This practice exam will help to prepare you for the actual final exam. The actual final exam will be 40 questions—one fourth the length of this practice final.

**MULTIPLE CHOICE.** Choose the one alternative that best completes the statement or answers the question.

**Simplify the exponential expression.**

1) \( \frac{x^{-9}}{x^2} \)

A) \( x^{11} \)  
B) \( \frac{1}{x^{11}} \)  
C) \( \frac{1}{x^{18}} \)  
D) \( \frac{1}{x^7} \)

2) \((-5x^4)(-2x^8)\)

A) \(10x^{32}\)  
B) \(-10x^{12}\)  
C) \(10x^{12}\)  
D) \(-10x^{32}\)

3) \((x^5y)^3\)

A) \(x^8y^4\)  
B) \(x^{15}y^3\)  
C) \(x^8y\)  
D) \(x^{15}y\)

4) \((7x^7)^2\)

A) \(49x^7\)  
B) \(7x^{14}\)  
C) \(7x^9\)  
D) \(49x^{14}\)

5) \((6x^{3/2})(4x^{1/3})\)

A) \(24x^{3/2}\)  
B) \(24x^{11/6}\)  
C) \(24x^{11/5}\)  
D) \(24x^{2/3}\)

6) \((9x^{3/4})(4x^{2/3})\)

A) \(36x^{3/4}\)  
B) \(36x^{5/12}\)  
C) \(36x^{17/7}\)  
D) \(36x^{17/12}\)

7) \(\frac{21x^{3/2}}{3x^{1/3}}\)

A) \(7x^{7/6}\)  
B) \(7x^{1/3}\)  
C) \(7x^{7/2}\)  
D) \(18x^{1/3}\)

8) \((100x^{10}y^{10})^{1/2}\)

A) \(10x^5y^5\)  
B) \(100x^5y^5\)  
C) \(1,000x^{20}y^{10}\)  
D) \(5x^5y^5\)

**Add or subtract terms whenever possible.**

9) \(5\sqrt{2} - 8\sqrt{50}\)

A) \(35\sqrt{2}\)  
B) \(-35\sqrt{2}\)  
C) \(-45\sqrt{2}\)  
D) \(-3\sqrt{2}\)

10) \(4\sqrt{2x} - 2\sqrt{2x}\)

A) \(6\sqrt{2}\)  
B) \(2\sqrt{2x}\)  
C) \(-8\sqrt{4x}\)  
D) \(2x\sqrt{4}\)

11) \(-9\sqrt{2} - 4\sqrt{50}\)

A) \(29\sqrt{2}\)  
B) \(-13\sqrt{2}\)  
C) \(-29\sqrt{2}\)  
D) \(-11\sqrt{2}\)

12) \(8\sqrt{125} - 3\sqrt{45} + 5\sqrt{180}\)

A) \(-266\sqrt{5}\)  
B) \(8\sqrt{5}\)  
C) \(266\sqrt{5}\)  
D) \(61\sqrt{5}\)

**Simplify the expression.**

13) \(\sqrt{\frac{12x^3}{3x}}\)

A) \(3x^2\)  
B) \(2|x|\sqrt{3}\)  
C) \(\frac{2x^2}{\sqrt{3}}\)  
D) \(2|x|\)

14) \(\sqrt{\frac{144x^4}{6x}}\)

A) \(\frac{x^2\sqrt{144}}{6}\)  
B) \(2|x|\sqrt{6x}\)  
C) \(144x^3\)  
D) \(6|x|\sqrt{x}\)
Factor the polynomial, or tell if it is prime.

15) \( \sqrt{175x^2} \)
   A) \( 7x^2 \sqrt{5} \)  B) \( 5x \sqrt{7} \)  C) \( 175x \)  D) \( 5 \sqrt{7x} \)

16) \( \sqrt{20} \)
   A) \( 4 \sqrt{5} \)  B) \( 2 \sqrt{5} \)  C) \( 10 \)  D) \( \) 

Find all numbers that must be excluded from the domain of the rational expression.

25) \( \frac{5}{x - 7} \)
   A) \( x \neq -5 \)  B) \( x \neq -7 \)  C) \( x \neq 0 \)  D) \( x \neq 7 \)

26) \( \frac{7}{x + 5} \)
   A) \( x \neq 5 \)  B) \( x \neq 0 \)  C) \( x \neq -7 \)  D) \( x \neq -5 \)

27) \( \frac{x + 8}{x^2 - 49} \)
   A) \( x \neq -49 \)  B) \( x \neq 7, x \neq -7 \)  C) \( x \neq 7 \)  D) \( x \neq -8 \)

28) \( \frac{x + 8}{x^2 - 15x + 56} \)
   A) \( x \neq -8 \)  B) \( x \neq 7, x \neq -8 \)  C) \( x \neq -7, x \neq -8 \)  D) \( x \neq 0 \)

Multiply or divide as indicated.

29) \( \frac{3x}{6x + 3} \cdot \frac{10x + 5}{3} \)
   A) \( \frac{5x}{9} \)  B) \( \frac{x}{3} \)  C) \( \frac{5}{3} \)  D) \( \frac{5x}{3} \)
30) \( \frac{5x - 5}{x} \cdot \frac{8x^2}{6x - 6} \)
   A) \( \frac{40x^3 - 40x^2}{6x^2 - 6x} \)
   B) \( \frac{3}{20x} \)
   C) \( \frac{20x}{3} \)
   D) \( \frac{30x^2 + 60x + 30}{8x^3} \)

31) \( \frac{1}{x + 6} + \frac{5}{x^2 - 36} \)
   A) \( \frac{x - 6}{5} \)
   B) \( x - 6 \)
   C) \( \frac{x + 6}{5} \)
   D) \( \frac{5}{x - 6} \)

32) \( \frac{x^2 + 7x + 12}{x^2 + 9x + 20} + \frac{x^2 + 3x}{x^2 + 15x + 50} \)
   A) \( \frac{x + 10}{x^2 + 5x} \)
   B) \( \frac{x + 10}{x} \)
   C) \( x + 10 \)
   D) \( \frac{x}{x^2 + 9x + 20} \)

Solve the rational equation.

33) \( \frac{x}{x - 3} - 4 = \frac{3}{x - 3} \)
   A) \( \emptyset \)
   B) \( \{-3, 3\} \)
   C) \( \{-3\} \)
   D) \( \{3\} \)

34) \( \frac{4}{x - 4} + \frac{4}{2x - 8} = 6 \)
   A) \( \{60\} \)
   B) \( \{5\} \)
   C) \( \{-3\} \)
   D) \( \{1\} \)

35) \( \frac{7}{y + 2} - \frac{9}{y - 2} = \frac{4}{y^2 - 4} \)
   A) \( \{18\} \)
   B) \( \{-18\} \)
   C) \( \sqrt{63} \)
   D) \( \{36\} \)

Solve the rational equation.

36) \( \frac{1}{x + 4} + \frac{2}{x + 3} = \frac{-1}{x^2 + 7x + 12} \)
   A) \( \{3\} \)
   B) \( \{-4\} \)
   C) \( \{0\} \)
   D) \( \emptyset \)

Solve the formula for the specified variable.

37) \( S = 2\pi h + 2\pi r^2 \) for \( h \)
   A) \( h = \frac{S}{2\pi} - 1 \)
   B) \( h = S - r \)
   C) \( h = \frac{S - 2\pi r^2}{2\pi} \)
   D) \( h = 2\pi(S - r) \)

38) \( P = 2L + 2W \) for \( L \)
   A) \( L = \frac{P - W}{2} \)
   B) \( L = P - W \)
   C) \( L = P - 2W \)
   D) \( L = \frac{P - 2W}{2} \)

39) \( \frac{1}{a} + \frac{1}{b} = \frac{1}{c} \) for \( c \)
   A) \( c = a + b \)
   B) \( c = \frac{ab}{a + b} \)
   C) \( c = \frac{a + b}{ab} \)
   D) \( c = ab(a + b) \)

40) \( P = s_1 + s_2 + s_3 \) for \( s_2 \)
   A) \( s_2 = P + s_1 - s_3 \)
   B) \( s_2 = P + s_1 + s_3 \)
   C) \( s_2 = s_1 + s_3 - P \)
   D) \( s_2 = P - s_1 - s_3 \)

Solve the quadratic equation.

41) \( x^2 + 5x - 14 = 0 \)
   A) \( \{-7, 2\} \)
   B) \( \{7, -2\} \)
   C) \( \{-7, 1\} \)
   D) \( \{7, 2\} \)

42) \( (x - 7)^2 = 25 \)
   A) \( \{-12, 2\} \)
   B) \( \{-5, 5\} \)
   C) \( \{32\} \)
   D) \( \{2, 12\} \)
43) \(x^2 + 5x + 2 = 0\)

A) \(\left\{ \frac{-5 - \sqrt{33}}{2}, \frac{-5 + \sqrt{33}}{2} \right\}\)

B) \(\left\{ \frac{-5 - \sqrt{17}}{2}, \frac{-5 + \sqrt{17}}{2} \right\}\)

C) \(\left\{ \frac{-5 - \sqrt{17}}{10}, \frac{-5 + \sqrt{17}}{10} \right\}\)

D) \(\left\{ \frac{5 - \sqrt{17}}{2}, \frac{5 + \sqrt{17}}{2} \right\}\)

44) \(2x^2 = -10x - 5\)

A) \(\left\{ \frac{-10 - \sqrt{15}}{2}, \frac{-10 + \sqrt{15}}{2} \right\}\)

B) \(\left\{ \frac{-5 - \sqrt{15}}{2}, \frac{-5 + \sqrt{15}}{2} \right\}\)

C) \(\left\{ \frac{-5 - \sqrt{15}}{4}, \frac{-5 + \sqrt{15}}{4} \right\}\)

D) \(\left\{ \frac{-5 - \sqrt{35}}{2}, \frac{-5 + \sqrt{35}}{2} \right\}\)

Solve the inequality. Use interval notation to express the solution set and graph the solution set on a number line.

45) \(3x - 9 \leq 3\)

A) \((-\infty, 4]\)

B) \([4, \infty)\)

C) \([-2, \infty)\)

D) \((-\infty, -2]\)

46) \(20x - 24 > 4(4x - 9)\)

A) \((-3, \infty)\)

B) \((-15, \infty)\)

C) \([-3, \infty)\)

D) \((\infty, -3)\)

47) \(-4 < x + 1 \leq 3\)

A) \([-5, 2]\)

B) \((-3, 4]\)

C) \((-5, 2]\)

D) \([-3, 4]\)
48) \(6 \leq \frac{9}{2}x - 3 < 24\)

\[
\begin{align*}
-4 & -3 -2 -1 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 \\
-6 & -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14
\end{align*}
\]

A) [2, 6]

B) [2, 3]

C) [2, 6]

D) [2, 3]

50) \(3x - 3 = 18\)

\[
\begin{align*}
-4 & -3 -2 -1 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 \\
-6 & -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14
\end{align*}
\]

A) [9, -3]

B) [3]

C) \(\emptyset\)

D) [3, -9]

51) \(|6x + 4| - 4 = -11\)

\[
\begin{align*}
-4 & -3 -2 -1 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 \\
-6 & -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14
\end{align*}
\]

A) \(\left\{\frac{1}{2}, \frac{11}{6}\right\}\)

B) \(\left\{-\frac{11}{6}\right\}\)

C) \(\left\{-\frac{11}{6}, -\frac{1}{2}\right\}\)

D) \(\emptyset\)

52) \(|5 - \frac{3}{4}x| = 6 = 11\)

\[
\begin{align*}
-4 & -3 -2 -1 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 \\
-6 & -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14
\end{align*}
\]

A) \(\left(-16, \frac{88}{3}\right)\)

B) \(\left(16, -\frac{88}{3}\right)\)

C) \(\left(-16, \frac{88}{3}\right)\)

D) \(\left(-9, 7\right)\)

Identify the intercepts.

53) \(A) (1, 0), (0, 7)\)

\(B) (-7, 0), (0, 7)\)

\(C) (-1, 0), (0, -7)\)

\(D) (-1, 0), (0, 7)\)

54) \(A) (0, -4)\)

\(B) (4, 0), (-4, 0)\)

\(C) (4, 0), (-4, 0), (0, 0)\)

\(D) (4, 0), (-4, 0), (0, -4)\)
Use the graph to determine the function's domain and range.

55) A) domain: [0, ∞)
range: [0, ∞)
B) domain: [0, ∞)
range: (−∞, ∞)
C) domain: [0, ∞)
range: [2, ∞)
D) domain: (−∞, ∞)
range: [2, ∞)

56) A) domain: (−∞, −4]
range: (−∞, 2]
B) domain: (−∞, ∞)
range: (−∞, ∞)
C) domain: (−∞, ∞)
range: (−∞, 2]
D) domain: (−∞, −4) or (−4, ∞)
range: (−∞, 2) or (2, ∞)

Find and simplify the difference quotient \( \frac{f(x + h) - f(x)}{h} \), \( h \neq 0 \) for the given function.

57) \( f(x) = 9x - 7 \)
A) 9
B) \( 9 + \frac{-14}{h} \)
C) 0
D) \( 9 + \frac{18(x - 7)}{h} \)

58) \( f(x) = 2x + 3 \)
A) \( 2 + \frac{4(x + 3)}{h} \)
B) \( 2 + \frac{6}{h} \)
C) 2
D) 0

59) \( f(x) = 6x^2 \)
A) \( 6(2x^2 + 2xh + h^2) \)
B) \( 6(2x + h) \)
C) 6
D) \( \frac{12}{h} + x + 6h \)

60) \( f(x) = x^2 + 4x - 7 \)
A) \( 2x + h - 7 \)
B) 1
C) \( \frac{2x^2 + 2x + 2xh + h^2 + h - 14}{h} \)
D) \( 2x + h + 4 \)

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

61) \( f(x) = x^3 - 4x \)
A) Odd
B) Neither
C) Even

62) \( f(x) = x^4 - x^3 \)
A) Even
B) Odd
C) Neither
Find the slope of the line that goes through the given points.

65) (2, 3), (-8, -8)
   A) $-\frac{11}{10}$       B) $\frac{11}{10}$
   C) $\frac{5}{6}$           D) $\frac{10}{11}$

66) (-1, 9), (-8, -5)
   A) $\frac{10}{3}$       B) 2
   C) $\frac{3}{10}$       D) $\frac{1}{2}$

67) (3, 7), (9, 7)
   A) 0       B) 1
   C) 15      D) 3

68) ($\frac{1}{5}$, -3) and ($\frac{1}{5}$, -2)
   A) $-\frac{5}{2}$
   B) $\frac{25}{2}$
   C) Undefined
   D) $-\frac{2}{5}$

Use the given conditions to write an equation for the line in slope-intercept form.

69) Passing through (4, 8) and (6, 2)
   A) $y = 3x + 20$       B) $y = 3x - 4$
   C) $y = -3x + 20$      D) $y = -\frac{1}{3}x + \frac{28}{3}$

70) Slope = $\frac{3}{4}$ passing through (8, 7)
   A) $y = \frac{3}{4}x + 1$       B) $y = \frac{3}{4}x + 13$
   C) $y = \frac{3}{4}x + \frac{21}{4}$
   D) $y = \frac{3}{4}x + \frac{13}{4}$

71) Slope = $\frac{2}{3}$, y-intercept = 4
   A) $f(x) = \frac{2}{3}x + 4$       B) $f(x) = \frac{3}{2}x + 6$
   C) $f(x) = \frac{2}{3}x - 4$       D) $f(x) = -\frac{2}{3}x - 4$

72) Passing through (-3, -3) and (-2, -5)
   A) $y = -\frac{1}{2}x - \frac{9}{2}$
   B) $y = 2x + 3$
   C) $y = 2x - 9$
   D) $y = -2x - 9$
Use the given conditions to write an equation for the line in the indicated form.

73) Passing through (5, 2) and parallel to the line whose equation is \( y = -\frac{1}{9}x + 8 \);
slope-intercept form
A) \( y = -\frac{1}{9}x + \frac{23}{9} \)  
B) \( y = -\frac{1}{9}x - \frac{23}{9} \)
C) \( y = \frac{1}{9}x - \frac{23}{9} \)  
D) \( y = -9x - 23 \)

74) Passing through (2, 5) and perpendicular to the line whose equation is \( y = \frac{1}{7}x + 6 \);
slope-intercept form
A) \( y = -\frac{1}{7}x - \frac{19}{7} \)  
B) \( y = -7x + 19 \)
C) \( y = -7x - 19 \)  
D) \( y = 7x - 19 \)

75) Passing through (2, 5) and parallel to the line whose equation is \( 2x + y - 8 = 0 \);
slope-intercept form
A) \( y = -2x + 9 \)  
B) \( y = 2x - 9 \)
C) \( y = -\frac{1}{2}x - \frac{9}{2} \)  
D) \( y = -2x - 9 \)

76) Passing through (5, 5) and perpendicular to the line whose equation is \( -3x + y - 9 = 0 \);
slope-intercept form
A) \( y = -\frac{1}{3}x - \frac{20}{3} \)  
B) \( y = -\frac{1}{3}x + \frac{20}{3} \)
C) \( y = \frac{1}{3}x - \frac{20}{3} \)  
D) \( y = -3x - 20 \)

For the given functions \( f \) and \( g \), find the indicated composition.

78) \( f(x) = 7x^2 - 8x \), \( g(x) = x^2 - 3x - 40 \)
Find \( \frac{f}{g} \).
A) \( \frac{7x}{x + 1} \)  
B) \( \frac{7x - 8}{-3} \)
C) \( \frac{7 - x}{40} \)  
D) \( \frac{7x^2 - 8x}{x^2 - 3x - 40} \)

79) \( f(x) = 7 - 9x \), \( g(x) = -5x + 9 \)
Find \( f + g \).
A) \(-5x + 7 \)  
B) \( 2x \)
C) \(-14x + 16 \)  
D) \(-4x + 16 \)

80) \( f(x) = 4x - 6 \), \( g(x) = 6x - 3 \)
Find \( fg \).
A) \( 24x^2 - 39x + 18 \)  
B) \( 10x^2 - 48x - 9 \)
C) \( 24x^2 - 48x + 18 \)  
D) \( 24x^2 + 18 \)

Given functions \( f \) and \( g \), perform the indicated operations.

77) \( f(x) = 8x - 2 \), \( g(x) = 5x - 4 \)
Find \( f - g \).
A) \( 3x - 6 \)  
B) \( 3x + 2 \)
C) \( 13x - 6 \)  
D) \( -3x - 2 \)

81) \( f(x) = 7x^2 - 2x \), \( g(x) = 9x - 6 \)
\((f \circ g)(12)\)
A) 8850  
B) 63,774
C) 72,624  
D) 100,368

82) \( f(x) = x^2 + 2x - 2 \), \( g(x) = x^2 + 2x - 1 \)
\((f \circ g)(2)\)
A) 48  
B) 61
C) 59  
D) 46

83) \( f(x) = 4x + 13 \), \( g(x) = 4x - 1 \)
\((f \circ g)(x)\)
A) \( 16x + 9 \)  
B) \( 16x + 51 \)
C) \( 16x + 17 \)  
D) \( 16x + 12 \)

84) \( f(x) = -3x + 3 \), \( g(x) = 6x + 8 \)
\((g \circ f)(x)\)
A) \(-18x + 27 \)  
B) \( 18x + 26 \)
C) \(-18x + 26 \)  
D) \(-18x - 10 \)
Find the inverse of the one-to-one function.

85) \( f(x) = 8x + 3 \)
   A) \( f^{-1}(x) = \frac{x - 3}{8} \)
   B) \( f^{-1}(x) = \frac{y - 3}{8} \)
   C) \( f^{-1}(x) = \frac{x + 3}{8} \)
   D) \( f^{-1}(x) = \frac{8x - 3}{8} \)

86) \( f(x) = \frac{3x + 4}{7} \)
   A) \( f^{-1}(x) = \frac{7}{3x - 4} \)
   B) \( f^{-1}(x) = \frac{7x - 4}{3} \)
   C) \( f^{-1}(x) = \frac{7}{3x + 4} \)
   D) \( f^{-1}(x) = \frac{7x + 4}{3} \)

87) \( f(x) = \frac{2}{3x + 7} \)
   A) \( f^{-1}(x) = \frac{7}{3} - \frac{2}{3x} \)
   B) \( f^{-1}(x) = \frac{3x + 7}{2} \)
   C) \( f^{-1}(x) = \frac{2}{3x} - \frac{7}{3} \)
   D) \( f^{-1}(x) = \frac{2}{3y} - \frac{7}{3} \)

88) \( f(x) = (x + 4)^3 \)
   A) \( f^{-1}(x) = \sqrt[3]{x} - 64 \)
   B) \( f^{-1}(x) = \sqrt[3]{x} + 4 \)
   C) \( f^{-1}(x) = \sqrt[3]{x} - 4 \)
   D) \( f^{-1}(x) = 3\sqrt[3]{x} - 4 \)

Find the distance between the pair of points.

89) \((3, -3)\) and \((-9, 2)\)
   A) 26
   B) 169
   C) 14
   D) 13

90) \((6, -1)\) and \((2, -3)\)
   A) 2
   B) \(2\sqrt{5}\)
   C) 12
   D) \(12\sqrt{3}\)

91) \((-4\sqrt{15}, -3)\) and \((-2\sqrt{15}, -1)\)
   A) 8
   B) 64
   C) 32
   D) 7

92) \((0, 0)\) and \((10, -4)\)
   A) \(2\sqrt{29}\)
   B) \(\sqrt{14}\)
   C) 116
   D) 6

Find the midpoint of the line segment whose end points are given.

93) \((5, 6)\) and \((6, 4)\)
   A) \((11, 10)\)
   B) \((-\frac{1}{2}, 1)\)
   C) \((-1, 2)\)
   D) \((-\frac{11}{2}, 5)\)

94) \((-2, 4)\) and \((4, 6)\)
   A) \((-6, -2)\)
   B) \((2, 10)\)
   C) \((1, 5)\)
   D) \((-3, -1)\)

95) \((-\frac{2}{5}, -2)\) and \((\frac{4}{5}, \frac{4}{3})\)
   A) \((\frac{3}{5}, \frac{5}{3})\)
   B) \((\frac{2}{5}, -\frac{2}{3})\)
   C) \((-\frac{3}{5}, -\frac{5}{3})\)
   D) \((\frac{1}{5}, -\frac{1}{3})\)

96) \((7\sqrt{2}, -7\sqrt{5})\) and \((12\sqrt{2}, -2\sqrt{5})\)
   A) \((19\sqrt{2}, -9\sqrt{5})\)
   B) \((\frac{5\sqrt{2}}{2}, \frac{5\sqrt{5}}{2})\)
   C) \((-\frac{5\sqrt{2}}{2}, -\frac{5\sqrt{5}}{2})\)
   D) \((\frac{19\sqrt{2}}{2}, -9\sqrt{5})\)

9
Find the center and the radius of the circle.

97) \((x - 9)^2 + (y - 6)^2 = 25\)
   A) \((9, 6), r = 5\)  
   B) \((-6, -9), r = 25\)  
   C) \((6, 9), r = 5\)  
   D) \((-9, -6), r = 25\)

98) \((x + 5)^2 + (y + 4)^2 = 9\)
   A) \((5, 4), r = 9\)  
   B) \((4, 5), r = 9\)  
   C) \((-5, -4), r = 3\)  
   D) \((-4, -5), r = 3\)

Write the standard form of the equation of the circle with the given center and radius.

99) \((0, 0); 3\)
   A) \(x^2 + y^2 = 6\)  
   B) \(x^2 + y^2 = 9\)  
   C) \(x^2 + y^2 = 3\)  
   D) \(x^2 - y^2 = 3\)

100) \((0, 0); 2\sqrt{2}\)
   A) \(x^2 + y^2 = 64\)  
   B) \(x^2 + y^2 = 4\)  
   C) \(x^2 + y^2 = 8\)  
   D) \(x^2 + y^2 = 2\sqrt{2}\)

Find the product and write the result in standard form.

101) \((1 + 5i)(1 - 5i)\)
   A) \(1 - 25i\)  
   B) \(26\)  
   C) \(-24\)  
   D) \(1 - 25i^2\)

102) \((-6 - 7i)(5 + i)\)
   A) \(-37 - 41i\)  
   B) \(-23 - 41i\)  
   C) \(-37 + 29i\)  
   D) \(-23 + 29i\)

Perform the indicated operations and write the result in standard form.

103) \(\frac{-35 + \sqrt{-98}}{7}\)
   A) \(-5 + i\sqrt{2}\)  
   B) \(-5 + i\sqrt{7}\)  
   C) \(-5 - i\sqrt{2}\)  
   D) \(5 + i\sqrt{2}\)

104) \(\sqrt{-64(4 - \sqrt{-36})}\)
   A) \(32i - 48\)  
   B) \(32i - 48i^2\)  
   C) \(48 + 32i\)  
   D) \(32i + 48i^2\)

Find the coordinates of the vertex for the parabola defined by the given quadratic function.

105) \(f(x) = (x - 4)^2 - 4\)
   A) \((4, -4)\)  
   B) \((-4, 0)\)  
   C) \((0, -4)\)  
   D) \((4, 4)\)

106) \(y + 9 = (x - 3)^2\)
   A) \((9, 3)\)  
   B) \((-3, -9)\)  
   C) \((9, -3)\)  
   D) \((3, -9)\)

107) \(f(x) = -x^2 + 4x + 2\)
   A) \((-2, -10)\)  
   B) \((2, 6)\)  
   C) \((-2, -2)\)  
   D) \((4, 2)\)

108) \(f(x) = 3 - x^2 + 2x\)
   A) \((1, -4)\)  
   B) \((-1, -4)\)  
   C) \((1, 4)\)  
   D) \((-1, 4)\)

Solve the problem.

109) A developer wants to enclose a rectangular grassy lot that borders a city street for parking. If the developer has 240 feet of fencing and does not fence the side along the street, what is the largest area that can be enclosed?
   A) \(3600\) ft\(^2\)  
   B) \(10,800\) ft\(^2\)  
   C) \(7200\) ft\(^2\)  
   D) \(14,400\) ft\(^2\)

110) You have 96 feet of fencing to enclose a rectangular plot that borders on a river. If you do not fence the side along the river, find the length and width of the plot that will maximize the area.
   A) length: 48 feet, width: 24 feet  
   B) length: 48 feet, width: 48 feet  
   C) length: 72 feet, width: 24 feet  
   D) length: 24 feet, width: 24 feet

111) A rectangular playground is to be fenced off and divided in two by another fence parallel to one side of the playground. 312 feet of fencing is used. Find the dimensions of the playground that maximize the total enclosed area.
   A) 52 ft by 78 ft  
   B) 39 ft by 78 ft  
   C) 78 ft by 78 ft  
   D) 26 ft by 117 ft
112) An arrow is fired into the air with an initial velocity of 96 feet per second. The height in feet of the arrow t seconds after it was shot into the air is given by the function \( h(x) = -16t^2 + 96t \). Find the maximum height of the arrow.
A) 144 ft  
B) 432 ft  
C) 240 ft  
D) 48 ft

Find the zeros of the polynomial function and give the multiplicity for each zero. State whether the graph crosses the x-axis or touches the x-axis and turns around, at each zero.

113) \( f(x) = 3(x - 6)(x - 4)^2 \)
A) -6, multiplicity 1, touches x-axis and turns around; -4, multiplicity 2, crosses x-axis  
B) 6, multiplicity 1, touches x-axis and turns around; 4, multiplicity 2, crosses x-axis  
C) 6, multiplicity 1, crosses x-axis; 4, multiplicity 2, touches x-axis and turns around  
D) -6, multiplicity 1, crosses x-axis; -4, multiplicity 2, touches x-axis and turns around

114) \( f(x) = \left( x + \frac{3}{2} \right)(x + 4)^3 \)
A) \( \frac{3}{2} \), multiplicity 1, crosses x-axis; 4, multiplicity 3, crosses x-axis  
B) -\( \frac{3}{2} \), multiplicity 1, crosses x-axis; -4, multiplicity 3, crosses x-axis  
C) \( \frac{3}{2} \), multiplicity 1, touches the x-axis and turns around; 4, multiplicity 3, touches x-axis and turns around  
D) -\( \frac{3}{2} \), multiplicity 1, touches the x-axis and turns around; -4, multiplicity 3, touches x-axis and turns around

Find the zeros of the polynomial function.

115) \( f(x) = x^3 + x^2 - 20x \)
A) \( x = 0, x = 3, x = 4 \)  
B) \( x = 0, x = -5, x = 4 \)  
C) \( x = 3, x = 4 \)  
D) \( x = -5, x = 4 \)

116) \( f(x) = x^3 - 10x^2 + 25x \)
A) \( x = 0, x = 5 \)  
B) \( x = 1, x = 5 \)  
C) \( x = 0, x = -5, x = 5 \)  
D) \( x = 0, x = -5 \)

Divide using synthetic division.

117) \( (x^2 + 15x + 48) ÷ (x + 6) \)
A) \( x + 9 - \frac{6}{x + 6} \)  
B) \( x + 9 + \frac{6}{x + 6} \)  
C) \( x + 10 \)  
D) \( x + \frac{9}{x + 6} \)

118) \( \frac{-2x^3 - 10x^2 - 17x - 15}{x + 3} \)
A) \( 2x^2 + 3x + 5 \)  
B) \( -\frac{2}{3}x^2 - \frac{10}{3}x - \frac{17}{3} \)  
C) \( -2x^2 - 4x - 5 \)  
D) \( 2x^2 - 3x - 5 \)

119) \( \frac{x^5 + x^3 - 4}{x + 3} \)
A) \( x^4 - 3x^3 + 9x^2 - 26x + 78 + \frac{-238}{x + 3} \)  
B) \( x^4 - 3x^3 + 10x^2 - 30x + 90 + \frac{-274}{x + 3} \)  
C) \( x^4 - 2x^2 + \frac{2}{x + 3} \)  
D) \( x^4 - 2 + \frac{2}{x + 3} \)
120) \( \frac{x^4 - 3x^3 + x^2 + 7x - 10}{x - 1} \)

A) \( x^3 - 2x^2 + 8 + \frac{8}{x - 1} \)

B) \( x^3 - 2x^2 + 8 - \frac{4}{x - 1} \)

C) \( x^3 - 2x^2 + 6 + \frac{8}{x - 1} \)

D) \( x^3 + 2x^2 + 8 - \frac{4}{x - 1} \)

**Solve the problem.**

121) The function \( f(x) = 400(0.5)^x/80 \) models the amount in pounds of a particular radioactive material stored in a concrete vault, where \( x \) is the number of years since the material was put into the vault. Find the amount of radioactive material in the vault after 180 years. Round to the nearest whole number.

A) 84 pounds    B) 89 pounds
C) 294 pounds   D) 450 pounds

122) The rabbit population in a forest area grows at the rate of 7% monthly. If there are 220 rabbits in September, find how many rabbits (rounded to the nearest whole number) should be expected by next September. Use \( y = 220(2.7)^{0.07t} \).

A) 499    B) 520
C) 507    D) 494

123) A city is growing at the rate of 0.3% annually. If there were 3,978,000 residents in the city in 1995, find how many (to the nearest ten-thousand) are living in that city in 2000.

Use \( y = 3,978,000(2.7)^{0.003t} \).

A) 160,000    B) 4,040,000
C) 10,740,000  D) 4,070,000

124) A city is growing at the rate of 0.5% annually. If there were 4,704,000 residents in the city in 1993, find how many (to the nearest ten-thousand) are living in that city in 2000.

Use \( y = 4,704,000(2.7)^{0.005t} \).

A) 4,870,000    B) 4,900,000
C) 12,700,000   D) 440,000

**Use the compound interest formulas** \( A = Pe^{rt} \) **to solve.**

125) Find the accumulated value of an investment of $17,000 at 5% compounded semiannually for 10 years.

A) $27,856.48    B) $21,761.44
C) $27,691.21    D) $25,500.00

126) Find the accumulated value of an investment of $800 at 14% compounded quarterly for 2 years.

A) $1053.45    B) $856.98
C) $1039.68    D) $1024.00

127) Find the accumulated value of an investment of $7000 at 8% compounded continuously for 3 years.

A) $8898.74    B) $8817.98
C) $8680.00    D) $8998.74

128) Find the accumulated value of an investment of $5000 at 5% compounded monthly for 8 years.

A) $12,911.25    B) $7452.93
C) $8060.16    D) $9093.60

**Solve the problem.**

129) The pH of a solution ranges from 0 to 14. An acid has a pH less than 7. Pure water is neutral and has a pH of 7. The pH of a solution is given by \( pH = -\log x \) where \( x \) represents the concentration of the hydrogen ions in the solution in moles per liter. Find the pH if the hydrogen ion concentration is \( 1 \times 10^{-3} \).

A) 11    B) 3
C) -11   D) -3

130) The pH of a solution ranges from 0 to 14. An acid has a pH less than 7. Pure water is neutral and has a pH of 7. The pH of a solution is given by \( pH = -\log x \) where \( x \) represents the concentration of the hydrogen ions in the solution in moles per liter. Find the pH if the hydrogen ion concentration is \( 1.1 \times 10^{-1} \).

A) 1.96    B) 1.04
C) 0.96    D) 0.04
131) The long jump record, in feet, at a particular school can be modeled by
\[ f(x) = 19.4 + 2.4 \ln (x + 1) \]
where \( x \) is the number of years since records began to be kept at the school. What is the record for the long jump 17 years after record started being kept? Round your answer to the nearest tenth.
A) 26.1 feet
B) 26.3 feet
C) 21.8 feet
D) 26.2 feet

132) The function \( f(x) = 1 + 1.4 \ln (x + 1) \) models the average number of free throws a basketball player can make consecutively during practice as a function of time, where \( x \) is the number of consecutive days the basketball player has practiced for two hours. After 618 days of practice, what is the average number of consecutive free throws the basketball player makes?
A) 14 consecutive free throws
B) 13 consecutive free throws
C) 11 consecutive free throws
D) 10 consecutive free throws

Use properties of logarithms to expand the logarithmic expression as much as possible. Where possible, evaluate logarithmic expressions without using a calculator. DO NOT LEAVE ANY RADICALS OR EXPONENTS IN YOUR ANSWER.

133) \( \log_b (yz^9) \)
A) \( \log_b y + \log_b 9z \)
B) \( \log_b y + 9 \log_b z \)
C) \( 9 \log_b yz \)
D) \( 9 \log_b y + 9 \log_b z \)

134) \( \log_2 \left( \frac{\sqrt{2}}{y^8} \right) \)
A) \( \frac{1}{4} \log_2 \left( \frac{\sqrt{x}}{y} \right) \)
B) \( 2 \log_2 x - 8 \log_2 y \)
C) \( 2 \log_2 x + 8 \log_2 y \)
D) \( 8 \log_2 y - 2 \log_2 x \)

135) \( \log_w \left( \frac{11x}{4} \right) \)
A) \( \log_w 11x - \log_w 4 \)
B) \( \log_w 11 + \log_w x + \log_w 4 \)
C) \( \log_w 11 + \log_w x - \log_w 4 \)
D) \( \log_w 7x \)

136) \( \log_2 \left( \frac{16}{\sqrt{x - 1}} \right) \)
A) \( 4 \cdot \frac{1}{2} \log_2 (x - 1) \)
B) \( \log_2 16 - \log_2 \sqrt{x - 1} \)
C) \( 4 - \log_2 \sqrt{x - 1} \)
D) \( 4 \log_2 2 - \frac{1}{2} \log_2 (x - 1) \)

Use properties of logarithms to condense the logarithmic expression. Write the expression as a single logarithm whose coefficient is 1. Where possible, evaluate logarithmic expressions.

137) \( \log_4 (x + 8) - \log_4 (x - 2) \)
A) \( \log_4 (x + 8) \cdot 6x - 16 \)
B) \( \log_4 10 \)
C) \( \log_4 \left( \frac{x + 8}{x - 2} \right) \)
D) \( \log_4 \left( \frac{x + 8}{x - 2} \right) \)

138) \( 6 \ln x - \frac{1}{3} \ln y \)
A) \( \ln \left( \frac{x^6}{y^3} \right) \)
B) \( \ln x^6 \sqrt[3]{y} \)
C) \( \ln \left( \frac{6}{y^{\frac{1}{3}}} \right) \)
D) \( \ln x^6 \sqrt[3]{y} \)
139) \( \frac{1}{3}(\log_3 x + \log_3 y) - 3 \log_3 (x + 2) \)

A) \( \log_3 \left( \frac{\sqrt[3]{x+y}}{(x+2)^3} \right) \)

B) \( \log_3 \left( \frac{3 \sqrt[3]{x+y}}{(x+2)^3} \right) \)

C) \( \log_3 \left( \frac{3 \sqrt[3]{xy}}{3(x+2)} \right) \)

D) \( \log_3 \left( \frac{3 \sqrt[3]{xy}}{(x+2)^3} \right) \)

140) \( \log x + \log (x^2 - 25) - \log 9 - \log (x - 5) \)

A) \( \log \left( \frac{x(x-25)(x-5)}{9} \right) \)

B) \( \log \left( \frac{x+5}{9} \right) \)

C) \( \log \left( \frac{2x+5}{14-x} \right) \)

D) \( \log \left( \frac{x(x-25)}{9(x-5)} \right) \)

Use common logarithms or natural logarithms and a calculator to evaluate to four decimal places

141) \( \log_4 8 \)

A) 1.5000

B) 0.3010

C) 1.5051

D) 0.6667

142) \( \log_{23} 355 \)

A) 3.9120

B) 0.5340

C) 1.1885

D) 1.8728

143) \( \log_{16} 78.8 \)

A) 0.6924

B) 0.6349

C) 1.5750

D) 3.1006

144) \( \log_{0.2} 17 \)

A) 0.5315

B) -0.5681

C) -1.7604

D) 1.9294

Solve the exponential equation. Use a calculator to obtain a decimal approximation, correct to two decimal places, for the solution.

145) \( 9^x = 16 \)

A) 1.26

B) 6.09

C) 1.15

D) 0.79

146) \( 27^x = 4.7 \)

A) 15.63

B) 0.40

C) 0.32

D) 13.19

147) \( e^{5x} = 7 \)

A) 9.73

B) 3.81

C) 0.39

D) 0.23

148) \( e^{x+8} = 4 \)

A) -6.50

B) 2.48

C) -5.52

D) -6.61

Solve.

149) The value of a particular investment follows a pattern of exponential growth. In the year 2000, you invested money in a money market account. The value of your investment t years after 2000 is given by the exponential growth model \( A = 1800e^{0.069t} \). When will the account be worth $2918?

A) 2006

B) 2008

C) 2007

D) 2009

150) The population of a particular country was 27 million in 1981; in 1986, it was 38 million. The exponential growth function \( A = 27e^{kt} \) describes the population of this country t years after 1981. Use the fact that 5 years after 1981 the population increased by 11 million to find k to three decimal places.

A) 1.387

B) 0.480

C) 0.068

D) 0.078

151) The half-life of silicon-32 is 710 years. If 30 grams is present now, how much will be present in 900 years? (Round your answer to three decimal places.)

A) 12.46

B) 0

C) 0.005

D) 27.477
152) The population of a certain country is growing at a rate of 1.2% per year. How long will it take for this country’s population to double? Use the formula \( t = \frac{\ln 2}{k} \), which gives the time, \( t \), for a population with growth rate \( k \), to double. (Round to the nearest whole year.)

- A) 58 years
- B) 59 years
- C) 57 years
- D) 60 years

158) Anne and Nancy use a metal alloy that is 19.6% copper to make jewelry. How many ounces of an alloy that is 13% copper must be mixed with an alloy that is 22% copper to form 75 ounces of the desired alloy?

- A) 60 ounces
- B) 22 ounces
- C) 20 ounces
- D) 55 ounces

159) In a chemistry class, 3 liters of a 4% silver iodide solution must be mixed with a 10% solution to get a 6% solution. How many liters of the 10% solution are needed?

- A) 0.5 L
- B) 3.0 L
- C) 2.5 L
- D) 1.5 L

160) Two cars leave a city and head in the same direction. After 4 hours, the faster car is 12 miles ahead of the slower car. The slower car has traveled 208 miles. Find the speeds of the two cars.

- A) 49 mph and 52 mph
- B) 54 mph and 57 mph
- C) 30 mph and 33 mph
- D) 52 mph and 55 mph

---

**Solve the system of linear equations.**

153) \( x - 2y = 20 \)

- A) \( \{(-6, -7)\} \)
- B) \( \{(-6, -6)\} \)
- C) \( \{(5, -6)\} \)
- D) \( \emptyset \)

154) \( 3x + 56y = 56 \)

- A) \( \{(0, 1)\} \)
- B) \( \{(1, 0)\} \)
- C) \( \{(0, 0)\} \)
- D) \( \{(1, 1)\} \)

155) \( 6x + 6y = -42 \)

- A) \( \{(-1, -5)\} \)
- B) \( \{(-1, -6)\} \)
- C) \( \{(-2, -5)\} \)
- D) \( \emptyset \)

156) \( 4y = 34 - 5x \)

- A) \( \{(-6, 16)\} \)
- B) \( \{(5, -16)\} \)
- C) \( \{(4, -16)\} \)
- D) \( \emptyset \)

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**Solve the problem.**

157) A chemist needs 110 milliliters of a 26% solution but has only 21% and 32% solutions available. How many milliliters of each should be mixed to obtain the desired solution?

- A) 65 ml of 21%; 45 ml of 32%
- B) 50 ml of 21%; 60 ml of 32%
- C) 60 ml of 21%; 50 ml of 32%
- D) 65 ml of 21%; 50 ml of 32%
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