**89.**
$$\begin{aligned} \frac{2x}{x-1}-5 &= \frac{2}{x-1} \\ (x-1)\left(\frac{2x}{x-1}-5\right) &= (x-1)\left(\frac{2}{x-1}\right) \\ 2x-5x+5 &= 2 \\ -3x &= -3 \\ x &= 1 \end{aligned}$$

The value is extraneous. The solution set is { } or ∅.

**90.**
$$\begin{aligned} \frac{1}{x+3}+\frac{1}{x-3} &= \frac{-5}{x^2-9} \\ (x+3)(x-3)\left(\frac{1}{x+3}+\frac{1}{x-3}\right) &= (x+3)(x-3)\left(\frac{-5}{(x+3)(x-3)}\right) \\ x-3+x+3 &= -5 \\ 2x &= -5 \\ x &= -\frac{5}{2} \end{aligned}$$

The value is not extraneous. The solution set is $\left\{-\frac{5}{2}\right\}$.

**91.** $x-2=x-2$; $x^2-5x+6=(x-2)(x-3)$

LCD = $(x-2)(x-3)$

$$\begin{aligned} \frac{2x}{x-2}-1 &= \frac{8x-24}{x^2-5x+6} \\ (x-2)(x-3)\left(\frac{2x}{x-2}-1\right) &= (x-2)(x-3)\left(\frac{8x-24}{(x-2)(x-3)}\right) \\ 2x(x-3)-1(x-2)(x-3) &= 8x-24 \\ 2x^2-6x-(x^2-5x+6) &= 8x-24 \\ 2x^2-6x-x^2+5x-6 &= 8x-24 \\ x^2-x-6 &= 8x-24 \\ x^2-9x+18 &= 0 \\ (x-6)(x-3) &= 0 \end{aligned}$$

$x-6=0$ or $x-3=0$

$x=6$ $\quad$ $x=3$

3 is extraneous. The solution set is {6}.

$$\frac{7}{r+3}+\frac{12}{r}=4$$
$$r(r+3)\left(\frac{7}{r+3}+\frac{12}{r}\right)=r(r+3)\cdot 4$$
$$7r+12(r+3)=4r(r+3)$$
$$7r+12r+36=4r^2+12r$$
$$19r+36=4r^2+12r$$
$$0=4r^2-7r-36$$
$$0=(4r+9)(r-4)$$
$$4r+9=0 \quad \text{or} \quad r-4=0$$
$$r=-\frac{9}{4} \quad \text{or} \quad r=4$$

Disregard the negative rate. The tourists hiked at 4 mph.

**Cumulative Review Chapters 1–7**

**1.** $$-6^2+4(-5+2)^3=-36+4(-3)^3$$
$$=-36+4(-27)$$
$$=-36+(-108)$$
$$=-144$$

**2.** $$3(4x-2)-(3x+5)=3\cdot 4x-3\cdot 2-3x-5$$
$$=12x-6-3x-5$$
$$=12x-3x-6-5$$
$$=9x-11$$

**3.** $$-3(x-5)+2x=5x-4$$
$$-3x+15+2x=5x-4$$
$$-x+15=5x-4$$
$$x-x+15=x+5x-4$$
$$15=6x-4$$
$$15+4=6x-4+4$$
$$19=6x$$
$$\frac{19}{6}=\frac{6x}{6}$$
$$\frac{19}{6}=x$$

The solution set is $\left\{\frac{19}{6}\right\}$.

**4.** $$3(2x-1)+5=6x+2$$
$$6x-3+5=6x+2$$
$$6x+2=6x+2$$
$$-6x+6x+2=-6x+6x+2$$
$$2=2$$

This is a true statement. It is an identity. The solution set is the set of all real numbers.

**5.** $$0.25x+0.10(x-3)=0.05(22)$$
$$100[0.25x+0.10(x-3)]=100[0.05(22)]$$
$$25x+10(x-3)=5(22)$$
$$25x+10x-30=110$$
$$35x-30=110$$
$$35x-30+30=110+30$$
$$35x=140$$
$$\frac{35x}{35}=\frac{140}{35}$$
$$x=4$$

The solution set is $\{4\}$.

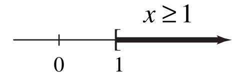
**6.** Let $w$ be the width of the poster.
Then $2w-3$ is the length of the poster.
$$\text{Perimeter}=2(\text{length}+\text{width})$$
$$24=2(2w-3+w)$$
$$24=2(3w-3)$$
$$24=6w-6$$
$$30=6w$$
$$5=w$$

The length of the poster is
$2w-3=2(5)-3=10-3=7$ feet.

**7.** Let $n$ be the first even integer. Then $n+2$ and $n+4$ are the second and third consecutive even integers, respectively. Their sum is 138.
$$n+(n+2)+(n+4)=138$$
$$n+n+2+n+4=138$$
$$3n+6=138$$
$$3n=132$$
$$n=44$$
$$n+2=46$$
$$n+4=48$$

The three integers are 44, 46, and 48.

**8.** $$2(x-3)-5\le 3(x+2)-18$$
$$2x-6-5\le 3x+6-18$$
$$2x-11\le 3x-12$$
$$-3x+2x-11\le -3x+3x-12$$
$$-x-11\le -12$$
$$-x-11+11\le -12+11$$
$$-x\le -1$$
$$x\ge 1$$




**9.** $$(3x-2y)^2=(3x)^2-2(3x)(2y)+(2y)^2$$
$$=9x^2-12xy+4y^2$$

**20.** $$\frac{\frac{2}{x^2}-\frac{3}{5x}}{\frac{4}{x}+\frac{1}{4x}}=\frac{20x^2\left(\frac{2}{x^2}-\frac{3}{5x}\right)}{20x^2\left(\frac{4}{x}+\frac{1}{4x}\right)}=\frac{40-12x}{80x+5x}=\frac{4(10-3x)}{85x}$$

**21.** LCD = $(x-4)(x+4)$
Undefined values: $x = 4$ and $x = -4$.
$$\frac{3}{x-4}=\frac{5x+4}{x^2-16}-\frac{4}{x+4}$$
$$\frac{3}{x-4}=\frac{5x+4}{(x+4)(x-4)}-\frac{4}{x+4}\cdot\frac{x-4}{x-4}$$
$$\frac{3}{x-4}=\frac{5x+4}{(x+4)(x-4)}-\frac{4x-16}{(x+4)(x-4)}$$
$$\frac{3}{x-4}=\frac{5x+4-4x+16}{(x+4)(x-4)}$$
$$\frac{3}{x-4}=\frac{x+20}{(x+4)(x-4)}$$
$$3(x+4)(x-4)=(x-4)(x+20)$$
$$3x^2-48=x^2+16x-80$$
$$2x^2-16x+32=0$$
$$2(x-4)(x-4)=0$$
$2=0$ or $x-4=0$
false or $x=4$
Since $x = 4$ is undefined, there is no solution.
The solution set is { } or ∅.

**22.** $$\frac{x-5}{3}=\frac{x+2}{2}$$
$$2(x-5)=3(x+2)$$
$$2x-10=3x+6$$
$$-10=x+6$$
$$-16=x$$
The solution set is {−16}.

**23.** Let $x$ represent the number of inches for 125 miles.
$$\frac{4}{50}=\frac{x}{125}$$
$$4(125)=50x$$
$$500=50x$$
$$10=x$$
There are 10 inches for 125 miles.

**24.** Let $s$ be the time for Sharona working alone. Then $s + 9$ is the time for Trent working alone.
Sharona can do $\frac{1}{s}$ of the job in an hour, whereas Trent can do $\frac{1}{s+9}$ of the job in an hour. It takes them 6 hours working together.
$$\frac{1}{s}+\frac{1}{s+9}=\frac{1}{6}$$
$$6s(s+9)\left(\frac{1}{s}+\frac{1}{s+9}\right)=6s(s+9)\left(\frac{1}{6}\right)$$
$$6(s+9)+6s=s(s+9)$$
$$6s+54+6s=s^2+9s$$
$$0=s^2-3s-54$$
$$0=(s+6)(s-9)$$
$s+6=0$ or $s-9=0$
$s=-6$ or $s=9$
Disregard the negative time. It takes Sharona 9 hours working alone.

**25.** Let $r$ be the rate he walks.

| | $d$ | $r$ | $t=\frac{d}{r}$ |
|---|---|---|---|
| jogged | 35 | $r+4$ | $\frac{35}{r+4}$ |
| walked | 6 | $r$ | $\frac{6}{r}$ |

It took him 7 hours total.
$$\frac{35}{r+4}+\frac{6}{r}=7$$
$$r(r+4)\left(\frac{35}{r+4}+\frac{6}{r}\right)=r(r+4)\cdot 7$$
$$35r+6(r+4)=7r(r+4)$$
$$35r+6r+24=7r^2+28r$$
$$0=7r^2-13r-24$$
$$0=(7r+8)(r-3)$$
$7r+8=0$ or $r-3=0$
$r=-\frac{8}{7}$ or $r=3$
Disregard the negative rate. Francisco jogs at $r + 4 = 3 + 4 = 7$ mph.

**26.** $(x_1, y_1)=(-1, 3); (x_2, y_2)=(5, 11)$
$$m=\frac{y_2-y_1}{x_2-x_1}=\frac{11-3}{5-(-1)}=\frac{8}{6}=\frac{4}{3}$$

# Getting Ready for Intermediate Algebra: A Review of Chapters 1 – 7

**1.** $\dfrac{4-(-6)}{8-2}=\dfrac{4+6}{8-2}=\dfrac{10}{6}=\dfrac{\cancel{2}\cdot 5}{\cancel{2}\cdot 3}=\dfrac{5}{3}$

**2.** Substitute 6 for $x$ in the expression $-\dfrac{2}{3}x+5$:

$-\dfrac{2}{3}(6)+5=-4+5=1$

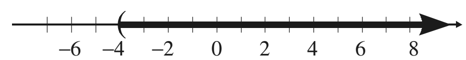
**3.**
$$\begin{aligned}4x+3&=17\\4x+3-3&=17-3\\4x&=14\\\frac{4x}{4}&=\frac{14}{4}\\x&=\frac{7}{2}\end{aligned}$$
The solution set is $\left\{\dfrac{7}{2}\right\}$. The equation is conditional.

**4.**
$$\begin{aligned}5(x-2)-2x&=3x+4\\5x-10-2x&=3x+4\\3x-10&=3x+4\\3x-3x-10&=3x-3x+4\\-10&=4\end{aligned}$$
The last statement is false, so the equation is a contradiction. Thus, the equation has no solution. The solution set is { } or $\varnothing$.

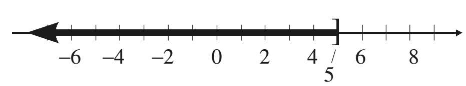
**5.**
$$\begin{aligned}\frac{1}{2}(x-4)+\frac{2}{3}x&=\frac{1}{6}(x-4)\\\frac{1}{2}x-2+\frac{2}{3}x&=\frac{1}{6}x-\frac{2}{3}\\6\left(\frac{1}{2}x-2+\frac{2}{3}x\right)&=6\left(\frac{1}{6}x-\frac{2}{3}\right)\\3x-12+4x&=x-4\\7x-12&=x-4\\6x-12&=-4\\6x&=8\\x&=\frac{8}{6}=\frac{4}{3}\end{aligned}$$
The solution set is $\left\{\dfrac{4}{3}\right\}$. The equation is conditional.

**6.**
$$\begin{aligned}0.3(x+1)-0.1(x-7)&=0.4x-0.2(x-5)\\0.3x+0.3-0.1x+0.7&=0.4x-0.2x+1\\0.2x+1&=0.2x+1\\0.2x-0.2x+1&=0.2x-0.2x+1\\1&=1\end{aligned}$$
The last statement is true, indicating that the equation is true for all real numbers $x$. The solution set is the set of all real numbers. The equation is an identity.

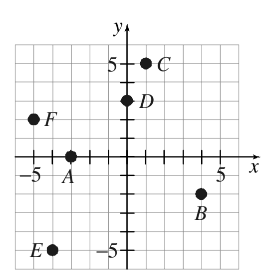
**7.**
$$\begin{aligned}6x-7&>-31\\6x-7+7&>-31+7\\6x&>-24\\\frac{6x}{6}&>\frac{-24}{6}\\x&>-4\end{aligned}$$
The solution set is $\{x\,|\,x>-4\}$ or $(-4,\infty)$.




**8.**
$$\begin{aligned}5(x-3)&\ge 7(x-4)+3\\5x-15&\ge 7x-28+3\\5x-15&\ge 7x-25\\5x-7x-15&\ge 7x-7x-25\\-2x-15&\ge -25\\-2x-15+15&\ge -25+15\\-2x&\ge -10\\\frac{-2x}{-2}&\le\frac{-10}{-2}\\x&\le 5\end{aligned}$$
The solution set is $\{x\,|\,x\le 5\}$ or $(-\infty,5]$.




**9.**



**17.** $x-3y>12$

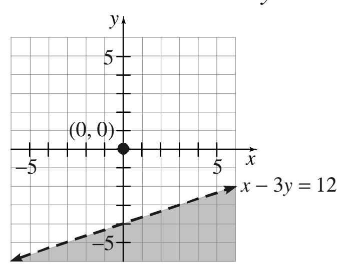
Replace the inequality symbol with an equal sign to obtain $x-3y=12$. Because the inequality is strict, graph $x-3y=12$ $\left(y=\frac{1}{3}x-4\right)$ using a dashed line.

Test Point: $(0,0)$: $(0)-3(0)\overset{?}{>}12$

$$0-0\overset{?}{>}12$$

$$0>12 \quad \text{False}$$

Therefore, the half-plane not containing $(0,0)$ is the solution set of $x-3y>12$.




**18.** $\begin{cases} y=4x-3 & (1) \\ 4x-3y=5 & (2) \end{cases}$

Substitute $4x-3$ for $y$ in equation (2).

$$\begin{aligned} 4x-3(4x-3)&=5 \\ 4x-12x+9&=5 \\ -8x+9&=5 \\ -8x&=-4 \\ x&=\frac{-4}{-8}=\frac{1}{2} \end{aligned}$$

Substitute $\frac{1}{2}$ for $x$ in equation (1).

$$y=4\left(\frac{1}{2}\right)-3=2-3=-1$$

The solution is the ordered pair $\left(\frac{1}{2},-1\right)$.

**19.** $\begin{cases} x+\ \ y=3 & (1) \\ 3x+2y=2 & (2) \end{cases}$

Multiply both sides of equation (1) by $-2$, and add the result to equation (2).

$$\begin{cases} -2x-2y=-6 \\ \underline{\ 3x+2y=\ \ 2} \end{cases}$$
$$x \qquad =-4$$

Substitute $-4$ for $x$ in equation (1).

$$\begin{aligned} -4+y&=3 \\ y&=7 \end{aligned}$$

The solution is the ordered pair $(-4,\ 7)$.

**20.** $\begin{cases} x+y\ge 2 \\ -3x+y\le 10 \end{cases}$

First, graph the inequality $x+y\ge 2$. To do so, replace the inequality symbol with an equal sign to obtain $x+y=2$. Because the inequality is non-strict, graph $x+y=2$ $(y=-x+2)$ using a solid line.

Test point: $(0,0)$: $0+0\overset{?}{\ge}2$

$$0\ge 2 \quad \text{False}$$

Therefore, the half-plane not containing $(0,0)$ is the solution set of $x+y\ge 2$.

Second, graph the inequality $-3x+y\le 10$. To do so, replace the inequality symbol with an equal sign to obtain $-3x+y=10$. Because the inequality is non-strict, graph $-3x+y=10$ $(y=3x+10)$ using a solid line.

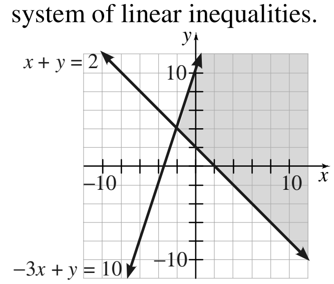
Test point: $(0,0)$: $-3(0)+0\overset{?}{\le}10$

$$0+0\overset{?}{\le}10$$

$$0\le 10 \quad \text{True}$$

Therefore, the half-plane containing $(0,0)$ is the solution set of $-3x+y\le 10$.

The overlapping shaded region (that is, the shaded region in the graph) is the solution to the system of linear inequalities.




**21.** $(12x^3+5x^2-3x+1)-(2x^3-4x+8)$

$$\begin{aligned} &=12x^3+5x^2-3x+1-2x^3+4x-8 \\ &=12x^3-2x^3+5x^2-3x+4x+1-8 \\ &=10x^3+5x^2+x-7 \end{aligned}$$

**33.** $$\frac{\frac{y^2-9}{2y^2-y-15}}{\frac{3y^2+10y+3}{2y^2+y-10}}=\frac{y^2-9}{2y^2-y-15}\cdot\frac{2y^2+y-10}{3y^2+10y+3}$$
$$=\frac{(y-3)(y+3)}{(2y+5)(y-3)}\cdot\frac{(2y+5)(y-2)}{(3y+1)(y+3)}$$
$$=\frac{\cancel{(y-3)}\cancel{(y+3)}}{\cancel{(2y+5)}\cancel{(y-3)}}\cdot\frac{\cancel{(2y+5)}(y-2)}{(3y+1)\cancel{(y+3)}}$$
$$=\frac{y-2}{3y+1}$$

**34.** $x-3$
$x+2$
$\text{LCD}=(x-3)(x+2)$
$$\frac{2x}{x-3}-\frac{x+1}{x+2}=\frac{2x}{x-3}\cdot\frac{x+2}{x+2}-\frac{x+1}{x+2}\cdot\frac{x-3}{x-3}$$
$$=\frac{2x^2+4x}{(x-3)(x+2)}-\frac{x^2-2x-3}{(x-3)(x+2)}$$
$$=\frac{2x^2+4x-(x^2-2x-3)}{(x-3)(x+2)}$$
$$=\frac{2x^2+4x-x^2+2x+3}{(x-3)(x+2)}$$
$$=\frac{x^2+6x+3}{(x-3)(x+2)}$$

**35.** $$\frac{9}{k-2}=\frac{6}{k}+3$$
$$k(k-2)\left(\frac{9}{k-2}\right)=k(k-2)\left(\frac{6}{k}+3\right)$$
$$9k=6(k-2)+3k(k-2)$$
$$9k=6k-12+3k^2-6k$$
$$0=3k^2-9k-12$$
$$0=k^2-3k-4$$
$$0=(k-4)(k+1)$$
$k-4=0$ or $k+1=0$
$k=4$ $\quad$ $k=-1$

Check: $k=-1$
$$\frac{9}{-1-2}\stackrel{?}{=}\frac{6}{-1}+3$$
$$\frac{9}{-3}\stackrel{?}{=}-6+3$$
$-3=-3$ True

Check: $k=4$
$$\frac{9}{4-2}\stackrel{?}{=}\frac{6}{4}+3$$
$$\frac{9}{2}\stackrel{?}{=}\frac{3}{2}+\frac{6}{2}$$
$\frac{9}{2}=\frac{9}{2}$ True

Both check. The solution set is $\{-1, 4\}$.

**36.** $$\frac{7}{y^2+y-12}-\frac{4y}{y^2+7y+12}=\frac{6}{y^2-9}$$
$$\frac{7}{(y-3)(y+4)}-\frac{4y}{(y+3)(y+4)}=\frac{6}{(y-3)(y+3)}$$
$$(y-3)(y+3)(y+4)\left(\frac{7}{(y-3)(y+4)}-\frac{4y}{(y+3)(y+4)}\right)=(y-3)(y+3)(y+4)\left(\frac{6}{(y-3)(y+3)}\right)$$
$$7(y+3)-4y(y-3)=6(y+4)$$
$$7y+21-4y^2+12y=6y+24$$
$$-4y^2+19y+21=6y+24$$
$$0=4y^2-13y+3$$
$$0=(4y-1)(y-3)$$
$4y-1=0$ or $y-3=0$
$y=\frac{1}{4}$ or $y=3$

Since $y=3$ is not in the domain of the variable, it is an extraneous solution.

Check $y=\frac{1}{4}$:
$$\frac{7}{\left(\frac{1}{4}\right)^2+\left(\frac{1}{4}\right)-12}-\frac{4\left(\frac{1}{4}\right)}{\left(\frac{1}{4}\right)^2+7\left(\frac{1}{4}\right)+12}\stackrel{?}{=}\frac{6}{\left(\frac{1}{4}\right)^2-9}$$
$$\frac{7}{\frac{1}{16}+\frac{1}{4}-12}-\frac{1}{\frac{1}{4}+\frac{7}{4}+12}\stackrel{?}{=}\frac{6}{\frac{1}{16}-9}$$
$$\frac{7}{\frac{1}{16}+\frac{1}{4}-12}\cdot\frac{16}{16}-\frac{1}{\frac{1}{16}+\frac{7}{4}+12}\cdot\frac{16}{16}\stackrel{?}{=}\frac{6}{\frac{1}{16}-9}\cdot\frac{16}{16}$$
$$\frac{112}{1+4-192}-\frac{16}{1+28+192}\stackrel{?}{=}\frac{96}{1-144}$$
$$\frac{112}{-187}-\frac{16}{221}\stackrel{?}{=}\frac{96}{-143}$$
$$-\frac{1456}{2431}-\frac{176}{2431}\stackrel{?}{=}-\frac{96}{143}$$
$$-\frac{1632}{2431}\stackrel{?}{=}-\frac{96}{143}$$
$$-\frac{96}{143}=-\frac{96}{143}\quad\text{True}$$

The solution set is $\left\{\frac{1}{4}\right\}$.