

Intro to Precalculus



Summer Review 2023

Each set of problems comes with an answer key to check the completed work.

Factoring Trinomials (a = 1)

Factor each completely.

1) $b^2 + 8b + 7$

2) $n^2 - 11n + 10$

3) $m^2 + m - 90$

4) $n^2 + 4n - 12$

5) $n^2 - 10n + 9$

6) $b^2 + 16b + 64$

7) $m^2 + 2m - 24$

8) $x^2 - 4x + 24$

9) $k^2 - 13k + 40$

10) $a^2 + 11a + 18$

11) $n^2 - n - 56$

12) $n^2 - 5n + 6$

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$$13) b^2 - 6b + 8$$

$$14) n^2 + 6n + 8$$

$$15) 2n^2 + 6n - 108$$

$$16) 5n^2 + 10n + 20$$

$$17) 2k^2 + 22k + 60$$

$$18) a^2 - a - 90$$

$$19) p^2 + 11p + 10$$

$$20) 5v^2 - 30v + 40$$

$$21) 2p^2 + 2p - 4$$

$$22) 4v^2 - 4v - 8$$

$$23) x^2 - 15x + 50$$

$$24) v^2 - 7v + 10$$

$$25) p^2 + 3p - 18$$

$$26) 6v^2 + 66v + 60$$

Factoring Trinomials (a = 1)

Factor each completely.

1) $b^2 + 8b + 7$
 $(b + 7)(b + 1)$

2) $n^2 - 11n + 10$
 $(n - 10)(n - 1)$

3) $m^2 + m - 90$
 $(m - 9)(m + 10)$

4) $n^2 + 4n - 12$
 $(n - 2)(n + 6)$

5) $n^2 - 10n + 9$
 $(n - 1)(n - 9)$

6) $b^2 + 16b + 64$
 $(b + 8)^2$

7) $m^2 + 2m - 24$
 $(m + 6)(m - 4)$

8) $x^2 - 4x + 24$
Not factorable

9) $k^2 - 13k + 40$
 $(k - 5)(k - 8)$

10) $a^2 + 11a + 18$
 $(a + 2)(a + 9)$

11) $n^2 - n - 56$
 $(n + 7)(n - 8)$

12) $n^2 - 5n + 6$
 $(n - 2)(n - 3)$

$$13) b^2 - 6b + 8$$

$$(b - 4)(b - 2)$$

$$14) n^2 + 6n + 8$$

$$(n + 2)(n + 4)$$

$$15) 2n^2 + 6n - 108$$

$$2(n + 9)(n - 6)$$

$$16) 5n^2 + 10n + 20$$

$$5(n^2 + 2n + 4)$$

$$17) 2k^2 + 22k + 60$$

$$2(k + 5)(k + 6)$$

$$18) a^2 - a - 90$$

$$(a - 10)(a + 9)$$

$$19) p^2 + 11p + 10$$

$$(p + 10)(p + 1)$$

$$20) 5v^2 - 30v + 40$$

$$5(v - 2)(v - 4)$$

$$21) 2p^2 + 2p - 4$$

$$2(p - 1)(p + 2)$$

$$22) 4v^2 - 4v - 8$$

$$4(v + 1)(v - 2)$$

$$23) x^2 - 15x + 50$$

$$(x - 10)(x - 5)$$

$$24) v^2 - 7v + 10$$

$$(v - 5)(v - 2)$$

$$25) p^2 + 3p - 18$$

$$(p - 3)(p + 6)$$

$$26) 6v^2 + 66v + 60$$

$$6(v + 10)(v + 1)$$

Factoring Special Cases

Factor each completely.

1) $16n^2 - 9$

2) $4m^2 - 25$

3) $16b^2 - 40b + 25$

4) $4x^2 - 4x + 1$

5) $9x^2 - 1$

6) $n^2 - 25$

7) $n^4 - 100$

8) $a^4 - 9$

9) $k^4 - 36$

10) $n^4 - 49$

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$$11) 98n^2 - 200$$

$$12) 3 + 6b + 3b^2$$

$$13) 400 - 36v^2$$

$$14) 100x^2 + 180x + 81$$

$$15) 10n^2 + 100n + 250$$

$$16) 49n^2 - 56n + 16$$

$$17) 49x^2 - 100$$

$$18) 1 - r^2$$

$$19) 10p^3 - 1960p$$

$$20) 343b^2 - 7b^4$$

$$21) 81v^4 - 900v^2$$

$$22) 200m^4 + 80m^3 + 8m^2$$

Factoring Special Cases

Factor each completely.

1) $16n^2 - 9$

$(4n + 3)(4n - 3)$

2) $4m^2 - 25$

$(2m + 5)(2m - 5)$

3) $16b^2 - 40b + 25$

$(4b - 5)^2$

4) $4x^2 - 4x + 1$

$(2x - 1)^2$

5) $9x^2 - 1$

$(3x + 1)(3x - 1)$

6) $n^2 - 25$

$(n + 5)(n - 5)$

7) $n^4 - 100$

$(n^2 + 10)(n^2 - 10)$

8) $a^4 - 9$

$(a^2 + 3)(a^2 - 3)$

9) $k^4 - 36$

$(k^2 + 6)(k^2 - 6)$

10) $n^4 - 49$

$(n^2 + 7)(n^2 - 7)$

$$11) 98n^2 - 200$$

$$2(7n + 10)(7n - 10)$$

$$12) 3 + 6b + 3b^2$$

$$3(1 + b)^2$$

$$13) 400 - 36v^2$$

$$4(10 + 3v)(10 - 3v)$$

$$14) 100x^2 + 180x + 81$$

$$(10x + 9)^2$$

$$15) 10n^2 + 100n + 250$$

$$10(n + 5)^2$$

$$16) 49n^2 - 56n + 16$$

$$(7n - 4)^2$$

$$17) 49x^2 - 100$$

$$(7x + 10)(7x - 10)$$

$$18) 1 - r^2$$

$$(1 + r)(1 - r)$$

$$19) 10p^3 - 1960p$$

$$10p(p + 14)(p - 14)$$

$$20) 343b^2 - 7b^4$$

$$7b^2(7 + b)(7 - b)$$

$$21) 81v^4 - 900v^2$$

$$9v^2(3v + 10)(3v - 10)$$

$$22) 200m^4 + 80m^3 + 8m^2$$

$$8m^2(5m + 1)^2$$

Dividing Polynomials

Divide.

1) $(m^2 - 7m - 11) \div (m - 8)$

2) $(n^2 - n - 29) \div (n - 6)$

3) $(n^2 + 10n + 18) \div (n + 5)$

4) $(k^2 - 7k + 10) \div (k - 1)$

5) $(n^2 - 3n - 21) \div (n - 7)$

6) $(a^2 - 28) \div (a - 5)$

7) $(r^2 + 14r + 38) \div (r + 8)$

8) $(x^2 + 5x + 3) \div (x + 6)$

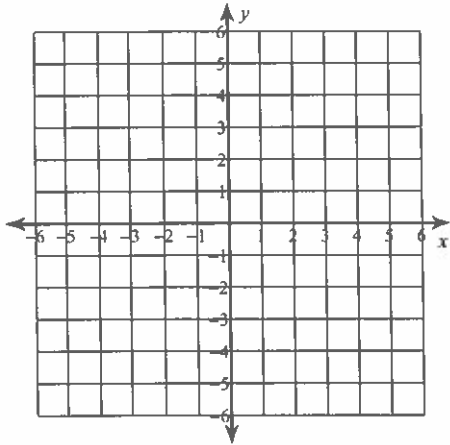
9) $(2x^2 - 17x - 38) \div (2x + 3)$

10) $(42x^2 - 33) \div (7x + 7)$

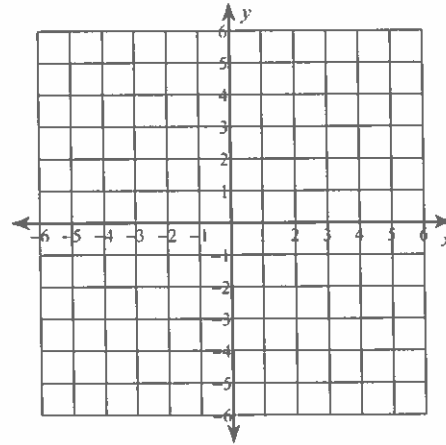
Review of Linear Equations

Sketch the graph of each line.

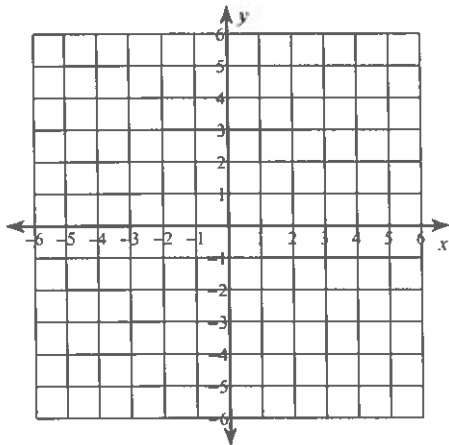
1) $y = -2x - 2$



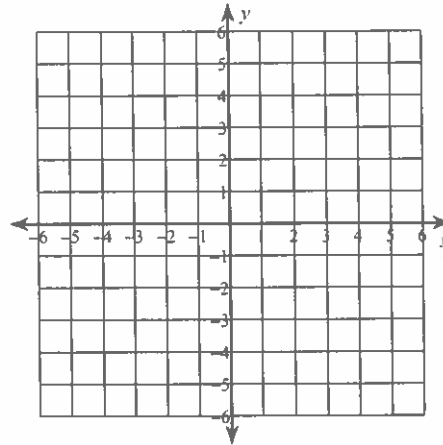
2) $y = -x - 2$



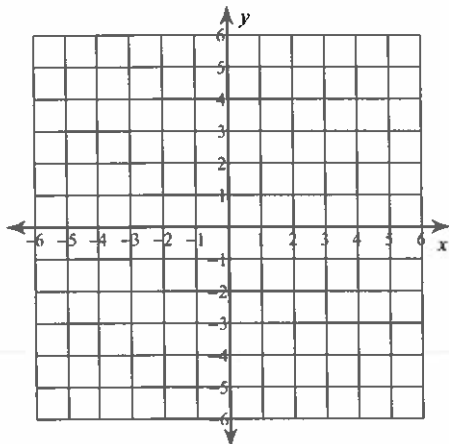
3) $2x - 5y = 5$



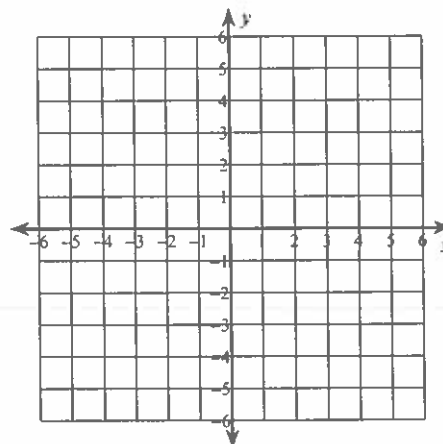
4) $x = -1$



5) $32 - 2x = 8y$



6) $0 = x + \frac{1}{4}y + \frac{1}{2}$



Write the standard form of the equation of each line given the slope and y-intercept.

7) Slope = $-\frac{3}{5}$, y-intercept = 5

8) Slope = 9, y-intercept = 4

Write the standard form of the equation of each line.

9) $y = -\frac{7}{5}x + 1$

10) $y = \frac{3}{2}x + 5$

11) $y + 4 = -7(x - 1)$

12) $y + 1 = -(x + 3)$

13) $-10x - y = -5$

14) $-4 - 2y = -x$

Write the standard form of the equation of the line through the given point with the given slope.

15) through: (4, -2), slope = -1

16) through: (-2, 4), slope = $-\frac{1}{7}$

Write the standard form of the equation of the line through the given points.

17) through: (-3, 2) and (0, -1)

18) through: (0, 4) and (-1, -1)

Write the standard form of the equation of the line described.

19) through: (2, 0), parallel to $y = \frac{2}{3}x$

20) through: (-2, 4), parallel to $y = -\frac{3}{2}x + 3$

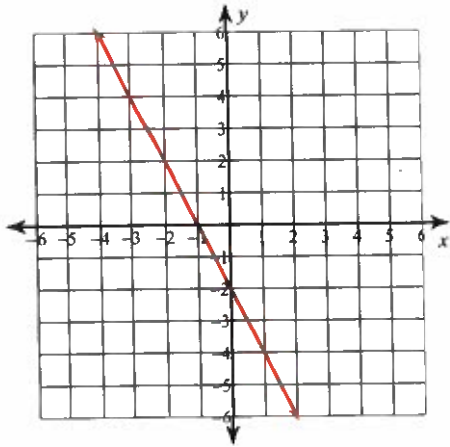
21) through: (2, 4), perp. to $y = -\frac{2}{7}x - 5$

22) through: (5, 0), perp. to $y = -x + 5$

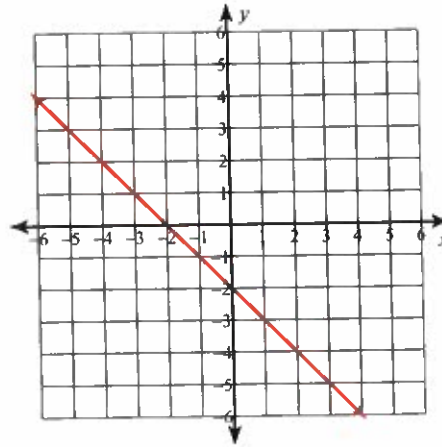
Review of Linear Equations

Sketch the graph of each line.

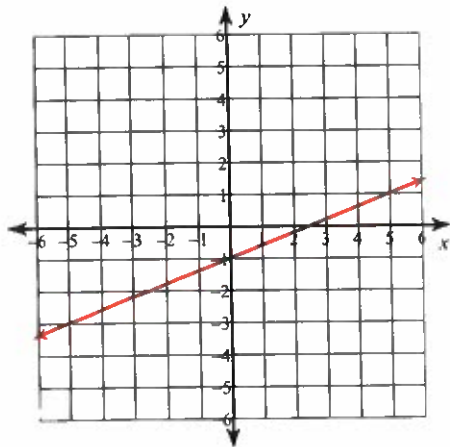
1) $y = -2x - 2$



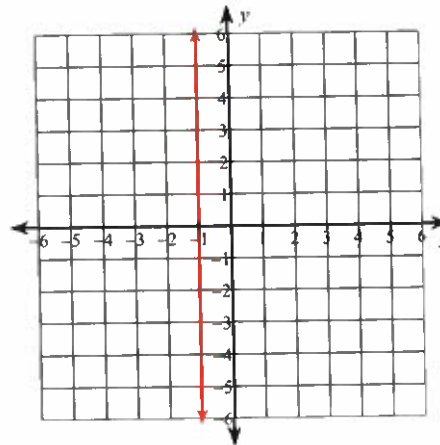
2) $y = -x - 2$



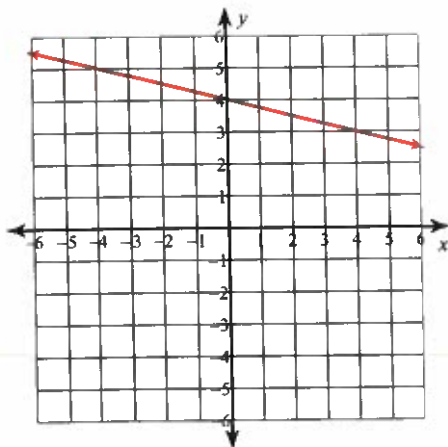
3) $2x - 5y = 5$



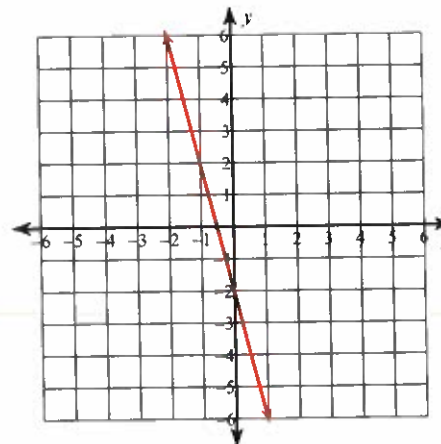
4) $x = -1$



5) $32 - 2x = 8y$



6) $0 = x + \frac{1}{4}y + \frac{1}{2}$



Write the standard form of the equation of each line given the slope and y-intercept.

7) Slope = $-\frac{3}{5}$, y-intercept = 5

$$3x + 5y = 25$$

8) Slope = 9, y-intercept = 4

$$9x - y = -4$$

Write the standard form of the equation of each line.

9) $y = -\frac{7}{5}x + 1$

$$7x + 5y = 5$$

10) $y = \frac{3}{2}x + 5$

$$3x - 2y = -10$$

11) $y + 4 = -7(x - 1)$

$$7x + y = 3$$

12) $y + 1 = -(x + 3)$

$$x + y = -4$$

13) $-10x - y = -5$

$$10x + y = 5$$

14) $-4 - 2y = -x$

$$x - 2y = 4$$

Write the standard form of the equation of the line through the given point with the given slope.

15) through: (4, -2), slope = -1

$$x + y = 2$$

16) through: (-2, 4), slope = $-\frac{1}{7}$

$$x + 7y = 26$$

Write the standard form of the equation of the line through the given points.

17) through: (-3, 2) and (0, -1)

$$x + y = -1$$

18) through: (0, 4) and (-1, -1)

$$5x - y = -4$$

Write the standard form of the equation of the line described.

19) through: (2, 0), parallel to $y = \frac{2}{3}x$

$$2x - 3y = 4$$

20) through: (-2, 4), parallel to $y = -\frac{3}{2}x + 3$

$$3x + 2y = 2$$

21) through: (2, 4), perp. to $y = -\frac{2}{7}x - 5$

$$7x - 2y = 6$$

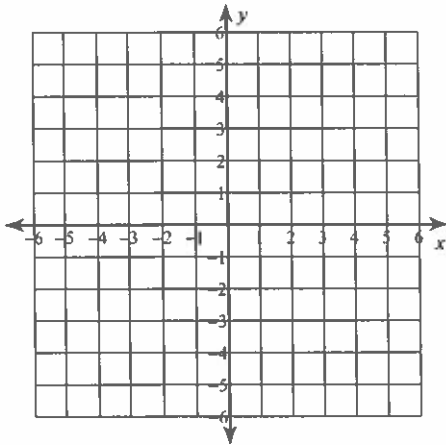
22) through: (5, 0), perp. to $y = -x + 5$

$$x - y = 5$$

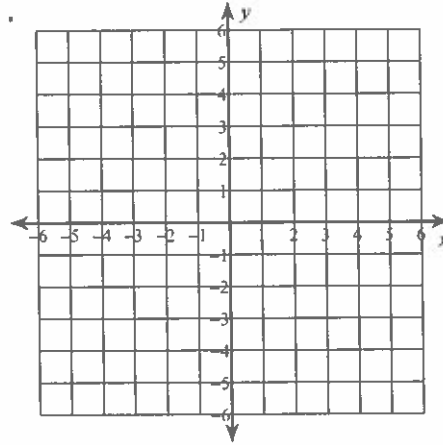
Graphing Absolute Value Equations

Graph each equation.

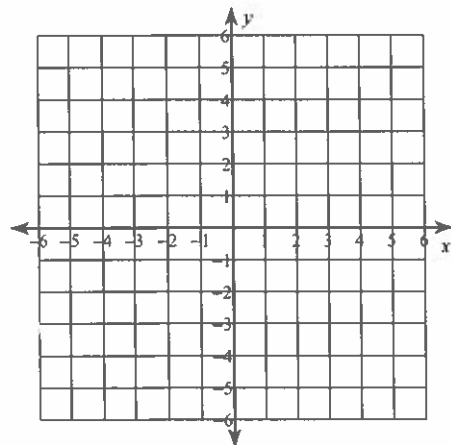
1) $y = |x - 1|$



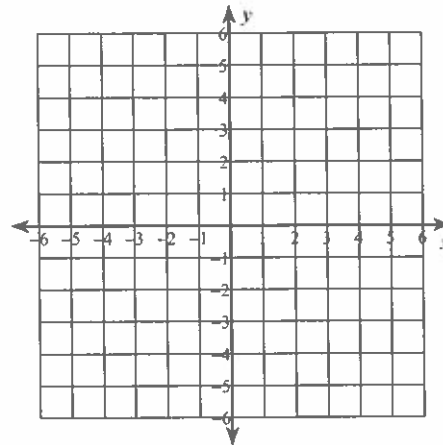
2) $y = |x + 4|$



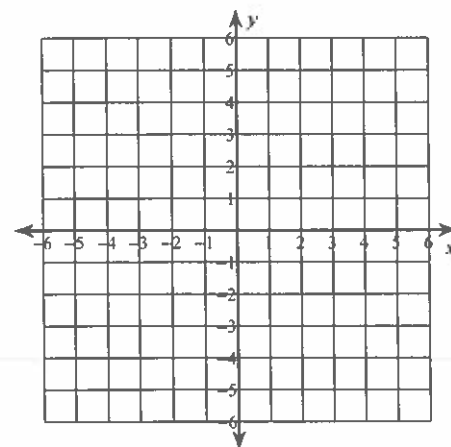
3) $y = |x - 2|$



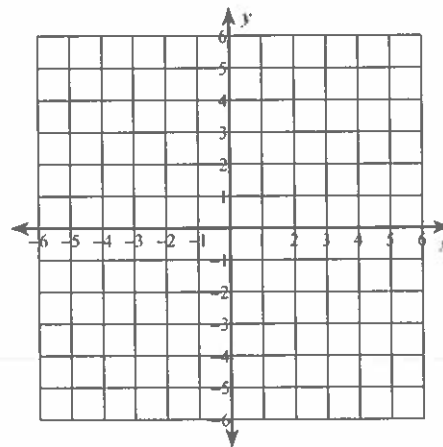
4) $y = -|x - 2|$



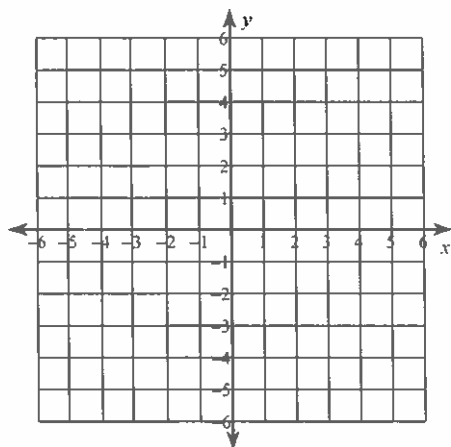
5) $y = -|x| - 1$



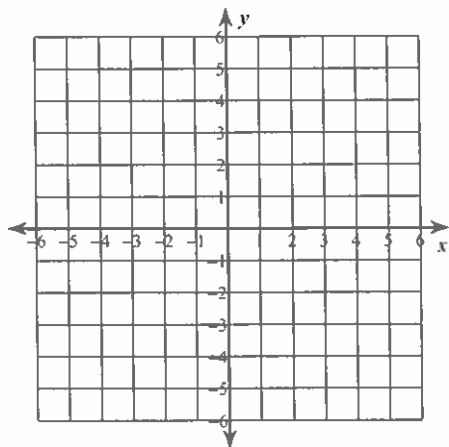
6) $y = -|x - 1|$



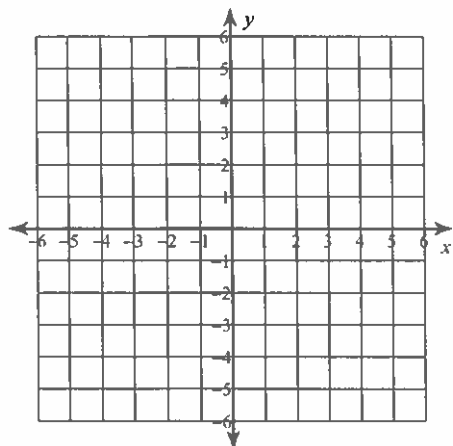
$$7) y = -2|2x + 2| + 4$$



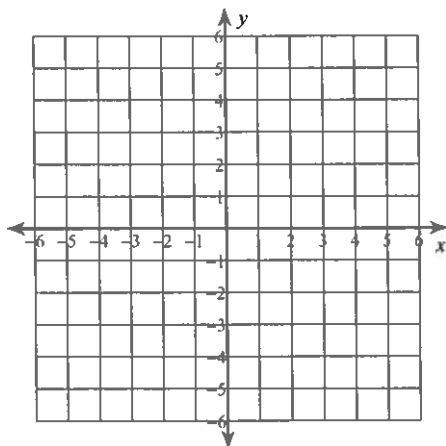
$$8) y = -3|3x - 3| + 1$$



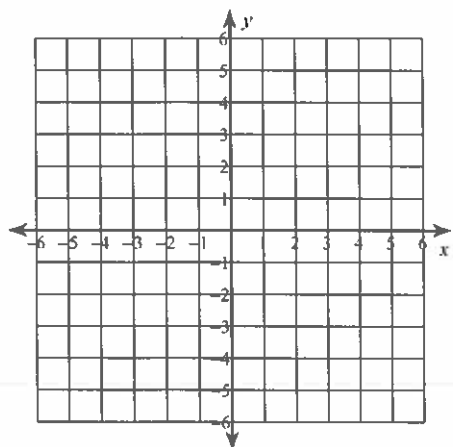
$$9) y = 2|2x - 3|$$



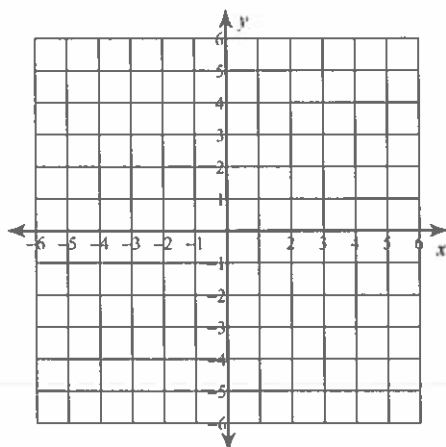
$$10) y = 3|-3x - 3|$$



$$11) y = 2|-3x + 4| - 3$$



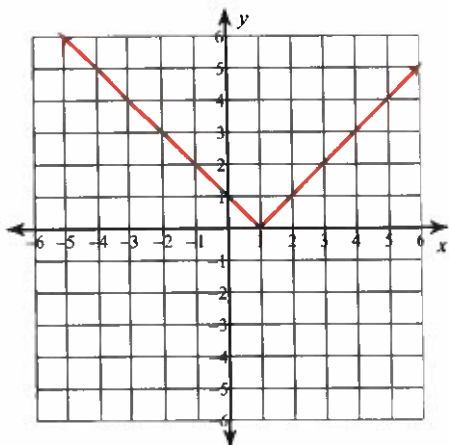
$$12) y = -3|-2x + 4| + 3$$



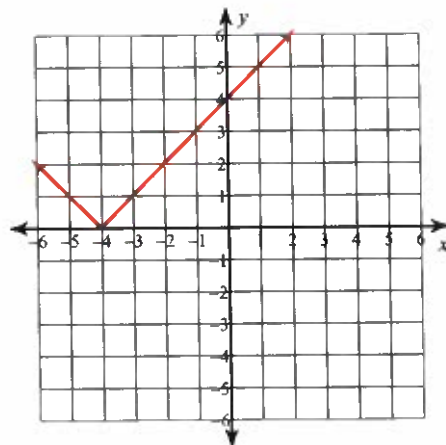
Graphing Absolute Value Equations

Graph each equation.

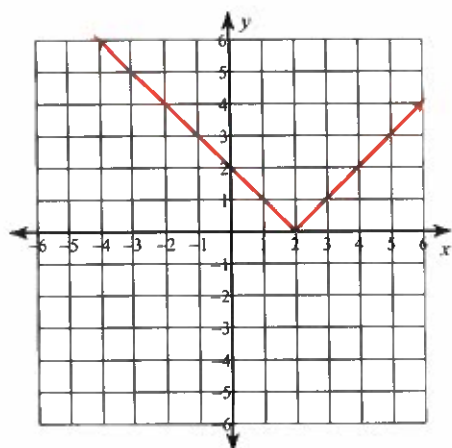
1) $y = |x - 1|$



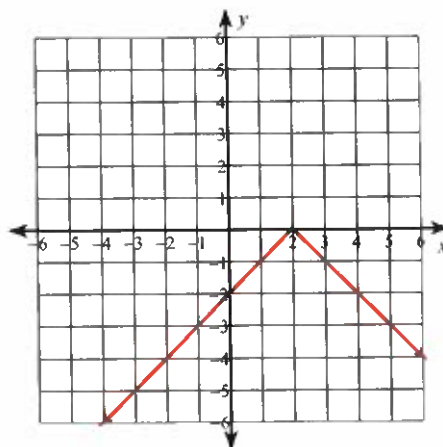
2) $y = |x + 4|$



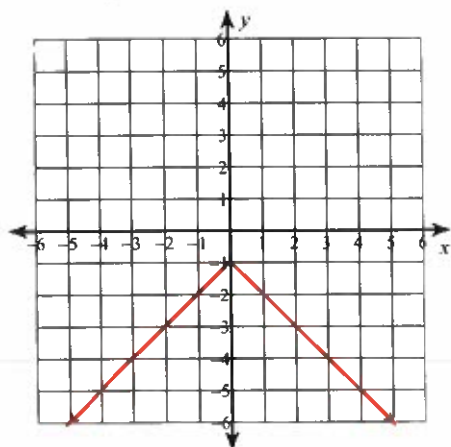
3) $y = |x - 2|$



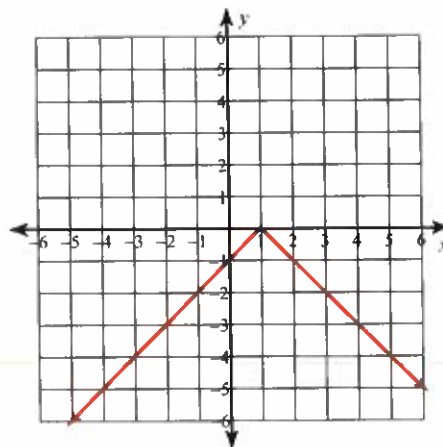
4) $y = -|x - 2|$



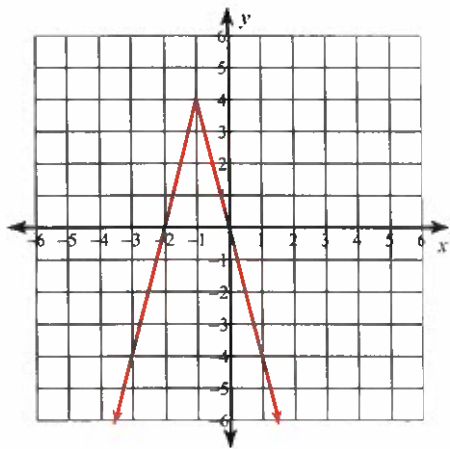
5) $y = -|x| - 1$



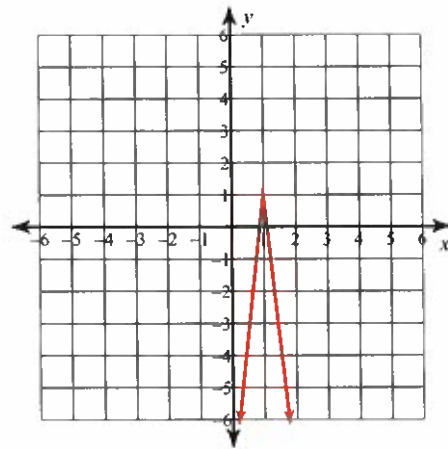
6) $y = -|x - 1|$



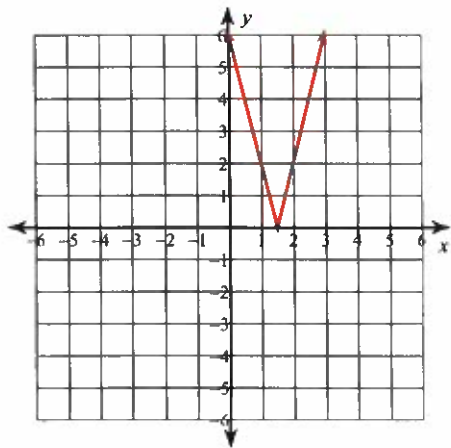
$$7) y = -2|2x + 2| + 4$$



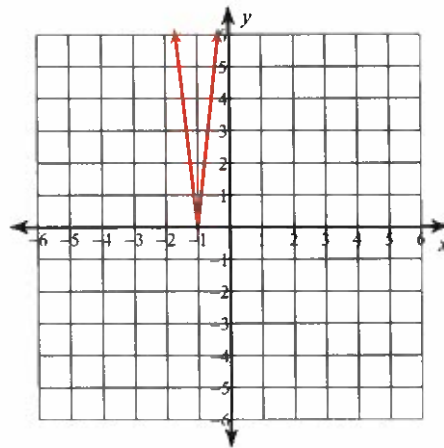
$$8) y = -3|3x - 3| + 1$$



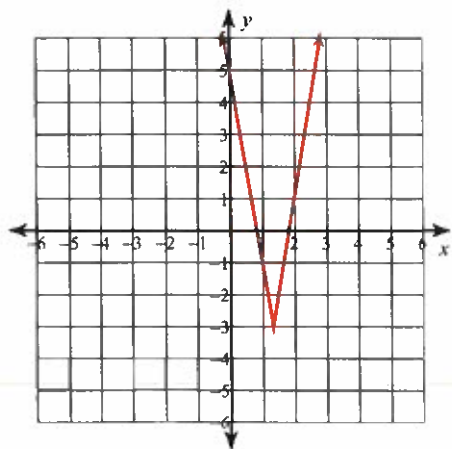
$$9) y = 2|2x - 3|$$



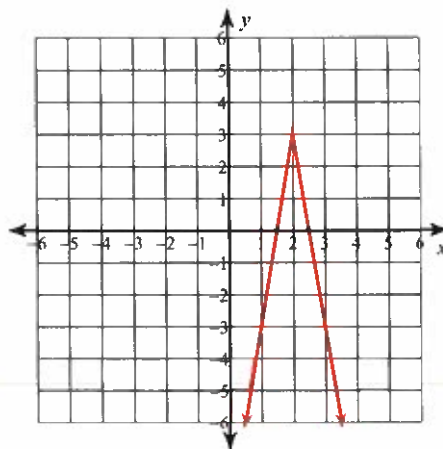
$$10) y = 3|-3x - 3|$$



$$11) y = 2|-3x + 4| - 3$$



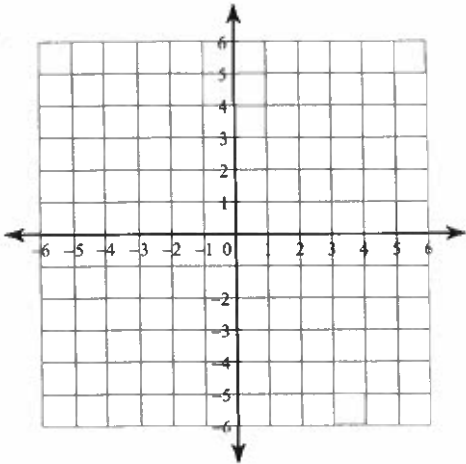
$$12) y = -3|-2x + 4| + 3$$



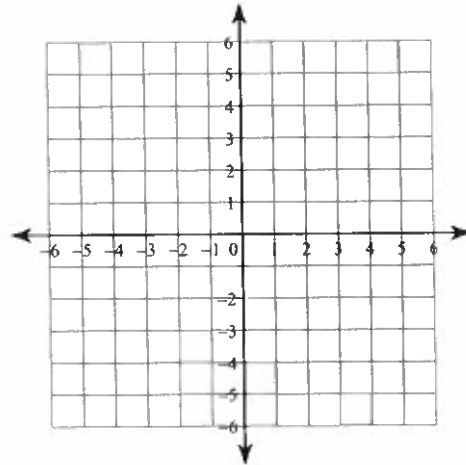
Graphing Linear Inequalities

Sketch the graph of each linear inequality.

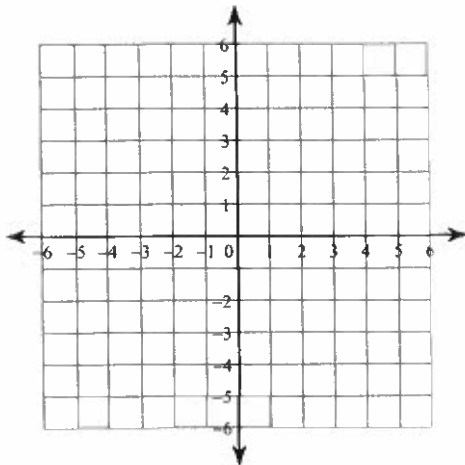
1) $y \geq -2x - 2$



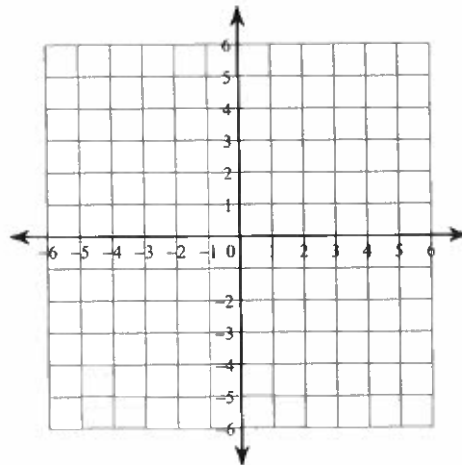
2) $y \leq -\frac{1}{3}x + 1$



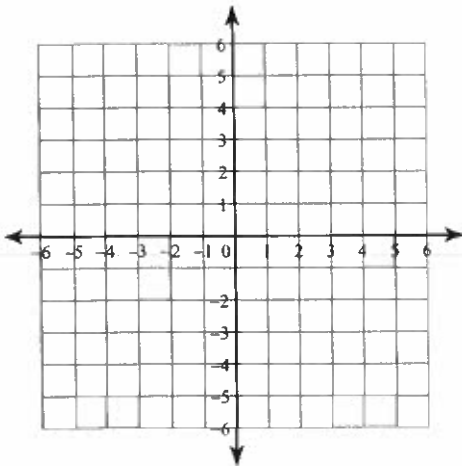
3) $x \geq -2$



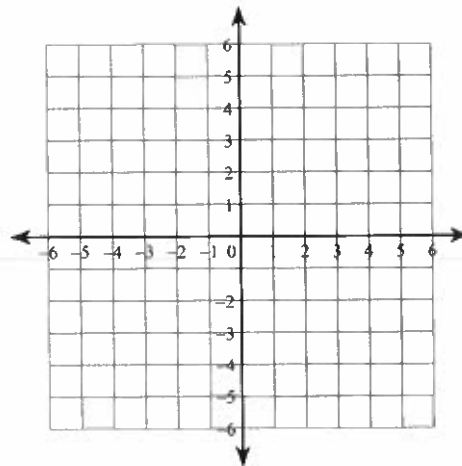
4) $y < x - 2$



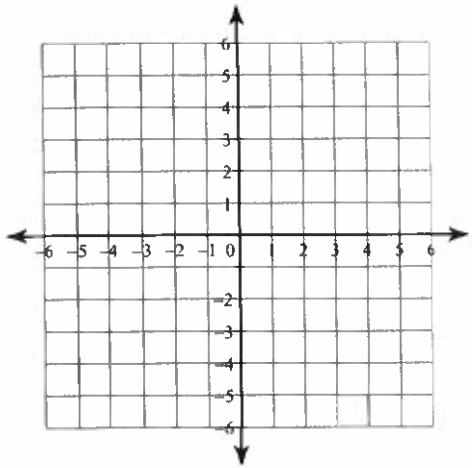
5) $y \geq x - 2$



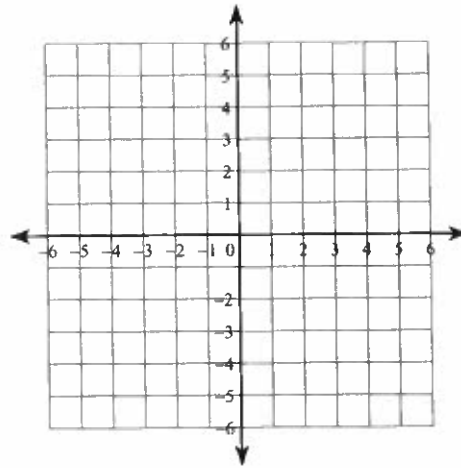
6) $y < 6x + 1$



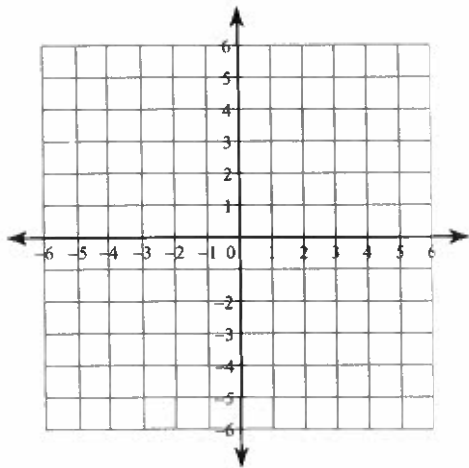
7) $5x - y \geq 5$



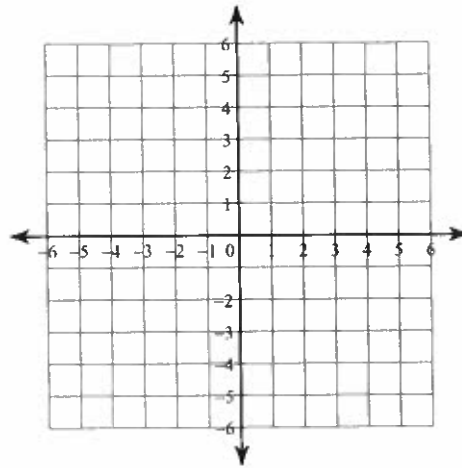
8) $x + 3y \geq 3$



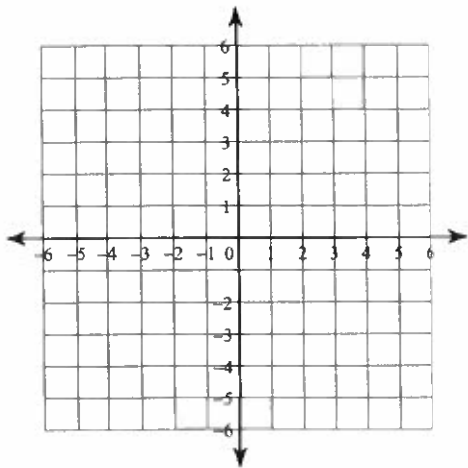
9) $y \geq 5$



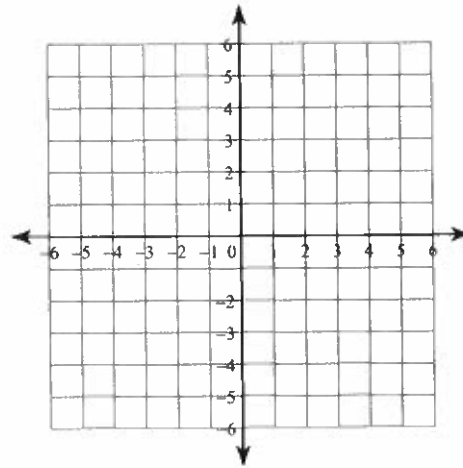
10) $2x - 5y \leq 10$



11) $8x - 3y \leq 12$



12) $x - y \geq 0$



Critical thinking questions:

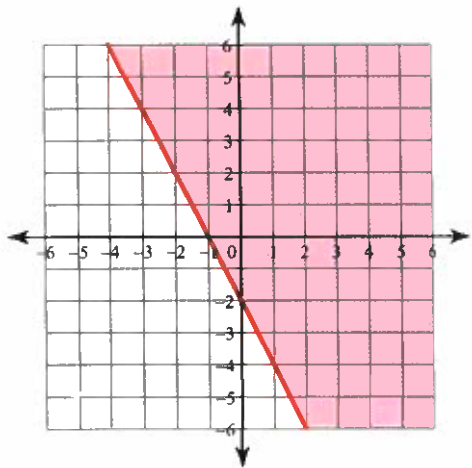
13) Name one particular solution to #11

14) Can you write a linear inequality whose solution contains only points with positive x -values and positive y -values? Why or why not?

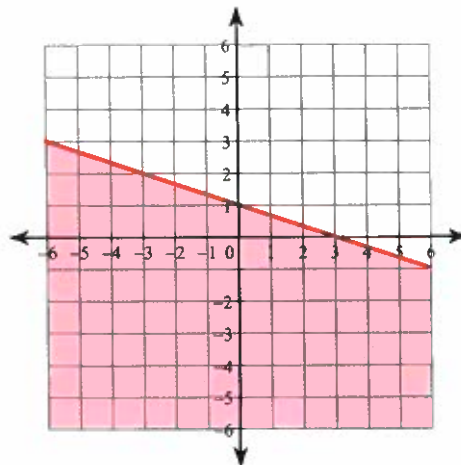
Graphing Linear Inequalities

Sketch the graph of each linear inequality.

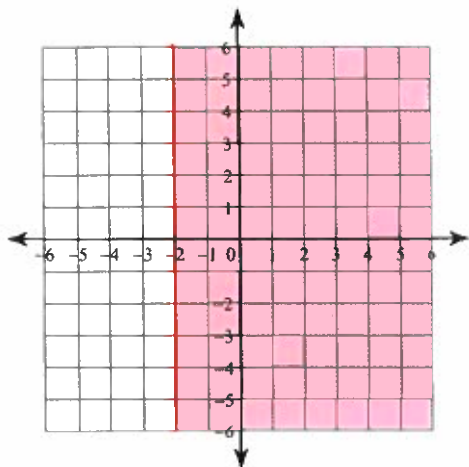
1) $y \geq -2x - 2$



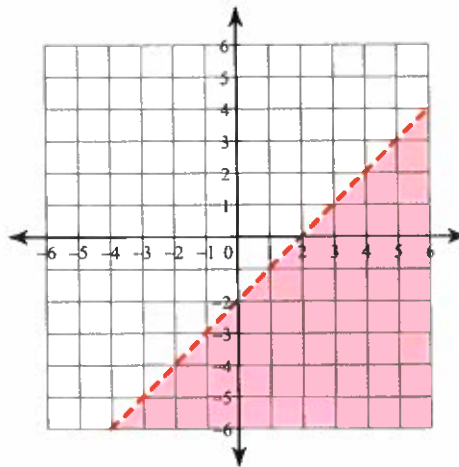
2) $y \leq -\frac{1}{3}x + 1$



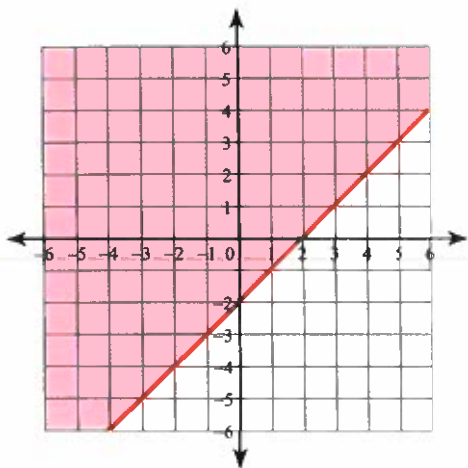
3) $x \geq -2$



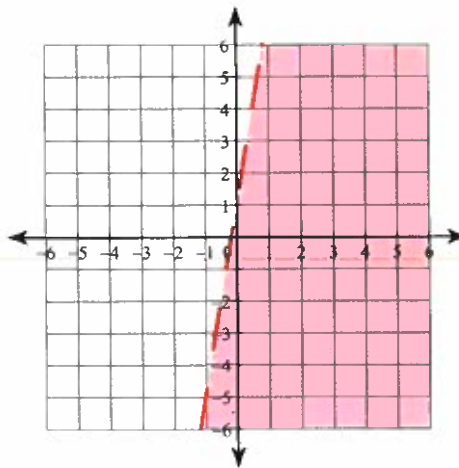
4) $y < x - 2$



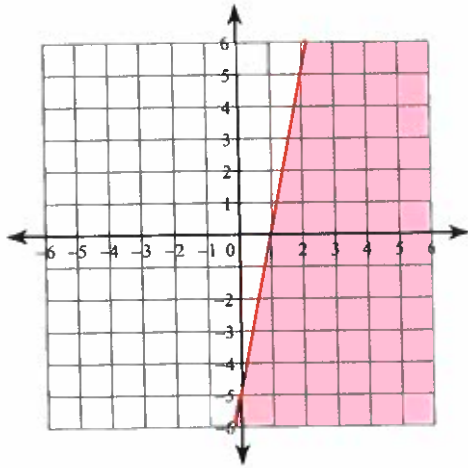
5) $y \geq x - 2$



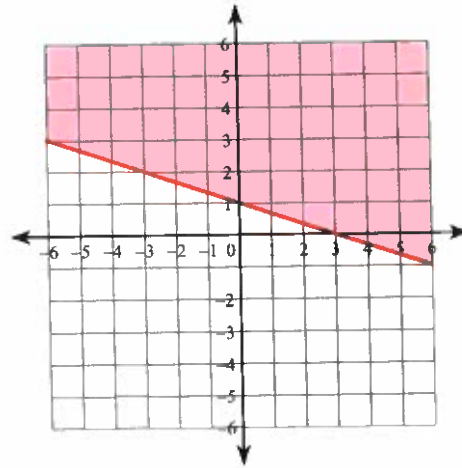
6) $y < 6x + 1$



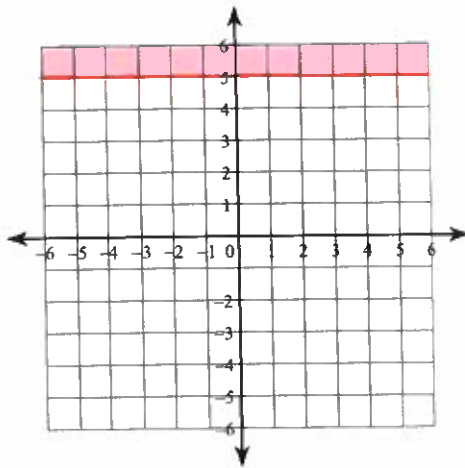
7) $5x - y \geq 5$



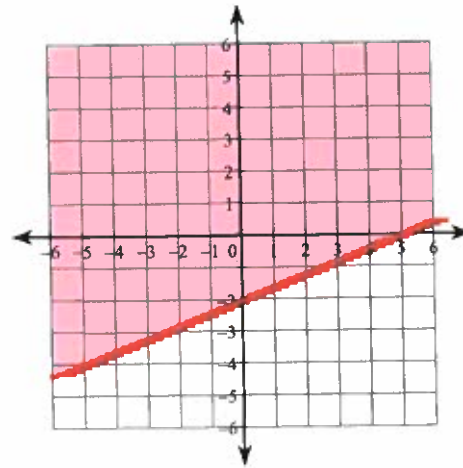
8) $x + 3y \geq 3$



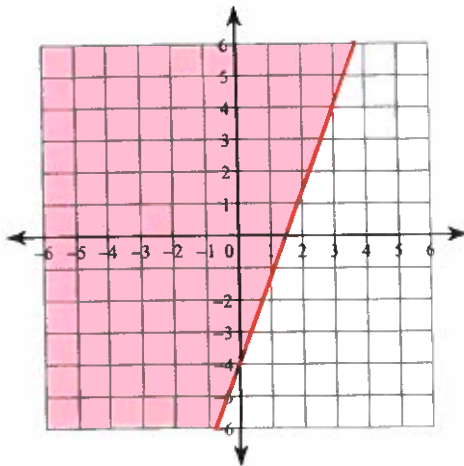
9) $y \geq 5$



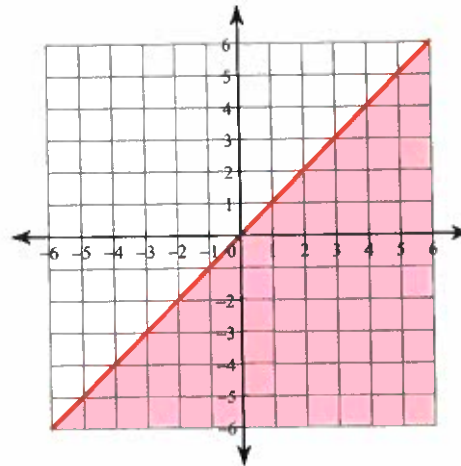
10) $2x - 5y \leq 10$



11) $8x - 3y \leq 12$



12) $x - y \geq 0$



Critical thinking questions:

13) Name one particular solution to #11

Any point in the shaded region or boundary. Ex: $(0, 0)$

14) Can you write a linear inequality whose solution contains only points with positive x -values and positive y -values? Why or why not?

No. No line can be in only the 1st quadrant.

Direct and Inverse Variation

Determine whether the given equation represents a direct or inverse variation.

1) $xy = 15$

2) $y = \frac{9}{x}$

3) $y = \frac{13}{12x}$

4) $y = 13x$

5) $-5x + y = 0$

6) $y = 4x$

Find the constant of variation.

7) $y = 3x$

8) $xy = 7$

9) $\frac{y}{x} = 5$

10) $y = \frac{1}{9x}$

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

12) $y = \frac{15}{x}$

Solve each problem involving direct or inverse variation.

13) If y varies directly as x , and $y = 6$ when $x = 15$, find y when $x = 2$.

14) If y varies inversely as x , and $y = 8$ when $x = 5$, find y when $x = 4$.

15) If y varies directly as x , and $y = 5$ when $x = 4$, find y when $x = 8$.

16) If y varies directly as x^2 , and $y = 10$ when $x = 2$, find y when $x = 3$.

17) If y varies inversely as x , and $y = 9$ when $x = 10$, find y when $x = 5$.

18) If y varies inversely as x , and $y = 4$ when $x = 12$, find y when $x = 2$.

19) If y varies inversely as x , and $y = 3$ when $x = 21$, find y when $x = 9$.

20) If y varies inversely as x^2 , and $y = \frac{11}{4}$ when $x = 4$, find y when $x = 2$.

21) If y varies directly as x , and $y = 10$ when $x = 20$, find y when $x = 3$.

22) If y varies directly as x , and $y = 4$ when $x = 6$, find y when $x = 5$.

Direct and Inverse Variation

Determine whether the given equation represents a direct or inverse variation.

1) $xy = 15$

Inverse

2) $y = \frac{9}{x}$

Inverse

3) $y = \frac{13}{12x}$

Inverse

4) $y = 13x$

Direct

5) $-5x + y = 0$

Direct

6) $y = 4x$

Direct

Find the constant of variation.

7) $y = 3x$

3

8) $xy = 7$

7

9) $\frac{y}{x} = 5$

5

10) $y = \frac{1}{9x}$

 $\frac{1}{9}$

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

 $\frac{3}{5}$

12) $y = \frac{15}{x}$

15

Solve each problem involving direct or inverse variation.

13) If y varies directly as x , and $y = 6$ when $x = 15$, find y when $x = 2$.

$$\frac{4}{5}$$

14) If y varies inversely as x , and $y = 8$ when $x = 5$, find y when $x = 4$.

$$10$$

15) If y varies directly as x , and $y = 5$ when $x = 4$, find y when $x = 8$.

$$10$$

16) If y varies directly as x^2 , and $y = 10$ when $x = 2$, find y when $x = 3$.

$$\frac{45}{2}$$

17) If y varies inversely as x , and $y = 9$ when $x = 10$, find y when $x = 5$.

$$18$$

18) If y varies inversely as x , and $y = 4$ when $x = 12$, find y when $x = 2$.

$$24$$

19) If y varies inversely as x , and $y = 3$ when $x = 21$, find y when $x = 9$.

$$7$$

20) If y varies inversely as x^2 , and $y = \frac{11}{4}$ when $x = 4$, find y when $x = 2$.

$$11$$

21) If y varies directly as x , and $y = 10$ when $x = 20$, find y when $x = 3$.

$$\frac{3}{2}$$

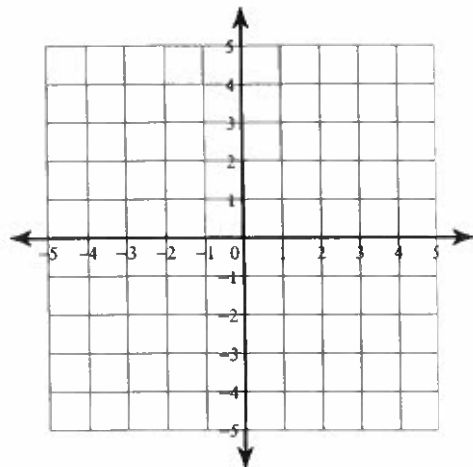
22) If y varies directly as x , and $y = 4$ when $x = 6$, find y when $x = 5$.

$$\frac{10}{3}$$

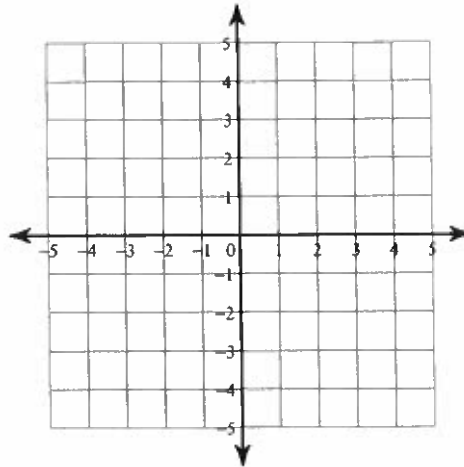
Systems of Inequalities

Sketch the solution to each system of inequalities.

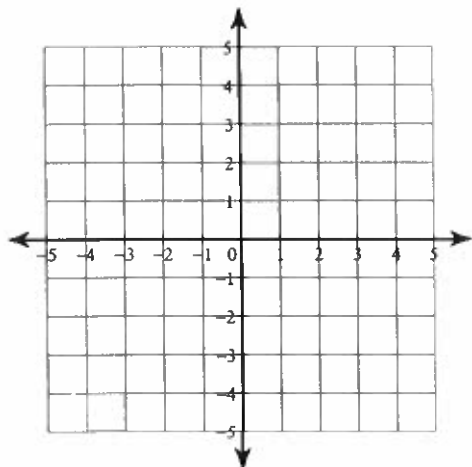
1) $y > 4x - 3$
 $y \geq -2x + 3$



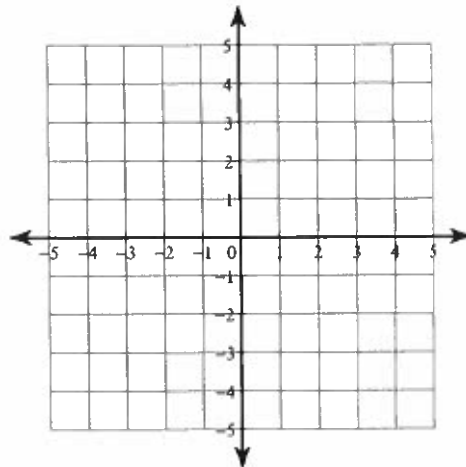
2) $y \geq -5x + 3$
 $y > -2$



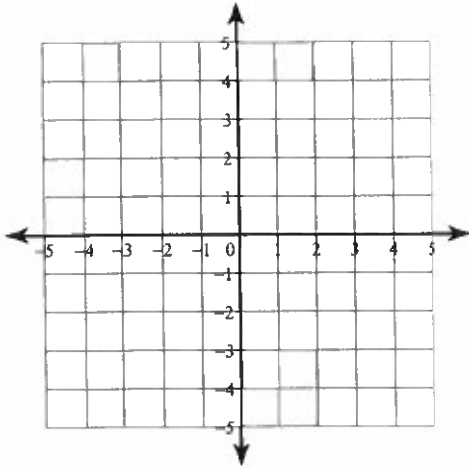
3) $y < 3$
 $y \leq -x + 1$



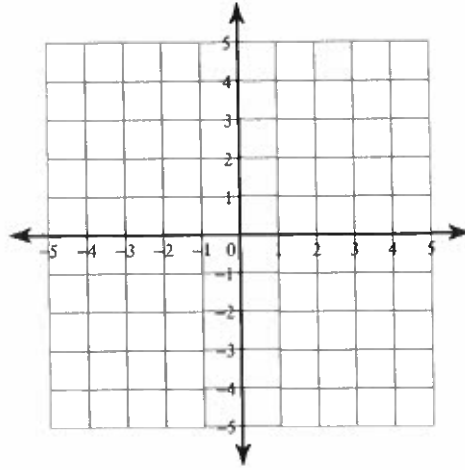
4) $y \geq x - 3$
 $y \geq -x - 1$



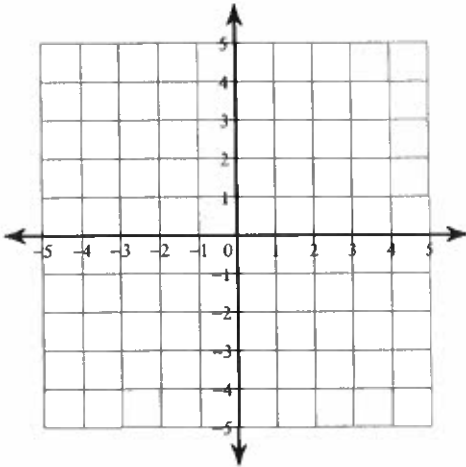
5) $x \leq -3$
 $5x + 3y \geq -9$



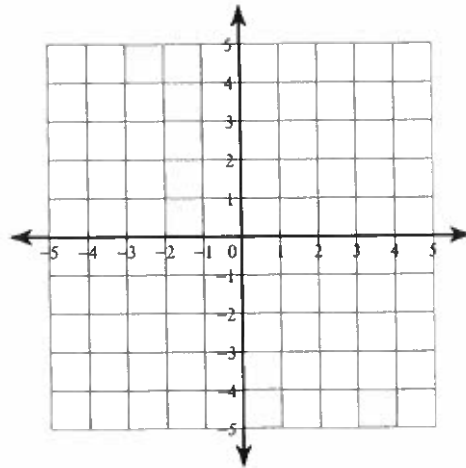
6) $4x - 3y < 9$
 $x + 3y > 6$



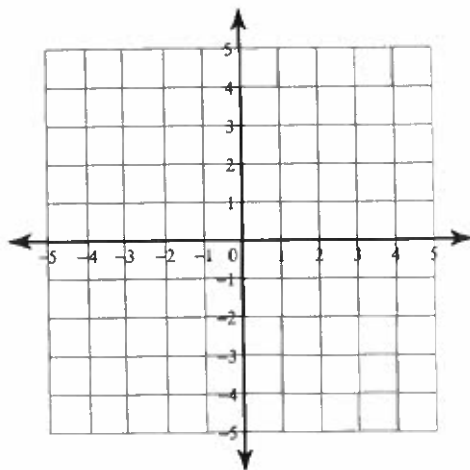
7) $x + y > 2$
 $2x - y > 1$



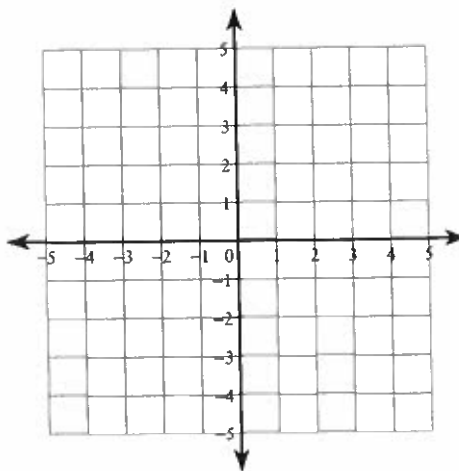
8) $x + y \geq 2$
 $4x + y \geq -1$



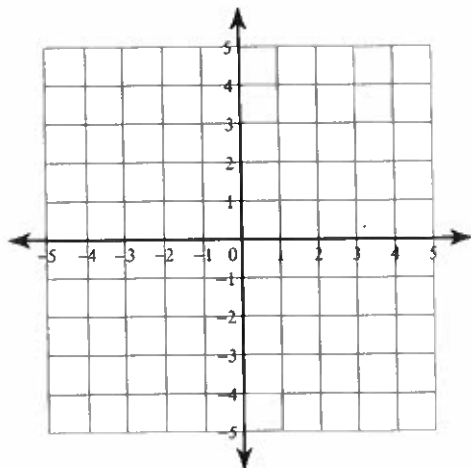
9) $4x + 3y > -6$
 $x - 3y \leq -9$



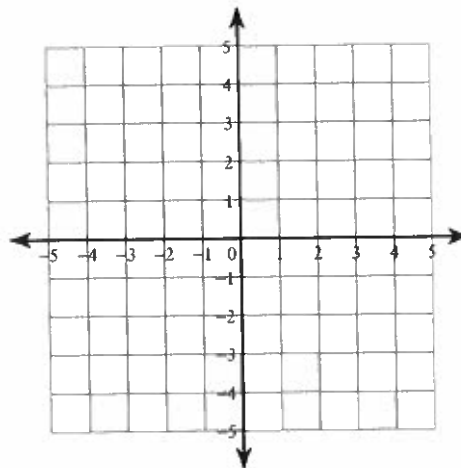
10) $y < -2$
 $x + y \geq 1$



11) $3x + y \geq -3$
 $x + 2y \leq 4$



12) $x + y \geq -3$
 $x + y \leq 3$



Critical thinking questions:

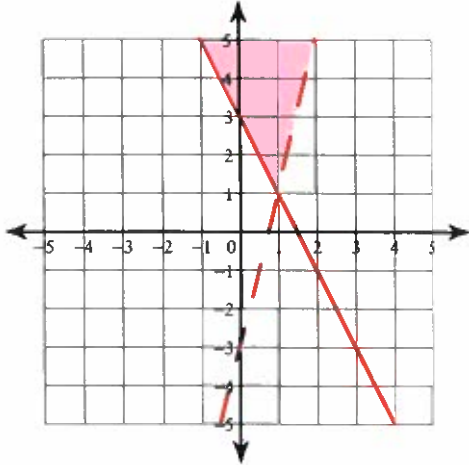
13) State one solution to the system
 $y < 2x - 1$
 $y \geq 10 - x$

14) Write a system of inequalities whose solution is the set of all points in quadrant I not including the axes.

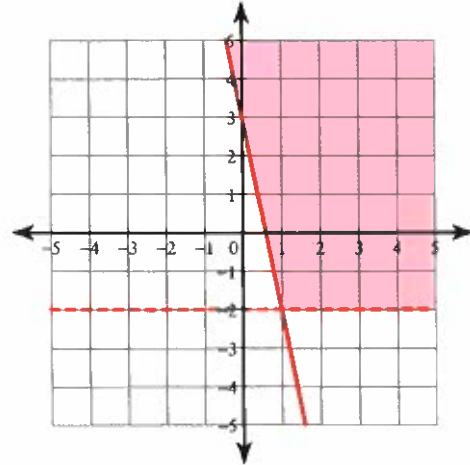
Systems of Inequalities

Sketch the solution to each system of inequalities.

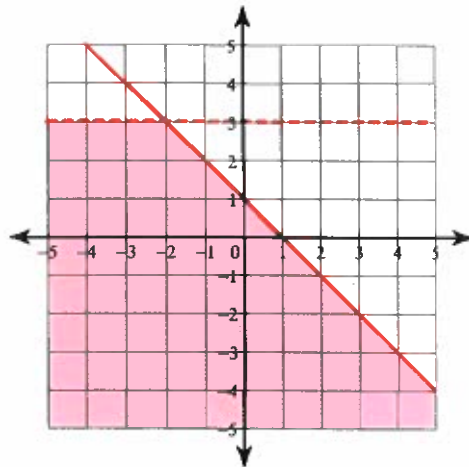
1) $y > 4x - 3$
 $y \geq -2x + 3$



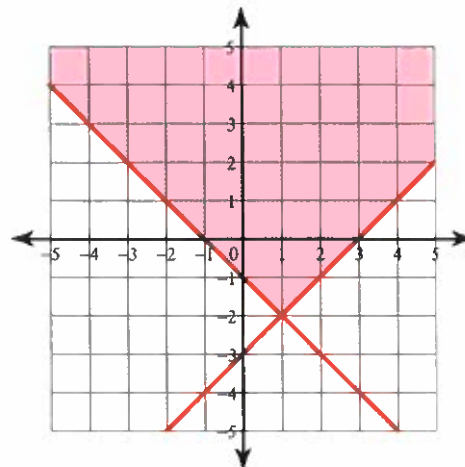
2) $y \geq -5x + 3$
 $y > -2$



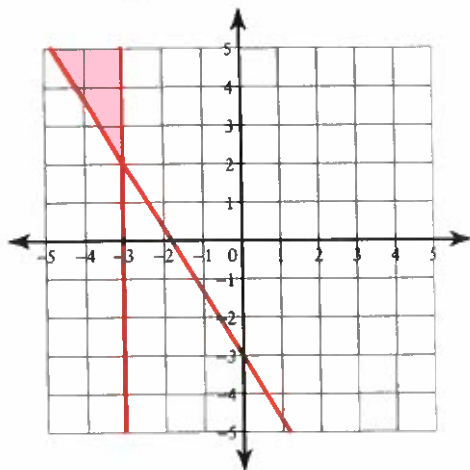
3) $y < 3$
 $y \leq -x + 1$



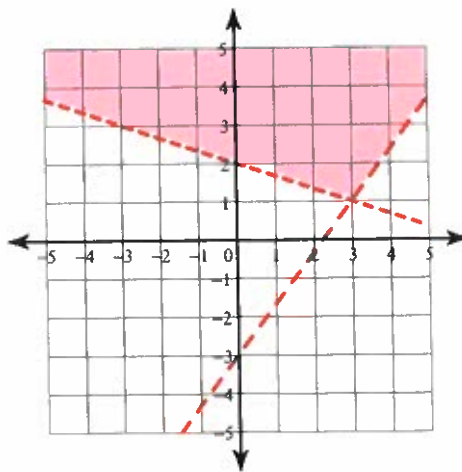
4) $y \geq x - 3$
 $y \geq -x - 1$



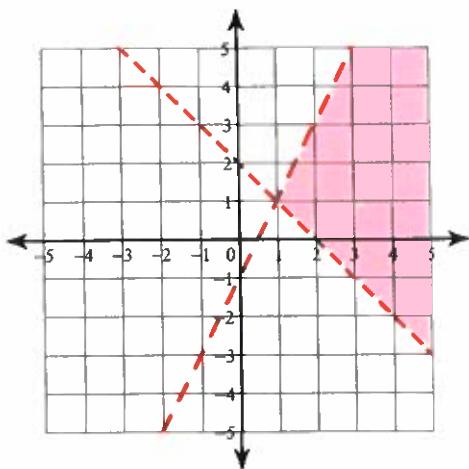
5) $x \leq -3$
 $5x + 3y \geq -9$



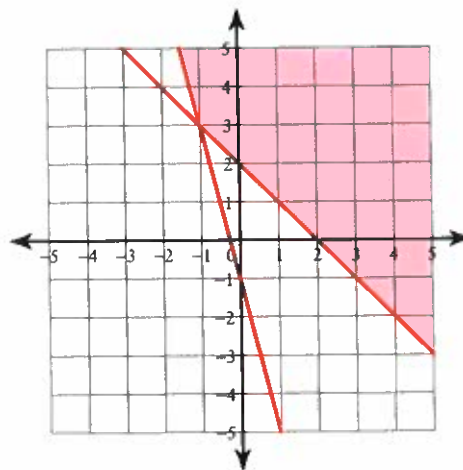
6) $4x - 3y < 9$
 $x + 3y > 6$



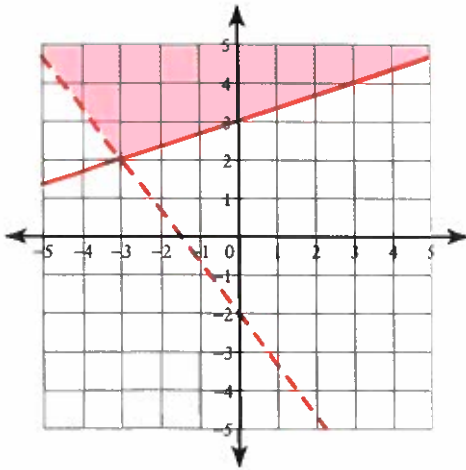
7) $x + y > 2$
 $2x - y > 1$



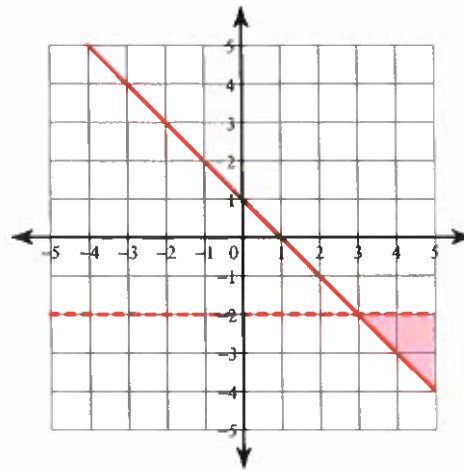
8) $x + y \geq 2$
 $4x + y \geq -1$



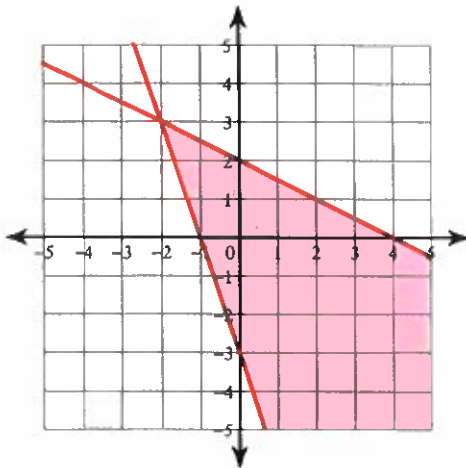
9) $4x + 3y > -6$
 $x - 3y \leq -9$



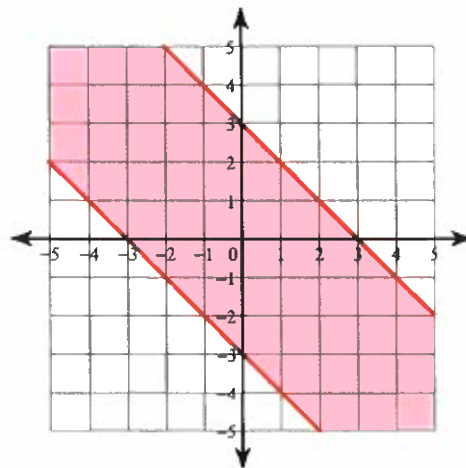
10) $y < -2$
 $x + y \geq 1$



11) $3x + y \geq -3$
 $x + 2y \leq 4$



12) $x + y \geq -3$
 $x + y \leq 3$



Critical thinking questions:

13) State one solution to the system

$y < 2x - 1$

$y \geq 10 - x$

Many solutions. Ex: (10, 10) or (5, 8)

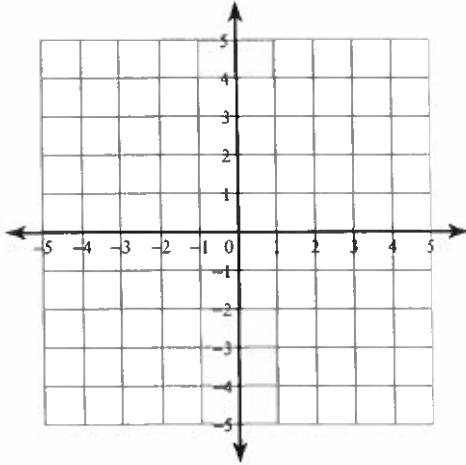
14) Write a system of inequalities whose solution is the set of all points in quadrant I not including the axes.

$x > 0, y > 0$

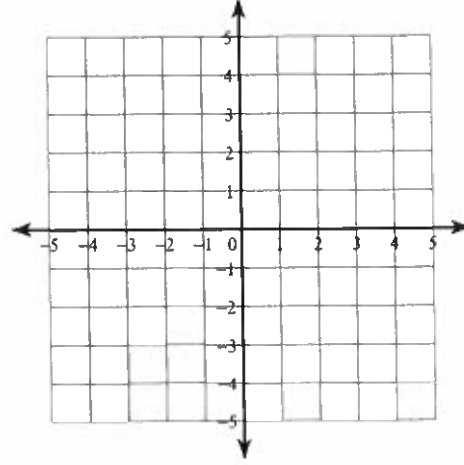
Systems of Two Equations

Solve each system by graphing.

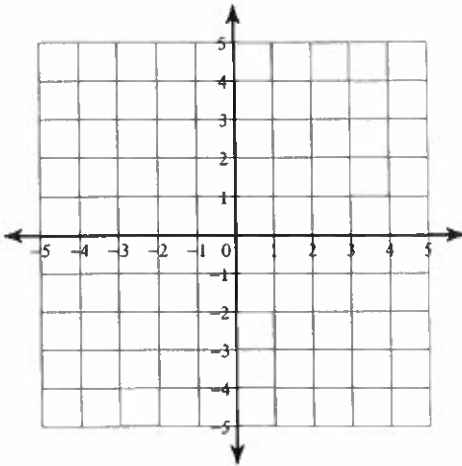
$$1) \begin{aligned} y &= -3x + 4 \\ y &= 3x - 2 \end{aligned}$$



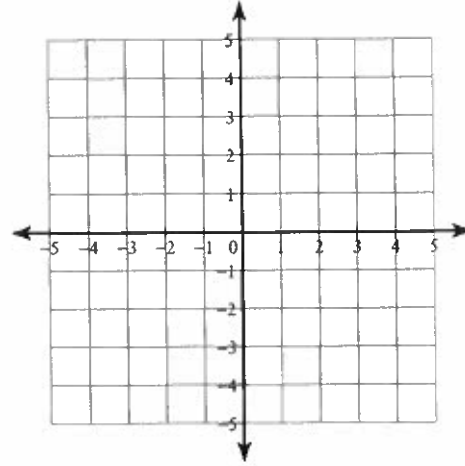
$$2) \begin{aligned} y &= x + 2 \\ x &= -3 \end{aligned}$$



$$3) \begin{aligned} x - y &= 3 \\ 7x - y &= -3 \end{aligned}$$



$$4) \begin{aligned} 4x + y &= 2 \\ x - y &= 3 \end{aligned}$$



Solve each system by substitution.

$$5) \begin{aligned} y &= 4x - 9 \\ y &= x - 3 \end{aligned}$$

$$6) \begin{aligned} 4x + 2y &= 10 \\ x - y &= 13 \end{aligned}$$

$$7) \begin{aligned} y &= -5 \\ 5x + 4y &= -20 \end{aligned}$$

$$8) \begin{aligned} x + 7y &= 0 \\ 2x - 8y &= 22 \end{aligned}$$

$$\begin{aligned} 9) \quad 6x + 8y &= -22 \\ y &= -5 \end{aligned}$$

$$\begin{aligned} 10) \quad -7x + 2y &= 18 \\ 6x + 6y &= 0 \end{aligned}$$

$$\begin{aligned} 11) \quad 7x + 2y &= -19 \\ -x + 2y &= 21 \end{aligned}$$

$$\begin{aligned} 12) \quad 3x - 5y &= 17 \\ y &= -7 \end{aligned}$$

$$\begin{aligned} 13) \quad -7x + 4y &= 24 \\ 4x - 4y &= 0 \end{aligned}$$

$$\begin{aligned} 14) \quad 4x - y &= 20 \\ -2x - 2y &= 10 \end{aligned}$$

Solve each system by elimination.

$$\begin{aligned} 15) \quad 8x - 6y &= -20 \\ -16x + 7y &= 30 \end{aligned}$$

$$\begin{aligned} 16) \quad 6x - 12y &= 24 \\ -x - 6y &= 4 \end{aligned}$$

$$\begin{aligned} 17) \quad -8x - 10y &= 24 \\ 6x + 5y &= 2 \end{aligned}$$

$$\begin{aligned} 18) \quad -24 - 8x &= 12y \\ 1 + \frac{5}{9}y &= -\frac{7}{18}x \end{aligned}$$

$$\begin{aligned} 19) \quad -4y - 11x &= 36 \\ 20 &= -10x - 10y \end{aligned}$$

$$\begin{aligned} 20) \quad -9 + 5y &= -4x \\ -11x &= -20 + 9y \end{aligned}$$

$$\begin{aligned} 21) \quad 0 &= -2y + 10 - 6x \\ 14 - 22y &= 18x \end{aligned}$$

$$\begin{aligned} 22) \quad -16y &= 22 + 6x \\ -11y - 4x &= 15 \end{aligned}$$

$$\begin{aligned} 23) \quad -16 + 20x - 8y &= 0 \\ 36 &= -18y - 22x \end{aligned}$$

$$\begin{aligned} 24) \quad -\frac{5}{7} - \frac{11}{7}x &= -y \\ 2y &= 7 + 5x \end{aligned}$$

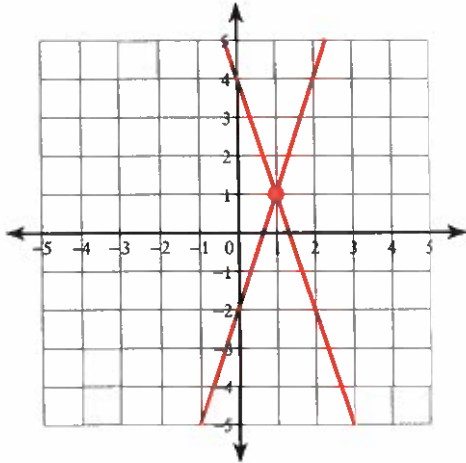
Critical thinking questions:

25) Write a system of equations with the solution $(4, -3)$.

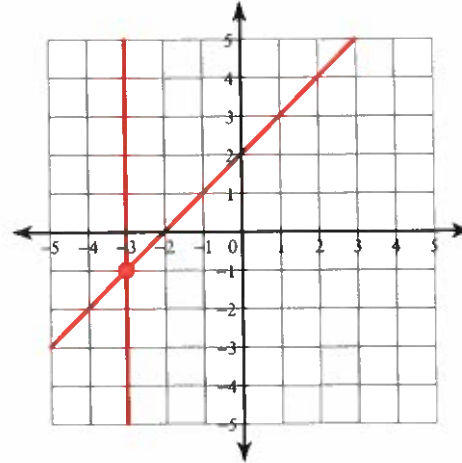
Systems of Two Equations

Solve each system by graphing.

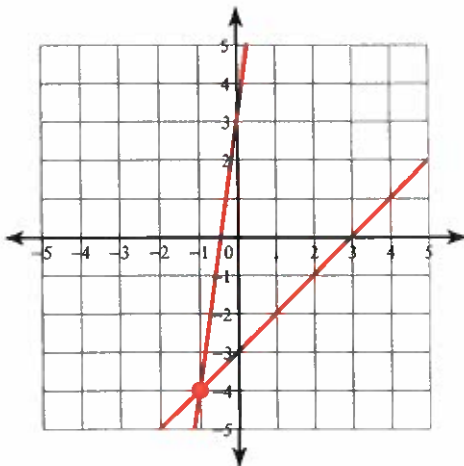
$$\begin{aligned} 1) \quad & y = -3x + 4 \\ & y = 3x - 2 \end{aligned}$$

 $(1, 1)$

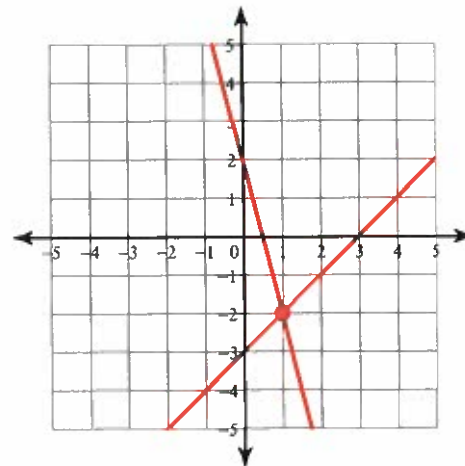
$$\begin{aligned} 2) \quad & y = x + 2 \\ & x = -3 \end{aligned}$$

 $(-3, -1)$

$$\begin{aligned} 3) \quad & x - y = 3 \\ & 7x - y = -3 \end{aligned}$$

 $(-1, -4)$

$$\begin{aligned} 4) \quad & 4x + y = 2 \\ & x - y = 3 \end{aligned}$$

 $(1, -2)$

Solve each system by substitution.

$$\begin{aligned} 5) \quad & y = 4x - 9 \\ & y = x - 3 \end{aligned}$$

 $(2, -1)$

$$\begin{aligned} 6) \quad & 4x + 2y = 10 \\ & x - y = 13 \end{aligned}$$

 $(6, -7)$

$$\begin{aligned} 7) \quad & y = -5 \\ & 5x + 4y = -20 \end{aligned}$$

 $(0, -5)$

$$\begin{aligned} 8) \quad & x + 7y = 0 \\ & 2x - 8y = 22 \end{aligned}$$

 $(7, -1)$

9) $6x + 8y = -22$

$y = -5$

$(3, -5)$

11) $7x + 2y = -19$

$-x + 2y = 21$

$(-5, 8)$

13) $-7x + 4y = 24$

$4x - 4y = 0$

$(-8, -8)$

10) $-7x + 2y = 18$

$6x + 6y = 0$

$(-2, 2)$

12) $3x - 5y = 17$

$y = -7$

$(-6, -7)$

14) $4x - y = 20$

$-2x - 2y = 10$

$(3, -8)$

Solve each system by elimination.

15) $8x - 6y = -20$

$-16x + 7y = 30$

$(-1, 2)$

16) $6x - 12y = 24$

$-x - 6y = 4$

$(2, -1)$

17) $-8x - 10y = 24$

$6x + 5y = 2$

$(7, -8)$

18) $-24 - 8x = 12y$

$1 + \frac{5}{9}y = -\frac{7}{18}x$

$(6, -6)$

19) $-4y - 11x = 36$

$20 = -10x - 10y$

$(-4, 2)$

20) $-9 + 5y = -4x$

$-11x = -20 + 9y$

$(1, 1)$

21) $0 = -2y + 10 - 6x$

$14 - 22y = 18x$

$(2, -1)$

22) $-16y = 22 + 6x$

$-11y - 4x = 15$

$(-1, -1)$

23) $-16 + 20x - 8y = 0$

$36 = -18y - 22x$

$(0, -2)$

24) $-\frac{5}{7} - \frac{11}{7}x = -y$

$2y = 7 + 5x$

$(-3, -4)$

Critical thinking questions:

25) Write a system of equations with the solution $(4, -3)$.

Many answers. Ex: $x + y = 1$, $2x + y = 5$

Systems of Equations Word Problems

- 1) The school that Lisa goes to is selling tickets to the annual talent show. On the first day of ticket sales the school sold 4 senior citizen tickets and 5 student tickets for a total of \$102. The school took in \$126 on the second day by selling 7 senior citizen tickets and 5 student tickets. What is the price each of one senior citizen ticket and one student ticket?

- 2) Flying with the wind a plane went 183 km/h. Flying into the same wind the plane only went 141 km/h. Find the speed of the plane in still air and the speed of the wind.

- 3) Castel and Gabriella are selling pies for a school fundraiser. Customers can buy apple pies and lemon meringue pies. Castel sold 6 apple pies and 4 lemon meringue pies for a total of \$80. Gabriella sold 6 apple pies and 5 lemon meringue pies for a total of \$94. What is the cost each of one apple pie and one lemon meringue pie?

- 4) The school that Imani goes to is selling tickets to the annual dance competition. On the first day of ticket sales the school sold 3 senior citizen tickets and 3 child tickets for a total of \$69. The school took in \$91 on the second day by selling 5 senior citizen tickets and 3 child tickets. What is the price each of one senior citizen ticket and one child ticket?

- 5) Ming and Carlos are selling cookie dough for a school fundraiser. Customers can buy packages of chocolate chip cookie dough and packages of gingerbread cookie dough. Ming sold 8 packages of chocolate chip cookie dough and 12 packages of gingerbread cookie dough for a total of \$364. Carlos sold 1 package of chocolate chip cookie dough and 4 packages of gingerbread cookie dough for a total of \$93. Find the cost each of one package of chocolate chip cookie dough and one package of gingerbread cookie dough.

- 6) Kayla's school is selling tickets to the annual dance competition. On the first day of ticket sales the school sold 3 senior citizen tickets and 5 child tickets for a total of \$70. The school took in \$216 on the second day by selling 12 senior citizen tickets and 12 child tickets. Find the price of a senior citizen ticket and the price of a child ticket.

- 7) A plane traveled 580 miles to Ankara and back. The trip there was with the wind. It took 5 hours. The trip back was into the wind. The trip back took 10 hours. Find the speed of the plane in still air and the speed of the wind.
- 8) Amanda and Ndiba are selling flower bulbs for a school fundraiser. Customers can buy packages of tulip bulbs and bags of daffodil bulbs. Amanda sold 6 packages of tulip bulbs and 12 bags of daffodil bulbs for a total of \$198. Ndiba sold 7 packages of tulip bulbs and 6 bags of daffodil bulbs for a total of \$127. Find the cost each of one package of tulips bulbs and one bag of daffodil bulbs.
- 9) The local amusement park is a popular field trip destination. This year the senior class at High School A and the senior class at High School B both planned trips there. The senior class at High School A rented and filled 16 vans and 8 buses with 752 students. High School B rented and filled 5 vans and 5 buses with 380 students. Each van and each bus carried the same number of students. How many students can a van carry? How many students can a bus carry?
- 10) The senior classes at High School A and High School B planned separate trips to New York City. The senior class at High School A rented and filled 16 vans and 5 buses with 417 students. High School B rented and filled 10 vans and 8 buses with 480 students. Every van had the same number of students in it as did the buses. How many students can a van carry? How many students can a bus carry?
- 11) The senior classes at High School A and High School B planned separate trips to the water park. The senior class at High School A rented and filled 14 vans and 16 buses with 1086 students. High School B rented and filled 10 vans and 13 buses with 870 students. Every van had the same number of students in it as did the buses. Find the number of students in each van and in each bus.
- 12) Yellowstone National Park is a popular field trip destination. This year the senior class at High School A and the senior class at High School B both planned trips there. The senior class at High School A rented and filled 7 vans and 10 buses with 332 students. High School B rented and filled 4 vans and 15 buses with 459 students. Each van and each bus carried the same number of students. Find the number of students in each van and in each bus.

Systems of Equations Word Problems

- 1) The school that Lisa goes to is selling tickets to the annual talent show. On the first day of ticket sales the school sold 4 senior citizen tickets and 5 student tickets for a total of \$102. The school took in \$126 on the second day by selling 7 senior citizen tickets and 5 student tickets. What is the price each of one senior citizen ticket and one student ticket?

senior citizen ticket: \$8, student ticket: \$14

- 2) Flying with the wind a plane went 183 km/h. Flying into the same wind the plane only went 141 km/h. Find the speed of the plane in still air and the speed of the wind.

Plane: 162 km/h, Wind: 21 km/h

- 3) Castel and Gabriella are selling pies for a school fundraiser. Customers can buy apple pies and lemon meringue pies. Castel sold 6 apple pies and 4 lemon meringue pies for a total of \$80. Gabriella sold 6 apple pies and 5 lemon meringue pies for a total of \$94. What is the cost each of one apple pie and one lemon meringue pie?

apple pie: \$4, lemon meringue pie: \$14

- 4) The school that Imani goes to is selling tickets to the annual dance competition. On the first day of ticket sales the school sold 3 senior citizen tickets and 3 child tickets for a total of \$69. The school took in \$91 on the second day by selling 5 senior citizen tickets and 3 child tickets. What is the price each of one senior citizen ticket and one child ticket?

senior citizen ticket: \$11, child ticket: \$12

- 5) Ming and Carlos are selling cookie dough for a school fundraiser. Customers can buy packages of chocolate chip cookie dough and packages of gingerbread cookie dough. Ming sold 8 packages of chocolate chip cookie dough and 12 packages of gingerbread cookie dough for a total of \$364. Carlos sold 1 package of chocolate chip cookie dough and 4 packages of gingerbread cookie dough for a total of \$93. Find the cost each of one package of chocolate chip cookie dough and one package of gingerbread cookie dough.

package of chocolate chip cookie dough: \$17, package of gingerbread cookie dough: \$19

- 6) Kayla's school is selling tickets to the annual dance competition. On the first day of ticket sales the school sold 3 senior citizen tickets and 5 child tickets for a total of \$70. The school took in \$216 on the second day by selling 12 senior citizen tickets and 12 child tickets. Find the price of a senior citizen ticket and the price of a child ticket.

senior citizen ticket: \$10, child ticket: \$8

- 7) A plane traveled 580 miles to Ankara and back. The trip there was with the wind. It took 5 hours. The trip back was into the wind. The trip back took 10 hours. Find the speed of the plane in still air and the speed of the wind.

plane: 87 mph, wind: 29 mph

- 8) Amanda and Ndiba are selling flower bulbs for a school fundraiser. Customers can buy packages of tulip bulbs and bags of daffodil bulbs. Amanda sold 6 packages of tulip bulbs and 12 bags of daffodil bulbs for a total of \$198. Ndiba sold 7 packages of tulip bulbs and 6 bags of daffodil bulbs for a total of \$127. Find the cost each of one package of tulips bulbs and one bag of daffodil bulbs.

package of tulips bulbs: \$7, bag of daffodil bulbs: \$13

- 9) The local amusement park is a popular field trip destination. This year the senior class at High School A and the senior class at High School B both planned trips there. The senior class at High School A rented and filled 16 vans and 8 buses with 752 students. High School B rented and filled 5 vans and 5 buses with 380 students. Each van and each bus carried the same number of students. How many students can a van carry? How many students can a bus carry?

Van: 18, Bus: 58

- 10) The senior classes at High School A and High School B planned separate trips to New York City. The senior class at High School A rented and filled 16 vans and 5 buses with 417 students. High School B rented and filled 10 vans and 8 buses with 480 students. Every van had the same number of students in it as did the buses. How many students can a van carry? How many students can a bus carry?

Van: 12, Bus: 45

- 11) The senior classes at High School A and High School B planned separate trips to the water park. The senior class at High School A rented and filled 14 vans and 16 buses with 1086 students. High School B rented and filled 10 vans and 13 buses with 870 students. Every van had the same number of students in it as did the buses. Find the number of students in each van and in each bus.

Van: 9, Bus: 60

- 12) Yellowstone National Park is a popular field trip destination. This year the senior class at High School A and the senior class at High School B both planned trips there. The senior class at High School A rented and filled 7 vans and 10 buses with 332 students. High School B rented and filled 4 vans and 15 buses with 459 students. Each van and each bus carried the same number of students. Find the number of students in each van and in each bus.

Van: 6, Bus: 29

Simplifying Radicals

Simplify. Use absolute value signs when necessary.

1) $\sqrt{24}$

2) $\sqrt[3]{1000}$

3) $\sqrt[3]{-162}$

4) $\sqrt{512}$

5) $\sqrt[4]{128n^8}$

6) $\sqrt{98k}$

7) $\sqrt[5]{224r^7}$

8) $\sqrt[3]{24m^3}$

9) $\sqrt{392x^2}$

10) $\sqrt{512x^2}$

11) $\sqrt[4]{405x^3y^2}$

12) $\sqrt[3]{-16a^3b^8}$

13) $\sqrt[4]{128x^7y^7}$

14) $\sqrt[3]{16xy}$

15) $\sqrt[6]{448x^7y^7}$

16) $\sqrt[3]{56x^5y}$

Critical thinking questions:

17) What simplifies into $2mn^2\sqrt[3]{5mn^2}$?

18) Simplify $\sqrt[n]{3 \cdot 2^n \cdot x^{2n} y^{n+3}}$

Simplifying Radicals

Simplify. Use absolute value signs when necessary.

1) $\sqrt{24}$

$2\sqrt{6}$

2) $\sqrt[3]{1000}$

10

3) $\sqrt[3]{-162}$

$-3\sqrt[3]{6}$

4) $\sqrt{512}$

$16\sqrt{2}$

5) $\sqrt[4]{128n^8}$

$2n^2\sqrt[4]{8}$

6) $\sqrt{98k}$

$7\sqrt{2k}$

7) $\sqrt[5]{224r^7}$

$2r\sqrt[5]{7r^2}$

8) $\sqrt[3]{24m^3}$

$2m\sqrt[3]{3}$

9) $\sqrt{392x^2}$

$14|x|\sqrt{2}$

10) $\sqrt{512x^2}$

$16|x|\sqrt{2}$

11) $\sqrt[4]{405x^3y^2}$

$3\sqrt[4]{5x^3y^2}$

12) $\sqrt[3]{-16a^3b^8}$

$-2ab^2\sqrt[3]{2b^2}$

13) $\sqrt[4]{128x^7y^7}$

$2|x| \cdot |y|\sqrt[4]{8x^3y^3}$

14) $\sqrt[3]{16xy}$

$2\sqrt[3]{2xy}$

15) $\sqrt[6]{448x^7y^7}$

$2|x| \cdot |y|\sqrt[6]{7xy}$

16) $\sqrt[3]{56x^5y}$

$2x\sqrt[3]{7x^2y}$

Critical thinking questions:

17) What simplifies into $2mn^2\sqrt[3]{5mn^2}$?

$\sqrt[3]{40m^4n^8}$

18) Simplify $\sqrt[n]{3 \cdot 2^n \cdot x^{2n} y^{n+3}}$

$2x^2y\sqrt[n]{3y^3}$

Adding, Subtracting, Multiplying Radicals

Simplify.

1) $-5\sqrt{3} - 3\sqrt{3}$

2) $2\sqrt{8} - \sqrt{8}$

3) $-4\sqrt{6} - \sqrt{6}$

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

5) $-3\sqrt{27} - 3\sqrt{27} - 3\sqrt{27}$

6) $-3\sqrt{12} + 3\sqrt{3} + 3\sqrt{20}$

7) $-2\sqrt{45} - 3\sqrt{20} - 2\sqrt{6}$

8) $-3\sqrt[6]{3} - 2\sqrt[6]{192} - \sqrt[6]{320}$

9) $-3\sqrt[3]{-3} + 2\sqrt[3]{162} + 3\sqrt[3]{81}$

10) $4\sqrt[6]{3} + 2\sqrt[4]{32} - 3\sqrt[6]{192} - 2\sqrt[6]{192}$

11) $-\sqrt[3]{320} - 4\sqrt[3]{5} + 2\sqrt[3]{135} + 2\sqrt[3]{16}$

12) $2\sqrt[3]{6} - \sqrt[6]{6} + 3\sqrt[3]{6} - 3\sqrt[6]{384}$

13) $\sqrt[3]{3} \cdot \sqrt[3]{-20}$

14) $\sqrt{5} \cdot \sqrt{3}$

15) $\sqrt{6} \cdot \sqrt{2}$

16) $\sqrt[3]{3} \cdot \sqrt[3]{9}$

17) $3\sqrt{3}(4 - 3\sqrt{5})$

18) $4\sqrt{15}(-3\sqrt{6} + 5)$

19) $4\sqrt{15}(\sqrt{6} + \sqrt{5})$

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

21) $\sqrt{15}(2\sqrt{10} - 4\sqrt{6})$

22) $(-7 + \sqrt{3x})(4 + \sqrt{3x})$

23) $(\sqrt{2a} - 5)(7\sqrt{2a} - 5)$

24) $(2 + \sqrt{5})(-2 + \sqrt{5k})$

25) $(\sqrt{3} + \sqrt{5x})(\sqrt{3} - 5\sqrt{5x})$

26) $(7 + \sqrt{6})(1 + \sqrt{6})$

Adding, Subtracting, Multiplying Radicals

Simplify.

$$1) -5\sqrt{3} - 3\sqrt{3}$$

$$-8\sqrt{3}$$

$$2) 2\sqrt{8} - \sqrt{8}$$

$$2\sqrt{2}$$

$$3) -4\sqrt{6} - \sqrt{6}$$

$$-5\sqrt{6}$$

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

$$-\sqrt{5}$$

$$5) -3\sqrt{27} - 3\sqrt{27} - 3\sqrt{27}$$

$$-27\sqrt{3}$$

$$6) -3\sqrt{12} + 3\sqrt{3} + 3\sqrt{20}$$

$$-3\sqrt{3} + 6\sqrt{5}$$

$$7) -2\sqrt{45} - 3\sqrt{20} - 2\sqrt{6}$$

$$-12\sqrt{5} - 2\sqrt{6}$$

$$8) -3\sqrt[6]{3} - 2\sqrt[6]{192} - \sqrt[6]{320}$$

$$-7\sqrt[6]{3} - 2\sqrt[6]{5}$$

$$9) -3\sqrt[3]{-3} + 2\sqrt[3]{162} + 3\sqrt[3]{81}$$

$$12\sqrt[3]{3} + 6\sqrt[3]{6}$$

$$10) 4\sqrt[6]{3} + 2\sqrt[4]{32} - 3\sqrt[6]{192} - 2\sqrt[6]{192}$$

$$-6\sqrt[6]{3} + 4\sqrt[4]{2}$$

$$11) -\sqrt[3]{320} - 4\sqrt[3]{5} + 2\sqrt[3]{135} + 2\sqrt[3]{16}$$

$$-2\sqrt[3]{5} + 4\sqrt[3]{2}$$

$$12) 2\sqrt[3]{6} - \sqrt[6]{6} + 3\sqrt[3]{6} - 3\sqrt[6]{384}$$

$$5\sqrt[3]{6} - 7\sqrt[6]{6}$$

$$13) \sqrt[3]{3} \cdot \sqrt[3]{-20} \\ -\sqrt[3]{60}$$

$$14) \sqrt{5} \cdot \sqrt{3} \\ \sqrt{15}$$

$$15) \sqrt{6} \cdot \sqrt{2} \\ 2\sqrt{3}$$

$$16) \sqrt[3]{3} \cdot \sqrt[3]{9} \\ 3$$

$$17) 3\sqrt{3}(4 - 3\sqrt{5}) \\ 12\sqrt{3} - 9\sqrt{15}$$

$$18) 4\sqrt{15}(-3\sqrt{6} + 5) \\ -36\sqrt{10} + 20\sqrt{15}$$

$$19) 4\sqrt{15}(\sqrt{6} + \sqrt{5}) \\ 12\sqrt{10} + 20\sqrt{3}$$

$$20) -\sqrt{2}(\sqrt{10} - 4\sqrt{6}) \\ -2\sqrt{5} + 8\sqrt{3}$$

$$21) \sqrt{15}(2\sqrt{10} - 4\sqrt{6}) \\ 10\sqrt{6} - 12\sqrt{10}$$

$$22) (-7 + \sqrt{3x})(4 + \sqrt{3x}) \\ -28 - 3\sqrt{3x} + 3x$$

$$23) (\sqrt{2a} - 5)(7\sqrt{2a} - 5) \\ 14a - 40\sqrt{2a} + 25$$

$$24) (2 + \sqrt{5})(-2 + \sqrt{5k}) \\ -4 + 2\sqrt{5k} - 2\sqrt{5} + 5\sqrt{k}$$

$$25) (\sqrt{3} + \sqrt{5x})(\sqrt{3} - 5\sqrt{5x}) \\ 3 - 4\sqrt{15x} - 25x$$

$$26) (7 + \sqrt{6})(1 + \sqrt{6}) \\ 13 + 8\sqrt{6}$$

Dividing Radicals

Simplify.

1) $\frac{\sqrt{9}}{\sqrt{25}}$

2) $\frac{\sqrt{4}}{\sqrt{36}}$

3) $\frac{\sqrt{15}}{\sqrt{12}}$

4) $\frac{\sqrt{4}}{2\sqrt{20}}$

5) $\frac{\sqrt{4}}{4\sqrt{5}}$

6) $\frac{4\sqrt{2}}{3\sqrt{5}}$

7) $\frac{-3 - \sqrt{2}}{3\sqrt{17}}$

8) $\frac{\sqrt{3} + 3\sqrt{5}}{2\sqrt{8}}$

9) $\frac{\sqrt{3}}{-1 - \sqrt{5}}$

10) $\frac{\sqrt{5}}{5 + \sqrt{2}}$

11) $\frac{2 - \sqrt{3}}{-2 - \sqrt{5}}$

12) $\frac{-4 + \sqrt{3}}{-1 - 2\sqrt{5}}$

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

14) $\frac{3}{-4k^2 - 5\sqrt{k^4}}$

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

16) $\frac{3}{\sqrt{5x} - 3}$

17) $\frac{\sqrt[5]{12}}{4\sqrt[5]{-4}}$

18) $\frac{\sqrt[3]{10}}{\sqrt[3]{625}}$

19) $\frac{\sqrt[5]{2}}{3\sqrt[5]{162}}$

20) $\frac{3\sqrt[4]{4}}{2\sqrt[4]{8}}$

21) $\frac{\sqrt[4]{5}}{4\sqrt[4]{27}}$

22) $\frac{\sqrt[3]{10}}{\sqrt[3]{32}}$

23) $\frac{-5 + 5\sqrt[4]{5}}{3\sqrt[4]{6}}$

24) $\frac{3 + \sqrt[3]{3}}{\sqrt[3]{9}}$

25) $\frac{-2x + \sqrt[3]{-5x^4y^3}}{3\sqrt[3]{15x^3y}}$

26) $\frac{3 - \sqrt[4]{5k^2}}{\sqrt[4]{3k^3}}$

Dividing Radicals

Simplify.

1) $\frac{\sqrt{9}}{\sqrt{25}}$

$$\frac{3}{5}$$

2) $\frac{\sqrt{4}}{\sqrt{36}}$

$$\frac{1}{3}$$

3) $\frac{\sqrt{15}}{\sqrt{12}}$

$$\frac{\sqrt{5}}{2}$$

4) $\frac{\sqrt{4}}{2\sqrt{20}}$

$$\frac{\sqrt{5}}{10}$$

5) $\frac{\sqrt{4}}{4\sqrt{5}}$

$$\frac{\sqrt{5}}{10}$$

6) $\frac{4\sqrt{2}}{3\sqrt{5}}$

$$\frac{4\sqrt{10}}{15}$$

7) $\frac{-3 - \sqrt{2}}{3\sqrt{17}}$

$$\frac{-3\sqrt{17} - \sqrt{34}}{51}$$

8) $\frac{\sqrt{3} + 3\sqrt{5}}{2\sqrt{8}}$

$$\frac{\sqrt{6} + 3\sqrt{10}}{8}$$

9) $\frac{\sqrt{3}}{-1 - \sqrt{5}}$

$$\frac{\sqrt{3} - \sqrt{15}}{4}$$

10) $\frac{\sqrt{5}}{5 + \sqrt{2}}$

$$\frac{5\sqrt{5} - \sqrt{10}}{23}$$

11) $\frac{2 - \sqrt{3}}{-2 - \sqrt{5}}$

$$4 - 2\sqrt{5} - 2\sqrt{3} + \sqrt{15}$$

12) $\frac{-4 + \sqrt{3}}{-1 - 2\sqrt{5}}$

$$\frac{-4 + 8\sqrt{5} + \sqrt{3} - 2\sqrt{15}}{19}$$

$$13) \frac{4 + 3\sqrt{2}}{-3 - \sqrt{5}}$$

$$\frac{-12 + 4\sqrt{5} - 9\sqrt{2} + 3\sqrt{10}}{4}$$

$$14) \frac{3}{-4k^2 - 5\sqrt{k^4}}$$

$$-\frac{1}{3k^2}$$

$$15) \frac{2}{3 - \sqrt{3x^2}}$$

$$\frac{6 + 2x\sqrt{3}}{9 - 3x^2}$$

$$16) \frac{3}{\sqrt{5x} - 3}$$

$$\frac{3\sqrt{5x} + 9}{5x - 9}$$

$$17) \frac{\sqrt[5]{12}}{4\sqrt[5]{-4}}$$

$$-\frac{\sqrt[5]{3}}{4}$$

$$18) \frac{\sqrt[3]{10}}{\sqrt[3]{625}}$$

$$\frac{\sqrt[3]{2}}{5}$$

$$19) \frac{\sqrt[5]{2}}{3\sqrt[5]{162}}$$

$$\frac{\sqrt[5]{3}}{9}$$

$$20) \frac{3\sqrt[4]{4}}{2\sqrt[4]{8}}$$

$$\frac{3\sqrt[4]{8}}{4}$$

$$21) \frac{\sqrt[4]{5}}{4\sqrt[4]{27}}$$

$$\frac{\sqrt[4]{15}}{12}$$

$$22) \frac{\sqrt[3]{10}}{\sqrt[3]{32}}$$

$$\frac{\sqrt[3]{20}}{4}$$

$$23) \frac{-5 + 5\sqrt[4]{5}}{3\sqrt[4]{6}}$$

$$\frac{-5\sqrt[4]{216} + 5\sqrt[4]{1080}}{18}$$

$$24) \frac{3 + \sqrt[3]{3}}{\sqrt[3]{9}}$$

$$\frac{3\sqrt[3]{3} + \sqrt[3]{9}}{3}$$

$$25) \frac{-2x + \sqrt[3]{-5x^4y^3}}{3\sqrt[3]{15x^3y}}$$

$$\frac{-2\sqrt[3]{225y^2} - 5y\sqrt[3]{9y^2x}}{45y}$$

$$26) \frac{3 - \sqrt[4]{5k^2}}{\sqrt[4]{3k^3}}$$

$$\frac{3\sqrt[4]{27k} - \sqrt[4]{135k^3}}{3k}$$

Radicals and Rational Exponents

Write each expression in radical form.

1) $7^{\frac{1}{2}}$

2) $4^{\frac{4}{3}}$

3) $2^{\frac{5}{3}}$

4) $7^{\frac{4}{3}}$

5) $6^{\frac{3}{2}}$

6) $2^{\frac{1}{6}}$

Write each expression in exponential form.

7) $(\sqrt{10})^3$

8) $\sqrt[6]{2}$

9) $(\sqrt[4]{2})^5$

10) $(\sqrt[4]{5})^5$

11) $\sqrt[3]{2}$

12) $\sqrt[6]{10}$

Write each expression in radical form.

13) $(5x)^{-\frac{5}{4}}$

14) $(5x)^{-\frac{1}{2}}$

15) $(10n)^{\frac{3}{2}}$

16) $a^{\frac{6}{5}}$

17) $(6v)^{1.5}$

18) $m^{-\frac{1}{2}}$

Write each expression in exponential form.

19) $(\sqrt[4]{m})^3$

20) $(\sqrt[3]{6x})^4$

21) $\sqrt[4]{v}$

22) $\sqrt{6p}$

23) $(\sqrt[3]{3a})^4$

24) $\frac{1}{(\sqrt{3k})^5}$

Simplify.

25) $9^{\frac{1}{2}}$

26) $343^{-\frac{4}{3}}$

27) $1000000^{\frac{1}{6}}$

28) $36^{\frac{3}{2}}$

29) $(x^6)^{\frac{1}{2}}$

30) $(9n^4)^{\frac{1}{2}}$

31) $(64n^{12})^{-\frac{1}{6}}$

32) $(81m^6)^{\frac{1}{2}}$

Radicals and Rational Exponents

Write each expression in radical form.

1) $7^{\frac{1}{2}}$

$\sqrt{7}$

2) $4^{\frac{4}{3}}$

$(\sqrt[3]{4})^4$

3) $2^{\frac{5}{3}}$

$(\sqrt[3]{2})^5$

4) $7^{\frac{4}{3}}$

$(\sqrt[3]{7})^4$

5) $6^{\frac{3}{2}}$

$(\sqrt{6})^3$

6) $2^{\frac{1}{6}}$

$\sqrt[6]{2}$

Write each expression in exponential form.

7) $(\sqrt{10})^3$

$10^{\frac{3}{2}}$

8) $\sqrt[6]{2}$

$2^{\frac{1}{6}}$

9) $(\sqrt[4]{2})^5$

$2^{\frac{5}{4}}$

10) $(\sqrt[4]{5})^5$

$5^{\frac{5}{4}}$

11) $\sqrt[3]{2}$

$2^{\frac{1}{3}}$

12) $\sqrt[6]{10}$

$10^{\frac{1}{6}}$

Write each expression in radical form.

13) $(5x)^{-\frac{5}{4}}$

$\frac{1}{(\sqrt[4]{5x})^5}$

14) $(5x)^{-\frac{1}{2}}$

$\frac{1}{\sqrt{5x}}$

15) $(10n)^{\frac{3}{2}}$

$(\sqrt{10n})^3$

16) $a^{\frac{6}{5}}$

$(\sqrt[5]{a})^6$

$$17) (6v)^{1.5}$$
$$(\sqrt{6v})^3$$

$$18) m^{-\frac{1}{2}}$$
$$\frac{1}{\sqrt{m}}$$

Write each expression in exponential form.

$$19) (\sqrt[4]{m})^3$$
$$m^{\frac{3}{4}}$$

$$20) (\sqrt[3]{6x})^4$$
$$(6x)^{\frac{4}{3}}$$

$$21) \sqrt[4]{v}$$
$$v^{\frac{1}{4}}$$

$$22) \sqrt{6p}$$
$$(6p)^{\frac{1}{2}}$$

$$23) (\sqrt[3]{3a})^4$$
$$(3a)^{\frac{4}{3}}$$

$$24) \frac{1}{(\sqrt{3k})^5}$$
$$(3k)^{-\frac{5}{2}}$$

Simplify.

$$25) 9^{\frac{1}{2}}$$
$$3$$

$$26) 343^{-\frac{4}{3}}$$
$$\frac{1}{2401}$$

$$27) 1000000^{\frac{1}{6}}$$
$$10$$

$$28) 36^{\frac{3}{2}}$$
$$216$$

$$29) (x^6)^{\frac{1}{2}}$$
$$x^3$$

$$30) (9n^4)^{\frac{1}{2}}$$
$$3n^2$$

$$31) (64n^{12})^{-\frac{1}{6}}$$
$$\frac{1}{2n^2}$$

$$32) (81m^6)^{\frac{1}{2}}$$
$$9m^3$$

Simplifying Rational Exponents

Simplify.

1) $(n^4)^{\frac{3}{2}}$

2) $(27p^6)^{\frac{5}{3}}$

3) $(25b^6)^{-1.5}$

4) $(64m^4)^{\frac{3}{2}}$

5) $(a^8)^{\frac{3}{2}}$

6) $(9r^4)^{0.5}$

7) $(81x^{12})^{1.25}$

8) $(216r^9)^{\frac{1}{3}}$

Simplify. Your answer should contain only positive exponents with no fractional exponents in the denominator.

9) $2m^2 \cdot 4m^{\frac{3}{2}} \cdot 4m^{-2}$

10) $3b^{\frac{1}{2}} \cdot b^{\frac{4}{3}}$

11) $\left(p^{\frac{3}{2}}\right)^{-2}$

12) $\left(a^{\frac{1}{2}}\right)^{\frac{3}{2}}$

$$13) \frac{2x^{-\frac{7}{4}}}{4x^{\frac{3}{4}}}$$

$$14) \frac{4x^2}{2x^{\frac{1}{2}}}$$

$$15) \frac{3x^{-\frac{1}{2}} \cdot 3x^{\frac{1}{2}} y^{-\frac{1}{3}}}{3y^{-\frac{7}{4}}}$$

$$16) \frac{3y^{\frac{1}{4}}}{4x^{-\frac{2}{3}} y^{\frac{3}{2}} \cdot 3y^{\frac{1}{2}}}$$

$$17) \left(m \cdot m^{-2} n^{\frac{5}{3}} \right)^2$$

$$18) \left(a^{-1} b^{\frac{1}{3}} \cdot a^{-\frac{4}{3}} b^2 \right)^2$$

$$19) \left(\frac{x^{\frac{1}{2}} y^{-2}}{yx^{-\frac{7}{4}}} \right)^4$$

$$20) \frac{(x^3 y^2)^{\frac{3}{2}}}{(x^{-1} y^{-\frac{2}{3}})^4}$$

$$21) \frac{\left(x^{-\frac{1}{2}} y^2 \right)^{-\frac{5}{4}}}{x^2 y^{\frac{1}{2}}}$$

$$22) \frac{\left(x^{-\frac{1}{2}} y^4 \right)^{\frac{1}{4}}}{x^{\frac{2}{3}} y^{\frac{3}{2}} \cdot x^{-\frac{3}{2}} y^{\frac{1}{2}}}$$

Simplifying Rational Exponents

Simplify.

1) $(n^4)^{\frac{3}{2}}$
 n^6

2) $(27p^6)^{\frac{5}{3}}$
 $243p^{10}$

3) $(25b^6)^{-1.5}$
 $\frac{1}{125b^9}$

4) $(64m^4)^{\frac{3}{2}}$
 $512m^6$

5) $(a^8)^{\frac{3}{2}}$
 a^{12}

6) $(9r^4)^{0.5}$
 $3r^2$

7) $(81x^{12})^{1.25}$
 $243x^{15}$

8) $(216r^9)^{\frac{1}{3}}$
 $6r^3$

Simplify. Your answer should contain only positive exponents with no fractional exponents in the denominator.

9) $2m^2 \cdot 4m^{\frac{3}{2}} \cdot 4m^{-2}$
 $32m^{\frac{3}{2}}$

10) $3b^{\frac{1}{2}} \cdot b^{\frac{4}{3}}$
 $3b^{\frac{11}{6}}$

11) $\left(p^{\frac{3}{2}}\right)^{-2}$
 $\frac{1}{p^3}$

12) $\left(a^{\frac{1}{2}}\right)^{\frac{3}{2}}$
 $a^{\frac{3}{4}}$

$$13) \frac{2x^{-\frac{7}{4}}}{4x^3}$$

$$\frac{x^{-\frac{11}{4}}}{2x^4}$$

$$14) \frac{4x^2}{2x^{\frac{1}{2}}}$$

$$2x^{\frac{3}{2}}$$

$$15) \frac{3x^{-\frac{1}{2}} \cdot 3x^{\frac{1}{2}} y^{-\frac{1}{3}}}{3y^{-\frac{7}{4}}}$$

$$3y^{\frac{17}{12}}$$

$$16) \frac{3y^{\frac{1}{4}}}{4x^{-\frac{2}{3}} y^{\frac{3}{2}} \cdot 3y^{\frac{1}{2}}}$$

$$\frac{x^{\frac{2}{3}} y^{\frac{1}{4}}}{4y^2}$$

$$17) \left(m \cdot m^{-2} n^{\frac{5}{3}}\right)^2$$

$$\frac{n^{\frac{10}{3}}}{m^2}$$

$$18) \left(a^{-1} b^{\frac{1}{3}} \cdot a^{-\frac{4}{3}} b^2\right)^2$$

$$\frac{a^{\frac{1}{3}} b^{\frac{14}{3}}}{a^5}$$

$$19) \left(\frac{x^{\frac{1}{2}} y^{-2}}{yx^{-\frac{7}{4}}}\right)^4$$

$$\frac{x^9}{y^{12}}$$

$$20) \frac{(x^3 y^2)^{\frac{3}{2}}}{\left(x^{-1} y^{-\frac{2}{3}}\right)^4}$$

$$y^{\frac{19}{6}} x^{\frac{19}{4}}$$

$$21) \frac{\left(x^{-\frac{1}{2}} y^2\right)^{-\frac{5}{4}}}{x^2 y^{\frac{1}{2}}}$$

$$\frac{x^{\frac{5}{8}}}{y^3 x^2}$$

$$22) \frac{\left(x^{-\frac{1}{2}} y^4\right)^{\frac{1}{4}}}{x^{\frac{2}{3}} y^{\frac{3}{2}} \cdot x^{-\frac{3}{2}} y^{\frac{1}{2}}}$$

$$\frac{x^{\frac{17}{24}}}{y}$$

Rational Expressions

State the excluded values for each.

1) $\frac{60x^3}{12x}$

2) $\frac{70v^2}{100v}$

3) $\frac{m+7}{m^2+4m-21}$

4) $\frac{n^2+6n+5}{n+1}$

5) $\frac{35x-35}{25x-40}$

6) $\frac{-n^2+16n-63}{n^2-2n-35}$

Simplify each and state the excluded values.

7) $\frac{p+4}{p^2+6p+8}$

8) $\frac{9}{15a-15}$

9) $\frac{2a^2+10a}{3a^2+15a}$

10) $\frac{p^2-3p-10}{p^2+p-2}$

11) $\frac{x^2+x-6}{x^2+8x+15}$

12) $\frac{a^2+5a+4}{a^2+9a+20}$

13) $\frac{x^2 - 2x - 15}{x^2 - 6x + 5}$

14) $\frac{10x - 6}{10x - 6}$

15) $\frac{(v-7)(v+8)}{(v+8)(v-10)} \div \frac{1}{v-10}$

16) $\frac{n+3}{n+2} \div \frac{(n-1)(n+3)}{(n-1)^2}$

17) $\frac{x+3}{4} \cdot \frac{3(x-6)}{3(x+3)}$

18) $\frac{x-8}{(x+6)(x-8)} \cdot \frac{4x(x+10)}{x+10}$

19) $\frac{2b^2 - 12b}{b+5} \div \frac{b-6}{b+5}$

20) $\frac{1}{n+9} \div \frac{6-n}{3n-18}$

21) $\frac{28-7b}{b-4} \cdot \frac{1}{b+10}$

22) $\frac{2}{v^2 - 12v + 27} \cdot \frac{v^2 - 12v + 27}{3}$

23) $\frac{1}{5p^2} \div \frac{9p-36}{5p^3-35p^2}$

24) $\frac{8-7x-x^2}{x+8} \cdot \frac{x+5}{9x-9}$

25) $\frac{x^2-16}{9-x} \cdot \frac{x^2+x-90}{x^2+14x+40}$

26) $\frac{10x^2-20x}{40x^3-80x^2} \cdot \frac{16x^3+80x^2}{6x+30}$

Rational Expressions

State the excluded values for each.

$$1) \frac{60x^3}{12x}$$

$$\{0\}$$

$$2) \frac{70v^2}{100v}$$

$$\{0\}$$

$$3) \frac{m+7}{m^2+4m-21}$$

$$\{-7, 3\}$$

$$4) \frac{n^2+6n+5}{n+1}$$

$$\{-1\}$$

$$5) \frac{35x-35}{25x-40}$$

$$\left\{ \frac{8}{5} \right\}$$

$$6) \frac{-n^2+16n-63}{n^2-2n-35}$$

$$\{-5, 7\}$$

Simplify each and state the excluded values.

$$7) \frac{p+4}{p^2+6p+8}$$

$$\frac{1}{p+2}; \{-2, -4\}$$

$$8) \frac{9}{15a-15}$$

$$\frac{3}{5(a-1)}; \{1\}$$

$$9) \frac{2a^2+10a}{3a^2+15a}$$

$$\frac{2}{3}; \{0, -5\}$$

$$10) \frac{p^2-3p-10}{p^2+p-2}$$

$$\frac{p-5}{p-1}; \{-2, 1\}$$

$$11) \frac{x^2+x-6}{x^2+8x+15}$$

$$\frac{x-2}{x+5}; \{-3, -5\}$$

$$12) \frac{a^2+5a+4}{a^2+9a+20}$$

$$\frac{a+1}{a+5}; \{-4, -5\}$$

$$13) \frac{x^2 - 2x - 15}{x^2 - 6x + 5}$$

$$\frac{x+3}{x-1}; \{1, 5\}$$

$$14) \frac{10x - 6}{10x - 6}$$

$$1; \left\{\frac{3}{5}\right\}$$

$$15) \frac{(v-7)(v+8)}{(v+8)(v-10)} \div \frac{1}{v-10}$$

$$v-7; \{-8, 10\}$$

$$16) \frac{n+3}{n+2} \div \frac{(n-1)(n+3)}{(n-1)^2}$$

$$\frac{n-1}{n+2}; \{-2, 1, -3\}$$

$$17) \frac{x+3}{4} \cdot \frac{3(x-6)}{3(x+3)}$$

$$\frac{x-6}{4}; \{-3\}$$

$$18) \frac{x-8}{(x+6)(x-8)} \cdot \frac{4x(x+10)}{x+10}$$

$$\frac{4x}{x+6}; \{-6, 8, -10\}$$

$$19) \frac{2b^2 - 12b}{b+5} \div \frac{b-6}{b+5}$$

$$2b; \{-5, 6\}$$

$$20) \frac{1}{n+9} \div \frac{6-n}{3n-18}$$

$$-\frac{3}{n+9}; \{-9, 6\}$$

$$21) \frac{28-7b}{b-4} \cdot \frac{1}{b+10}$$

$$-\frac{7}{b+10}; \{4, -10\}$$

$$22) \frac{2}{v^2 - 12v + 27} \cdot \frac{v^2 - 12v + 27}{3}$$

$$\frac{2}{3}; \{3, 9\}$$

$$23) \frac{1}{5p^2} \div \frac{9p-36}{5p^3-35p^2}$$

$$\frac{p-7}{9(p-4)}; \{0, 7, 4\}$$

$$24) \frac{8-7x-x^2}{x+8} \cdot \frac{x+5}{9x-9}$$

$$-\frac{(x+5)}{9}; \{-8, 1\}$$

$$25) \frac{x^2 - 16}{9-x} \cdot \frac{x^2 + x - 90}{x^2 + 14x + 40}$$

$$-(x-4); \{9, -4, -10\}$$

$$26) \frac{10x^2 - 20x}{40x^3 - 80x^2} \cdot \frac{16x^3 + 80x^2}{6x + 30}$$

$$\frac{2x}{3}; \{0, 2, -5\}$$

Adding and Subtracting Polynomials

Simplify each expression.

1) $(5p^2 - 3) + (2p^2 - 3p^3)$

2) $(a^3 - 2a^2) - (3a^2 - 4a^3)$

3) $(4 + 2n^3) + (5n^3 + 2)$

4) $(4n - 3n^3) - (3n^3 + 4n)$

5) $(3a^2 + 1) - (4 + 2a^2)$

6) $(4r^3 + 3r^4) - (r^4 - 5r^3)$

7) $(5a + 4) - (5a + 3)$

8) $(3x^4 - 3x) - (3x - 3x^4)$

9) $(-4k^4 + 14 + 3k^2) + (-3k^4 - 14k^2 - 8)$

10) $(3 - 6n^5 - 8n^4) - (-6n^4 - 3n - 8n^5)$

11) $(12a^5 - 6a - 10a^3) - (10a - 2a^5 - 14a^4)$

12) $(8n - 3n^4 + 10n^2) - (3n^2 + 11n^4 - 7)$

13) $(-x^4 + 13x^5 + 6x^3) + (6x^3 + 5x^5 + 7x^4)$

14) $(9r^3 + 5r^2 + 11r) + (-2r^3 + 9r - 8r^2)$

15) $(13n^2 + 11n - 2n^4) + (-13n^2 - 3n - 6n^4)$

16) $(-7x^5 + 14 - 2x) + (10x^4 + 7x + 5x^5)$

17) $(7 - 13x^3 - 11x) - (2x^3 + 8 - 4x^5)$

18) $(13a^2 - 6a^5 - 2a) - (-10a^2 - 11a^5 + 9a)$

19) $(3v^5 + 8v^3 - 10v^2) - (-12v^5 + 4v^3 + 14v^2)$

20) $(8b^3 - 6 + 3b^4) - (b^4 - 7b^3 - 3)$

21) $(k^4 - 3 - 3k^3) + (-5k^4 + 6k^3 - 8k^5)$

22) $(-10k^2 + 7k + 6k^4) + (-14 - 4k^4 - 14k)$

23) $(-7n^2 + 8n - 4) - (-11n + 2 - 14n^2)$

24) $(14p^4 + 11p^2 - 9p^5) - (-14 + 5p^5 - 11p^2)$

25) $(8k + k^2 - 6) - (-10k + 7 - 2k^2)$

26) $(-9v^2 - 8u) + (-2uv - 2u^2 + v^2) + (-v^2 + 4uv)$

27) $(4x^2 + 7x^3y^2) - (-6x^2 - 7x^3y^2 - 4x) - (10x + 9x^2)$

28) $(-5u^3v^4 + 9u) + (-5u^3v^4 - 8u + 8u^2v^2) + (-8u^4v^2 + 8u^3v^4)$

29) $(-9xy^3 - 9x^4y^3) + (3xy^3 + 7y^4 - 8x^4y^4) + (3x^4y^3 + 2xy^3)$

30) $(y^3 - 7x^4y^4) + (-10x^4y^3 + 6y^3 + 4x^4y^4) - (x^4y^3 + 6x^4y^4)$

Adding and Subtracting Polynomials

Simplify each expression.

$$1) (5p^2 - 3) + (2p^2 - 3p^3)$$

$$-3p^3 + 7p^2 - 3$$

$$2) (a^3 - 2a^2) - (3a^2 - 4a^3)$$

$$5a^3 - 5a^2$$

$$3) (4 + 2n^3) + (5n^3 + 2)$$

$$7n^3 + 6$$

$$4) (4n - 3n^3) - (3n^3 + 4n)$$

$$-6n^3$$

$$5) (3a^2 + 1) - (4 + 2a^2)$$

$$a^2 - 3$$

$$6) (4r^3 + 3r^4) - (r^4 - 5r^3)$$

$$2r^4 + 9r^3$$

$$7) (5a + 4) - (5a + 3)$$

$$1$$

$$8) (3x^4 - 3x) - (3x - 3x^4)$$

$$6x^4 - 6x$$

$$9) (-4k^4 + 14 + 3k^2) + (-3k^4 - 14k^2 - 8)$$

$$-7k^4 - 11k^2 + 6$$

$$10) (3 - 6n^5 - 8n^4) - (-6n^4 - 3n - 8n^5)$$

$$2n^5 - 2n^4 + 3n + 3$$

$$11) (12a^5 - 6a - 10a^3) - (10a - 2a^5 - 14a^4)$$

$$14a^5 + 14a^4 - 10a^3 - 16a$$

$$12) (8n - 3n^4 + 10n^2) - (3n^2 + 11n^4 - 7)$$

$$-14n^4 + 7n^2 + 8n + 7$$

$$13) (-x^4 + 13x^5 + 6x^3) + (6x^3 + 5x^5 + 7x^4)$$

$$18x^5 + 6x^4 + 12x^3$$

$$14) (9r^3 + 5r^2 + 11r) + (-2r^3 + 9r - 8r^2)$$

$$7r^3 - 3r^2 + 20r$$

$$15) (13n^2 + 11n - 2n^4) + (-13n^2 - 3n - 6n^4)$$

$$-8n^4 + 8n$$

$$16) (-7x^5 + 14 - 2x) + (10x^4 + 7x + 5x^5)$$

$$-2x^5 + 10x^4 + 5x + 14$$

17) $(7 - 13x^3 - 11x) - (2x^3 + 8 - 4x^5)$

$4x^5 - 15x^3 - 11x - 1$

18) $(13a^2 - 6a^5 - 2a) - (-10a^2 - 11a^5 + 9a)$

$5a^5 + 23a^2 - 11a$

19) $(3v^5 + 8v^3 - 10v^2) - (-12v^5 + 4v^3 + 14v^2)$

$15v^5 + 4v^3 - 24v^2$

20) $(8b^3 - 6 + 3b^4) - (b^4 - 7b^3 - 3)$

$2b^4 + 15b^3 - 3$

21) $(k^4 - 3 - 3k^3) + (-5k^4 + 6k^3 - 8k^5)$

$-8k^5 - 4k^4 + 3k^3 - 3$

22) $(-10k^2 + 7k + 6k^4) + (-14 - 4k^4 - 14k)$

$2k^4 - 10k^2 - 7k - 14$

23) $(-7n^2 + 8n - 4) - (-11n + 2 - 14n^2)$

$7n^2 + 19n - 6$

24) $(14p^4 + 11p^2 - 9p^5) - (-14 + 5p^5 - 11p^2)$

$-14p^5 + 14p^4 + 22p^2 + 14$

25) $(8k + k^2 - 6) - (-10k + 7 - 2k^2)$

$3k^2 + 18k - 13$

26) $(-9v^2 - 8u) + (-2uv - 2u^2 + v^2) + (-v^2 + 4uv)$

$-9v^2 + 2uv - 2u^2 - 8u$

27) $(4x^2 + 7x^3y^2) - (-6x^2 - 7x^3y^2 - 4x) - (10x + 9x^2)$

$14x^3y^2 + x^2 - 6x$

28) $(-5u^3v^4 + 9u) + (-5u^3v^4 - 8u + 8u^2v^2) + (-8u^4v^2 + 8u^3v^4)$

$-2u^3v^4 - 8u^4v^2 + 8u^2v^2 + u$

29) $(-9xy^3 - 9x^4y^3) + (3xy^3 + 7y^4 - 8x^4y^4) + (3x^4y^3 + 2xy^3)$

$-8x^4y^4 - 6x^4y^3 + 7y^4 - 4xy^3$

30) $(y^3 - 7x^4y^4) + (-10x^4y^3 + 6y^3 + 4x^4y^4) - (x^4y^3 + 6x^4y^4)$

$-9x^4y^4 - 11x^4y^3 + 7y^3$

Multiplying Polynomials

Find each product.

1) $6v(2v + 3)$

2) $7(-5v - 8)$

3) $2x(-2x - 3)$

4) $-4(v + 1)$

5) $(2n + 2)(6n + 1)$

6) $(4n + 1)(2n + 6)$

7) $(x - 3)(6x - 2)$

8) $(8p - 2)(6p + 2)$

9) $(6p + 8)(5p - 8)$

10) $(3m - 1)(8m + 7)$

11) $(2a - 1)(8a - 5)$

12) $(5n + 6)(5n - 5)$

$$13) (4p - 1)^2$$

$$14) (7x - 6)(5x + 6)$$

$$15) (6n + 3)(6n - 4)$$

$$16) (8n + 1)(6n - 3)$$

$$17) (6k + 5)(5k + 5)$$

$$18) (3x - 4)(4x + 3)$$

$$19) (4a + 2)(6a^2 - a + 2)$$

$$20) (7k - 3)(k^2 - 2k + 7)$$

$$21) (7r^2 - 6r - 6)(2r - 4)$$

$$22) (n^2 + 6n - 4)(2n - 4)$$

$$23) (6n^2 - 6n - 5)(7n^2 + 6n - 5)$$

$$24) (m^2 - 7m - 6)(7m^2 - 3m - 7)$$

Multiplying Polynomials

Find each product.

1) $6v(2v + 3)$

$12v^2 + 18v$

2) $7(-5v - 8)$

$-35v - 56$

3) $2x(-2x - 3)$

$-4x^2 - 6x$

4) $-4(v + 1)$

$-4v - 4$

5) $(2n + 2)(6n + 1)$

$12n^2 + 14n + 2$

6) $(4n + 1)(2n + 6)$

$8n^2 + 26n + 6$

7) $(x - 3)(6x - 2)$

$6x^2 - 20x + 6$

8) $(8p - 2)(6p + 2)$

$48p^2 + 4p - 4$

9) $(6p + 8)(5p - 8)$

$30p^2 - 8p - 64$

10) $(3m - 1)(8m + 7)$

$24m^2 + 13m - 7$

11) $(2a - 1)(8a - 5)$

$16a^2 - 18a + 5$

12) $(5n + 6)(5n - 5)$

$25n^2 + 5n - 30$

$$13) (4p - 1)^2$$
$$16p^2 - 8p + 1$$

$$14) (7x - 6)(5x + 6)$$
$$35x^2 + 12x - 36$$

$$15) (6n + 3)(6n - 4)$$
$$36n^2 - 6n - 12$$

$$16) (8n + 1)(6n - 3)$$
$$48n^2 - 18n - 3$$

$$17) (6k + 5)(5k + 5)$$
$$30k^2 + 55k + 25$$

$$18) (3x - 4)(4x + 3)$$
$$12x^2 - 7x - 12$$

$$19) (4a + 2)(6a^2 - a + 2)$$
$$24a^3 + 8a^2 + 6a + 4$$

$$20) (7k - 3)(k^2 - 2k + 7)$$
$$7k^3 - 17k^2 + 55k - 21$$

$$21) (7r^2 - 6r - 6)(2r - 4)$$
$$14r^3 - 40r^2 + 12r + 24$$

$$22) (n^2 + 6n - 4)(2n - 4)$$
$$2n^3 + 8n^2 - 32n + 16$$

$$23) (6n^2 - 6n - 5)(7n^2 + 6n - 5)$$
$$42n^4 - 6n^3 - 101n^2 + 25$$

$$24) (m^2 - 7m - 6)(7m^2 - 3m - 7)$$

$$7m^4 - 52m^3 - 28m^2 + 67m + 42$$

13) $(3 + 7v^2)(3 - 7v^2)$

14) $(7v^2 - 6)(7v^2 + 6)$

15) $(2 + v)^2$

16) $(6v + 3)(6v - 3)$

17) $(8a^2 - 2)(8a^2 + 2)$

18) $(4a + 7)^2$

19) $(2n - 7)^2$

20) $(-m + 5n)(-m - 5n)$

21) $(7u + 4v)(7u - 4v)$

22) $(-y - 3x)(-y + 3x)$

23) $(-9x^2 - 10y)^2$

24) $(4u + 9v)^2$

25) $(7u + 6v)(7u - 6v)$

26) $(-6x - 7y^2)^2$