



Pre-Calculus

Summer Math Packet

Congratulations! You will soon be learning Pre-Calculus!

This summer math packet is a review of some of the concepts learned in your Algebra II course that are needed when you begin your Pre-Calculus course in August. It will assure that all students begin the school year on the same page and with equal opportunity to learn and build upon mathematical concepts that should have been learned in previous courses.

Instructions for completing the packet:

- Please print the packet or use loose leaf paper to complete the packet by hand showing all work. Work must be neat and legible.
- Please use your Algebra II notes or the websites provided to help you if you need reminders on how to complete some practice problems.
- Take notes as you complete your work. You will be given a quiz on this material the first week of school.
- Work on the packet with your friends. Help each other. Every student is responsible for knowing the material in this packet when you return in August. We will review as a team and everyone will be expected to participate.
- Bring your packet to our first class together. It will be collected for a grade. Only packets done with paper and pencil will be accepted.

Helpful Websites:

<http://www.mathtv.com/>

<http://www.purplemath.com/modules/index.htm>

<https://www.khanacademy.org>

Helpful for graphing functions:

<https://www.education.ti.com/en/resources/family-of-functions>

To ensure your success in Precalculus, it is essential that you thoroughly understand and master all the topics presented in this packet. Make use of all available resources to deepen your understanding and, most importantly, to truly learn these concepts. This will help solidify your foundational knowledge and address any gaps you may have.

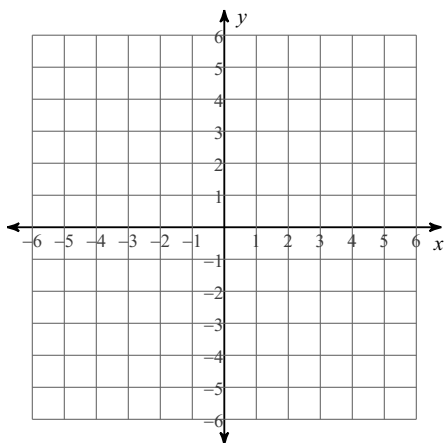
Please show all work.

Staple all extra pages of work to the back of this packet and turn into your teacher on the FIRST day of class.

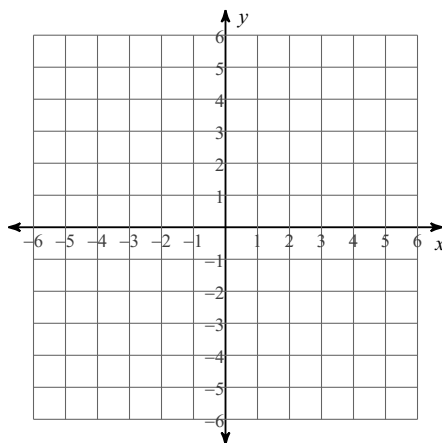
LINEAR EQUATIONS & INEQUALITIES

Sketch the graph of each line. Identify intercepts, slope, and domain and range.

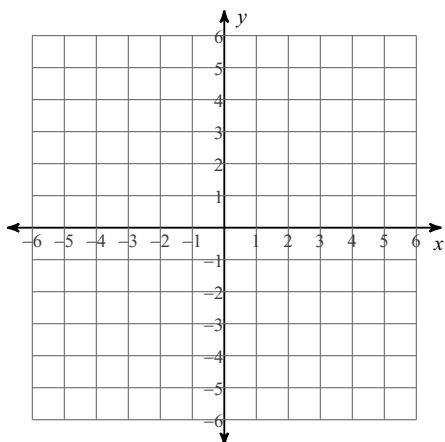
1) $9x + 4y = 20$



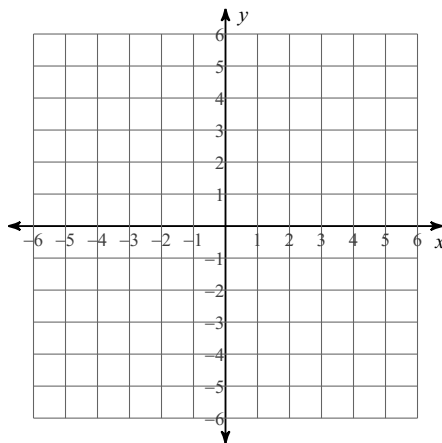
2) $x = -4$



3) $y = -\frac{3}{5}x$

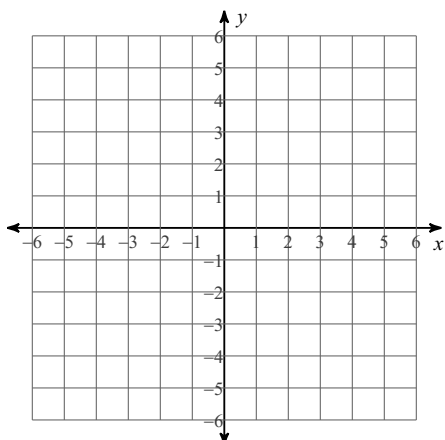


4) $y = -5$

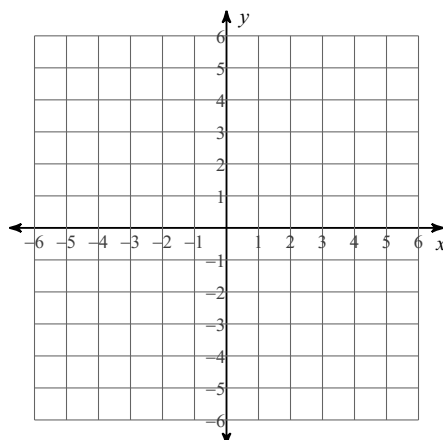


Sketch the graph of each linear inequality.

5) $x \leq 4$



6) $3x + 5y < 5$

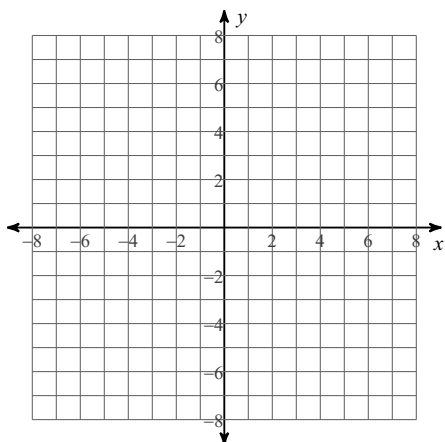


QUADRATIC FUNCTIONS

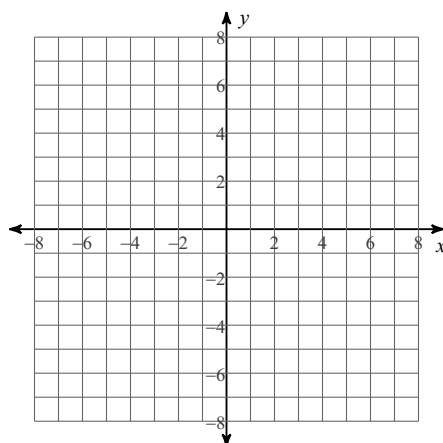
Identify the vertex, axis of symmetry, direction of opening, min/max value, y-intercept, and x-intercepts of each. Then sketch the graph.

Reminder: If the equation is in vertex form the vertex (h,k) is easily identified. If the equation is in standard form, the x-coordinate of the vertex is $-b/2a$ and the y-coordinate is found by evaluating the function using the x-coordinate of the vertex.

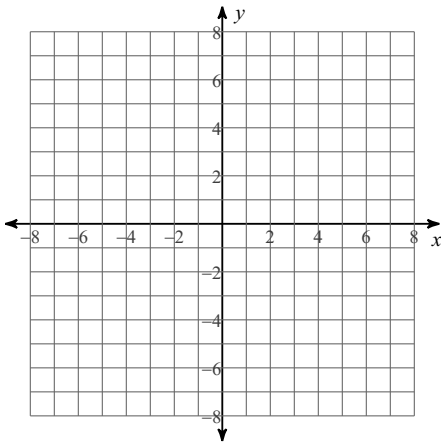
7) $y = 2x^2$



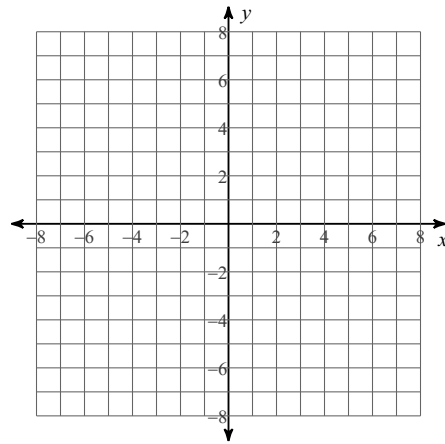
8) $y = \frac{1}{2}x^2$



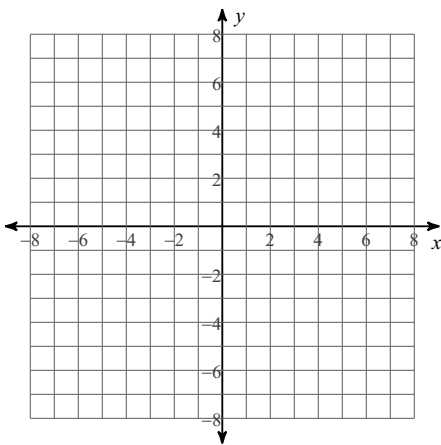
$$9) y = 2(x + 4)^2 - 8$$



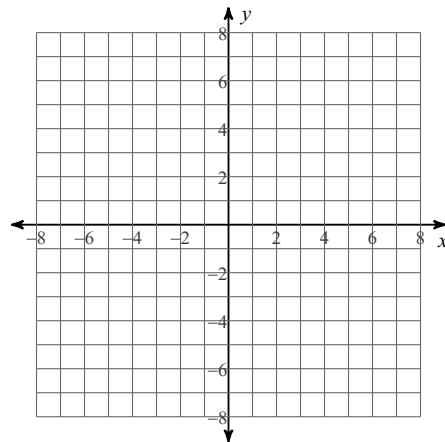
$$10) y = -(x - 4)^2 - 1$$



$$11) y = -\frac{1}{2}x^2 - 4x - 8$$



$$12) y = x^2 - 8x + 16$$



Solve each quadratic equation.

Reminder: Quadratic equations can be solved by factoring, using the square root property, using the quadratic formula, or completing the square. Please show that you know how to use all the methods by following the instructions.

Solve by factoring.

$$13) 2x^2 = 16x$$

$$14) n^2 - 20 = -n$$

$$15) 6n^2 = -14 + 25n$$

$$16) 6x^2 - 17x = -12$$

Solve by taking square roots.

17) $9x^2 + 5 = 752$

18) $64n^2 - 2 = 79$

Solve by completing the square.

19) $n^2 + 12n - 94 = -9$

20) $10n^2 + 20n - 46 = -10$

Solve with the quadratic formula.

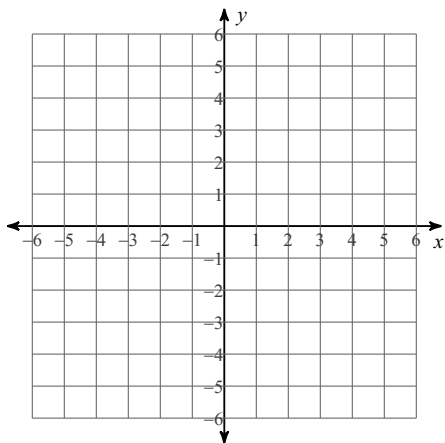
21) $b^2 = 11b + 102$

22) $11n^2 + 2n = 6$

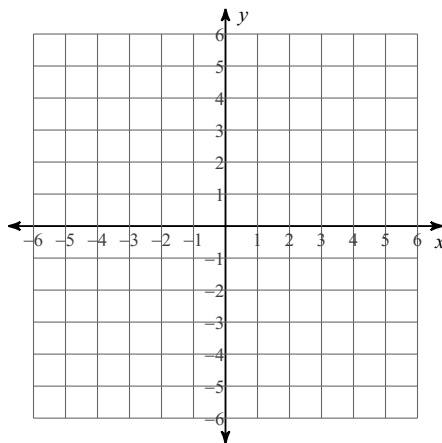
ABSOLUTE VALUE FUNCTIONS

Reminder: To graph an absolute value function you must first identify the vertex and then graph. If the variable inside of the absolute value bars has a coefficient, remember to factor the coefficient outside of the bars before identifying the vertex.

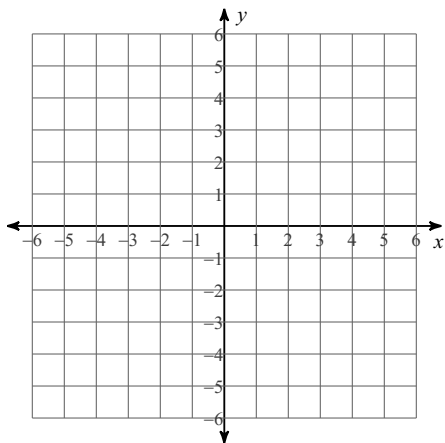
23) $y = -|x + 3| + 3$



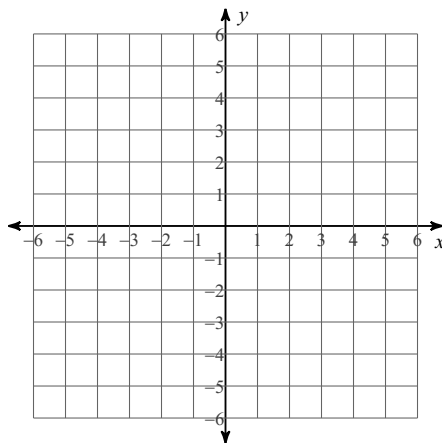
24) $y = |x - 2| + 3$



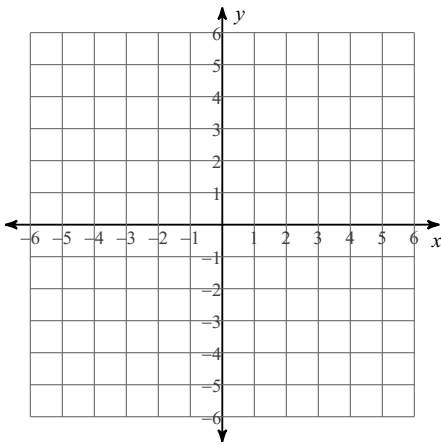
25) $y = -2|x - 2|$



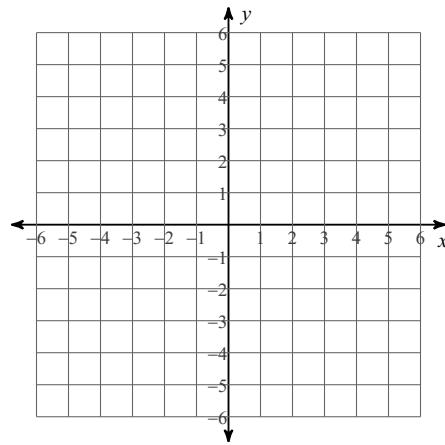
26) $y = 2|x + 3| - 2$



$$27) y = |3x - 2| + 4$$



$$28) y = -|3x + 3| + 2$$



Solve each absolute value equation.

Reminder: To solve an absolute value equation you must first isolate the absolute value term on one side of the equation. You may have no solution, one solution, or two solutions. Absolute value equations may contain extraneous solutions, so you must always check your answers.

$$29) \frac{|7b|}{9} = 1$$

$$30) |8 + n| - 3 = 14$$

$$31) -9|1 + n| - 10 = -28$$

$$32) 9 + 7\left|\frac{n}{7}\right| = 6$$

Solve each absolute value inequality and give the solution using interval notation.

$$33) |7n| - 7 \leq -91$$

$$34) -6 - 4|p - 7| < -10$$

$$35) 9|10 + x| - 1 \geq -19$$

$$36) 10 + 5\left|\frac{n}{6}\right| < 15$$

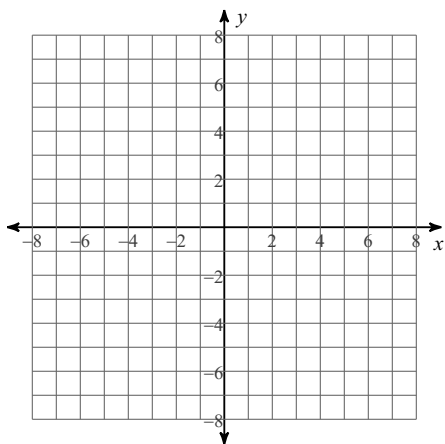
$$37) 8 + 2|p - 9| < 32$$

$$38) 4 + 5|-4n| \leq 64$$

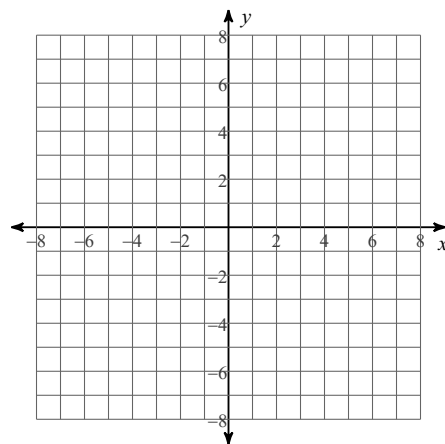
RADICAL FUNCTIONS

Sketch the graph of each function by using transformations. State the domain and range.

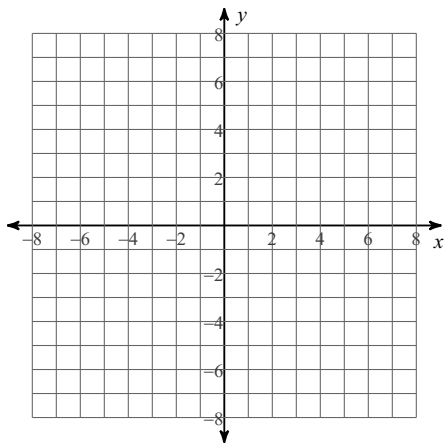
$$39) y = \sqrt{x}$$



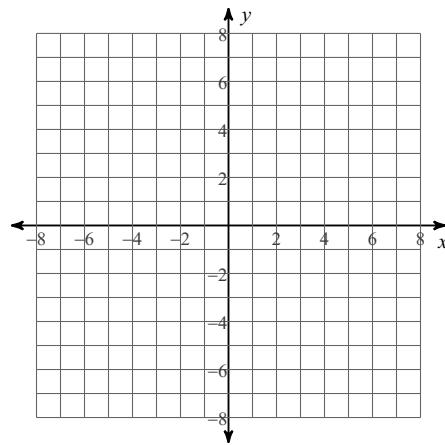
$$40) y = \sqrt{x - 2}$$



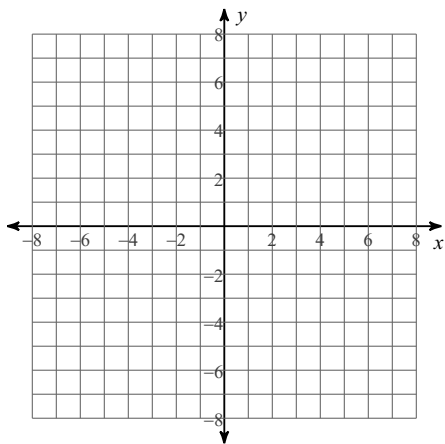
41) $y = \sqrt{x-1} - 4$



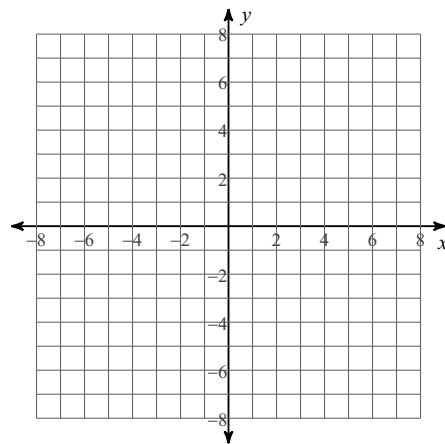
42) $y = 2\sqrt{x-4}$



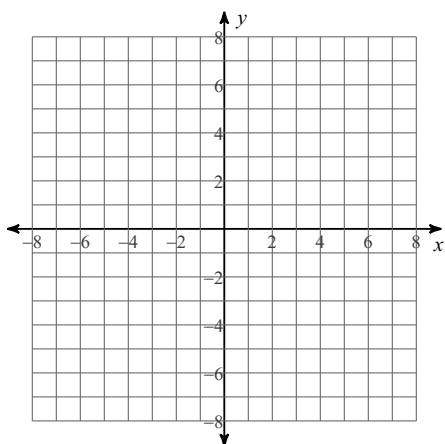
43) $y = \sqrt{x+3} - 5$



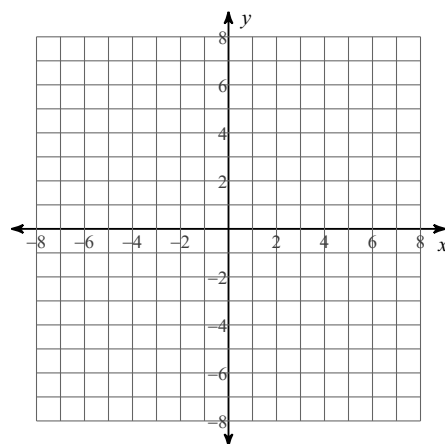
44) $y = -4\sqrt{x} + 4$



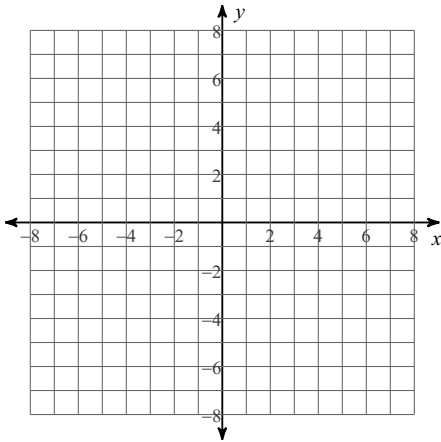
45) $y = \sqrt[3]{x}$



46) $y = 2\sqrt[3]{x+2}$



$$47) y = 2 + \sqrt[3]{x + 6}$$



Solve each radical equation. Remember to check for extraneous solutions.

Reminder: To solve radical equations isolate the radical. If two radicals exist, each radical should be on different sides of the equation and make sure only one side of the equation contains a binomial. Square both sides of the equation. If after squaring both sides, a radical still exists, you must repeat the process.

$$48) 17 = \sqrt{2k + 108} + 7$$

$$49) \sqrt{2n - 28} = \sqrt{n - 10}$$

$$50) 5 = -5 + \sqrt{98 - 2r}$$

$$51) \sqrt{9 - 2b} = \sqrt{-7 - 2b} + 2$$

Reminder: To solve equations with a radical greater than two isolate the radical and raise both sides of the equation to the value of the index. To solve equations with a rational exponent, isolate the term with the rational exponent and raise both sides of the equation to the value of the reciprocal of the exponent. If a rational exponent contains a numerator with an even number and a denominator with an odd number, then absolute value must be used to solve the equation.

$$52) -632 = 8 - 5 \cdot (4x)^{\frac{7}{6}}$$

$$53) -6 = -8 + \sqrt[3]{3m + 32}$$

$$54) -6 - (4 - 15a)^{\frac{3}{2}} = -518$$

$$55) -2(-7 - 11r)^{\frac{1}{4}} - 7 = -13$$

$$56) -2(35 - m)^{\frac{4}{3}} - 7 = -519$$

$$57) -8 - \sqrt[4]{2k} = -10$$

$$58) -5 - 5(n - 29)^{\frac{3}{2}} = -325$$

Solve the equations by finding all roots.

Reminder: To solve equations of degree three or higher, start by attempting to factor the equation. If the equation cannot be factored then use the Rational Root Theorem and synthetic division to find your roots. Once you have reduced your polynomial to linear quadratic factors, you may use the quadratic formula to finish solving the equation.

$$59) x^3 - 125 = 0$$

$$60) x^4 - 12x^2 + 27 = 0$$

61) $x^3 - 6x^2 + 5x = 0$

62) $x^4 - 16 = 0$

63) $x^3 - 11x^2 - 25x - 13 = 0$

64) $x^4 + 7x^3 - x^2 - 7x = 0$

Solve each rational equation. Remember to check for extraneous solutions.

Reminder: To solve rational equations first multiply both sides of the equation by the least common denominator. This will clear the fractions or rational expressions. To find the LCD factor the denominators.

65) $\frac{n-2}{4n} = \frac{3}{2} - \frac{3}{4n}$

66) $\frac{1}{5n} + 1 = \frac{3}{5n}$

67) $\frac{r^2 - 4r - 12}{r^2} = \frac{4}{r} + \frac{r-4}{r}$

68) $\frac{x+4}{3} = \frac{x^2 - x - 6}{x} + \frac{1}{x}$

$$69) \frac{m^2 + 10m + 24}{2m^2} + \frac{1}{m^2} = \frac{1}{2m^2}$$

$$70) \frac{1}{x^2 - 2x} = \frac{4}{x^2 - 2x} - \frac{1}{x - 2}$$

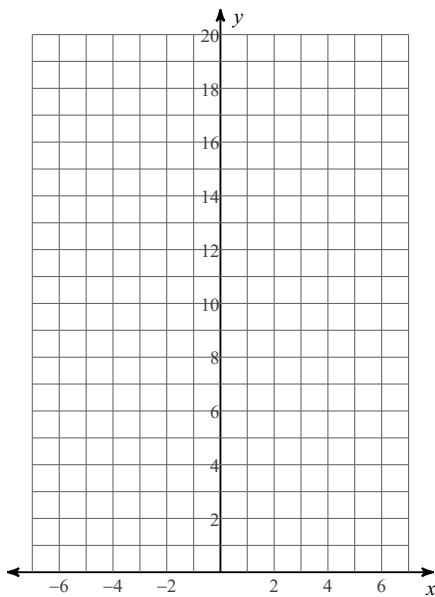
$$71) \frac{b + 3}{b^2 - b} + 1 = \frac{b + 2}{b}$$

$$72) \frac{6}{p - 5} = \frac{6p + 6}{p - 5} + \frac{p + 5}{p^2 - 3p - 10}$$

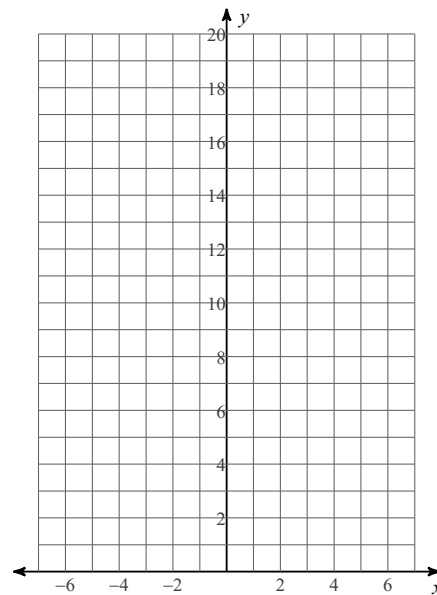
EXPONENTIAL FUNCTIONS

To graph exponential functions, identify transformations, graph the asymptote, and then plot the three basic points ($x=-1$, $x=0$, and $x=1$ at transformation).

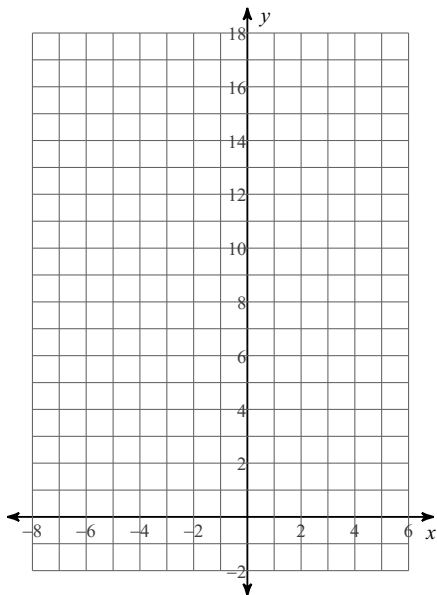
$$73) y = \left(\frac{1}{3}\right)^x$$



$$74) y = 4^x$$



$$75) y = 4^{x+1} - 2$$



Solve each exponential equation.

Reminder: To solve an exponential equation you must first isolate the exponential term on one side of the equation. If both sides of the equation can be converted to a term with the same base, then the equation can be solved by simply equating the exponents once the terms have the same base. If this is not possible, then you must solve by using logarithms.

$$76) 4^{-3b} = 16$$

$$77) 1000^{3m} = 10000^{3-m}$$

$$78) 7^{-3k-3} = 7^3$$

$$79) 625^{2m} = 25^{-3m}$$

$$80) \left(\frac{1}{4}\right)^{2x} = 16^{3x}$$

$$81) 16^{2x-3} = \left(\frac{1}{64}\right)^{-3x}$$

$$82) 10^{9n} = 57$$

$$83) 6 \cdot 2^x = 20$$

84) $e^{k-3} + 10 = 39$

85) $10e^{n-10} = 33$

Evaluate each expression without the use of a calculator.

86) $\log_2 16$

87) $\log_7 \frac{1}{49}$

88) $\log_2 64$

89) $\log_2 \frac{1}{8}$

90) $\log_{16} 1$

91) $\log_{15} 225$

92) $\ln e^3$

Solve each logarithmic equation. Give exact solution.

Reminder: If both sides of an equation contain one logarithmic term with the same base then the equation can be solved by setting the terms inside of the parenthesis equal to each other. If this is not the case, then use the properties of logarithms to condense the logarithms on one side of the equation. Convert the equation to exponential form and solve.

93) $\log_4 (k^2 + 2k) = \log_4 (49 + 2k)$

94) $-4\log_6 3b = -12$

$$95) 3 \ln -2m + 9 = 12$$

$$96) -2 + 4 \ln 10n = 10$$

$$97) \ln (x + 5) + \ln 7 = 3$$

$$98) \log 5x^2 + \log 2 = 5$$

$$99) \log 7 - \log (x + 1) = 1$$

$$100) \ln 2x^2 + \ln 8 = 2$$

PROPERTIES OF EXPONENTS

Simplify. Your answer should contain only positive exponents.

$$101) \frac{2m^4 n^{-3} \cdot nm^{-3}}{(2m^{-1} n^{-4})^2}$$

$$102) \frac{u^3 v^{-1} \cdot 2v}{(v^4)^3}$$

$$103) \frac{(2xy^3)^4}{x^2y^2 \cdot 2x^4y^{-2}}$$

OPERATIONS WITH RADICALS

Simplify without the use of a calculator. Use absolute value signs when necessary.

$$104) \sqrt{48n^2}$$

$$105) \sqrt[3]{56n^7}$$

$$106) \sqrt[3]{-48n^2}$$

$$107) \sqrt[4]{243r^4}$$

$$108) \sqrt{75mn^3}$$

$$109) \sqrt{32a^4b^3}$$

$$110) \sqrt{147xy^3}$$

Simplify.

$$111) -\sqrt[3]{40} - 3\sqrt[3]{40}$$

$$112) \sqrt[3]{36x^3} \cdot 4\sqrt[3]{-3x^2}$$

$$113) \sqrt{10x} \cdot \sqrt{6x^2}$$

$$114) 3\sqrt{5}(2 + \sqrt{10})$$

$$115) -4\sqrt{10}(\sqrt{2} - 4\sqrt{6})$$

$$116) \frac{2\sqrt{3xy^3}}{\sqrt{15x^3y^2}}$$

$$117) \frac{4 + 3\sqrt{3r^3}}{\sqrt{6r^2}}$$

$$118) \frac{3\sqrt{2x}}{4x - \sqrt{3x^4}}$$

OPERATIONS WITH RATIONAL EXPRESSIONS

Simplify each expression.

$$119) \frac{5x}{6} - \frac{5y}{5xy}$$

$$120) \frac{4}{6y} - \frac{2y}{4x}$$

$$121) \frac{4x}{x+4} - \frac{5x}{3x+6}$$

$$122) \frac{2}{3k} - \frac{k-1}{k+1}$$

Simplify each and state the excluded values.

$$123) \frac{7n + 70}{2n - 16} \div \frac{n - 10}{2n - 16}$$

$$124) \frac{9x + 54}{4x + 16} \cdot \frac{4x + 16}{x + 6}$$

$$125) \frac{x^2 + 3x - 40}{18x + 63} \cdot \frac{18x + 63}{9x - 45}$$

$$126) \frac{a - 2}{a^2 - 5a + 6} \div \frac{a^2 + 3a - 18}{9a - 27}$$

COMPLEX FRACTIONS

Simplify each expression.

$$127) \frac{\frac{2x + 3}{9} - \frac{2x + 3}{3}}{\frac{9}{2x + 3}}$$

$$128) \frac{\frac{x^2}{16} - \frac{1}{x}}{4}$$

$$129) \frac{\frac{4}{yx} - \frac{x}{2}}{xy}$$

$$130) \frac{\frac{1}{m} - \frac{1}{2}}{n + 4}$$

COMPLEX NUMBERS

Simplify.

$$131) (3 - 2i) - (4 + 7i)$$

$$132) (8i)(7 - 6i) - 3(8 - 7i)$$

$$133) (-4i)(-6i)(6 + 6i)$$

$$134) \frac{1}{9 + 10i}$$

$$135) \frac{4 + 4i}{-7i}$$

$$136) \frac{-2 + 3i}{-6 + 6i}$$

Simplify. Remember that in order to add and subtract radicals, they must look the same. If they are not, look to see if you can simplify them first.

$$137) -\sqrt{5} + 3\sqrt{20} + 3\sqrt{27}$$

$$138) -3\sqrt{24} - \sqrt{54} - \sqrt{5}$$

Simplify.

$$139) \frac{5\sqrt{3} + \sqrt{2}}{-4 - 5\sqrt{5}}$$

$$140) \frac{\sqrt{3} + 3}{-1 + 2\sqrt{5}}$$

$$141) (-\sqrt{2} + 5)(\sqrt{2} + 4)$$

Factor each completely.

$$142) 6x^4 - 30x^2 + 36$$

$$143) 6x^4 - 54x^2 + 84$$

$$144) 12u^4 + 44u^2 - 80$$

$$145) 5a^2 - 10a - 120$$

$$146) v^2 + 14v + 49$$

$$147) 9n^2 - 1$$

$$148) 16x^2 + 8x + 1$$

$$149) 2x^3 - 14x^2 - 7x + 49$$

$$150) 24p^3 + 40p^2 - 15p - 25$$

Evaluate each function.

$$151) p(t) = -4t + 4; \text{ Find } p(-4)$$

$$152) k(t) = -t^3 + 4t; \text{ Find } k(5)$$

Perform the indicated operation.

$$153) \begin{aligned} g(t) &= -4t + 1 \\ f(t) &= t - 5 \\ \text{Find } (g \circ f)(t) \end{aligned}$$

$$154) \begin{aligned} g(a) &= a^3 + 2a \\ h(a) &= 2a - 1 \\ \text{Find } (g \circ h)(a) \end{aligned}$$

$$155) \begin{aligned} f(a) &= 2a^3 + a \\ g(a) &= 2a - 1 \\ \text{Find } (f \cdot g)(a) \end{aligned}$$

$$156) \begin{aligned} f(x) &= 4x + 4 \\ g(x) &= x^3 - 5 \\ \text{Find } (f + g)(x) \end{aligned}$$

$$157) \begin{aligned} h(x) &= x + 1 \\ g(x) &= x^2 - 5 \\ \text{Find } (h \cdot g)(5) \end{aligned}$$

$$158) \begin{aligned} f(n) &= 3n - 3 \\ g(n) &= n^2 - 2n \\ \text{Find } \left(\frac{f}{g}\right)(7) \end{aligned}$$

$$159) \begin{aligned} f(t) &= t^2 + 3t \\ g(t) &= t - 5 \\ \text{Find } (f + g)(3) \end{aligned}$$

Solve each system by elimination.

$$160) \begin{aligned} -2x + 2y &= -12 \\ x - 10y &= -3 \end{aligned}$$

$$161) \begin{aligned} 5x + 4y &= -25 \\ -3x - 6y &= 15 \end{aligned}$$

$$162) \begin{aligned} 5a - 3b + 4c &= 2 \\ 3a + b - 5c &= -21 \\ -5a - 2b + 4c &= 22 \end{aligned}$$

$$163) \begin{aligned} -2r + 5s + 3t &= 22 \\ 4r - 5s + t &= -20 \\ -3r - 6s + 6t &= 9 \end{aligned}$$

Please show all work.

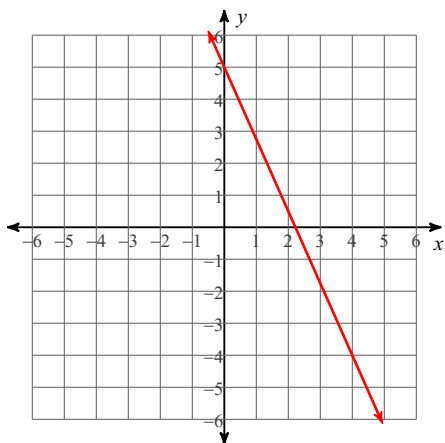
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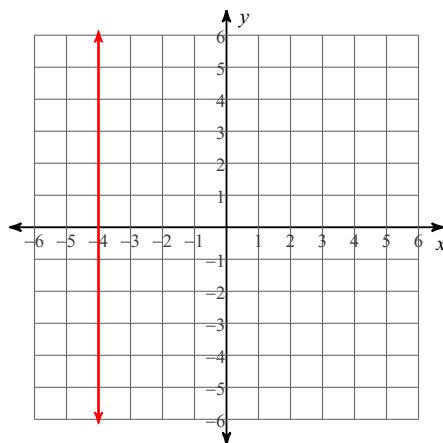
LINEAR EQUATIONS & INEQUALITIES

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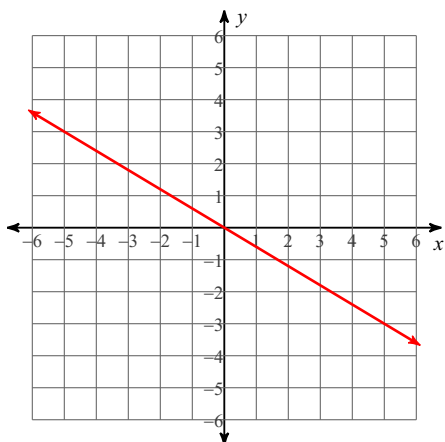
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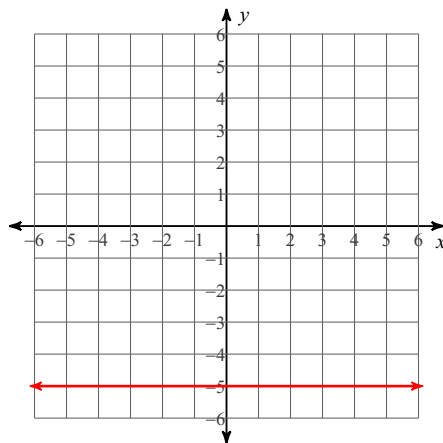
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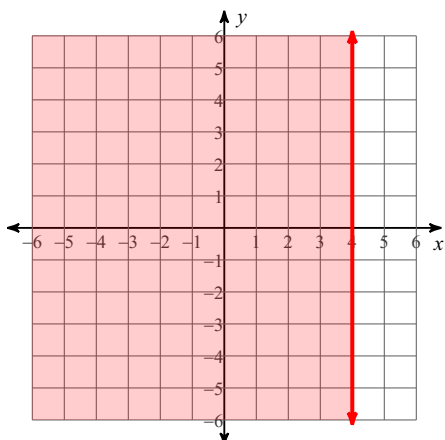


4) $y = -5$

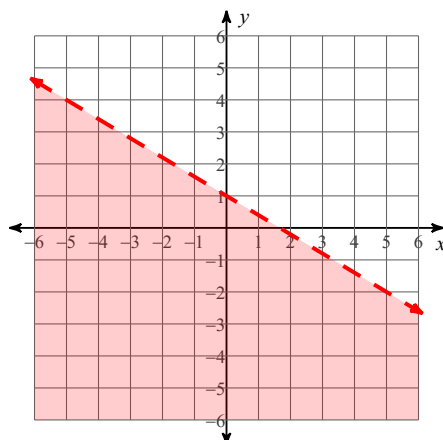


Sketch the graph of each linear inequality.

5) $x \leq 4$



6) $3x + 5y < 5$

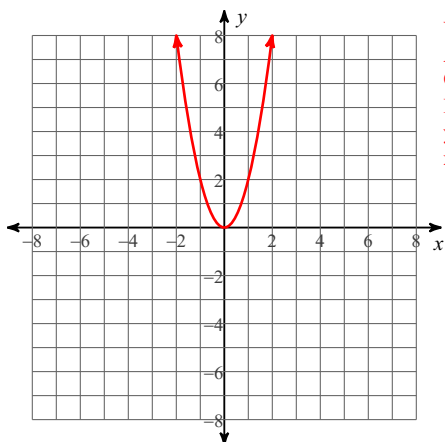


QUADRATIC FUNCTIONS

Identify the vertex, axis of symmetry, direction of opening, min/max value, y-intercept, and x-intercepts of each. Then sketch the graph.

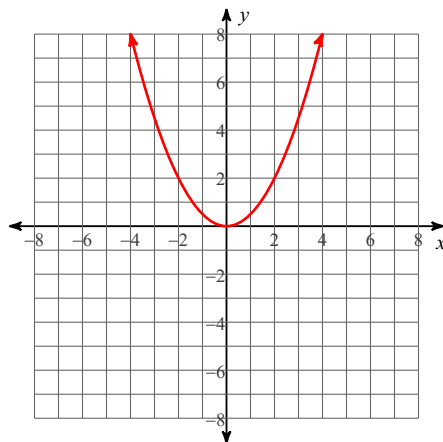
Reminder: If the equation is in vertex form the vertex (h,k) is easily identified. If the equation is in standard form, the x-coordinate of the vertex is $-b/2a$ and the y-coordinate is found by evaluating the function using the x-coordinate of the vertex.

7) $y = 2x^2$



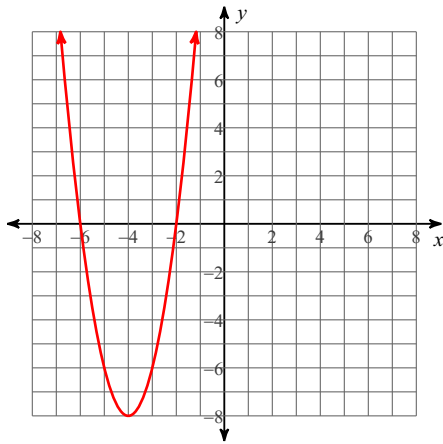
Vertex: (0, 0)
 Axis of Sym.: $x = 0$
 Opens: Up
 Min value = 0
 y-int: 0
 x-int: 0

8) $y = \frac{1}{2}x^2$



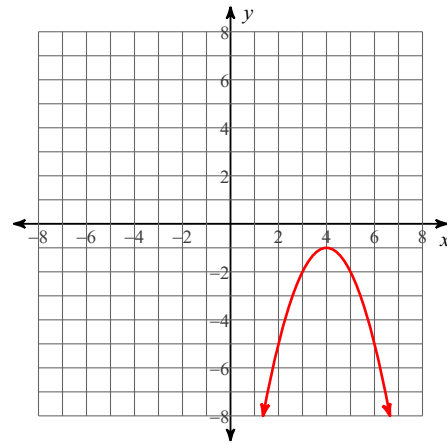
Vertex: (0, 0)
 Axis of Sym.: $x = 0$
 Opens: Up
 Min value = 0
 y-int: 0
 x-int: 0

$$9) y = 2(x + 4)^2 - 8$$



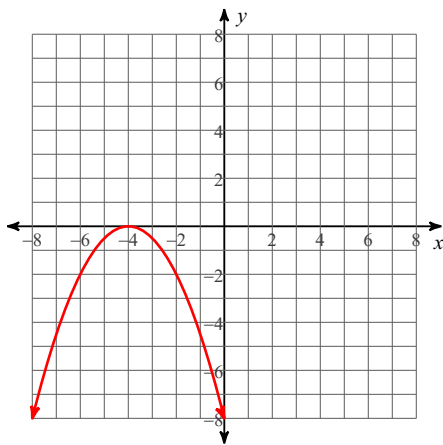
Vertex: $(-4, -8)$
 Axis of Sym.: $x = -4$
 Opens: Up
 Min value = -8
 y-int: -8
 x-int: -6 and -2

$$10) y = -(x - 4)^2 - 1$$



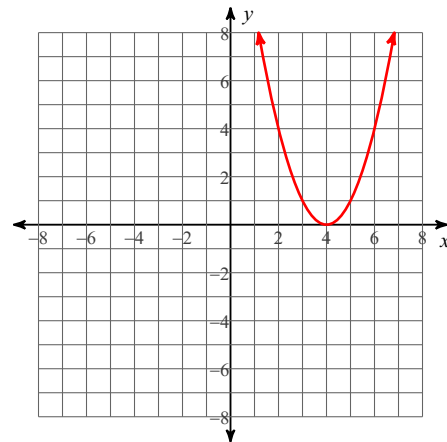
Vertex: $(4, -1)$
 Axis of Sym.: $x = 4$
 Opens: Down
 Max value = -1
 y-int: -17
 x-int: None

$$11) y = -\frac{1}{2}x^2 - 4x - 8$$



Vertex: $(-4, 0)$
 Axis of Sym.: $x = -4$
 Opens: Down
 Max value = 0
 y-int: -8
 x-int: -8

$$12) y = x^2 - 8x + 16$$



Vertex: $(4, 0)$
 Axis of Sym.: $x = 4$
 Opens: Up
 Min value = 0
 y-int: 16
 x-int: 4

Solve each quadratic equation.

Reminder: Quadratic equations can be solved by factoring, using the square root property, using the quadratic formula, or completing the square. Please show that you know how to use all the methods by following the instructions.

Solve by factoring.

$$13) 2x^2 = 16x$$

$\{8, 0\}$

$$14) n^2 - 20 = -n$$

$\{4, -5\}$

$$15) 6n^2 = -14 + 25n$$

$\left\{\frac{2}{3}, \frac{7}{2}\right\}$

$$16) 6x^2 - 17x = -12$$

$\left\{\frac{3}{2}, \frac{4}{3}\right\}$

Solve by taking square roots.

$$17) 9x^2 + 5 = 752$$
$$\{\sqrt{83}, -\sqrt{83}\}$$

$$18) 64n^2 - 2 = 79 \left\{ \frac{9}{8}, -\frac{9}{8} \right\}$$

Solve by completing the square.

$$19) n^2 + 12n - 94 = -9$$
$$\{5, -17\}$$

$$20) 10n^2 + 20n - 46 = -10$$
$$\left\{ \frac{-5 + \sqrt{115}}{5}, \frac{-5 - \sqrt{115}}{5} \right\}$$

Solve with the quadratic formula.

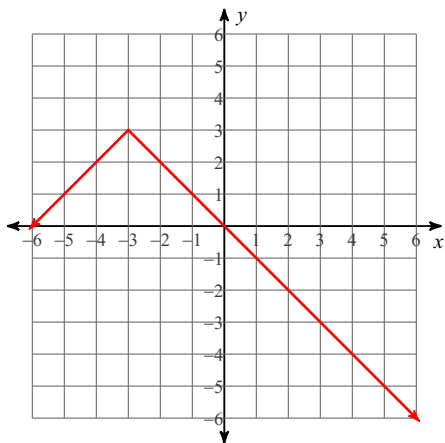
$$21) b^2 = 11b + 102$$
$$\{17, -6\}$$

$$22) 11n^2 + 2n = 6$$
$$\left\{ \frac{-1 + \sqrt{67}}{11}, \frac{-1 - \sqrt{67}}{11} \right\}$$

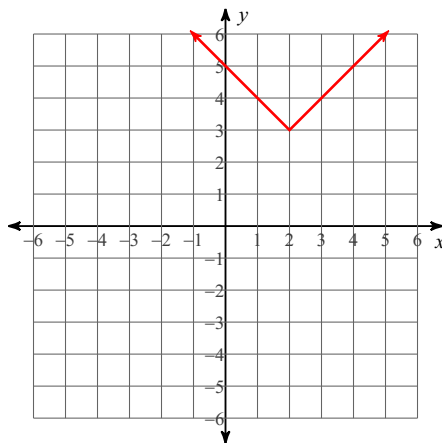
ABSOLUTE VALUE FUNCTIONS

Reminder: To graph an absolute value function you must first identify the vertex and then graph. If the variable inside of the absolute value bars has a coefficient, remember to factor the coefficient outside of the bars before identifying the vertex.

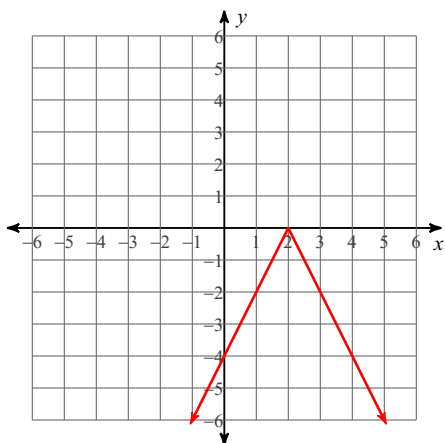
23) $y = -|x + 3| + 3$



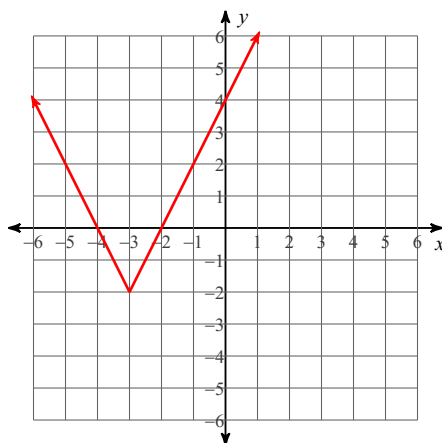
24) $y = |x - 2| + 3$



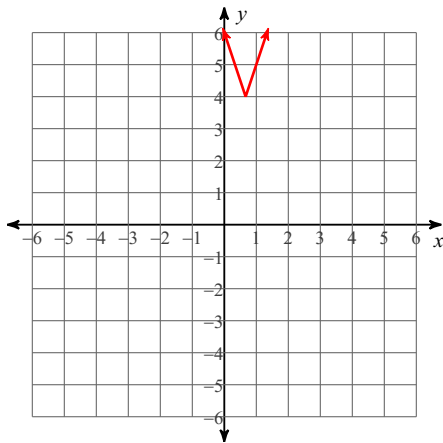
25) $y = -2|x - 2|$



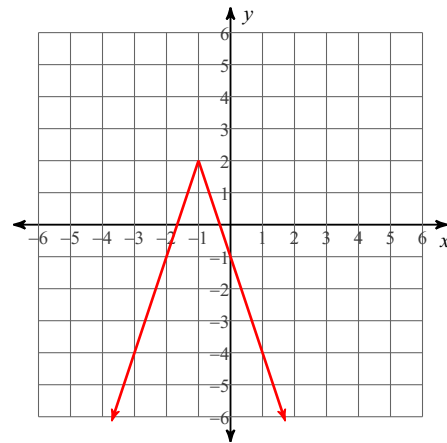
26) $y = 2|x + 3| - 2$



$$27) y = |3x - 2| + 4$$



$$28) y = -|3x + 3| + 2$$



Solve each absolute value equation.

Reminder: To solve an absolute value equation you must first isolate the absolute value term on one side of the equation. You may have no solution, one solution, or two solutions. Absolute value equations may contain extraneous solutions, so you must always check your answers.

$$29) \frac{|7b|}{9} = 1$$

$$\left\{ \frac{9}{7}, -\frac{9}{7} \right\}$$

$$30) |8 + n| - 3 = 14$$

$$\{9, -25\}$$

$$31) -9|1 + n| - 10 = -28$$

$$\{1, -3\}$$

$$32) 9 + 7\left|\frac{n}{7}\right| = 6$$

No solution.

Solve each absolute value inequality and give the solution using interval notation.

$$33) |7n| - 7 \leq -91$$

No solution.

$$34) -6 - 4|p - 7| < -10$$

$$p > 8 \text{ or } p < 6$$

$$35) 9|10 + x| - 1 \geq -19$$

{ All real numbers. }

$$36) 10 + 5\left|\frac{n}{6}\right| < 15$$

$$-6 < n < 6$$

$$37) 8 + 2|p - 9| < 32$$

$$-3 < p < 21$$

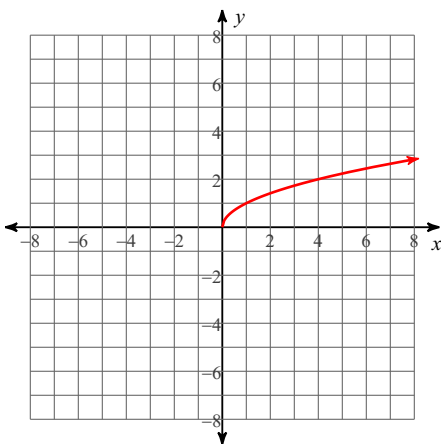
$$38) 4 + 5|-4n| \leq 64$$

$$-3 \leq n \leq 3$$

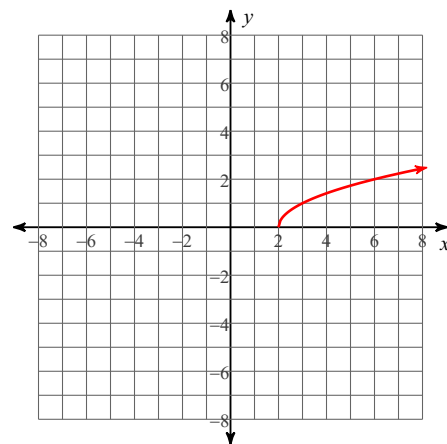
RADICAL FUNCTIONS

Sketch the graph of each function by using transformations. State the domain and range.

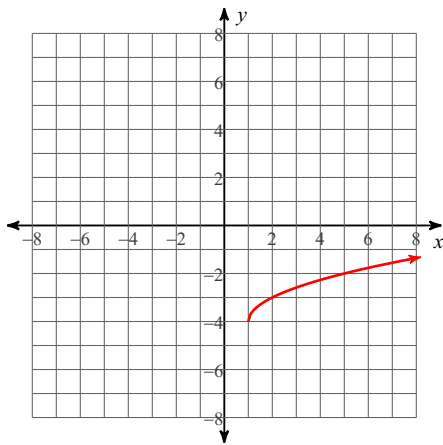
$$39) y = \sqrt{x}$$



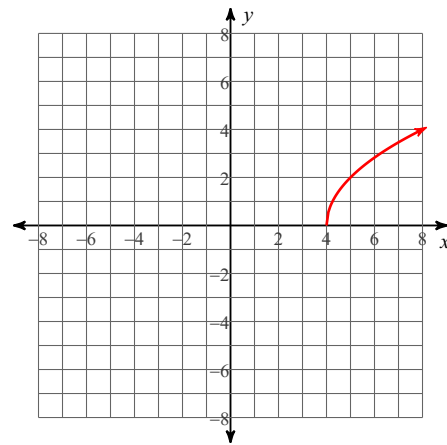
$$40) y = \sqrt{x - 2}$$



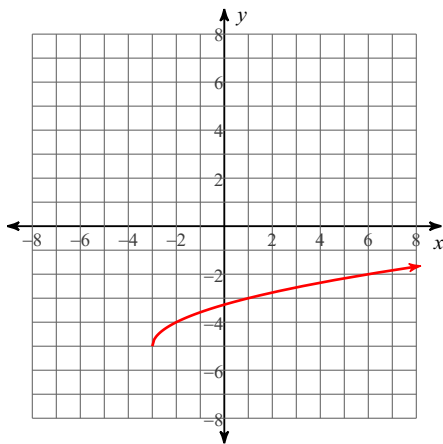
$$41) y = \sqrt{x-1} - 4$$



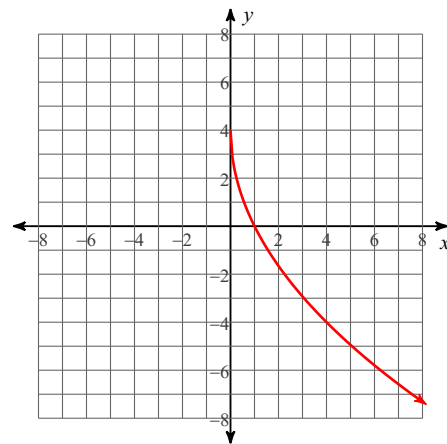
$$42) y = 2\sqrt{x-4}$$



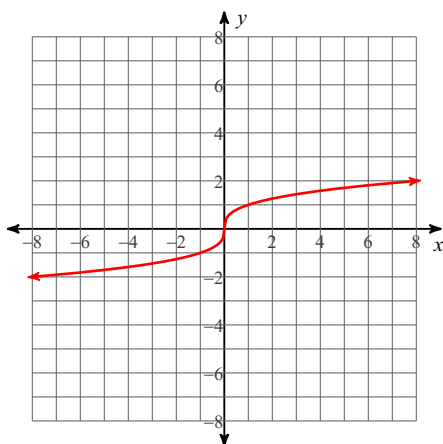
$$43) y = \sqrt{x+3} - 5$$



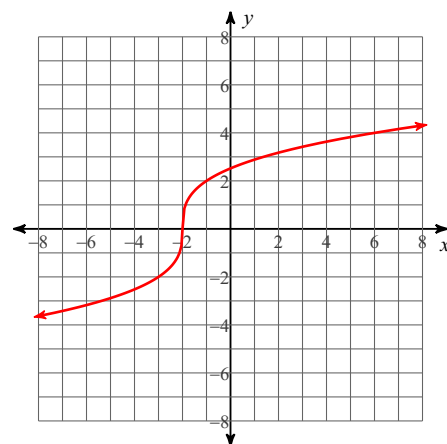
$$44) y = -4\sqrt{x} + 4$$



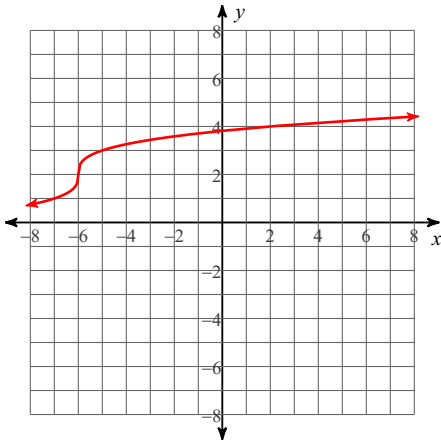
$$45) y = \sqrt[3]{x}$$



$$46) y = 2\sqrt[3]{x+2}$$



$$47) y = 2 + \sqrt[3]{x + 6}$$



Solve each radical equation. Remember to check for extraneous solutions.

Reminder: To solve radical equations isolate the radical. If two radicals exist, each radical should be on different sides of the equation and make sure only one side of the equation contains a binomial. Square both sides of the equation. If after squaring both sides, a radical still exists, you must repeat the process.

$$48) 17 = \sqrt{2k + 108} + 7$$

$$\{-4\}$$

$$49) \sqrt{2n - 28} = \sqrt{n - 10}$$

$$\{18\}$$

$$50) 5 = -5 + \sqrt{98 - 2r}$$

$$\{-1\}$$

$$51) \sqrt{9 - 2b} = \sqrt{-7 - 2b} + 2$$

$$\{-8\}$$

Reminder: To solve equations with a radical greater than two isolate the radical and raise both sides of the equation to the value of the index. To solve equations with a rational exponent, isolate the term with the rational exponent and raise both sides of the equation to the value of the reciprocal of the exponent. If a rational exponent contains a numerator with an even number and a denominator with an odd number, then absolute value must be used to solve the equation.

$$52) -632 = 8 - 5 \cdot (4x)^{\frac{7}{6}}$$

$$\{16\}$$

$$53) -6 = -8 + \sqrt[3]{3m + 32}$$

$$\{-8\}$$

$$54) -6 - (4 - 15a)^{\frac{3}{2}} = -518$$

$$\{-4\}$$

$$55) -2(-7 - 11r)^{\frac{1}{4}} - 7 = -13$$

$$\{-8\}$$

$$56) -2(35 - m)^{\frac{4}{3}} - 7 = -519$$

$$\{-29, 99\}$$

$$57) -8 - \sqrt[4]{2k} = -10$$

$$\{8\}$$

$$58) -5 - 5(n - 29)^{\frac{3}{2}} = -325$$

$$\{45\}$$

Solve the equations by finding all roots.

Reminder: To solve equations of degree three or higher, start by attempting to factor the equation. If the equation cannot be factored then use the Rational Root Theorem and synthetic division to find your roots. Once you have reduced your polynomial to linear quadratic factors, you may use the quadratic formula to finish solving the equation.

$$59) x^3 - 125 = 0$$

$$\left\{ 5, \frac{-5 + 5i\sqrt{3}}{2}, \frac{-5 - 5i\sqrt{3}}{2} \right\}$$

$$60) x^4 - 12x^2 + 27 = 0$$

$$\{3, -3, \sqrt{3}, -\sqrt{3}\}$$

61) $x^3 - 6x^2 + 5x = 0$

$\{0, 1, 5\}$

62) $x^4 - 16 = 0$

$\{2i, -2i, 2, -2\}$

63) $x^3 - 11x^2 - 25x - 13 = 0$

$\{13, -1 \text{ mult. } 2\}$

64) $x^4 + 7x^3 - x^2 - 7x = 0$

$\{0, -7, 1, -1\}$

Solve each rational equation. Remember to check for extraneous solutions.

Reminder: To solve rational equations first multiply both sides of the equation by the least common denominator. This will clear the fractions or rational expressions. To find the LCD factor the denominators.

65) $\frac{n-2}{4n} = \frac{3}{2} - \frac{3}{4n}$

$\left\{\frac{1}{5}\right\}$

66) $\frac{1}{5n} + 1 = \frac{3}{5n} \left\{\frac{2}{5}\right\}$

67) $\frac{r^2 - 4r - 12}{r^2} = \frac{4}{r} + \frac{r-4}{r}$

$\{-3\}$

68) $\frac{x+4}{3} = \frac{x^2 - x - 6}{x} + \frac{1}{x} \left\{5, -\frac{3}{2}\right\}$

$$69) \frac{m^2 + 10m + 24}{2m^2} + \frac{1}{m^2} = \frac{1}{2m^2}$$

{-5}

$$70) \frac{1}{x^2 - 2x} = \frac{4}{x^2 - 2x} - \frac{1}{x - 2}$$

{3}

$$71) \frac{b + 3}{b^2 - b} + 1 = \frac{b + 2}{b}$$

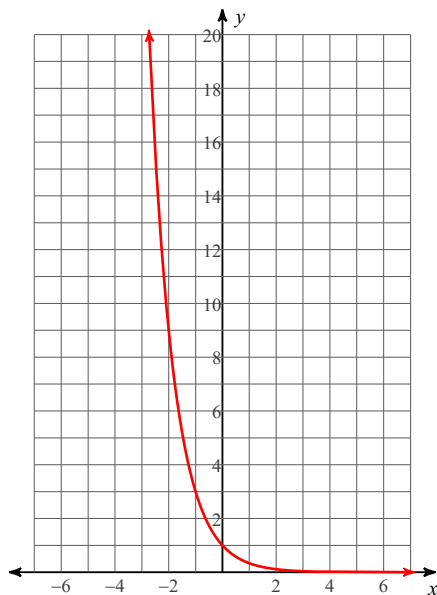
{5}

$$72) \frac{6}{p - 5} = \frac{6p + 6}{p - 5} + \frac{p + 5}{p^2 - 3p - 10} \left\{ -\frac{1}{2}, -\frac{5}{3} \right\}$$

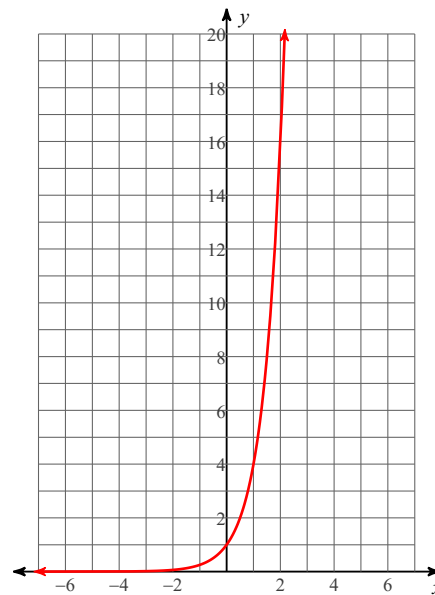
EXPONENTIAL FUNCTIONS

To graph exponential functions, identify transformations, graph the asymptote, and then plot the three basic points (x=-1, x=0, and x=1 at transformation).

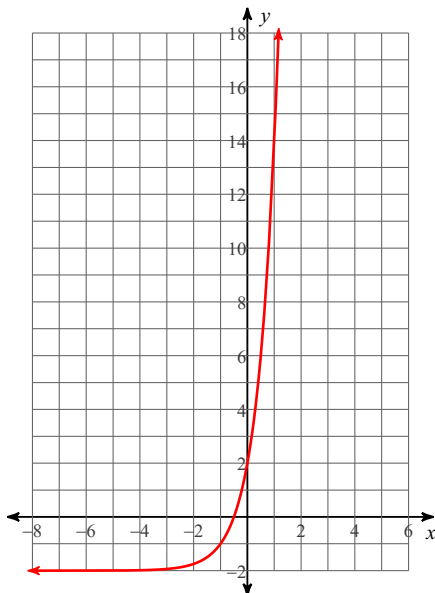
$$73) y = \left(\frac{1}{3}\right)^x$$



$$74) y = 4^x$$



$$75) y = 4^{x+1} - 2$$



Solve each exponential equation.

Reminder: To solve an exponential equation you must first isolate the exponential term on one side of the equation. If both sides of the equation can be converted to a term with the same base, then the equation can be solved by simply equating the exponents once the terms have the same base. If this is not possible, then you must solve by using logarithms.

$$76) 4^{-3b} = 16$$

$$\left\{ -\frac{2}{3} \right\}$$

$$77) 1000^{3m} = 10000^{3-m} \left\{ \frac{12}{13} \right\}$$

$$78) 7^{-3k-3} = 7^3$$

$$\{-2\}$$

$$79) 625^{2m} = 25^{-3m}$$

$$\{0\}$$

$$80) \left(\frac{1}{4} \right)^{2x} = 16^{3x}$$

$$\{0\}$$

$$81) 16^{2x-3} = \left(\frac{1}{64} \right)^{-3x} \left\{ -\frac{6}{5} \right\}$$

$$82) 10^{9n} = 57$$

$$\frac{\log 57}{9}$$

$$83) 6 \cdot 2^x = 20 \log_2 \frac{10}{3}$$

84) $e^{k-3} + 10 = 39$

$\ln 29 + 3$

85) $10e^{n-10} = 33$ $\ln \frac{33}{10} + 10$

Evaluate each expression without the use of a calculator.

86) $\log_2 16$

4

87) $\log_7 \frac{1}{49}$

-2

88) $\log_2 64$

6

89) $\log_2 \frac{1}{8}$

-3

90) $\log_{16} 1$

0

91) $\log_{15} 225$

2

92) $\ln e^3$

3

Solve each logarithmic equation. Give exact solution.

Reminder: If both sides of an equation contain one logarithmic term with the same base then the equation can be solved by setting the terms inside of the parenthesis equal to each other. If this is not the case, then use the properties of logarithms to condense the logarithms on one side of the equation. Convert the equation to exponential form and solve.

93) $\log_4 (k^2 + 2k) = \log_4 (49 + 2k)$

$\{7, -7\}$

94) $-4\log_6 3b = -12$

$\{72\}$

$$95) 3 \ln -2m + 9 = 12$$

$$\left\{ -\frac{e}{2} \right\}$$

$$96) -2 + 4 \ln 10n = 10 \quad \left\{ \frac{e^3}{10} \right\}$$

$$97) \ln (x + 5) + \ln 7 = 3$$

$$\left\{ \frac{e^3 - 35}{7} \right\}$$

$$98) \log 5x^2 + \log 2 = 5$$

$$\{100, -100\}$$

$$99) \log 7 - \log (x + 1) = 1$$

$$\left\{ -\frac{3}{10} \right\}$$

$$100) \ln 2x^2 + \ln 8 = 2 \quad \left\{ \frac{e}{4}, -\frac{e}{4} \right\}$$

PROPERTIES OF EXPONENTS

Simplify. Your answer should contain only positive exponents.

$$101) \frac{2m^4 n^{-3} \cdot nm^{-3}}{(2m^{-1} n^{-4})^2}$$

$$\frac{m^3 n^6}{2}$$

$$102) \frac{u^3 v^{-1} \cdot 2v}{(v^4)^3} \quad \frac{2u^3}{v^{12}}$$

$$103) \frac{(2xy^3)^4}{x^2y^2 \cdot 2x^4y^{-2}}$$
$$\frac{8y^{12}}{x^2}$$

OPERATIONS WITH RADICALS

Simplify without the use of a calculator. Use absolute value signs when necessary.

$$104) \sqrt{48n^2}$$
$$4|n|\sqrt{3}$$

$$105) \sqrt[3]{56n^7}$$
$$2n^2\sqrt[3]{7n}$$

$$106) \sqrt[3]{-48n^2}$$
$$-2\sqrt[3]{6n^2}$$

$$107) \sqrt[4]{243r^4}$$
$$3|r|\sqrt[4]{3}$$

$$108) \sqrt{75mn^3}$$
$$5|n|\sqrt{3mn}$$

$$109) \sqrt{32a^4b^3}$$
$$4a^2|b|\sqrt{2b}$$

$$110) \sqrt{147xy^3}$$
$$7|y|\sqrt{3xy}$$

Simplify.

$$111) -\sqrt[3]{40} - 3\sqrt[3]{40} \\ -8\sqrt[3]{5}$$

$$112) \sqrt[3]{36x^3} \cdot 4\sqrt[3]{-3x^2} \\ -12x\sqrt[3]{4x^2}$$

$$113) \sqrt{10x} \cdot \sqrt{6x^2} \\ 2x\sqrt{15x}$$

$$114) 3\sqrt{5}(2 + \sqrt{10}) \\ 6\sqrt{5} + 15\sqrt{2}$$

$$115) -4\sqrt{10}(\sqrt{2} - 4\sqrt{6}) \\ -8\sqrt{5} + 32\sqrt{15}$$

$$116) \frac{2\sqrt{3xy^3}}{\sqrt{15x^3y^2}} \\ \frac{2\sqrt{5y}}{5x}$$

$$117) \frac{4 + 3\sqrt{3r^3}}{\sqrt{6r^2}} \\ \frac{4\sqrt{6} + 9r\sqrt{2r}}{6r}$$

$$118) \frac{3\sqrt{2x}}{4x - \sqrt{3x^4}} \cdot \frac{12\sqrt{2x} + 3x\sqrt{6x}}{16x - 3x^3}$$

OPERATIONS WITH RATIONAL EXPRESSIONS

Simplify each expression.

$$119) \frac{5x}{6} - \frac{5y}{5xy} \\ \frac{5x^2 - 6}{6x}$$

$$120) \frac{4}{6y} - \frac{2y}{4x} \\ \frac{4x - 3y^2}{6yx}$$

$$121) \frac{4x}{x+4} - \frac{5x}{3x+6} \\ \frac{7x^2 + 4x}{3(x+4)(x+2)}$$

$$122) \frac{2}{3k} - \frac{k-1}{k+1} \\ \frac{-3k^2 + 5k + 2}{3k(k+1)}$$

Simplify each and state the excluded values.

$$123) \frac{7n+70}{2n-16} \div \frac{n-10}{2n-16}$$
$$\frac{7(n+10)}{n-10}; \{8, 10\}$$

$$124) \frac{9x+54}{4x+16} \cdot \frac{4x+16}{x+6}$$
$$9; \{-4, -6\}$$

$$125) \frac{x^2+3x-40}{18x+63} \cdot \frac{18x+63}{9x-45}$$
$$\frac{x+8}{9}; \left\{-\frac{7}{2}, 5\right\}$$

$$126) \frac{a-2}{a^2-5a+6} \div \frac{a^2+3a-18}{9a-27} \frac{9}{(a-3)(a+6)}; \{3, 2, -6\}$$

COMPLEX FRACTIONS

Simplify each expression.

$$127) \frac{\frac{2x+3}{9} - \frac{2x+3}{3}}{\frac{9}{2x+3}}$$
$$\frac{-8x^2 - 24x - 18}{81}$$

$$128) \frac{\frac{x^2}{16} - \frac{1}{x}}{4} \frac{x^3 - 16}{64x}$$

$$129) \frac{\frac{4}{yx} - \frac{x}{2}}{xy}$$
$$\frac{8 - x^2y}{2y^2x^2}$$

$$130) \frac{\frac{1}{m} - \frac{1}{2}}{n+4} \frac{2-m}{2mn+8m}$$

COMPLEX NUMBERS

Simplify.

$$131) (3 - 2i) - (4 + 7i) \\ -1 - 9i$$

$$132) (8i)(7 - 6i) - 3(8 - 7i) \\ 24 + 77i$$

$$133) (-4i)(-6i)(6 + 6i) \\ -144 - 144i$$

$$134) \frac{1}{9 + 10i} \frac{9 - 10i}{181}$$

$$135) \frac{4 + 4i}{-7i} \frac{4i - 4}{7}$$

$$136) \frac{-2 + 3i}{-6 + 6i} \frac{5 - i}{12}$$

Simplify. Remember that in order to add and subtract radicals, they must look the same. If they are not, look to see if you can simplify them first.

$$137) -\sqrt{5} + 3\sqrt{20} + 3\sqrt{27} \\ 5\sqrt{5} + 9\sqrt{3}$$

$$138) -3\sqrt{24} - \sqrt{54} - \sqrt{5} \\ -9\sqrt{6} - \sqrt{5}$$

Simplify.

$$139) \frac{5\sqrt{3} + \sqrt{2}}{-4 - 5\sqrt{5}} \frac{20\sqrt{3} - 25\sqrt{15} + 4\sqrt{2} - 5\sqrt{10}}{109}$$

$$140) \frac{\sqrt{3} + 3}{-1 + 2\sqrt{5}} \frac{\sqrt{3} + 2\sqrt{15} + 3 + 6\sqrt{5}}{19}$$

$$141) (-\sqrt{2} + 5)(\sqrt{2} + 4) \\ 18 + \sqrt{2}$$

Factor each completely.

$$142) 6x^4 - 30x^2 + 36 \\ 6(x^2 - 3)(x^2 - 2)$$

$$143) 6x^4 - 54x^2 + 84 \\ 6(x^2 - 7)(x^2 - 2)$$

$$144) 12u^4 + 44u^2 - 80 \\ 4(3u^2 - 4)(u^2 + 5)$$

$$145) 5a^2 - 10a - 120 \\ 5(a + 4)(a - 6)$$

$$146) v^2 + 14v + 49 \\ (v + 7)^2$$

$$147) 9n^2 - 1 \\ (3n + 1)(3n - 1)$$

$$148) 16x^2 + 8x + 1 \\ (4x + 1)^2$$

$$149) 2x^3 - 14x^2 - 7x + 49 \\ (2x^2 - 7)(x - 7)$$

$$150) 24p^3 + 40p^2 - 15p - 25$$
$$(8p^2 - 5)(3p + 5)$$

Evaluate each function.

$$151) p(t) = -4t + 4; \text{ Find } p(-4)$$
$$20$$

$$152) k(t) = -t^3 + 4t; \text{ Find } k(5)$$
$$-105$$

Perform the indicated operation.

$$153) g(t) = -4t + 1$$
$$f(t) = t - 5$$
$$\text{Find } (g \circ f)(t)$$
$$-4t + 21$$

$$154) g(a) = a^3 + 2a$$
$$h(a) = 2a - 1$$
$$\text{Find } (g \circ h)(a)$$
$$8a^3 - 12a^2 + 10a - 3$$

$$155) f(a) = 2a^3 + a$$
$$g(a) = 2a - 1$$
$$\text{Find } (f \cdot g)(a)$$
$$4a^4 - 2a^3 + 2a^2 - a$$

$$156) f(x) = 4x + 4$$
$$g(x) = x^3 - 5$$
$$\text{Find } (f + g)(x)$$
$$x^3 + 4x - 1$$

$$157) h(x) = x + 1$$
$$g(x) = x^2 - 5$$
$$\text{Find } (h \cdot g)(5)$$
$$120$$

$$158) f(n) = 3n - 3$$
$$g(n) = n^2 - 2n$$
$$\text{Find } \left(\frac{f}{g}\right)(7)$$
$$\frac{18}{35}$$

$$159) f(t) = t^2 + 3t$$
$$g(t) = t - 5$$
$$\text{Find } (f + g)(3)$$
$$16$$

Solve each system by elimination.

$$160) -2x + 2y = -12$$
$$x - 10y = -3$$
$$(7, 1)$$

$$161) 5x + 4y = -25$$
$$-3x - 6y = 15$$
$$(-5, 0)$$

$$162) 5a - 3b + 4c = 2$$
$$3a + b - 5c = -21$$
$$-5a - 2b + 4c = 22$$
$$(-2, 0, 3)$$

$$163) -2r + 5s + 3t = 22$$
$$4r - 5s + t = -20$$
$$-3r - 6s + 6t = 9$$
$$(-3, 2, 2)$$