TECEP® Test Description for MAT-121-TE

COLLEGE ALGEBRA

This exam assesses students' understanding of algebraic concepts, processes, and practical applications. Topics include linear equations and inequalities; quadratic equations; systems of equations and inequalities; complex numbers; and exponential and logarithmic expressions and functions. Proficiency with these math skills are fundamental to the study of advanced courses in mathematics, statistics, engineering, and computer technology as well as in the sciences. Various applications in other fields such as finance, medicine, and environmental studies also require an understanding of algebraic concepts. (3 credits)

- **Test format:** 50 multiple choice questions (1 point each).
- **Passing score:** 70% (35/50 points). Your grade will be reported as CR (credit) or NC (no credit).
- **Time limit:** 3 hours.

Note: The exam is a closed-book exam. But you are permitted to use a calculator (scientific, graphing, or financial) but ***may not*** use a calculator on a phone, PDA, or any similar device. The use of **blank** scratch paper for doing math calculations is permitted during online test administrations.

OUTCOMES ASSESSED ON THE TEST

- Incorporate and further develop critical thinking skills through the use of algebraic concepts and processes.
- Identify and implement basic pre-algebra concepts.
- Identify and implement algebraic concepts.
- Graph a variety of equations/functions including linear, quadratic, cubic, absolute value, polynomial, exponential, and logarithmic.
- Solve problems involving variation, linear, quadratic, power, polynomial, exponential, and logarithmic equations.
- Model real-world applications using direction/indirect/joint variation, linear functions, quadratic functions, exponential functions, and logarithmic functions.
- Solve systems of linear and nonlinear equations and inequalities.
- Apply algebraic concepts and processes to solve real-world problems.

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TOPICS ON THE TEST AND THEIR APPROXIMATE DISTRIBUTION

The table below indicates the main topics covered by this exam and the approximate percentage of the exam devoted to each main topic. Under the main topic heading is a list of related–but more specific–topics. It is important to review these topics to determine how much prior knowledge you have and/or how much additional study is necessary.

Topic	Percentage
Review of Basic Concepts • Real numbers • Radicals • Rational expressions • Polynomials • Factoring polynomials	**15%**
Equations and Inequalities • Linear equations in one variable • Models and applications • Complex numbers • Quadratic equations • Radical and absolute value equations • Linear inequalities and absolute value inequalities	**20%**
Functions • Function and function notation • Domain and range • Rates of change and behavior of graphs • Composition of functions • Transformation of functions • Inverse functions • Linear functions • Modeling with linear functions	**15%**
Polynomial and Rational Functions • Quadratic functions • Power functions and polynomial functions • Graphs of polynomial functions • Dividing polynomials • Zeros of polynomial functions • Rational functions • Inverses and radical functions • Modeling using variation	**15%**

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Exponential and Logarithmic Functions ● Exponential functions ● Graphs of exponential functions ● Logarithmic functions ● Graphs of logarithmic functions ● Logarithmic properties ● Exponential and logarithmic equations ● Exponential and logarithmic models	**20%**
Systems of Equations and Inequalities ● Systems of linear equations: two variables ● Systems of linear equations: three variables ● Systems of nonlinear equations and inequalities: Two variables	**15%**

STUDY MATERIALS

Below is a list of recommended study materials to help prepare you for your exam. We encourage you to explore these resources to make sure that you are familiar with multiple perspectives on the topics above. All of these resources are openly licensed, which means that they are free to be revised, remixed, reused, redistributed, and retained, so long as their unique terms are followed. You can learn more about open licensing here.

Title	License
Abramson, J. (2019). *College algebra*. Houston, TX: OpenStax.	CC BY 4.0

In addition to the resource listed above, you may also wish to review the following site, which also provides free materials. Note that these materials are *not* open-source.

- *Algebra (all content)* [Khan Academy Course]. Mountain View, CA: Khan Academy.

SAMPLE QUESTIONS

The questions below are designed to help you study for your TECEP. Answering these questions does not guarantee a passing score on your exam.

Please note that the questions below **will not** appear on your exam.

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1. Simplify the given expression: $9 \div 3 - (125 \div 5^2)$

    a. -622
    b. -4.5
    c. -2
    d. $\frac{-9}{622}$

2. During a recent storm clean up, there is a mound of m tons of sand at the beach. Throughout the day, 1400 tons of sand is added to the mound. Two dump trucks come in and take 600 tons of sand each from the mound. At the end of the day, the mound has 3,200 tons of sand. Write and solve the equation that describes the situation.

    a. $m + 2(1400) - 2(600) = 3200$; $m = 1600$ tons
    b. $m + 1400 - 4(600) = 3200$; $m = 2200$ tons
    c. $m + 1400 - 600 = 3200$; $m = 2400$ tons
    d. $m + 1400 - 2(600) = 3200$; $m = 3000$ tons

3. Simplify the given expression:

    a. $-3 \cdot [36 \div (6-3)^2]^2$
    b. -62208
    c. -48
    d. $\frac{-16}{3}$
    e. 144

4. Find the greatest common factor (GCF): $16x^2y^3 - 32x^3y^3 + 64x^4y^2$

    a. $64x^4y^3$
    b. $16x^2y^2$
    c. $16x^4y^2$
    d. $16x^4y^3$

5. Simplify the rational expression: $\frac{6a^2-22a+12}{2a^2+4a-30}$

    a. $\frac{6a-4}{2a+10}$
    b. $\frac{3a+2}{a-5}$
    c. $\frac{3a-2}{a-5}$
    d. $\frac{3a-2}{a+5}$

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6. Factor by grouping: $6a^2 - 7a - 20$

   a. $6a^2 + 8a - 15a - 20 = 2a(3a + 4) - 5(3a + 4) = (3a + 4)(2a - 5)$
   b. $6a^2 - 8a + 15a - 20 = 2a(3a - 4) + 5(3a - 4) = (3a - 4)(2a + 5)$
   c. $6a^2 - 8a + 15a + 20 = -2a(3a + 4) - 5(3a + 4) = (3a + 4)(-2a - 5)$
   d. $6a^2 - 7a - 20 = (-3a)(-2a) + 8a - 15a - 20 = -2a(-3a + 4) + 5(-3a + 4) = (-3a + 3)(-2a + 5)$

7. Find the x-intercept and the y-intercept without graphing. Write the coordinates of each intercept:
   7x + 3y = 21

   a. *x*-intercept: (0,3); *y*-intercept: (7,0)
   b. *x*-intercept: (3,0); *y*-intercept: (0,7)
   c. *x*-intercept: (3,0); *y*-intercept: (0,21)
   d. *x*-intercept: (7,0); *y*-intercept: (0,3)

8. Solve the equation for *x*: $\frac{2x}{3} + \frac{5}{9} = \frac{5x+7}{18}$

   a. $x = \frac{-3}{7}$
   b. $x = \frac{1}{4}$
   c. $x = \frac{3}{7}$
   d. $x = 1$

9. Solve the inequality. Write your final answer in interval notation: -7(*x* + 5) > 6*x* + 7 -2*x*

   a. $\frac{-42}{11} < x; [\frac{-42}{11}, \infty)$
   b. $\frac{-42}{11} < x; (\frac{-42}{11}, \infty)$
   c. $\frac{-42}{11} < x; (-\infty, \frac{-42}{11})$
   d. $\frac{-42}{11} < x; (-\infty, \frac{-42}{11}]$

10. Solve the inequality involving absolute value. Write your final answer in interval notation:
    |8*x* – 9| < 12

    a. $\frac{3}{8} > x > \frac{-21}{8}; (\frac{-21}{8}, \frac{3}{8})$
    b. $\frac{-3}{2} < x < \frac{21}{8}; (\frac{-3}{2}, \frac{21}{8})$
    c. $\frac{-3}{8} < x < \frac{3}{2}; (\frac{-3}{8}, \frac{3}{2})$
    d. $\frac{-3}{8} < x < \frac{21}{8}; (\frac{-3}{8}, \frac{21}{8})$

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11. Given the function: $f(x) = 3x^2 - 5x + 6$, simplify $\frac{f(x+h)-f(x)}{h}$, $h \neq 0$

    a. $f(x) = -10x + 3h - 12h$
    b. $f(x) = -6xh + 3h\,h^2 - 5h$
    c. $f(x) = -6x + 3h - 5$
    d. $f(x) = -6x + 3h + 5$

12. The number of cubic yards of compost, *C*, needed to cover a garden with area *a* square feet is given by $C = h(a)$.

    i. A garden with area 5,000 square feet requires 25 cubic yards of compost. Express this information in terms of the function *h*.
    ii. Explain the meaning of the statement $h(2500) = 12.5$.

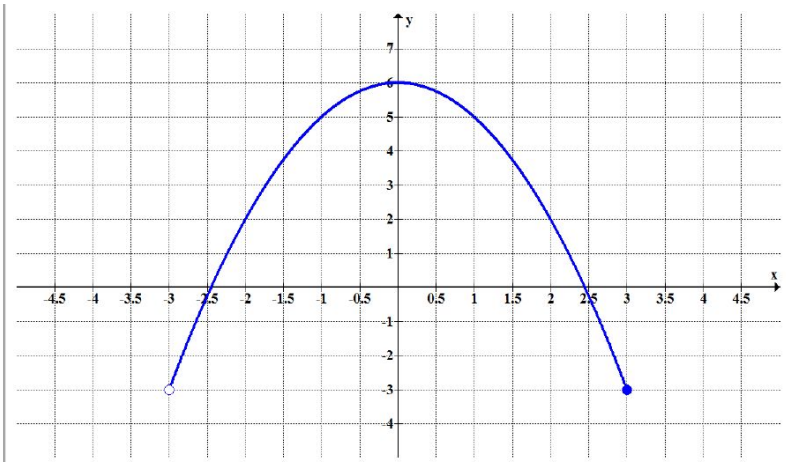
    a. i. $h(a) = \frac{125}{10000}a$
       ii. A 10000 square foot garden needs 125 cubic yards of compost.

    b. i. $h(a) = \frac{25}{2500}a$
       ii. A 2500 square foot garden needs 25 cubic yards of compost.

    c. i. $h(a) = \frac{5}{1000}a$
       ii. A 1000 square foot garden needs 5 cubic yards of compost.

    d. i. $h(a) = \frac{1}{200}a$
       ii. A 200 square foot garden needs 1 cubic yard of compost.

13. Write the domain and range of each function using interval notation.



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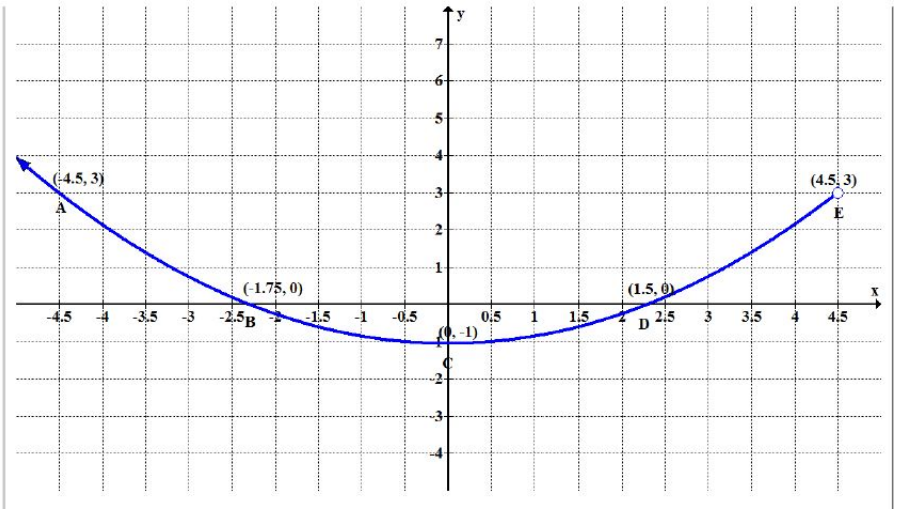
a. Domain: (-3, 6]; Range: [6, ∞)
b. Domain: (-3, 3]; Range: [-3, 6]
c. Domain: (-3, 6]; Range: (-3, 3]
d. Domain: [-3, 3]; Range: [-3, 6]

14. Find the average rate of change of each function on the interval specified for real number *b* in the simplest form: $f(x) = 3x^2 - 2x + 6 \; on \; [-1, \; -1 + b]$

a. Average rate of change: -3*b* + 8
b. Average rate of change 3*b* + 8
c. Average rate of change 3*b* – 8
d. Average rate of change $3b^2$ – 8*b*

15. Consider the graph of *f* shown below:



Estimate the average rate of change from point C to point E.

a. $\frac{4}{9}$
b. $\frac{6}{7}$
c. $\frac{8}{9}$
d. 2

16. Determine the composition, (*f* °*g*)(*x*), and domain for each function in interval notation: $f(x) = \frac{4}{x} \; and \; g(x) = x + 2$

a. $(f \circ g)(x) = f(g(x)) = \frac{4}{x+2}; Domain: (-\infty, \; -2) \cup (-2, \; \infty)$
b. $(f \circ g)(x) = f(g(x)) = \frac{4}{x+2}; Domain: (-\infty, \; -2] \cup [-2, \; \infty)$
c. $(f \circ g)(x) = f(g(x)) = \frac{4}{x+2}; Domain: (-\infty, \; -2] \cup (-2, \; \infty)$
d. $(f \circ g)(x) = f(g(x)) = \frac{4}{x+2}; Domain: (-\infty, \; -2) \cup [-2, \; \infty)$

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17. Write a formula for the function obtained when the graph is shifted as described:
$h(x) = \frac{1}{x}$ is shifted up 4 units and to the left 3 units.

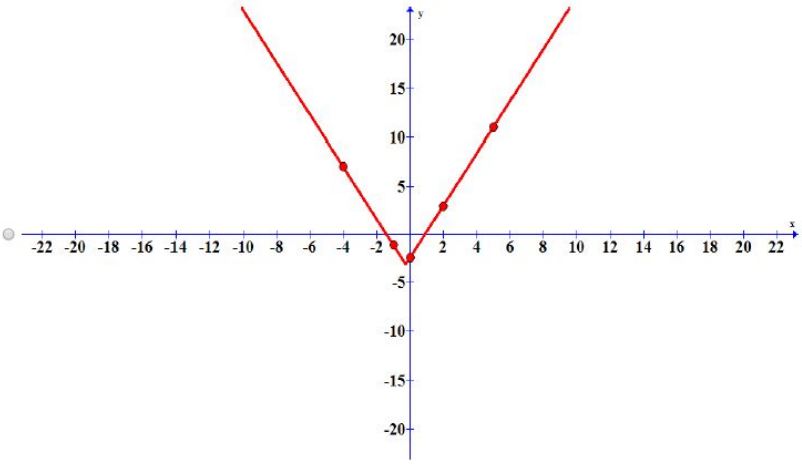
    a. $h(x) = \frac{1}{x+4} + 3$
    b. $h(x) = \frac{1}{x-4} + 3$
    c. $h(x) = \frac{1}{x+3} + 4$
    d. $h(x) = \frac{1}{x-3} + 4$

18. The true proportion p of people who give a favorable rating to the local town council is 46% with a margin of error of 9.5%. Describe this statement using an absolute value equation.

    a. $|p + 0.46| \leq 0.095$
    b. $|p - 0.46| \leq 0.095$
    c. $|p - 0.46| \leq 9.5$
    d. $|p - 0.095| \leq 0.46$

19. Graph the absolute value function. Plot at least five points by hand for each graph.
$y = \frac{2}{3}|4x + 1| - 3$

    a.



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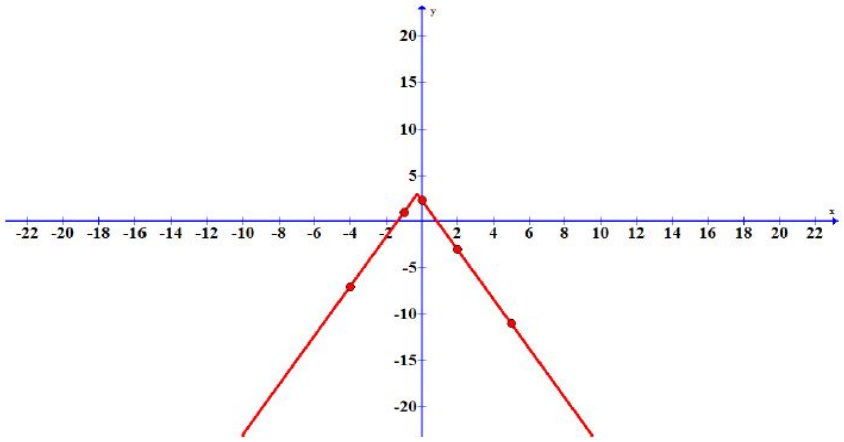
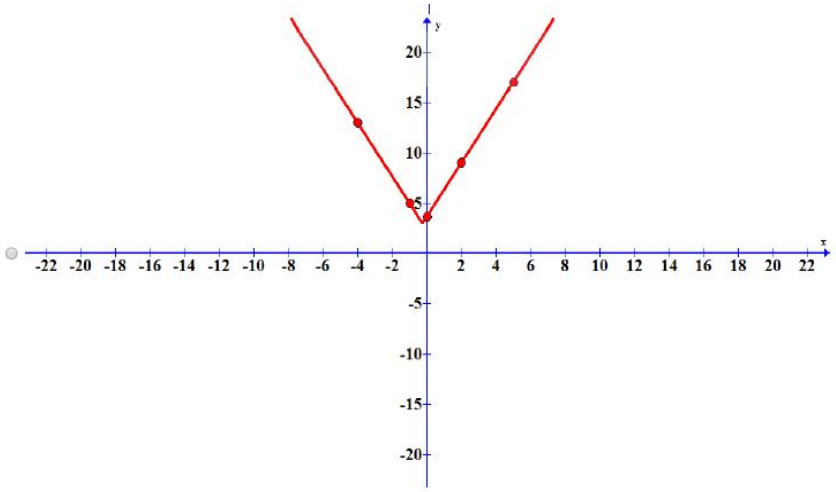
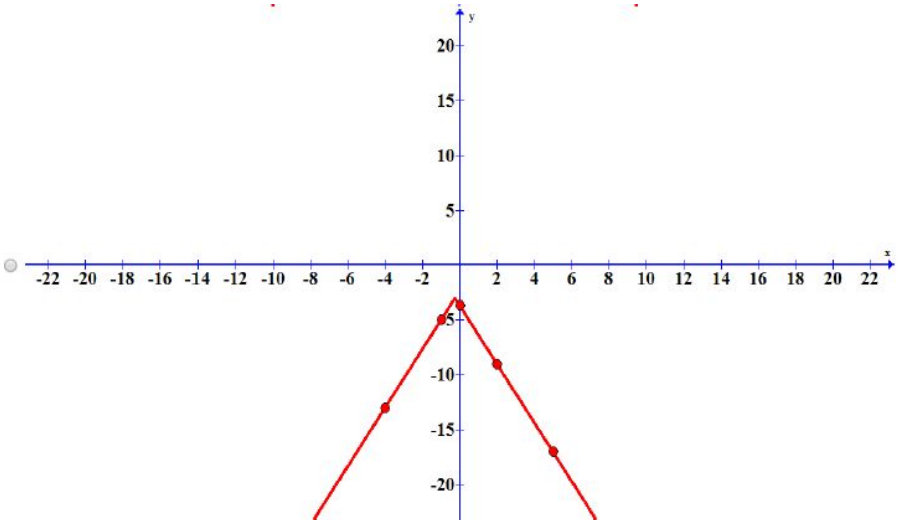
b.



c.



d.



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20. Find $f^{-1}(x)$ for each function. State the domain and range of the inverse function in interval notation: $f(x) = \frac{x-2}{2x+8}$

    a. $f^{-1}(x) = \frac{-8x-2}{2x-1}$; Domain: $(-\infty, \frac{1}{2}) \cup (\frac{1}{2}, \infty)$; Range: $(-\infty, -4) \cup (-4, \infty)$
    b. $f^{-1}(x) = \frac{8x+2}{1+2x}$; Domain: $(-\infty, \frac{-1}{2}) \cup (\frac{-1}{2}, \infty)$; Range: $(-\infty, 4) \cup (4, \infty)$
    c. $f^{-1}(x) = \frac{8x-2}{1-2x}$; Domain: $(-\infty, \frac{1}{2}) \cup (\frac{1}{2}, \infty)$; Range: $(-\infty, -4) \cup (-4, \infty)$
    d. $f^{-1}(x) = \frac{8x-2}{1+2x}$; Domain: $(-\infty, \frac{-1}{2}) \cup (\frac{1}{2}, \infty)$; Range: $(-\infty, 4) \cup (4, \infty)$

21. Find a linear equation satisfying the conditions, if possible:
    - *x*-intercept at (-3, 0)
    - *y*-intercept at (0, 9)

    a. $y = -3x + 9$
    b. $y = 3x + 9$
    c. $y = \frac{-1}{3}x + 9$
    d. $y = \frac{1}{3}x + 9$

22. An athletic stadium holds 85,000 fans. With a ticket price of $15, the average attendance has been 38,000. When the price dropped to $11, the average attendance rose to 45,000. Assuming that attendance is linearly related to ticket price, what ticket price would maximize revenue? Round ticket price to the nearest ten cents.

    a. $18.20
    b. $18.30
    c. $18.40
    d. $18.50

23. Find the degree and leading coefficient for the given function if it is a polynomial.
    $g(x) = 2(x^3 - 3)^3 + (x^4 - 3)(x^4 + 3)$

    a. Degree: 8; leading coefficient: 1
    b. Degree: 9; leading coefficient: 2
    c. Degree: 9; leading coefficient: 8
    d. Degree: 27; leading coefficient: 8

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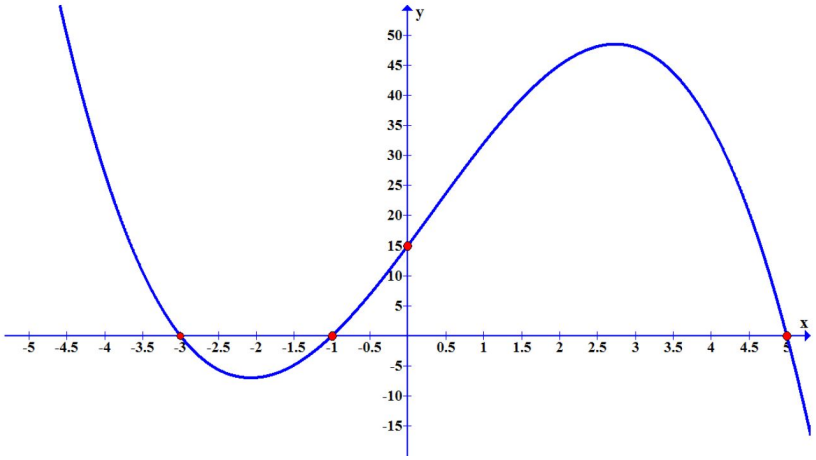
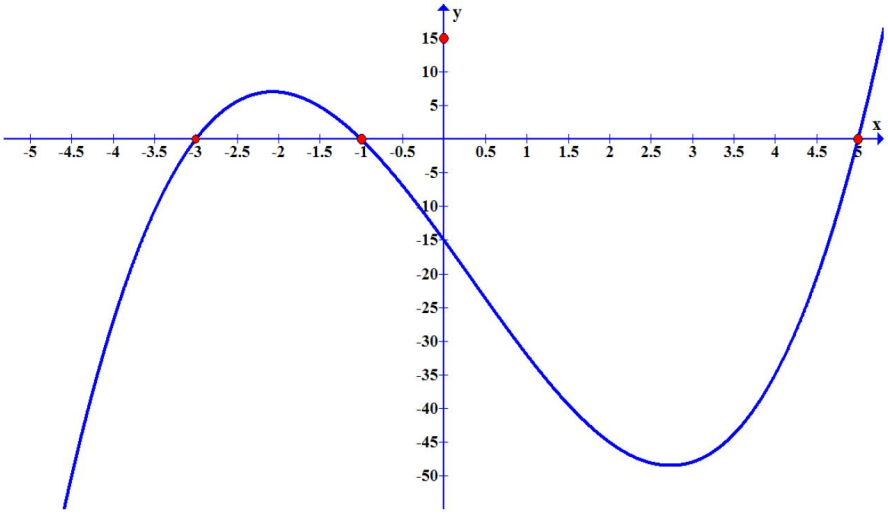
24. Graph the polynomial function. Note *x*- and *y*- intercepts, multiplicity, and end behavior.
$f(x) = (x+3)(5-x)(x+1)$

a. As *x* approaches $-\infty$, *f(x)* approaches ∞
As *x* approaches ∞, *f(x)* approaches $-\infty$



b. As *x* approaches $-\infty$, *f(x)* approaches $-\infty$
As *x* approaches ∞, *f(x)* approaches ∞



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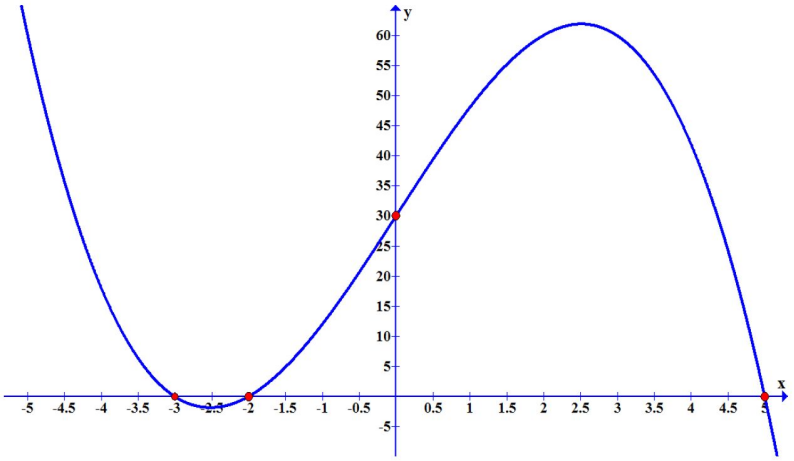
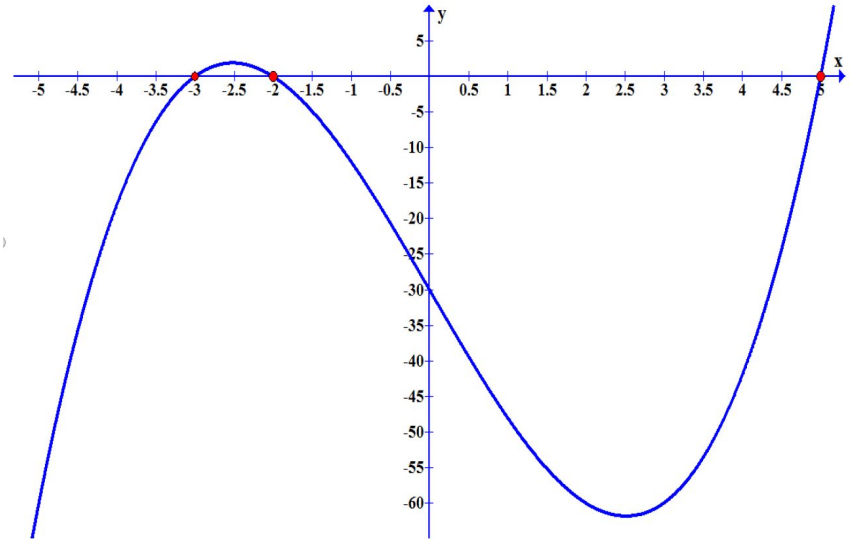
c. As *x* approaches $-\infty$, *f(x)* approaches ∞
As *x* approaches ∞, *f(x)* approaches $-\infty$



d. As *x* approaches $-\infty$, *f(x)* approaches $-\infty$
As *x* approaches ∞, *f(x)* approaches ∞



25. Use synthetic division to find the quotient. $(4x^3 - 14x^2 + 26x - 21) \div (2x - 3)$

a. $-2x^2 + 4x + 7$
b. $2x^2 + 4x - 7$
c. $2x^2 - 4x + 7$
d. $2x^2 - 4x - 7$

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26. Use the Factor Theorem to find all real zeros for the given polynomial function and one factor.
$f(x) = 4x^3 + 13x^2 - 37x - 10; x + 5$

a. $(x + 5)(-x + 2)(4x + 1)$
b. $(x + 5)(x + 2)(4x - 1)$
c. $(x + 5)(x -+ 2)(4x + 1)$
d. $(x + 5)(x - 2)(4x - 1)$

27. Find the inverse of the function. $f(x) = 4 - 7x^3$

a. $f^{-1}(x) = \frac{\sqrt[3]{x-12}}{7}$
b. $f^{-1}(x) = \frac{\sqrt[3]{4-x}}{7}$
c. $f^{-1}(x) = \frac{\sqrt[3]{49x-196}}{7}$
d. $f^{-1}(x) = \frac{\sqrt[3]{196-49x}}{7}$

28. Joanie opened a retirement account with 2.95% APR in the year 2000. Her initial deposit was $22,050. How much will the account be worth in 2025 if interest compounds monthly? How much more would she make if interest compounded continuously? Round to the nearest cent.

a. $45,261.19; $46,106.55
b. $46,058.28; $46,099.98
c. $46,058.28; $46,099.98
d. $46,081.26; $46,099.94

29. Solve each equation for *x*:
Log (4*x* + 9) + log(5*x* – 2) = log(2*x*)

a. $\frac{-35+\sqrt{2665}}{40}$
b. $\frac{-35\pm\sqrt{2665}}{40}$
c. $\frac{35+\sqrt{2665}}{40}$
d. $\frac{35\pm\sqrt{2665}}{40}$

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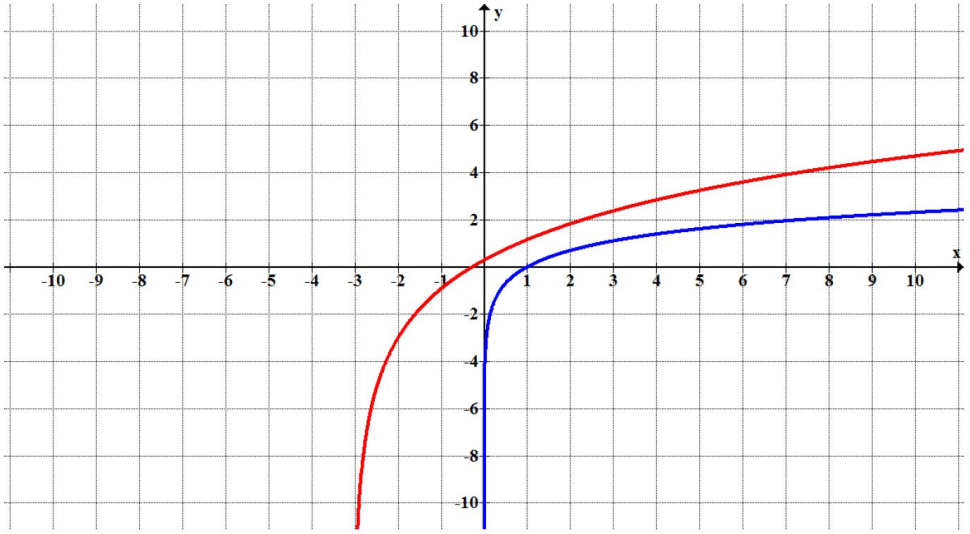
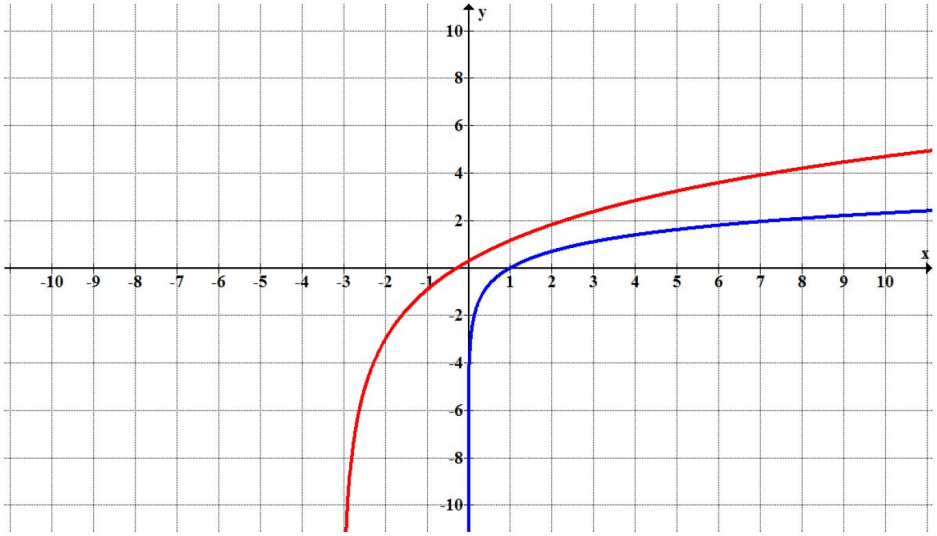
30. Start with the graph of $f(x) = \ln(x)$. Then write a function, $g(x)$, that results from the given transformation. Graph both $f(x)$ and its transformation on the same axes.

    Shift $f(x)$ 3 units down, left 3 units, stretched by a factor of 3.

    a. $g(x) = 3\ln(x + 3) - 3$



    b. $g(x) = 3\ln(x - 3) - 3$



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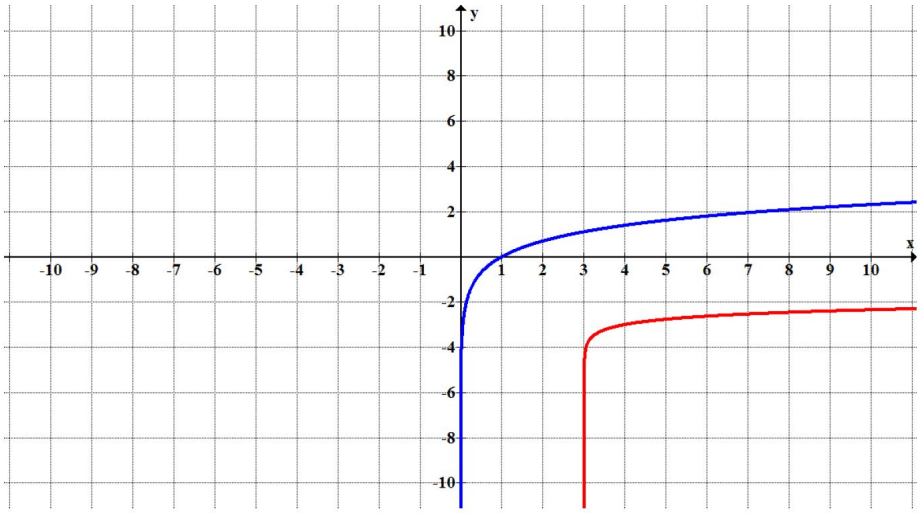
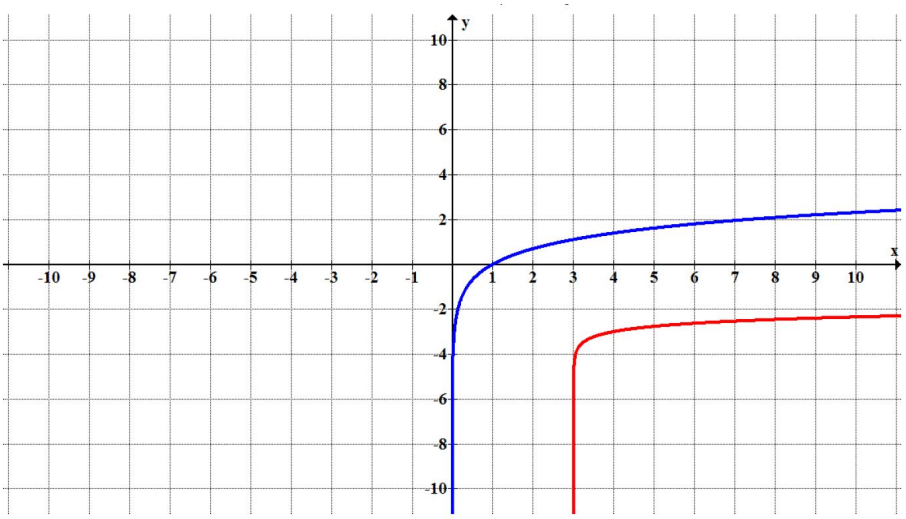
c. $g(x) = \frac{1}{3}\ln(x + 3) - 3$



d. $g(x) = \frac{1}{3}\ln(x - 3) - 3$



31. For the graph of $f(x) = 0.5^x$, write the function that results from the following transformation.

Shift *f(x)* 2 units down and 5 units left.

a. $f(x) = 0.5^{x-5} - 2$
b. $f(x) = 0.5^{x-5} + 2$
c. $f(x) = 0.5^{x+5} - 2$
d. $f(x) = 0.5^{x+5} + 2$

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32. Solve each system by substitution.
$x + 4y = 13$ and $4x - 3y = 8$

    a. $x = \frac{-50}{19}; y = \frac{47}{19}$
    b. $x = \frac{-47}{19}; y = \frac{-50}{19}$
    c. $x = \frac{-71}{19}; y = \frac{44}{19}$
    d. $x = \frac{71}{19}; y = \frac{44}{19}$

33. Use a system of linear equations with two variables and two equations to solve.

    A pickup truck and Lamborghini enter a highway running east-west at the same exit heading in opposite directions. The truck entered the highway 55 minutes before the Lamborghini did, and traveled 35 mph slower than the Lamborghini. After 4 hours from the time the Lamborghini entered the highway, the vehicles were 675 miles apart. Find the speed of each car, assuming they were driven on cruise control.

    a. The truck was traveling 66.875 miles per hour and the Lamborghini was driving 101.875 miles per hour.
    b. The truck was traveling 66.88 miles per hour and the Lamborghini was driving 101.88 miles per hour.
    c. The truck was traveling 66.9 miles per hour and the Lamborghini was driving 101.9 miles per hour.
    d. The truck was traveling 67 miles per hour and the Lamborghini was driving 102 miles per hour.

34. Solve each system by substitution.

    $2x - 5y + 3z = 3$
    $-x + 7y - 12z = 3$
    $6x - 12y + z = 12$

    a. $x = 0, y = 1, z = 4$
    b. $x = 1, y = 4, z = 0$
    c. $x = 4, y = 0, z = 1$
    d. $x = 4, y = 1, z = 0$

35. Use the definition of common and natural logarithms to simplify. Round answer to 4 decimal places. $\log(10^{4.35})$

    a. $x = 0.6385$
    b. $x = 4.35$
    c. $x = 22387.2114$
    d. $x = \frac{1}{4.35}$

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ANSWERS TO SAMPLE QUESTIONS

1. (**c**)
2. (**b**)
3. (**b**)
4. (**b**)
5. (**d**)
6. (**a**)
7. (**b**)
8. (**a**)
9. (**c**)
10. (**d**)
11. (**c**)
12. (**d**)
13. (**b**)
14. (**c**)
15. (**c**)
16. (**a**)
17. (**c**)
18. (**b**)
19. (a)
20. (**a**)
21. (**b**)
22. (**c**)
23. (**b**)
24. (**a**)
25. (**c**)
26. (**c**)
27. (**d**)
28. (**b**)
29. (**a**)
30. (**a**)
31. (**c**)
32. (**d**)
33. (**a**)
34. (**d**)
35. (**b**)

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