.3 & -0.1 \end{bmatrix}$

36. Let $f(x) = \begin{cases} 2x & \text{if } x < 0 \\ x + 3 & \text{if } 0 \leq x \leq 4 \\ x - 1 & \text{if } 4 < x < \infty \end{cases}$

Find $f(1)$.

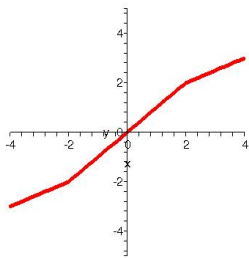
- (a) 0 (b) 1 (c) 2 (d) 4

37. Find any vertical asymptote(s) of the graph of the function f .

$$f(x) = \frac{x + 3}{(x + 2)(x - 1)}$$

- (a) $x = -3$, $x = -2$, and $x = 1$
 (b) $x = 2$ and $x = -1$
 (c) $x = -2$ and $x = 1$
 (d) $x = 0$

38. The graph of a function f is given.

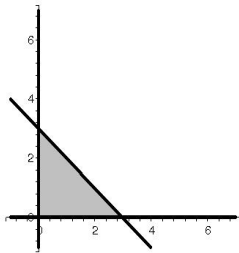


Does f have an inverse function?

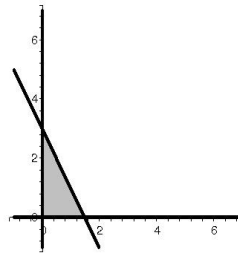
- (a) Yes
 (b) No
 (c) Not enough information
 (d) This is not the graph of a function

39. Graph the solution set of the system of inequalities: $\begin{cases} x & \geq 0 \\ y & \geq 0 \\ x + y & \leq 3 \end{cases}$

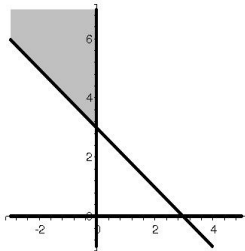
(a)



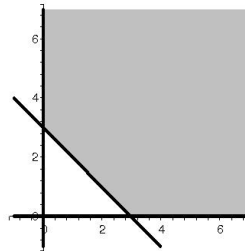
(b)



(c)



(d)



40. Let $g(x) = \sqrt{x+5}$. The graph of g is the graph of $y = \sqrt{x}$ shifted ...

(a) up 5 units (b) down 5 units (c) left 5 units (d) right 5 units

41. A ship leaves port on a heading of N 50° E and travels 30 miles before turning to a heading of N 70° W. The ship continues on this heading to a point due north of the port. At this point, how far, to the nearest tenth of a mile, is the ship from the port?

(a) 11.8 mi (b) 27.6 mi (c) 36.8 mi (d) 24.5 mi

42. For the matrices A and B defined below, find their product AB , if possible.

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

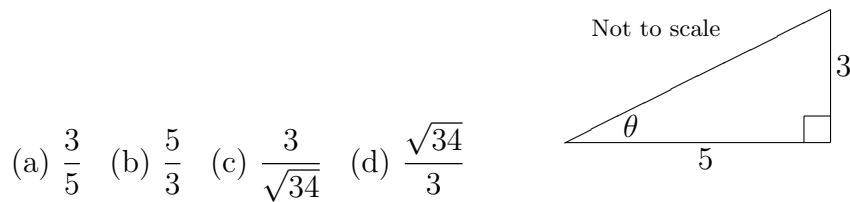
$AB =$

(a) $\begin{bmatrix} 3 & -4 \\ 0 & 2 \end{bmatrix}$ (b) $\begin{bmatrix} 3 & 7 \\ -6 & 4 \end{bmatrix}$ (c) $\begin{bmatrix} 4 & 3 \\ -2 & 3 \end{bmatrix}$ (d) $\begin{bmatrix} 5 & 11 \\ -4 & 2 \end{bmatrix}$

43. Let $f(x) = (x - 3)(x + 2i)(x - 2i)(x - 4)$. Find the zeros of f .

- (a) $-3, -4$ (b) $3, 4$ (c) $-2i, 2i, -3, -4$ (d) $-2i, 2i, 3, 4$

44. For the indicated right triangle, find $\sin \theta$.



45. Perform the indicated operation, if possible, for the matrix $A = \begin{bmatrix} 3 \\ -1 \\ 5 \end{bmatrix}$.

$3A =$ (a) $\begin{bmatrix} 6 \\ 2 \\ 8 \end{bmatrix}$ (b) $\begin{bmatrix} 9 \\ -3 \\ 15 \end{bmatrix}$ (c) $\begin{bmatrix} 9 \\ 3 \\ 15 \end{bmatrix}$ (d) 21

46. In $\triangle ABC$, side a has length 5m, side b has length 6m, and $\angle C$ has measure 27° . Find the length of side c to the nearest hundredth of a meter.

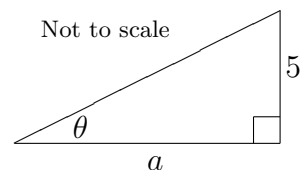
- (a) 2.75m (b) 7.54m (c) 7.81m (d) 5.85m

47. Let $f(x) = -2x^4 + 3x^3 - 7x^2 + 15x - 7$. Describe the end behavior of f .

- (a) Rises to the left; Rises to the right
 (b) Rises to the left; Falls to the right
 (c) Falls to the left; Rises to the right
 (d) Falls to the left; Falls to the right

48. For the indicated right triangle, $\theta = 35^\circ$.

Find the length of side a to the nearest hundredth of a unit.



- (a) 10.55 (b) 7.14 (c) 2.87 (d) 3.50

49. Let $f(x) = x + 1$ and let $g(x) = \sqrt{3 - x^2}$. Find a formula for $(f + g)(x)$.

(a) $(f + g)(x) = \sqrt{3 - x^2} + 1$

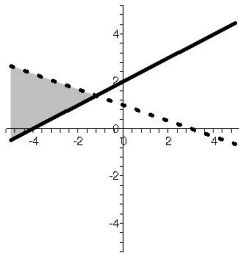
(b) $(f + g)(x) = \sqrt{3 - (x + 1)^2}$

(c) $(f + g)(x) = x$

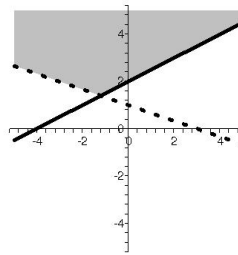
(d) $(f + g)(x) = x + 1 + \sqrt{3 - x^2}$

50. Graph the solution set of the system of inequalities. $\begin{cases} x - 2y \leq -4 \\ 2x + 6y < 6 \end{cases}$

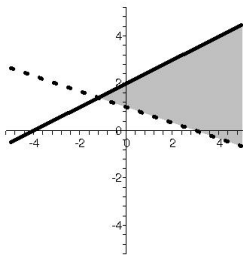
(a)



(b)



(c)



(d)

