College Algebra and College Algebra with Review Final Review

The final exam comprises 30 questions. Each of the 20 multiple choice questions is worth 3 points and each of the 10 open-ended questions is worth 4 points.

Instructions for the Actual Final Exam: Work individually. Support your answers on open-ended questions with algebraic steps and/or a graph, including your window. If you fail to use the method indicated, you will lose points. Do not share calculators.

Give the equations of any asymptotes of the type specified for the graph of the rational function.

1) f(x) = $\frac{7x^2-3x-2}{8x^2-2x+9}$; horizontal

A) y = 0 B) y = $\frac{7}{8}$ C) y = $\frac{3}{2}$ D) None

2) f(x) = $\frac{x+4}{x^2+4x-2}$; horizontal

A) x = -5 B) y = 0 C) y = 1/2 D) None

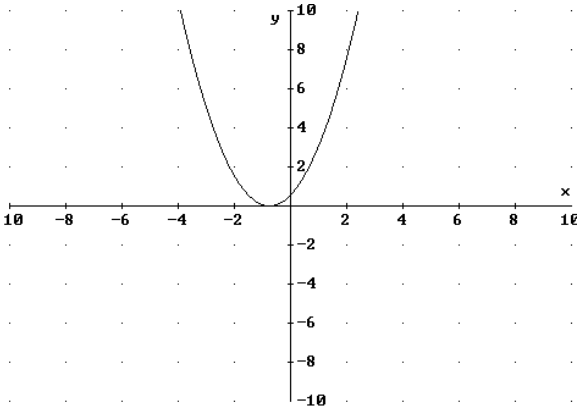
3) f(x) = $\frac{6x+2}{5x-3}$; vertical

A) x = -2 C) x = $\frac{3}{5}$ E) x = $-\frac{5}{3}$

B) x = $\frac{6}{5}$ D) x = $\frac{5}{3}$

It is not apparent from the standard viewing window whether the graph of the quadratic function intersects the x-axis once, twice, or not at all. Redraw the graph clearly to show the x-intercept(s), if any, state the window and identify the coordinates of any x-intercept(s) to the nearest hundredth.

4) y = x^2 + 1.5x + 0.56



5) Wind speed varies in the first twenty meters above the ground. For a particular day, let $f(x) = 1.3 \ln x + 8.5$ compute the wind speed x meters above the ground. What is the wind speed 12 meters above the ground? Round your result to the nearest hundredth.

A) 11.73 m/sec C) -5.27 m/sec E) 11.28 m/sec
B) 10.98 m/sec D) 3.93 m/sec

6) Assume that the annual sales of a small manufacturer can be modeled by a linear function and that sales were $15,000 in 1988 and $47,000 in 1993. Let x = 0 represent 1988 and f(x) represent annual sales, and write a formula for f(x).

A) f(x) = 6400x + 47,000 C) f(x) = 32,000x + 15,000
B) f(x) = 6400x + 15,000 D) f(x) = 32,000x + 47,000

7) How long will it take for prices in the economy to double at a 7% annual inflation rate? (Round to the nearest year.)

A) 23 yr B) 9 yr C) 16 yr D) 10 yr

8) A projectile is thrown upward so that its distance above the ground after t seconds is $h = -10t^2 + 240t$. After how many seconds does it reach its maximum height? What is its maximum height?

A) 12 s; 1440 ft B) 24 s; 1440 ft C) 12 s; 11,520 ft D) 24 s; 11,520 ft

9) A sample of 600 grams of radioactive substance decays according to the function $A(t) = 600e^{-0.029t}$ where t is the time in years. How much of the substance will be left in the sample after 40 years? Round to the nearest whole gram.

A) 188 g B) 0 g C) 1 g D) 5326 g

Solve the equation.

10) $| 3x + 6 | - 2 = 7$

A) {-1, 5} B) {1, -5} C) $\left\{\frac{1}{2}, -\frac{5}{2}\right\}$ D) $\emptyset$

11) $4^{(9-3x)} = 64$

A) {2} B) {3} C) {16} D) {-2}

12) $e^{5x-1} = (e^3)^{-x}$

A) $\left\{\frac{2}{3}\right\}$ B) {0} C) $\left\{\frac{1}{8}\right\}$ D) $\left\{\frac{1}{2}\right\}$

13) $\log_4 x = -2$

A) {-16} B) $\left\{\frac{1}{16}\right\}$ C) {-8} D) {2}

14) $\log_5\left(\frac{1}{125}\right) = x$

A) $\left\{\frac{1}{625}\right\}$ B) {3} C) {-3} D) $\left\{\frac{1}{25}\right\}$

The given function is one-to-one. Find $f^{-1}(x)$.

15) $f(x) = \frac{5x-4}{7}$

A) $f^{-1}(x) = \frac{7x-4}{5}$ C) $f^{-1}(x) = \frac{7x+4}{5}$

B) $f^{-1}(x) = \frac{7}{5x-4}$ D) $f^{-1}(x) = \frac{7}{5x+4}$

Solve the problem. Round your answer to the nearest tenth.

16) If $2500 is invested in an account that pays interest compounded continuously, how long will it take to grow to $5000 at 8%?

A) 11.5 years B) 5.5 years C) 9.0 years D) 8.7 years

Find the equation of the line satisfying the given conditions, giving it in slope-intercept form if possible.

17) Through (-6, 7), parallel to -6x + 7y = 43

18) Through (7, 3), perpendicular to -7x + 3y = -58

Find the requested composition or operation.

19) f(x) = 9x – 3, g(x) = 2x + 8 Find (fg)(x).

A) $18x^2 + 2x - 24$ B) $x^2 + 66x + 5$ C) $18x^2 - 24$ D) $18x^2 + 66x - 24$

20) $f(x) = \sqrt{x+3}$, g(x) = 8x – 7 Find (f ∘ g)(x).

A) $2\sqrt{2x+1}$ B) $2\sqrt{2x-1}$ C) $8\sqrt{x-4}$ D) $8\sqrt{x-3}-7$

Find the real or imaginary solutions.

21) $7t^2 + 3t + 4 = 0$

A) $\frac{-3\pm\sqrt{103}}{14}$ B) $\frac{-3\pm i\sqrt{103}}{14}$ C) $\frac{4}{7}$ D) 1

Find the center and radius of the circle.

22) $(x-1)^2 + (y+3)^2 = 16$

A) (-3, 1), r = 4 B) (3, -1), r = 16 C) (-1, 3), r = 16 D) (1, -3), r = 4

Solve the inequality.

23) $|x - 5| - 9 > 9$

A) $(-\infty, -13) \cup (5, \infty)$ C) $(-\infty, -5) \cup (13, \infty)$ E) $(-\infty, -13) \cup (23, \infty)$

B) $[-5, 13]$ D) $(-13, 23)$

Find the center-radius form of the equation of the circle satisfying the given conditions.

24) Center (6, 3), radius $\sqrt{19}$

A) $(x - 6)^2 + (y - 3)^2 = 19$ C) $(x - 3)^2 + (y - 6)^2 = 361$

B) $(x + 6)^2 + (y + 3)^2 = 19$ D) $(x + 3)^2 + (y + 6)^2 = 361$

Solve the equation and express the solution in exact form.

25) $\ln(5x - 4) = \ln 8 - \ln(x - 2)$

A) $\left\{\frac{14}{5}\right\}$ B) $\left\{0, \frac{14}{5}\right\}$ C) $\left\{2, \frac{2}{5}\right\}$ D) $\emptyset$

26) $\log(x + 18) = 0$

A) {-17} B) {0} C) {18} D) {1}

27) $\log_9(x - 5) + \log_9(x - 5) = 1$

A) $\left\{\sqrt{26}\right\}$ B) $\left\{-\sqrt{26}, \sqrt{26}\right\}$ C) {-8, 8} D) {8}

Find the requested value.

28) f(0) for $f(x) = \begin{cases} x - 2 & if\ x < 5 \\ 9 - x & if\ x \geq 5 \end{cases}$

A) -2 and 9 C) 4 E) 3

B) -2 D) 9

State whether the vertex of the function is a maximum or minimum and give the corresponding maximum or minimum value of the function.

29) $f(x) = x^2 + 12x + 32$

A) minimum: -4 B) maximum: -6 C) minimum: -6 D) maximum: 0

Solve the rational equation.

30) $\frac{x-3}{x+7} = -2$

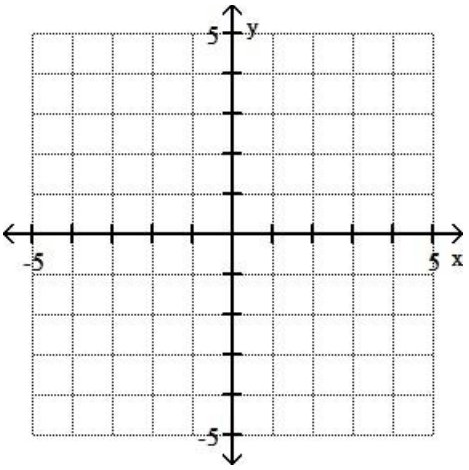
A) $\left\{-\frac{17}{3}\right\}$ C) $\left\{-\frac{11}{3}\right\}$ E) $\emptyset$

B) {6} D) {17}

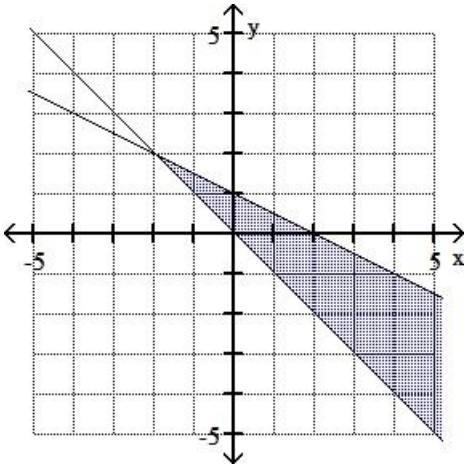
Graph the system of inequalities.

31) $x + 2y \geq 2$

$x - y \leq 0$



A.



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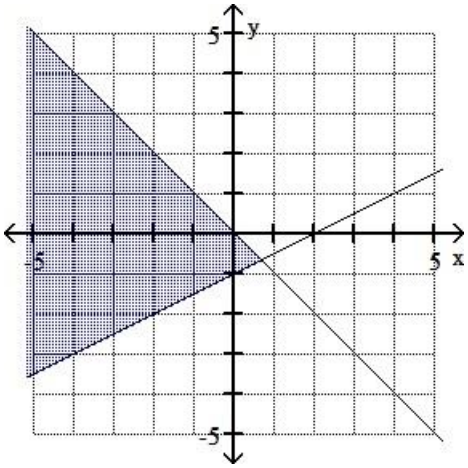

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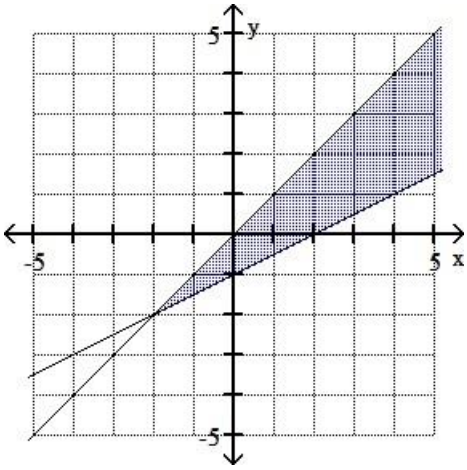
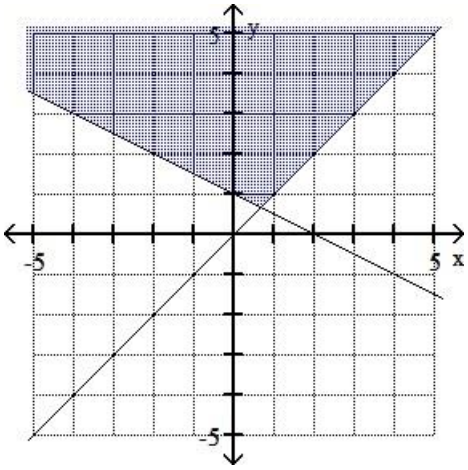


D.



Solve the system. If you use matrices to solve, you must write down your initial and final matrices for full credit. Write the answer as an ordered triple.

32) $x - y + 2z = 3$
$x + 2y + z = -6$
$2x + z = 0$

Use an end behavior diagram ( ,  ,  , or ) to describe the end behavior of the graph of the function.

33) $P(x) = -\sqrt{2}x^3 + 4x^2 + 2x - 4$

A) 
B) 
C) 
D) 

Identify the vertex of the parabola.

34) $P(x) = 3x^2 - 18x + 31$

A) (-3, -4) B) (4, 3) C) (3, 4) D) (-4, -3)

Solve the inequality analytically. Support the answer graphically. Give exact values for endpoints.

35) $x^2 + 5x \leq -6$

A) [-3, -2]
B) [2, 3]
C) $(-\infty,-3) \cup (-2, \infty)$
D) $(-\infty, 2] \cup [3, \infty)$
E) (2, 3)

Find the complete quotient when P(x) is divided by the binomial following it.

36) $P(x) = 2x^3 + 3x^2 + 4x - 10$; $x + 1$

A) $2x^2 + 5x + 9 - \frac{1}{x+1}$
B) $2x^2 + x + 3 - \frac{13}{x+1}$
C) $2x^2 + x + 3 + \frac{13}{x+1}$
D) $2x^2 + 5x + 9 + \frac{1}{x+1}$

Determine whether the function is even, odd, or neither.

37) $8x^4 - 3x^2 + 3$

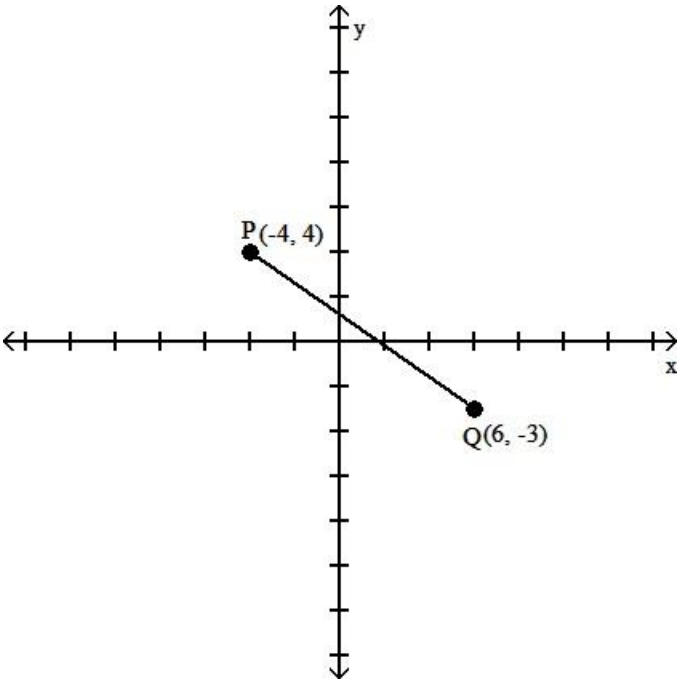
A) Even (y-axis symmetry)
B) Odd (origin symmetry)
C) Both
D) Neither

Determine the difference quotient $\frac{f(x+h)-f(x)}{h}$ ($h \neq 0$) for the function f. Simplify completely.

38) $f(x) = 4x - 12$

Find the distance between P and Q and the coordinates of the midpoint of the segment joining P and Q.

39)



A) $\sqrt{51}; \left(\frac{1}{2}, \frac{3}{2}\right)$

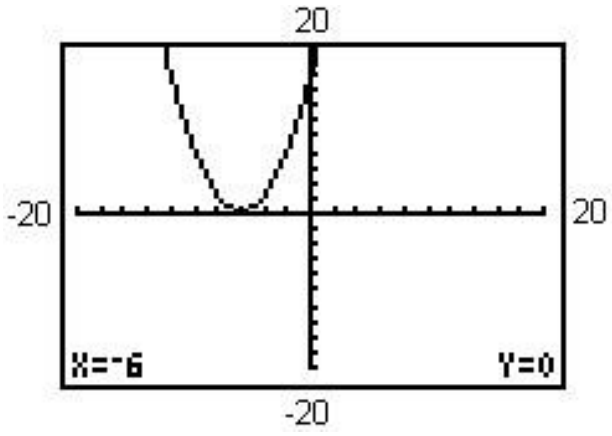
B) $\sqrt{149}; \left(1, \frac{1}{2}\right)$

C) $\sqrt{149}; \left(\frac{1}{2}, 1\right)$

D) $\sqrt{51}; \left(\frac{3}{2}, \frac{1}{2}\right)$

Tell whether the relation is a function. Determine the domain and range.

40)



A) Function; Domain: $(-\infty, \infty)$; Range: $(-\infty, \infty)$

B) Not a function; Domain: $(-\infty, \infty)$; Range: $(-\infty, \infty)$

C) Function; Domain: $[0, \infty)$; Range: $(-\infty, \infty)$

D) Function; Domain: $(-\infty, \infty)$; Range: $[0, \infty)$

E) Not a function; Domain: $(-\infty, \infty)$; Range: $[0, \infty)$

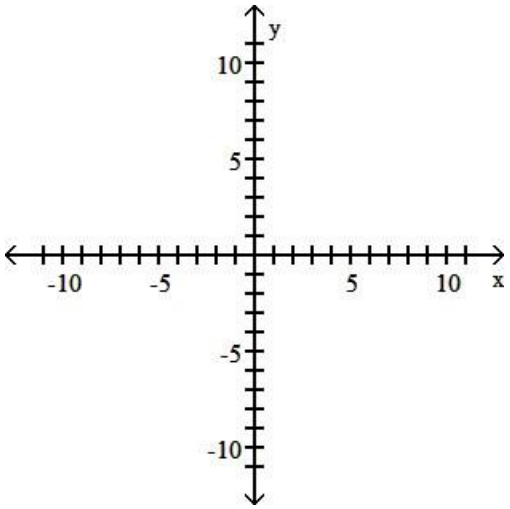
Find a function P(x) of least possible degree, having real coefficients, with the given zeros.
41) 2 and 6i

Give the equation of the function whose graph is described.
42) The graph of $y = x^2$ is shifted 4 units to the left. This graph is then vertically stretched by applying a factor of 6 and reflected across the x-axis. Finally, the graph is shifted 7 units downward.

A) $y = -6(x - 4)^2 - 7$
C) $y = -6(x + 4)^2 - 7$
B) $y = -6(x + 7)^2 - 4$
D) $y = -6(x - 4)^2 + 7$

Find all real solutions. Do not use a calculator.
43) $x^3 + 5x^2 - 14x = 0$

Graph the line. Also, give the x-intercept (if any), y-intercept (if any), and slope of the line (if defined).
44) $f(x) = -\frac{1}{2}x + 2$



Divide as indicated. Write the quotient in standard form.
45) $\frac{3-9i}{5-7i}$

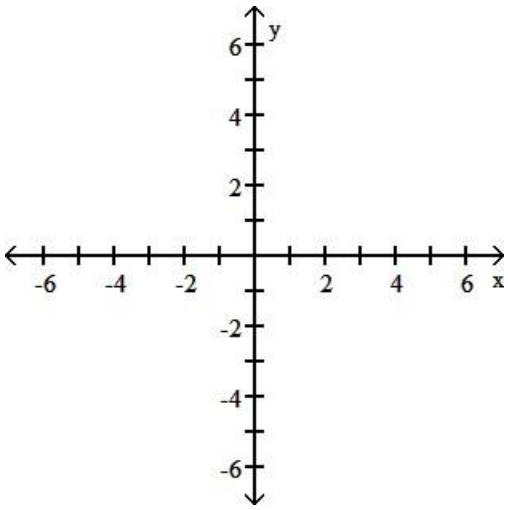
A) $\frac{39}{37} - \frac{12}{37}i$
B) $2 - \frac{1}{2}i$
C) $-\frac{48}{37} + \frac{66}{37}i$
D) $-\frac{13}{8} - \frac{1}{2}i$

Use the compound interest formula to determine the final value of the given amount.
46) $2970 at 8% compounded continuously for 20 years

A) $7808.97
B) $752.21
C) $1.83
D) $14,710.51

Graph the function.

47) $f(x) = \begin{cases} -4 & if\ x \geq 1 \\ -1 - x & if\ x < 1 \end{cases}$



Use the compound interest formula to determine the final value of the given amount.

48) $480 at 17% compounded quarterly for 6 years

A) $1331.13 B) $3401.71 C) $1231.28 D) $1303.37

Solve the inequality analytically, writing the solution set in interval notation.

49) $8 < \frac{3x-10}{3} < 13$

A) $\left(\frac{34}{3}, \frac{49}{3}\right)$

B) $\left(-\infty, \frac{34}{3}\right) \cup \left(\frac{49}{3}, \infty\right)$

C) $\left(-\frac{49}{3}, \frac{34}{3}\right)$

D) $\left(-\frac{34}{3}, \frac{49}{3}\right)$

Perform the requested composition or operation.

50) Find (f + g)(4) when f(x) = x – 1 and g(x) = x + 2.

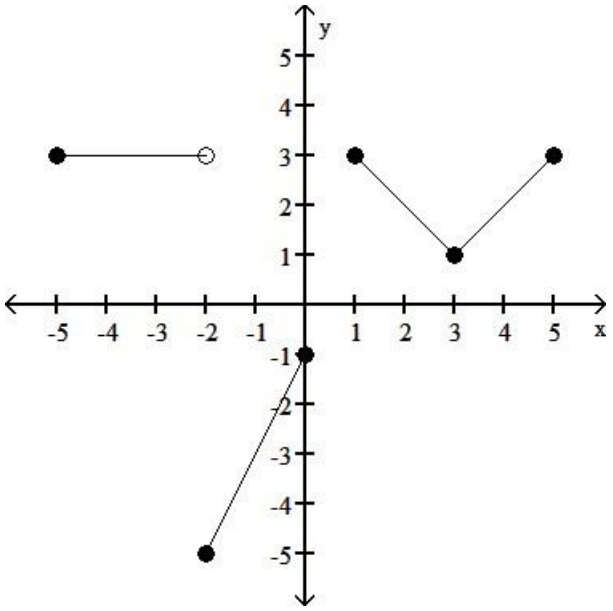
A) 9 B) 11 C) 5 D) 7

Solve the system algebraically. Write the answer as an ordered pair.

51) 9x + 8y = 36
-3x – 4y = -24

Determine the intervals on which the function is increasing, decreasing, and constant.

52)



A) Increasing on (-1, 0) and (3, 5); Decreasing on (0, 3); Constant on (-5, -3)
B) Increasing on (-5, -1) and (1, 3); Decreasing on (3, 1); Constant on {3}
C) Increasing on (1, 3); Decreasing on (-2, 0) and (3, 5); Constant on (2, 5)
D) Increasing on (-2, 0) and (3, 4); Decreasing on (-5, -2) and (1, 3)
E) Increasing on (-2, 0) and (3, 5); Decreasing on (1, 3); Constant on (-5, -2)

Solve the equation algebraically.

53) $\sqrt{5x+6} = 2x - 6$

A) $\left\{\frac{5\pm\sqrt{697}}{8}\right\}$
B) {1.25, 6}
C) {1.25}
D) {6}
E) ∅

Write the system of equations associated with the augmented matrix. Do not solve.

54) $\begin{bmatrix} 9 & 4 & 5 & -2 \\ 8 & 0 & 3 & 4 \\ 2 & 6 & 0 & 2 \end{bmatrix}$

Use synthetic division to find P(k).

55) k = -3; $P(x) = 2x^3 - 3x^2 - 4x + 19$

Solve the equation. Write the answer both in log form and rounded to the nearest thousandth.

56) $3^{(5x-3)} = 14$

Solve the equation for all complex solutions, giving exact forms in your solution set.

57) $5x^4 + 7x^3 + 119x^2 + 175x - 150 = 0$

If f is one-to-one, find an equation for its inverse.

58) $f(x) = x^3 - 2$

A) Not a one-to-one function

B) $f^{-1}(x) = \sqrt[3]{x+2}$

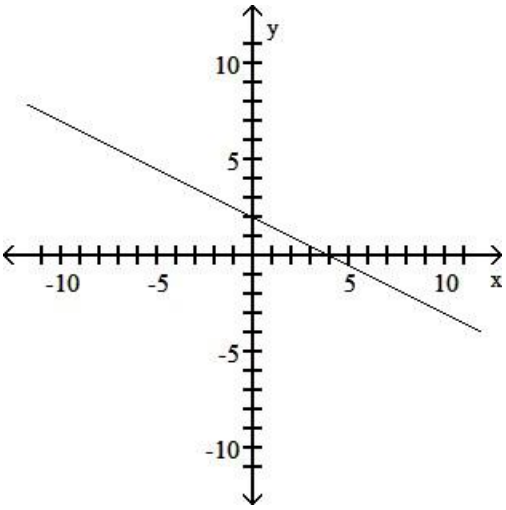
C) $f^{-1}(x) = \sqrt[3]{x} + 2$

D) $f^{-1}(x) = \sqrt[3]{x-2}$

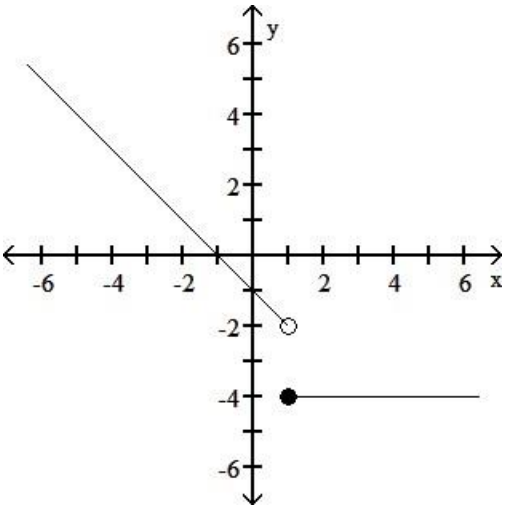
Answer Key

1) B Section 4.2
2) B Section 4.2
3) C Section 4.2
4) (-0.8, 0), (-0.7, 0), One Possible Window: [-0.9, -0.6] by [-0.015, 0.018] Section 3.5
5) A Section 5.4
6) B Section 1.3
7) D Section 5.6
8) A Section 3.4
9) A Section 5.6
10) B Section 2.4
11) A Section 5.2
12) C Section 5.2
13) B Section 5.3
14) C Section 5.3
15) C Section 5.1
16) D Section 5.3
17) $y = \frac{6}{7}x + \frac{85}{7}$ Section 1.4
18) $y = -\frac{3}{7}x + 6$ Section 1.4
19) D Section 2.6
20) B Section 2.6
21) B Section 3.3
22) D Section 7.1
23) E Section 2.4
24) A Section 7.1
25) A Section 5.5
26) A Section 5.5
27) D Section 5.5
28) B Section 2.5
29) A Section 3.2
30) C Section 4.3
31) D Section 6.7
32) {(0, -3, 0)} $\begin{bmatrix} 1 & -1 & 2 & 3 \\ 1 & 2 & 1 & -6 \\ 2 & 0 & 1 & 0 \end{bmatrix} \rightarrow \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & -3 \\ 0 & 0 & 1 & 0 \end{bmatrix}$ Section 6.3
33) C Section 3.4
34) C Section 3.2
35) A Section 3.3
36) B Section 3.6
37) A Section 2.1

38) 4 Section 2.6
39) B Section 1.1
40) D Section 1.2
41) $P(x) = x^3 - 2x^2 + 36x - 72$ Section 3.7
42) C Section 2.3
43) {0, -7, 2} Section 3.8
44) x-intercept: (4, 0); y-intercept: (0, 2); slope: $-\frac{1}{2}$ Section 1.3



45) A Section 3.1
46) D Section 5.2
47) Section 2.5



48) D Section 5.2
49) A Section 1.5
50) A Section 2.6
51) {(-4, 9)} Section 6.1
52) E Section 2.1
53) D Section 4.5

54) $9x + 4y + 5z = -2$
$8x + 3z = 4$
$2x + 6y = 2$ Section 6.3

55) -50 Section 3.6

56) x ≈ 1.080; $x = \frac{\log_3(14)+3}{5}$ *or* $\frac{\ln(14)}{5\ln(3)} + \frac{3}{5}$ *or* $\frac{\log(14)}{5\log(3)} + \frac{3}{5}$ Section 5.5

57) -2, $\frac{3}{5}$, 5i, -5i Section 3.8

58) B Section 5.1

Distance Formula

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

Midpoint Formula

$$\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$$

Circles

$(x - h)^2 + (y - k)^2 = r^2$

Where (h, k) is the center and r is the radius

Properties of Logarithms

$\log_b(b^p) = p$

$b^{\log_b(p)} = p$

$\log_b(b) = 1$

$\log_b(1) = 0$

$\ln(x) = \log_e(x)$

$y = \log_b(x)$ if and only if $b^y = x$

$\log_b\left(\frac{M}{N}\right) = \log_b(M) - \log_b(N)$

$\log_b(M \cdot N) = \log_b(M) + \log_b(N)$

$\log_b(M^p) = p \cdot \log_b(M)$

$\log(x) = \log_{10}(x)$

Change-of-Base Rule

$$\log_b(x) = \frac{\log(x)}{\log(b)}$$

$$or\ \log_b(x) = \frac{\ln(x)}{\ln(b)}$$

Lines

Slope	Point-Slope Form	Slope-Intercept Form
$m = \frac{y_2 - y_1}{x_2 - x_1}$	$y - y_1 = m(x - x_1)$	$y = mx + b$

Compound Interest

Compounded n times per year

$A = P \cdot (1 + \frac{r}{n})^{n \cdot t}$

A = Amount after t years
n = number of times compounded per year
r = yearly interest rate (as a decimal)

Compounded Continuously

$A = P \cdot e^{r \cdot t}$

P = Principal (original amount)
e = base of the natural log
t = number of years

Quadratic Formula

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Vertex of a Parabola

(h, k) where $h = \frac{-b}{2a}$ and k = f(h)

Properties of Absolute Value

If $k > 0$, then $|ax + b| = k$ is equivalent to $ax + b = k$ or $ax + b = -k$.
If $k > 0$, then $|ax + b| > k$ is equivalent to $ax + b > k$ or $ax + b < -k$.
If $k > 0$, then $|ax + b| < k$ is equivalent to $-k < ax + b < k$.
The two properties above also hold for ≤ and ≥

Properties of Polynomial Equations

If a polynomial P(x) is divided by x – r, the remainder is P(r).
If P(r) = 0, then x – r is a factor of P(x). If x – r is a factor of P(x), then P(r) = 0.

Even and Odd Functions

Even Function:	(y-Axis Symmetry)	f(-x) = f(x)
Odd Function:	(Origin Symmetry)	f(-x) = -f(x)