1. Given functions $f(x) = 9x - 3$ and $g(x) = 3x + 4$, find $f \cdot g$.

   a) $12x^2 + 1$
   b) $27x^2 - 12$
   c) $27x^2 - 5x - 12$
   d) $12x^2 + 27x + 1$
   e) $27x^2 + 27x - 12$

2. Solve the system of equations.

$$52 + 3z = 4(x - 4y)$$
$$3(x - 3y - z) = 27$$
$$-3(2x + y) + 2z = -7$$

   a) (4, 9, 4)
   b) (4, -3, 4)
   c) (4, -12, 4)
   d) (4, -9, 12)
   e) (-4, -9, -12)

3. In how many ways can 7 women and 4 men be seated in a row of 11 seats at a movie theater assuming that all the women must sit together, and all the men must sit together?

   a) 2048
   b) 52,100
   c) 120,960
   d) 241,920
   e) 39,916,800

4. Determine the maximum possible number of turning points for the graph of the function.

$$f(x) = (5x - 3)^2(x^2 + 6)(x + 8)$$

   a) 2
   b) 3
   c) 4
   d) 5
   e) 6

5. The volume V of a given mass of gas varies directly as the temperature T and inversely as the pressure P. A measuring device is calibrated to give $V = 144$ in^3 when $T = 240°$ and $P = 25$ lb/in^2. What is the volume on this device when the temperature is 500° and the pressure is 10 lb/in^2?

   a) $V = 50$ in^3
   b) $V = 700$ in^3
   c) $V = 730$ in^3
   d) $V = 750$ in^3
   e) $V = 770$ in^3

6. A herd of deer is introduced to a wildlife refuge. The number of deer, $N(t)$, after t years is described by the polynomial function $N(t) = -t^4 + 18t + 120$. As t increases, what will eventually happen to the deer population?

   a) The deer population in the refuge will die out.
   b) The deer population in the refuge will stay the same.
   c) The deer population in the refuge will grow out of control.
   d) The deer population in the refuge will be displaced by oil wells.
   e) The deer population in the refuge will reach a constant amount greater than 0.

7. Suppose that an open box is to be made from a square sheet of cardboard by cutting out 4-inch squares from each corner. If the box is to have a volume of 16 cubic inches, find the original dimensions of the sheet of cardboard.

   a) 10 in. by 10 in.
   b) 20 in. by 20 in.
   c) $12\sqrt{2}$ in. by $12\sqrt{2}$ in.
   d) $12\sqrt{3}$ in. by $12\sqrt{3}$ in.
   e) $22\sqrt{2}$ in. by $22\sqrt{2}$ in.

8. The concentration, in parts per million, of a particular drug in a patient's blood x hours after the drug administered is given by the function $f(x) = -x^4 + 13x^3 - 54x^2 + 84x$. How many hours after the drug is administered will it be eliminated from the bloodstream?

   a) 6 hours
   b) 7 hours
   c) 8 hours
   d) 12 hours
   e) 19 hours

9. A developer wants to enclose a rectangular grassy lot that borders a city street for parking. If the developer has 228 feet of fencing and does not fence the side along the street, what is the largest area that can be enclosed?

   a) 3249 ft^2
   b) 6498 ft^2
   c) 8452 ft^2
   d) 9747 ft^2
   e) 12,996 ft^2

10. A local race for charity has taken place since 1993. Using the actual speeds of the winners from 1993 through 1998, mathematicians obtained the formula $y = 0.18x + 5$, in which x represents the number of years after 1993 and y represents the winning speed in miles per hour. In what year is the winning speed predicted to be 7.16 mph?

    a) 2004
    b) 2005
    c) 2006
    d) 2007
    e) 2008

11. Solve the equation $2x^3 - 17x^2 + 31x + 20 = 0$ given that 4 is a zero of

    $f(x) = 2x^3 - 17x^2 + 31x + 20.$

    a) $(2, -1, 5)$
    b) $\left(4, 1, -\frac{5}{2}\right)$
    c) $\left(4, 5, -\frac{1}{2}\right)$
    d) $\left(4, -5, \frac{1}{2}\right)$
    e) $\left(4, -1, \frac{5}{2}\right)$

12. A stack of 10 different cards are shuffled and spread out face down. If 4 cards are turned face up, how many different 4-card combinations are possible?

    a) 210
    b) 2520
    c) 4000
    d) 5040
    e) 151,200

13. A ball is thrown vertically upward with an initial velocity of 160 feet per second. The distance in feet of the ball from the ground after t seconds is $s = 160t - 16t^2$. For what intervals of time is the ball less than 384 above the ground (after it is tossed until it returns to the ground)?

a) Between 4 and 6 seconds
b) Between 0 and 2 seconds and between 5 and 6 seconds
c) Between 0 and 4 seconds and between 6 and 10 seconds
d) Between 0 and 3.5 seconds and between 6.5 and 10 seconds
e) Between 0 and 4.5 seconds and between 5.5 and 10 seconds

14. The following is known about three numbers: If the second number is subtracted from the sum of the first number and 2 times the third number, the result is 3. The third number plus 4 times the first number is 4. The first number plus 3 times the second number plus the third number is 19. Find the three numbers.

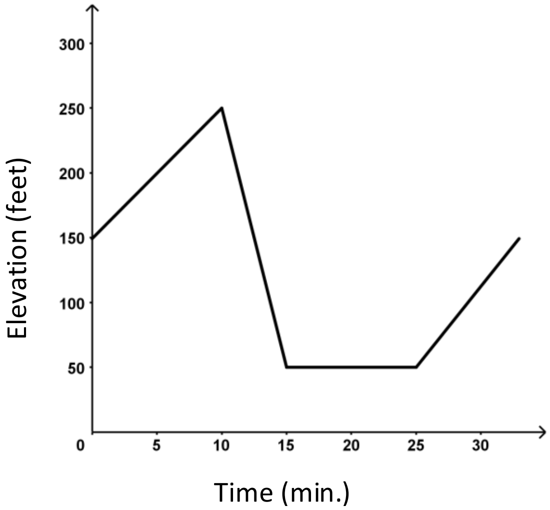
a) The first number is -1. The second number is 5. The third number is 8.
b) The first number is 1. The second number is 6. The third number is 4.
c) The first number is 0. The second number is 4. The third number is 7.
d) The first number is 0. The second number is 5. The third number is 4.
e) The first number is -1. The second number is 3. The third number is 5.

15. A formula for the measure of a diagonal from the upper corner of a box to the opposite lower corner is $d = \sqrt{L^2 + W^2 + H^2}$, where L, W and H are the length, width and height of the box, respectively. Find the length, L, of the box when the length of diagonal, d, is $\sqrt{677}$ inches, the width is 14 inches and the height is 9 inches.

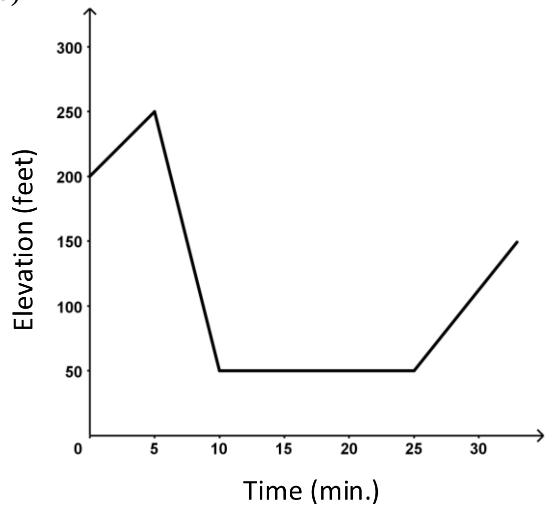
a) 9 in.
b) 20 in.
c) 22 in.
d) $\sqrt{43}$ in.
e) $\sqrt{86}$ in.

16. Mark started out by walking up a hill for 5 minutes. For the next 5 minutes, he walked down a steep hill to an elevation lower than his starting point. For the next ten minutes, he walked on level ground. For the next 10 minutes, he walked uphill. Determine which graph of elevation above sea level versus time illustrates the story.

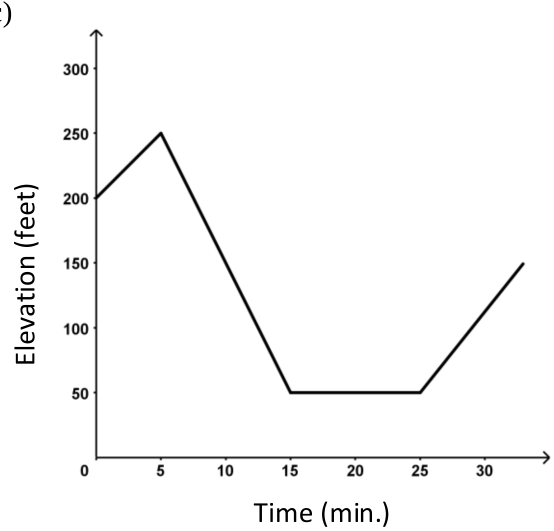
a)



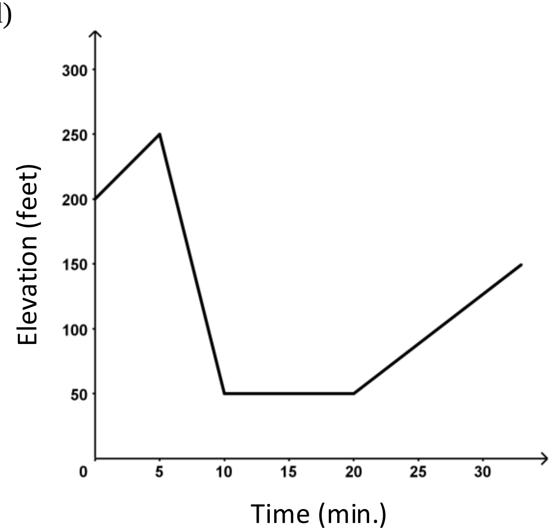
b)



c)



d)



e) None of these

17. Find the domain of the composite function $f \circ g$, when $f(x) = \frac{10}{x+10}$ and $g(x) = \frac{10}{x}$.

a) $(-\infty, \infty)$
b) $(-\infty, -1) \cup (-1, 10)$
c) $(-\infty, -1) \cup (-1, 0) \cup (0, \infty)$
d) $(-\infty, -10) \cup (-10, 0) \cup (0, \infty)$
e) $(-\infty, -10) \cup (-10, 1) \cup (-1, 0) \cup (0, \infty)$

18. Divide. $(x^4 + 625) \div (x - 5)$

a) $x^3 + 5x^2 + 25x + 125$
b) $x^3 + 25x^2 + 25x + 25 + \frac{250}{x-5}$
c) $x^3 + 5x^2 + 25x + 125 + \frac{650}{x-5}$
d) $x^3 + 5x^2 + 25x + 125 + \frac{1250}{x-5}$
e) $x^3 - 5x^2 + 25x - 125 + \frac{1250}{x-5}$

19. Compute the discriminant. Then determine the number and type of solutions for the equation $6x^2 = -8x - 7$.

a) 0; one real solution
b) -104; two irrational solutions
c) 104; two unequal real solutions
d) 232; two unequal real solutions
e) 336; two unequal real solutions

20. Solve the system of equations.

$$x - 3 = 2y$$
$$x^2 - xy = 20$$

a) $\left\{(-5, -1), \left(\frac{11}{2}, 8\right)\right\}$
b) $\left\{(-5, -1), \left(8, \frac{11}{2}\right)\right\}$
c) $\left\{(5, 1), \left(-\frac{11}{2}, -8\right)\right\}$
d) $\left\{(5, 1), \left(-8, -\frac{11}{2}\right)\right\}$
e) $\left\{(5, 1), \left(8, \frac{11}{2}\right)\right\}$

21. The profits (in millions) for a company for 8 years were as follows:

Year (x)	Profits (P)
1	1.1
2	1.7
3	2.0
4	1.4
5	1.3
6	1.5
7	1.8
8	2.1

Which of the following polynomials is the best model for this data?

a) $P(x) = 0.05x^2 - 0.8x + 6$
b) $P(x) = 0.3x^3 - 0.7x^2 + 1.3x + 0.17$
c) $P(x) = 0.03x^3 - 0.3x^2 + 1.3x + 0.17$
d) $P(x) = -0.08x^4 + 7x^2 + 1.3x - 0.18$
e) $P(x) = -0.03x^4 - 0.3x^2 + 1.3x + 0.17$

22. A vendor has learned that, by pricing pretzels at \$1.50, sales will reach 102 pretzels per day. Raising the price to \$2.00 will cause the sales to fall to 76 pretzels per day. Let y be the number of pretzels sold per day when the price is x dollars each. Find the equation of the line that best models this scenario.

a) $y = 52x + 24$
b) $y = 52x + 180$
c) $y = \frac{1}{52}x + \frac{10605}{104}$
d) $y = -52x - 180$
e) $y = -52x + 180$

23. Find all values of x satisfying the given conditions.

$y_1 = 8x + 4(4 + x), y_2 = 3(x - 6) + 10x,$ and $y_1 = y_2$

a) -34
b) -10
c) 10
d) 12
e) 34

24. Find all values of x satisfying the given conditions.

$$y_1 = \frac{6}{x+3}, y_2 = \frac{8}{x-3}, y_3 = \frac{14}{x^2-9} \text{ and } y_1 - y_2 = y_3$$

a) -28
b) $\sqrt{43}$
c) 28
d) 56
e) 81

25. Solve the logarithmic equation. Be sure to reject any value that is not in the domain of the original logarithmic expressions. Give the exact answer.

$$\log_3(x+6) + \log_3(x-6) - \log_3 x = 2$$

a) -3
b) $\emptyset$
c) 2
d) 12
e) $\{12, -3\}$

26. Solve. $-4[3x + 7 + 3(x+1)] = -7x - 5$

a) -7
b) $-\frac{35}{17}$
c) $\frac{21}{17}$
d) $\frac{35}{3}$
e) 35

27. Perform the matrix row operations and select the new matrix.

$$\left[\begin{array}{cccc|c} 1 & 1 & -1 & 1 & 2 \\ 0 & -1 & 1 & -3 & 0 \\ 5 & 0 & -4 & -5 & 5 \\ -2 & 4 & 0 & 2 & -1 \end{array}\right] \begin{array}{l} -4R_1 + R_3 \to R_3 \\ 2R_1 + R_4 \to R_4 \end{array}$$

a. $\left[\begin{array}{cccc|c} -4 & -4 & 4 & 4 & -8 \\ 0 & -1 & 1 & -3 & 0 \\ 1 & -4 & 0 & -9 & -3 \\ 0 & 6 & -2 & 4 & 3 \end{array}\right]$

b. $\left[\begin{array}{cccc|c} 1 & 1 & -1 & 1 & 2 \\ 0 & -1 & 1 & -3 & 0 \\ 5 & 4 & -8 & -1 & 13 \\ 0 & 6 & -2 & 4 & 3 \end{array}\right]$

c. $\left[\begin{array}{cccc|c} 1 & 1 & -1 & 1 & 2 \\ 0 & -1 & 1 & -3 & 0 \\ 1 & -4 & 0 & -9 & -3 \\ 0 & 6 & -2 & 4 & 3 \end{array}\right]$

d. $\left[\begin{array}{cccc|c} 1 & 1 & -1 & 1 & 2 \\ 0 & -1 & 1 & -3 & 0 \\ 1 & -4 & 0 & -9 & -3 \\ -2 & 4 & 0 & 2 & -1 \end{array}\right]$

e. $\left[\begin{array}{cccc|c} 2 & 2 & -2 & 2 & 4 \\ 0 & -1 & 1 & -3 & 0 \\ 5 & 0 & -4 & -5 & 5 \\ 0 & 6 & -2 & 4 & 3 \end{array}\right]$

28. Given functions *f* and *g*, determine the domain of *f* + *g*.

$$f(x) = \frac{2x}{x-9}, \qquad g(x) = \frac{4}{x+4}$$

a) $(-\infty, \infty)$
b) $(-\infty, -9) \cup (-9, 4) \cup (4, \infty)$
c) $(-\infty, -4) \cup (-4, 9) \cup (9, \infty)$
d) $(-\infty, -4) \cup (-4, -2) \cup (-2, \infty)$
e) $(-\infty, -9) \cup (-9, -4) \cup (-4, \infty)$

29. Solve the rational inequality. Express the solution set in interval notation.

$$\frac{(x+10)(x-8)}{x-1} \geq 0$$

a) $[-10,1) \cup [8,\infty)$
b) $[-10,1) \cup (8,\infty)$
c) $[-10,1] \cup [8,\infty)$
d) $(-\infty,-10] \cup (1,8]$
e) $(-\infty,-10] \cup [8,\infty)$

30. Solve the equation. $32^x = \frac{1}{\sqrt{2}}$

a) -5
b) $-\frac{1}{5}$
c) $-\frac{1}{10}$
d) $\frac{1}{10}$
e) 10

31. Solve the equation. $4^{x+4} = 5^{2x+5}$

a) $\frac{5\ln 5 - 4\ln 4}{\ln 4 - 2\ln 5}$
b) $\ln\left|\frac{5^5}{4^4} - \frac{4}{5^2}\right|$
c) $\ln 5 - \ln 4$
d) $\ln 8 - \ln 15$
e) $7\ln 5 - 5\ln 4$

32. Write the equation in standard form. Then give the center and radius of the circle.

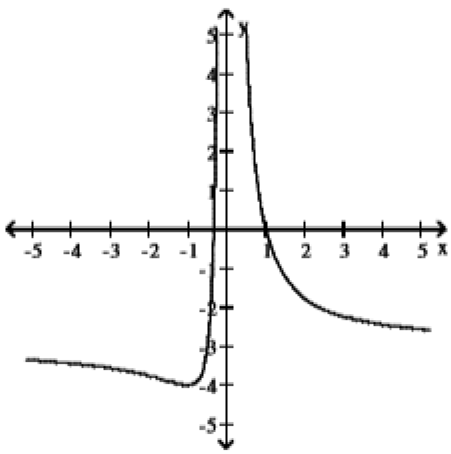
$$x^2 + y^2 + 6x + 4y = 3$$

a) $(x+3)^2 + (y+2)^2 = 16,\ (3,2),\ r = 16$
b) $(x+2)^2 + (y+3)^2 = 16,\ (2,3),\ r = 16$
c) $(x+3)^2 + (y+2)^2 = 16,\ (-3,-2),\ r = 4$
d) $(x+2)^2 + (y+3)^2 = 16,\ (-2,-3),\ r = 4$
e) $(x+6)^2 + (y+4)^2 = 16,\ (-6,-4),\ r = 4$

33. Find the midpoint of the line segment whose endpoints are (4, 7) and (7, -6).

a) $(11, 1)$
b) $\left(\frac{11}{2}, \frac{1}{2}\right)$
c) $(-3, 2)$
d) $(-3, 13)$
e) $\left(-\frac{3}{2}, \frac{13}{2}\right)$

34. Match the graph with its function.



a) $x^2y = 1 - 2x + 3x^2$
b) $x^2y = 1 + 2x + 3x^2$
c) $x^2y = 1 - 2x - 3x^2$
d) $x^2y = 1 + 2x - 3x^2$
e) $x^2y = -1 - 2x + 3x^2$

35. Find the product AB, if possible.

$$A=\begin{bmatrix}-1 & 3\\ 1 & 6\end{bmatrix},\ B=\begin{bmatrix}0 & -2 & 4\\ 1 & -3 & 2\end{bmatrix}$$

a) $\begin{bmatrix}3 & 6\\ -7 & -20\\ 2 & 16\end{bmatrix}$

b) $\begin{bmatrix}3 & -7 & 2\\ 6 & -20 & 16\end{bmatrix}$

c) $\begin{bmatrix}0 & -6 & 12\\ 6 & -20 & 12\end{bmatrix}$

d) $\begin{bmatrix}-1 & -1 & 4\\ 2 & 3 & 8\end{bmatrix}$

e) AB is not defined.

36. Solve the equation $10x^{-2}+11x^{-1}+1=0$

a) $\{-1,-10\}$

b) $\left\{-1,-\frac{1}{10}\right\}$

c) $\left\{-\frac{1}{10},-1\right\}$

d) $\{1,10\}$

e) $\left\{\frac{1}{10},1\right\}$

37. Find the complete solution to the system of equations.

$$\begin{gathered} x + 3y + 2z = 11 \\ 4y + 9z = -12 \\ x + 7y + 11z = -1 \end{gathered}$$

a) $\left(\frac{19z}{4} + 20,\ \frac{9z}{4} + 3,\ z\right)$

b) $\left(\frac{19z}{4} + 20, -\frac{9z}{4} + 3,\ z\right)$

c) $\left(\frac{19z}{4} + 20, -\frac{9z}{4} - 3,\ z\right)$

d) $\left(\frac{19z}{4} - 20, -\frac{9z}{4} - 3,\ z\right)$

e) $\left(-\frac{19z}{4} + 20, -\frac{9z}{4} + 3,\ z\right)$

38. Solve the equation $x^3 + 4x^2 - x - 4 = 0$

a) $\{16\}$

b) $\{1, 4\}$

c) $\{-4, 4\}$

d) $\{1, -4, 4\}$

e) $\{-1, 1, -4\}$

39. Solve the equation $6x^2 + 72x + 240 = 0$

a) {8, 4}

b) {-8, -4}

c) {-6 + 2i}

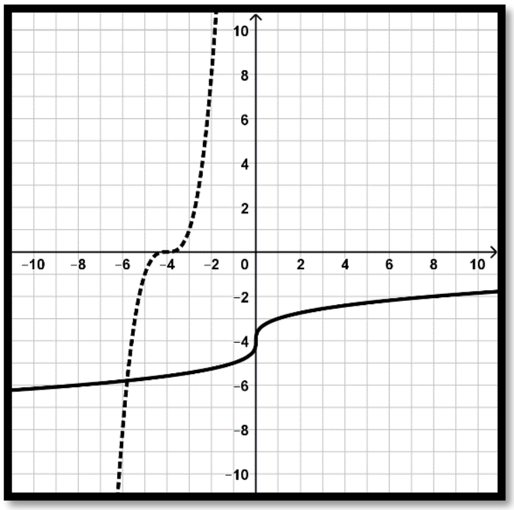
d) {-6 – 2i, -6 + 2i}

e) {-6 – 4i, -6 + 4i}

40. Graph f as a solid line and f^{-1} as a dashed line in the same rectangular coordinate space. Use interval notation to give the domain and range of f and f^{-1}.

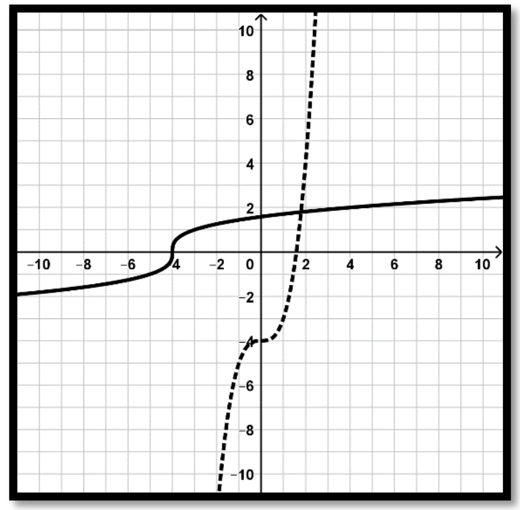
$$f(x) = \sqrt[3]{x} + 4$$

a)



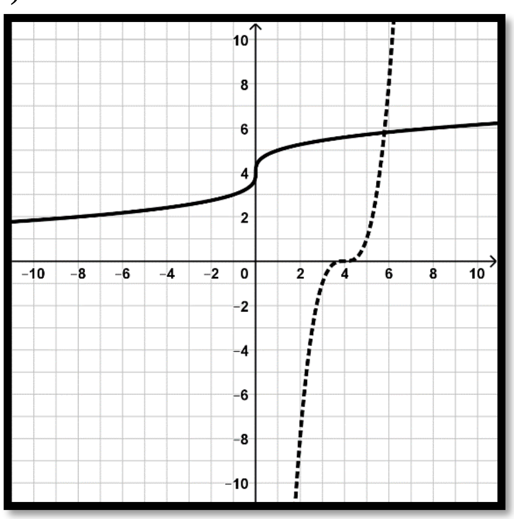
f domain = (-∞, ∞); range = (-∞, ∞)
f^{-1} domain = (-∞, ∞); range = (-∞, ∞)

b)



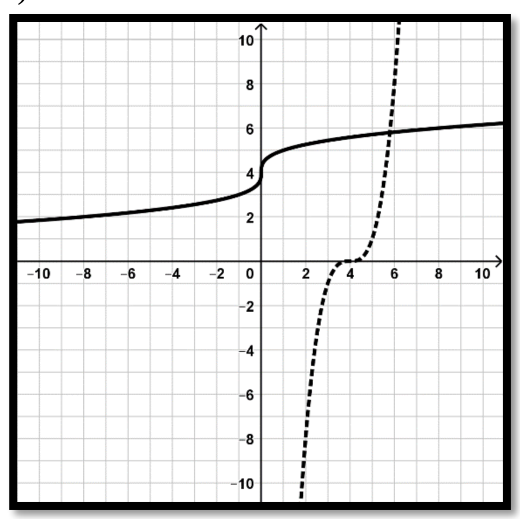
f domain = (-∞, ∞); range = (-∞, ∞)
f^{-1} domain = (-∞, ∞); range = (-∞, ∞)

c)



f domain = (-∞, ∞); range = (0, ∞)
f^{-1} domain = (0, ∞); range = (-∞, ∞)

d)



f domain = (-∞, ∞); range = (-∞, ∞)
f^{-1} domain = (-∞, ∞); range = (-∞, ∞)

e) None of these