Factor completely

1) \(2x^4 - 162\)  
2) \(6x^2 - 11x - 10\)  
3) \(a^2x - bx + a^2y - by\)  
4) \(x^2n - 2x^n - 3\)  
5) \(x^2 + 10x + 25 - y^4\)  
6) \(x^6 - y^{12}\)  
7) \(48x^5y + 6x^2yz^6\)  
8) \(9x^2y^2 - 30xy + 25\)  
9) \(5x^4(x + 4)^2 + 2x^5(x + 4)\)

10) Factor out \(2x^{-4}\) from \(6x^{-3} + 10x^{-3}\)

11) Given \(P(x) = x^4 + x^2 - 6\)
   a) Using the Factor Theorem determine if \(x + 3\) is a factor of \(P(x)\).
   b) Using the Factor Theorem determine if \(x - \sqrt{2}\) is a factor of \(P(x)\).

12) Divide using synthetic division: \((2x^3 - 5x^2 + x - 6) ÷ (x + 3)\)

13) Let \(A = (-3, 7)\) and \(B = (9, 22)\) be points in the \(xy\)-plane.
   a) Find the distance between them.
   b) Find the equation of the line joining \(A\) and \(B\).
   c) Find the midpoint of the segment joining \(A\) and \(B\).

14) Given the equation of the line \(5x - 2y = 10\).
   a) Determine the slope.
   b) Determine the \(x\)-intercept.
   c) Determine the \(y\)-intercept.
   d) Find an equation of the line through \((3, 7)\) parallel to the given line.
   e) Graph the given line \(5x - 2y = 10\) and the line found in part d) on the same set of axes.

15) Find the equation of the line perpendicular to \(5x + 3y = 12\) through the point \((5, -21)\).

16) Given \(x_1 = -3, x_2 = 5, x_3 = 7,\) and \(x_4 = 8\) determine
   a) \(\sum_{i=1}^{3} x_i = \)  
   b) \(\sum_{k=1}^{3} (x_k)^2 = \)  
   c) \(\sum_{j=2}^{4} (1-x_j) = \)
Solve for the indicated variable

17) \[ m = \frac{y - y_1}{x - x_1}, \quad \text{for } x \]
18) \[ x = \frac{5y + 2}{3y - 1}, \quad \text{for } y \]
19) \[ A = P + Prt, \quad \text{for } P \]
20) \[ \log_b x = A, \quad \text{for } x \]

Perform the indicated operations and reduce if possible.

21) \[ \frac{x^2 - 8x - 10}{x - 3} + \frac{x - 28}{3 - x} \]
22) \[ \frac{x^2 + 3x - 70}{5x^2 + 6x - 8} \cdot \frac{x^2 + 9x + 14}{7x - x^2} \]
23) \[ \frac{4}{x^2 - x - 6} - \frac{3}{x + 2} \]
24) \[ \frac{-3 - x - \frac{2}{x}}{\frac{6}{x^2 - 4} - \frac{5}{x}} \]
25) \[ \frac{x + 1}{x^2 - x} - \frac{18x^2 + 3x - 10}{9x^2 - 4} \div \frac{6x^2 - x - 5}{6x + 4} \]

Perform the indicated operations and simplify, assume all variables are positive.

26) \[ \sqrt[3]{25a^8bc^7} \sqrt[3]{25ab^5c^7} \]
27) \[ \frac{4}{\sqrt{2}} \]
28) \[ 5\sqrt[3]{4x^3} + 7x\sqrt[3]{8x} - 2x\sqrt[3]{9x} + \sqrt[3]{2x} \]
29) \[ \frac{4\sqrt[3]{3}}{\sqrt[3]{3} + \sqrt[3]{11}} \]
30) \[ \frac{\sqrt[3]{5x^3y^1z^6}}{\sqrt[3]{160x^9y^7z^{11}}} \]

31) Rewrite the radicals into fractional exponential form:
   a) \( (3x + 1)\sqrt{x^2 + 4} \)
   b) \( \sqrt[3]{\frac{2x + 1}{x - 7}} \)

32) Rewrite into radical form:
   a) \( 5x^{2/3} \)
   b) \( 6x^{-2/7} \)
Perform the indicated operations and leave your answer in simplest form. Assume all variables are unrestricted except by the natural domains.

33) \((-2x^2y^5z)^3(x^3z^2)^4\)

34) \(\frac{(-6x^2y^3)^{-3}}{(4x^7y^2)^{-2}}\)

35) \((2x^n - 1)(x^n + 2)\)

36) \(5x^{2/3}(x^{1/3} + x^{-2/3})\)

37) \(\sum_{j=0}^{3} (-1)^j(2j+1)\)

38) \(4(3x^2 - 4x + 5) - (2x^2 + 3x)^2 - (5x - 2)(3x^2 + 4x + 14)\)

39) \(\frac{25x^3 - 15x^2y^2 - 10xy}{-10xy}\)

40) \((2x^5 + 9x^4 + 14x^3 + 9x^2 + 6x + 1) + (2x^2 + 3x + 1)\)

41) \(\left(\sqrt{2} + \sqrt{-2}\right)(-3 - \sqrt{-2})\) Answer in \(a + bi\) form

42) \(\frac{14 - 8i}{2 - 4i}\) Answer in \(a + bi\) form

43) \(i^{50} + i^{273}\) Answer in \(a + bi\) form

44) \(|3 - 4i|\)

45) \(\left(\sqrt{3x} - \sqrt{6}\right)^2\)

46) \(\sqrt{75x^2}\)

47) \(3\sqrt{\frac{1}{9}(x - 5)^2} + 5\)

48) \(\sqrt[3]{-8x^3}\)

49) \(\sqrt{x^2 - 4x + 4}\)

Find each value without the aid of a calculator

50) \(\log_4 64\)

51) \(\log_4 8\)

52) \(\log_6 \left(\frac{1}{6}\right)\)

53) \(\ln(1)\)

54) \(17^{\log_{17} 2}\)

55) \(\log_{\pi} \pi^e\)

56) \((-8)^{-2/3}\)
57) Explain why \( \ln(-1) \) is undefined.

58) Write the expression as sums or differences of simpler logarithmic expressions. Express your answer in such a way that no logarithm of products, quotients, or power appears:

\[
\log_b \frac{b^2(x^2 + 2)^3}{y^2 \sqrt{z}}
\]

59) Write the expression as one logarithm:

\[
3 \log_5(x - 2) - \frac{1}{3} \log_5 y + 5 \log_5 z
\]

**Solve each equation, if possible.**

60) \( 3|y - 7| + 5 = 29 \)

61) \( |6y - 5| = |3y + 9| \)

62) \( x^4 - 13x^2 = -12 \)

63) \( 15x = 6x^3 - x^2 \)

64) \( 2x^2 - 12x - 3 = 0 \)

65) \( \frac{1}{x + 8} + \frac{x + 15}{x^2 + 9x + 8} = \frac{1}{x + 6} \)

66) \( 3\sqrt{5} - x + 12 = 9 \)

67) \( \sqrt{8 - 2x} - \sqrt{8 + x} = 2 \)

68) \( 3x - 10x^{\frac{1}{2}} - 8 = 0 \)

69) \( \frac{2}{x^3} - 5x^{\frac{1}{3}} - 14 = 0 \)

70) \( \frac{2}{\sqrt{x^3}} + 6 = 15 \)

71) \( 3(x + 2)^2 - 5 = 12 \)

72) \( (x - 7)^2 = -5 \)

73) \( 6^{x + 2} = 8 \)

74) \( 3^{x^2 + 4x} = \frac{1}{81} \)

75) \( (e^x - 3)(e^x + 2) = 0 \)

76) \( 4 \cdot \ln(3 + x) = 9 \)

77) \( \log_5 (2x + 6) + \log_5 (4x + 7) = 2 \)
Solve each inequality. Give the result in interval notation and graph it.

78) \( \frac{1}{3}x + \frac{2}{5} \leq x + 4 \) 
79) \( 7x + 2 \geq -x + 6 \geq 2x - 5 \) 
80) \( |2x + 7| < -3 \)

81) \( |6 - 2x| > 9 \) 
82) \( |2x + 5| \leq 10 \) 
83) \( -3(x + 4) \geq 9 \) or \( 2x + 7 < 15 \)

84) \( \frac{3x + 2}{2x - 1} < 6 \) 
85) \( (x + 1)^2(x - 3) \geq 0 \) 
86) \( \frac{x + 7}{x^2 + 2x - 8} \geq 0 \)

Solve each of the following system of equations, if possible. If a system is inconsistent or if the equations are dependent, so indicate.

87) \[
\begin{align*}
x &= 7y - 4 \\
-2x + 14y &= 8
\end{align*}
\]
88) \[
\begin{align*}
x^2 + y^2 &= 34 \\
x^2 - y &= 4
\end{align*}
\]
89) \[
\begin{align*}
\frac{2}{x} - \frac{5}{y} &= 6 \\
\frac{3}{x} + \frac{10}{y} &= 2
\end{align*}
\]
90) \[
\begin{align*}
3x - 5y &= 4 \\
6x - 10y &= 9
\end{align*}
\]

91) Solve each of the following system using Gauss-Jordan Elimination.
\[
\begin{align*}
x + y + z &= 4 \\
3x + 2y - z &= 13 \\
2x - y + 2z &= -1
\end{align*}
\]

92) Given \( f(x) = -3x - 5 \), determine
   a) \( f(-4) \) 
   b) \( f(2t) \) 
   c) \( f(x + 2) \)

93) Given \( g(x) = 2x^2 - 5x + 1 \), find
   a) \( g(0) \) 
   b) \( g(-2) \) 
   c) \( g(2) + g(3) \)

94) Given \( f(x) = x^2 + 5 \), find \( \frac{f(x + h) - f(x)}{h} \)
95) Given \( f(x) = 5x + 2 \) and \( g(x) = 2x^2 + x + 4 \) find
\[
\begin{align*}
(a) & \quad (f \circ g)(3) \\
(b) & \quad (g - f)(-4) \\
(c) & \quad \left(\frac{f}{g}\right)(2) \\
(d) & \quad (f + g)(t) \\
(e) & \quad (fg)(x) \\
(f) & \quad (g \circ f)(x)
\end{align*}
\]

96) Given \( g(x) = 2x^2 - 20x - 7 \)
\[
\begin{align*}
a) & \quad \text{Using the method of completing the square rewrite into standard form: } g(x) = a(x - h)^2 + k \\
b) & \quad \text{Determine the axis of symmetry} \\
c) & \quad \text{Determine the vertex} \\
d) & \quad \text{Determine the domain} \\
e) & \quad \text{Determine the range} \\
f) & \quad \text{Graph}
\end{align*}
\]

97) A company’s cost function is given by \( C(x) = 5,000x + 25,000 \) where \( x \) represents the quantity produced in thousands and \( C \) represents the company’s cost in thousands of dollars.
\[
\begin{align*}
a) & \quad \text{What is the company’s cost of producing 32,000 units?} \\
b) & \quad \text{If the company has allocated $70 million dollars, how many units can they produce?}
\end{align*}
\]

98) Given \( f(x) = 3x + 2 \)
\[
\begin{align*}
a) & \quad \text{Is this function one to one? Explain your answer.} \\
b) & \quad \text{Determine the inverse of this function and if possible express your answer as } f^{-1}(x).
\end{align*}
\]

99) For the following three problems use the graph of \( y = f(x) \). Assume each grid mark represents one unit.
\[
\begin{align*}
a) & \quad \text{Estimate } f\left(\frac{1}{2}\right). \\
b) & \quad \text{For which values of } x \text{ (if any) does } f(x) = 1? \\
c) & \quad \text{Give the x-intercepts.} \\
d) & \quad \text{Give its domain.} \\
e) & \quad \text{Give its range.}
\end{align*}
\]

100) Given the relation \( y = \frac{x + 3}{3} \)
\[
\begin{align*}
a) & \quad \text{Is it a function?} \\
b) & \quad \text{Give its domain} \\
c) & \quad \text{Give its range} \\
d) & \quad \text{Find its inverse}
\end{align*}
\]
e) Determine whether or not the inverse is a function

For problems 101-108 determine:

- a) Domain
- b) Range
- c) $x$-intercepts, if any
- d) $y$-intercepts, if any
- e) asymptotes, if any
- f) vertex, if the graph is a parabola
- g) Graph

101) $f(x) = \frac{2}{3}x - 5$
102) $f(x) = 3x^2 - 24x - 28$
103) $h(x) = \sqrt{x + 7}$
104) $f(x) = (x + 2)^3 - 8$
105) $f(x) = \frac{5}{x - 1} + 2$
106) $f(x) = -|x - 3|$
107) $f(x) = 4^x + 1$
108) $f(x) = \log_2(x - 1)$

109) Graph $x^2 + y^2 = 14$. Find an exact value for the radius and also a decimal approximation for the radius, to the nearest tenth.

110) Graph $(x - 2)^2 + (x + 4)^2 = 16$

111) Graph $x^2 + y^2 - 10x + 14y = -65$

112) For the equation below, find the vertex. State which way the parabola opens.

$$12y^2 - 3x - 30y = -60$$

113) Estimate the solution to the following system of equations by graphing. Determine if your estimate is the actual solution.

$$\begin{cases} y = \frac{2}{3}x + 1 \\ 3x + 4y = 12 \end{cases}$$

114) Graph each inequality on a set of coordinate axes:

- a) $5x - 6y < 30$
- b) $2y \geq 3x - 8$
115) Find the equation of the boundary line or lines. Then give the inequality whose graph is shown.

Graph the solution set of each system.

116) \[
\begin{cases}
y > 2x + 3 \\
y \leq -\frac{2}{3}x + 1
\end{cases}
\]

117) \[
\begin{cases}
5x + 2y \geq 10 \\
2x - y < 6 \\
x \geq 0
\end{cases}
\]

118) Solve the following linear programming problem.

Maximize \( P = x + 3y \) subject to the following constraints:

\[
\begin{cases}
x \geq 0 \\
y \geq 0 \\
y \leq 2 \\
x + 4y \leq 12 \\
x + y \leq 9
\end{cases}
\]

119) The volume of a cylindrical tank varies jointly with the height of the tank and the square of the radius of its circular base. The volume is \( 4\pi \) cubic feet when \( h = 4 \) feet and \( r = 1 \) foot. Find the height when the volume is \( 8\pi \) cubic feet and \( r = 2 \) feet.

120) Use the discriminant to determine what type of solutions exist for the equation \( 3x^2 - 10x + 5 = 0 \)

121) An initial deposit of \$2,500 earns 4% interest, compounded semiannually. How much will be in the account after 3 years?
Applications: Solve each of the following by identifying unknowns, setting up equations, solving the equation(s) and answering in a sentence which includes quantifiers.

122) The dimensions of a rectangle are 5 inches by 9 inches. When both dimensions are increased by the same amount, the area of the new rectangle increased by 120 in$^2$. Find the dimensions of the new rectangle.

123) 100 liters of a 40% alcohol solution is required for a chemistry experiment. Determine the amount of pure alcohol that would be required to dilute a 25% alcohol solution to get the required concentration.

124) A retired couple invested part of $15,000 at 5% interest and the rest at 6.5%. If their annual income from these investments is $825, how much was invested at each rate?

125) The owner of a home decorating shop wants to mix dried rose petals selling for $6 per pound, dried lavender selling for $5 per pound, and buckwheat hulls selling for $4 per pound to get 10 pounds of mixture that would sell for $5.50 per pound. She wants to use twice as many pounds of rose petals as lavender. How many pounds of each should she use?

126) You have the following scores on three exams this semester: 88, 85, and 93. There is still the final exam to be taken. In order to receive an A in the course, you must have at least a 90 average. If the weight of the final exam is twice that of a regular exam, determine the lowest score you can get on the final exam worth 100 points to receive an A in the course.

127) Helen can spend at most $3.00 that she got from her grandparents. She goes to the candy store and wants to buy bubble gum that cost $0.10 each and gummy bears that cost $0.25 each.
   a) Write a linear inequality that describes Helen’s options for buying candy.
   b) Can Helen buy 18 bubble gums and 5 gummy bears?
   c) Can Helen buy 19 bubble gums and 4 gummy bear?

128) A light plane flew for 576 km directly into a strong wind and then flew back with the same wind. If the total flying time was 5 hours and the speed of the plane was 250 km/hr in still air, determine the speed of the wind.

129) Dan and his brother want to meet their friends at the beach at 1:00 p.m. At 10:00 a.m., their father informs them they can go only after the garden has been weeded. It takes Dan 4 hours to do the weeding by himself, while his brother who is younger requires 6 hours to complete the job himself. If they work together, will they finish in time to meet up with their friends at 1:00 p.m.?

Estimate the irrational numbers in the left column without a calculator to the nearest two integers. Use this estimate to bound the more complicated expression.

\[
\begin{align*}
130) \sqrt{19} & \quad 131) \frac{2 + \sqrt{19}}{4} \\
132) \log_{3} 8 & \quad 133) 5 + \log_{3} 8 \\
134) \frac{3 + \sqrt{17}}{2} & \quad 135) \log_{3} 100 \\
136) 1 + 3e^{0.2} &
\end{align*}
\]
ANSWERS

1) \(2(x - 3)(x + 3)(x^2 + 9)\)  
2) \((3x + 2)(2x - 5)\)  
3) \((x + y)(a^2 - b)\)  
4) \((x^n - 3)(x^n + 1)\)

5) \((x + 5 - y^2)(x + 5 + y^2)\)  
6) \((x - y^2)(x^2 + xy^2 + y^4)(x + y^2)(x^2 - xy^2 + y^4)\)

7) \(6x^2y(2x + z^2)(4x^2 - 2xz^2 + z^4)\)  
8) \((3xy - 5)^2\)  
9) \(x^4(x + 4)(7x + 20)\)

10) \(2x^4(3 + 5x)\)

11) a) \(P(-3) \neq 0\) so \((x + 3)\) not a factor  
b) \(P(\sqrt{2}) = 0\) so \((x - \sqrt{2})\) is a factor

12) \(2x^2 - 11x + 34 + \frac{-108}{x + 3}\)

13) a) \(3\sqrt{41}\)  
b) \(y = \frac{5}{4}x + \frac{43}{4}\)  
c) \(\left(3, \frac{29}{2}\right)\)

14) a) \(\frac{5}{2}\)  
b) \((2, 0)\)  
c) \((0, -5)\)  
d) \(5x - 2y = 1\)

15) \(y = \frac{3}{5}x - 24\)

16) a) 9  
b) 83  
c) -17

17) \(x = \frac{mx_1 + y - y_1}{m}\)

18) \(y = \frac{x + 2}{3x - 5}\)

19) \(P = \frac{A}{1 + rt}\)

20) \(b^4 = x\)

21) \(x - 6\)

22) \(-\frac{(x + 10)(x + 7)}{x(5x - 4)}\)

23) \(\frac{13 - 3x}{x^2 - x - 6}\)

24) \(\frac{x^2 + x}{4x - 3}\)

25) \(-\frac{1}{x}\)

26) \(5a^3b^2c^4\sqrt[3]{5c^2}\)

27) \(2\sqrt[3]{4}\)

28) \(14x\sqrt{2x} + 4x\sqrt{x} + \sqrt{2x}\)

29) \(\frac{3}{2} + \frac{\sqrt{33}}{2}\)

30) \(\frac{y^3\sqrt{2yz}}{8x^3z^3}\)

31) a) \((3x + 1)(x^2 + 4)^{1/2}\)  
b) \(\left(\frac{2x + 1}{x - 7}\right)^{1/3}\)

32) a) \(5\sqrt[3]{x^2}\)  
b) \(\frac{6}{\sqrt[3]{x^2}}\)

33) \(-8x^{18}y^{15}z^{11}\)

34) \(-\frac{2x^{20}}{27y^{13}}\)

35) \(2x^{2n} + 3x^n - 2\)
36) \(5x + 5\)  
37) \(-4\)  
38) \(-4x^4 - 27x^3 - 11x^2 - 78x + 48\)

39) \(-\frac{5x^2}{2y} + \frac{3xy}{2} + 1\)  
40) \(x^3 + 3x^2 + 2x + \frac{4x + 1}{2x^2 + 3x + 1}\)

41) \((-3\sqrt{2} + 2) + (-2 - 3\sqrt{2})i\)  
42) \(3 + 2i\)

43) \(-1 + 1i\)  
44) \(5\)  
45) \(3x + 6 - 6\sqrt{2}x\)

46) \(5|x|\sqrt{3}\)

47) \(|x - 5| + 5\)  
48) \(-2x\)  
49) \(|x - 2|\)

50) \(3\)

51) \(\log_4 8 = \frac{\log_2 8}{\log_2 4} = \frac{\log_2 2^3}{\log_2 2^2} = \frac{3}{2}\)

52) \(-1\)  
53) \(0\)

54) \(2\)  
55) \(e\)  
56) \(\frac{1}{4}\)

57) \(f(x) = \ln(x)\) is the inverse function of \(g(x) = e^x > 0\). So the domain of \(f\) equals the range of \(g\)

\(D_f = R_g = [0, \infty)\).

\(f(-1)\) is not defined then because \(x = -1\) is not in the domain of \(f\).

58) \(2 + 3\log_b(x^2 + 2) - 7\log_b y - \frac{1}{2}\log_b z\)

59) \(\log_5 \left(\frac{(x - 2)^3}{\sqrt[5]{y}}\right)\)

60) \(\{-1, 15\}\)

61) \(\left\{-\frac{4}{9}, \frac{14}{3}\right\}\)

62) \(\left\{-2\sqrt{3}, -1, 1, 2\sqrt{3}\right\}\)

63) \(\left\{-\frac{3}{2}, 0, \frac{5}{3}\right\}\)

64) \(\left\{\pm\frac{\sqrt{42}}{2} + 3\right\}\)

65) \(\{-11\}\)

66) \(\{\}\)

67) \(\{-4\}\)

68) \(\{16\}\)

69) \(\{-8, 343\}\)

70) \(\{-27, 27\}\)

71) \(\left\{\pm\frac{\sqrt{51}}{3} - 2\right\}\)

72) \(\left\{7 \pm \sqrt{5} i\right\}\) If directions said “Find all real solutions” answer is \(\{\}\)
73) Use conversion: \( b' = A > 0 \iff \log_b A = t \). So \( 6^{x+2} = 8 \iff \log_6 8 = x + 2 \iff x = -2 + \log_6 8 \)
Remark: \( x = -2 + \log_6 8 = -2 + \frac{\ln 8}{\ln 6} \)

74) \( \{ -2 \} \)
75) \( \{ \ln(3) \} \)
76) \( e^2 - 3 \)
77) \( \left\{ -\frac{1}{2} \right\} \)

78) \( \left[ -\frac{27}{5}, \infty \right) \)
79) \( \left[ \frac{1}{2}, \frac{11}{3} \right] \)

80) \( \{ \} \)
81) \( (-\infty, -\frac{3}{2}) \cup \left( \frac{15}{2}, \infty \right) \)

82) \( \left[ -\frac{15}{2}, \frac{5}{2} \right] \)
83) \( (-\infty, 4) \)

84) \( (-\infty, \frac{1}{2}) \cup \left( \frac{8}{9}, \infty \right) \)
85) \( \{-1\} \cup [3, \infty) \)

86) \( [-7, -4) \cup (2, \infty) \)
87) Dependent \( \left\{ (x, y) \mid y = \frac{1}{7}x + \frac{4}{7} \right\} \)

88) \( \{ (3, 5), (-3, 5) \} \)
89) \( \left\{ \left( \frac{1}{2}, -\frac{5}{2} \right) \right\} \)
90) “Inconsistent” \( \{ \} \)
91) \( \{ (2, 3, -1) \} \)

92) a) 7 b) -6t - 5 c) -3x - 11
93) a) 1 b) 19 c) 3
94) \( 2x + h \)

95) a) 127 b) 50 c) \( \frac{6}{7} \) d) \( 2t^2 + 6t + 6 \) e) \( 10x^3 + 9x^2 + 22x + 8 \) f) \( 50x^2 + 45x + 14 \)

96) a) \( g(x) = 2(x - 5)^2 - 57 \) b) \( x = 5 \) c) \( (5, -57) \) d) \( (-\infty, \infty) \) e)
\[-57, \infty) \quad f) \left( -\frac{\sqrt{114}}{2} + 5, 0 \right), \left( \frac{\sqrt{114}}{2} + 5, 0 \right)\]

g) \( (0, -7) \) h)

97) Make sure to take into account that 1,000 units means \( x = 1 \), and Cost of $1,000 means \( C = 1 \)
a) $185 million
b) 9,000 units
98) a) Yes, because graph passes horizontal line test. Or Yes because the definition of a one to one function is a function that satisfies “ \( f(a) = f(b) \) implies \( a = b \)”. So if we assume \( f(a) = f(b) \) then \( 3a + 2 = 3b + 2 \) so \( a = b \).
Our function is one to one because it satisfies the definition.

b) \( f^{-1}(x) = \frac{x-2}{3} \)

99) a) 1.5 b) \( \approx \{-1.3, 0, 1.3\} \) c) \((-1,0) (1,0)\) d) \((-\infty,\infty)\) e) \([0,\infty)\)

100) a) Yes since each value of \( x \) determines a unique value for \( y \). b) \((-\infty,\infty)\) c) \((-\infty,\infty)\) d) \( f^{-1}(x) = 3x-3 \) e) Yes since the original was one to one.

d) \( f^{-1}(x) = 3x-3 \)

101) a) \((-\infty,\infty)\) b) \((-\infty,\infty)\)

c) \( \left(\frac{15}{2}, 0\right) \)

d) \((0, -5)\)

e) none

f) NA

“slope \(\frac{2}{3}\) y-intercept -5 - line”

102) a) \((-\infty,\infty)\) b) \([-76,\infty)\)

c) \( \left(\frac{2}{3}\sqrt{57}+4,0\right) \)

d) \((0, -28)\)

e) none

f) \((4, -76)\)

“right 4 down 76 – parabola”

103) a) \([-7,\infty)\) b) \([0,\infty)\)

c) \((-7,0)\)

d) \((0, \sqrt{7})\)

e) none

f) NA

“left 7 – half parabola”

104) a) \((-\infty,\infty)\) b) \((-\infty,\infty)\)

c) \((0,0)\)

d) \((0, 0)\)

e) none

f) NA

“left 2 down 8 cubic”

105) a) \((-\infty,1) \cup (1,\infty)\) b) \((-\infty,2) \cup (2,\infty)\)

c) \( \left(-\frac{3}{2},0\right) \)

d) \((0, -3)\)

e) \(x=1, y=2\)

f) NA

“shift right 1 up 2 of reciprocal function”

106) a) \((-\infty,\infty)\) b) \((-\infty,0]\)

c) \((3,0)\)

d) \((0, -3)\)

e) none

f) NA

“shift absolute value function right 3, reflected about \(x\)-axis.”
107) a) $(-\infty, \infty)$  
   b) $(1, \infty)$  
   c) none  
   d) $(0, 2)$  
   e) $y = 1$  
   f) NA  
   “shift up 1 of exponential growth function”  

108) a) $(1, \infty)$  
   b) $(-\infty, \infty)$  
   c) $(2, 0)$  
   d) none  
   e) $x = 1$  
   f) NA  
   “shift right 1 of logarithmic growth curve”  

109) Circle with center $(0, 0)$ and radius $r = \sqrt{14} \approx 3.7$  

110) Circle with center $(2, -4)$ and radius $r = \sqrt{16} = 4$  

111) Circle with center $(5, -7)$ and radius $r = \sqrt{9} = 3$  

112) Vertex $\left(\frac{55}{4}, \frac{5}{4}\right)$ opens to the right  

113) Intersection of two curves is $\approx (1.4, 2)$ but $y = \frac{2}{3}x + 1$ which is false. So estimate is not the actual solution.  

114)  
   a)  
   b)  

115) $-5 \leq x < 3$
116) $P = 11$ at $(8,1)$

117) $h = 2$ feet

118) Two unequal irrational solutions

119) $11$ in by $15$ in

120) $2,815.41$

121) $11$ in by $15$ in

122) $20$ liters would be needed of pure alcohol

123) $6$ lbs of rose petals, $3$ lbs of lavender and $1$ lb of buckwheat hulls

124) $20,000$ at $5\%$ and $5,000$ at $6.5\%$

125) The lowest score on the final you can get is $92$.

126) $a)$ Let $x$ be the number of bubble gum pieces she can buy and $y$ be the number of gummi bear pieces she can buy. $0 \leq 0.10x + 0.25y \leq 3$

127) $b)$ No $c)$ Yes

128) The speed of the wind is $70$ mph.

129) $32 + 97 < 244$

130) $4 < \sqrt{19} < 5$

131) $\frac{3}{2} < \frac{2 + \sqrt{19}}{4} < \frac{7}{4}$

132) $1 < \log, 8 < 2$

133) $6 < 5 + \log, 8 < 7$

134) $3.562$

135) $2.861$

136) $4.664$