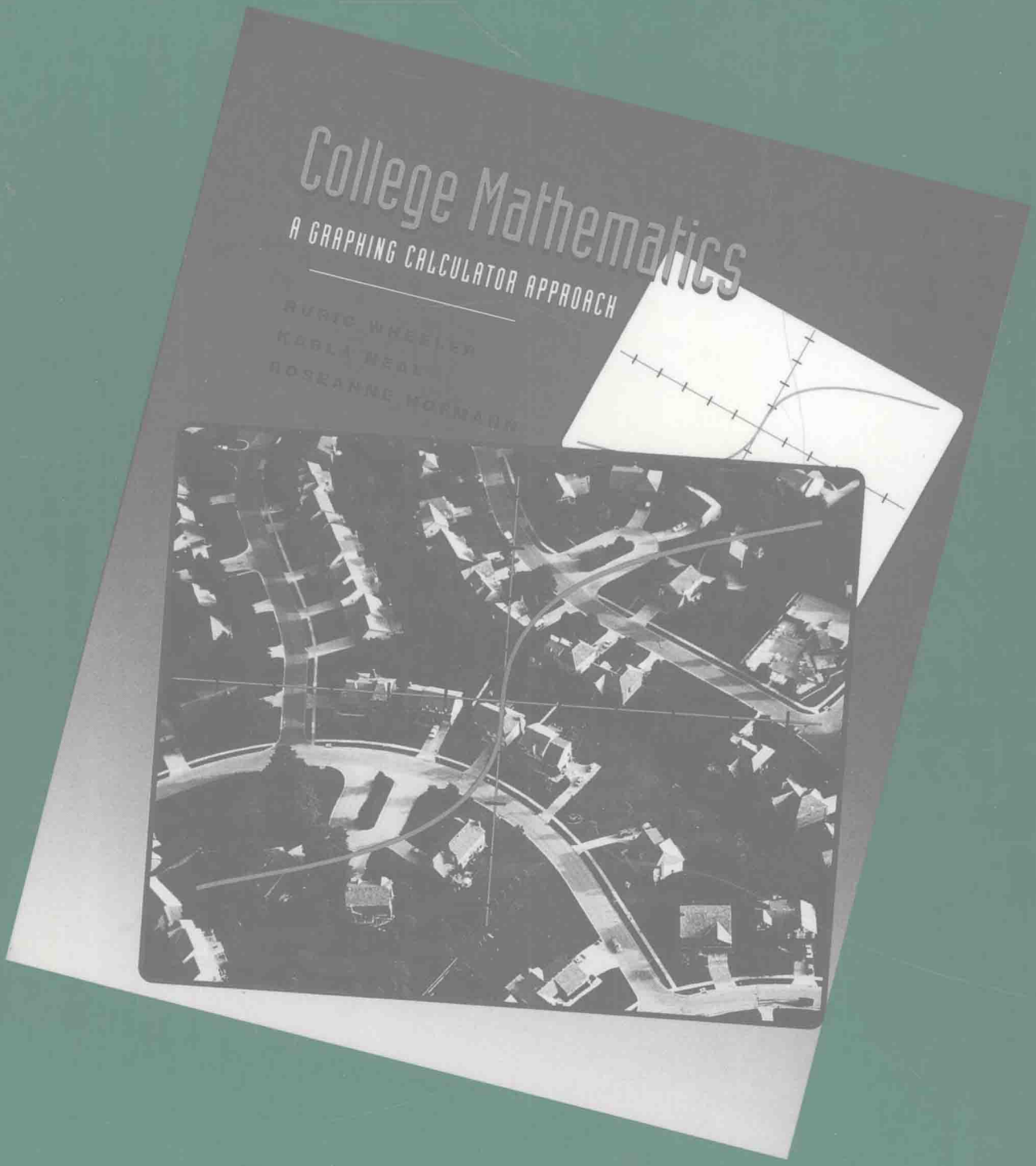
Student Solutions Manual



JDENT SOLUTIONS MANUAL

to accompany

COLLEGE MATHEMATICS

A Graphing Calculator Approach

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Chapter 0
Linear Models and an Introduction to the Graphing Calculator

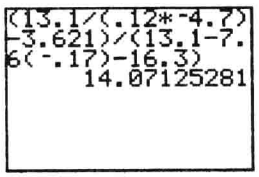
Section 0.1 - Foundations: Sets and the Real Number System, Page 11

1. (a) True
   (b) False $81 \notin A$
   (c) False $21 \notin A$ so $\{21\} \not\subset A$
   (d) True
   (e) True
   (f) False, $0 \notin A$, 0 is not a counting number

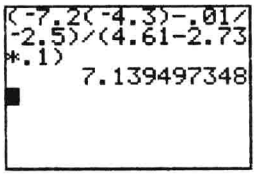
3. (a) $A' = \{4, 8\}$
   (b) Yes
   (c) No

5. N - natural number, I - integer, Q - rational, H - irrational, R - real
   (a) H,R (b) Q,R (c) Q,R (d) I,Q,R (e) Q,R
   (f) H,R (g) H,R (h) H,R (i) Q,R (j) H,R

7. (a) 14.0712528



   (b) 7.139497

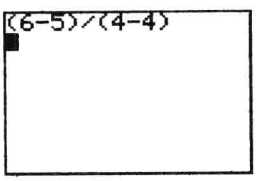


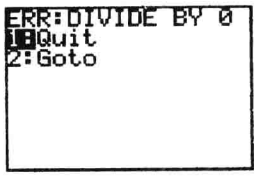
9. 11.
11. 11
13. 7

15. $\left(\frac{-4}{3}\right)\left(\frac{1}{4} - \frac{2}{5}\right) = \left(\frac{-4}{3}\right)\left(\frac{5-8}{20}\right) = \left(\frac{-4}{3}\right)\left(\frac{-3}{20}\right) = \frac{1}{5}$

17. $-8\left(\frac{2}{3} - 4\right) = \frac{-8}{1}\left(\frac{2-12}{3}\right) = \frac{-8}{1}\left(\frac{-10}{3}\right) = \frac{80}{3}$

19. $\frac{(6-5)}{(4-4)} = \frac{1}{0}$ which is undefined. Notice that the calculator shows an error.





21. $-\left(\frac{3}{8}-\frac{7}{8}\right)=-\left(\frac{-4}{8}\right)=\frac{1}{2}$

23. $\frac{2}{3}\cdot\frac{0}{1}\cdot\frac{13}{2}=\frac{0}{6}=0$

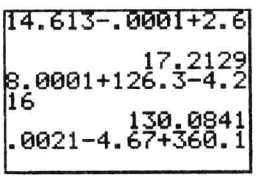
25. $\left(-\frac{3}{2}+\frac{17}{2}\right)\left(-\frac{2}{5}+\frac{3}{8}\right)=\left(\frac{14}{2}\right)\left(\frac{-16+15}{40}\right)=\left(\frac{14}{2}\right)\left(-\frac{1}{40}\right)=-\frac{7}{40}$

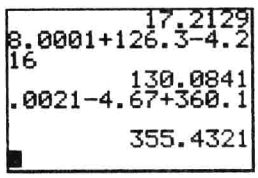
27. $6xy+(-4xy)=2xy$

29. $-(-3+4)=-1$

31. (a) 17.2129 (b) 130.0841 (c) 355.4321

(d) Line up the decimal points, then perform addition and subtraction as always.





33. (a) 7000 (b) 2. (c) .2

(d) Move your decimal point in the divisor so it becomes a whole number, move the decimal point in the numerator the same number of places. Keep the decimal point in the quotient where ever the point was in the numerator.

(e) As long as you change the number of places in the mode setting.

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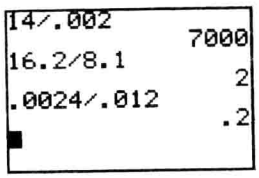
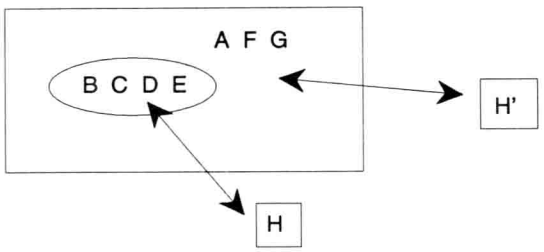


35. $H' = \{A, F, G\}$



37. $\sum_{i=1}^{10} i = \frac{n(n+1)}{2} = \frac{10(11)}{2} = 55$

$\frac{10}{55} \cdot 15000 = 2727.27$ $\quad$ $\frac{9}{55} \cdot 15000 = 2454.55$

$\frac{8}{55} \cdot 15000 = 2181.82$ $\quad$ $\frac{7}{55} \cdot 15000 = 1909.09$

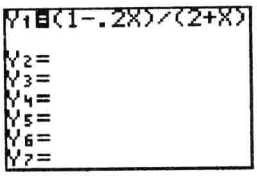
$\frac{6}{55} \cdot 15000 = 1636.36$ $\quad$ $\frac{5}{55} \cdot 15000 = 1363.64$

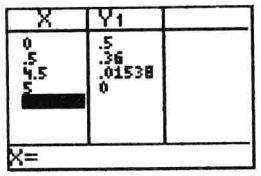
$\frac{4}{55} \cdot 15000 = 1090.90$ $\quad$ $\frac{3}{55} \cdot 15000 = 818.18$

$\frac{2}{55} \cdot 15000 = 545.46$ $\quad$ $\frac{1}{55} \cdot 15000 = 272.73$

39. Let $Y_1 = (1 - .2X)/(2 + X)$ then calculate:

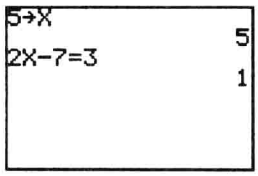
$$Y_1(0) = .5, Y_2(.5) = .36, Y_3(9/2) = .015, Y_4(5) = 0$$



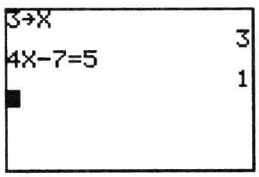


Section 0.2 - Solving Equations and Inequalities, Page 22

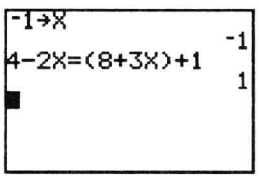
1. $2x - 7 = 3 \quad \Rightarrow \quad 2x = 10 \quad \Rightarrow \quad x = 5$



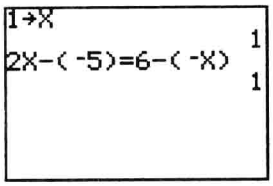
3. $4x - 7 = 5 \quad \Rightarrow \quad 4x = 12 \quad \Rightarrow \quad x = 3$



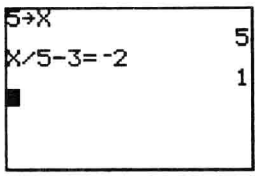
5. $4 - 2x = (8 + 3x) + 1 \quad \Rightarrow \quad 4 - 2x = 9 + 3x \quad \Rightarrow \quad -2x = 5 + 3x \quad \Rightarrow$
$-5x = 5 \quad \Rightarrow \quad x = -1$



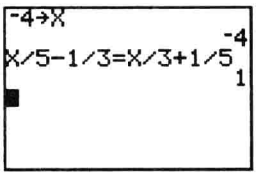
7. $2x-(-5)=6-(-x) \quad \Rightarrow \quad 2x+5=6+x \quad \Rightarrow \quad 2x=1+x \quad \Rightarrow \quad x=1$



9. $\frac{x}{5}-3=-2 \quad \Rightarrow \quad \frac{x}{5}=1 \quad \Rightarrow \quad x=5$



11. $\frac{x}{5}-\frac{1}{3}=\frac{x}{3}+\frac{1}{5} \quad \Rightarrow \quad 3x-5=5x+3 \quad \Rightarrow \quad 3x=5x+8 \quad \Rightarrow$
$-2x=8 \quad \Rightarrow \quad x=-4$



13. $-x+(-4)<-7 \quad \Rightarrow \quad -x<-3 \quad \Rightarrow \quad x>3 \quad \Rightarrow \quad (3,\infty)$

15. $\frac{x}{3}+2<-5 \quad \Rightarrow \quad \frac{x}{3}<-7 \quad \Rightarrow \quad x<-21 \quad \Rightarrow \quad (-\infty,-21)$

17. $\frac{x}{3}+\frac{4}{6}<\frac{x}{2}-\frac{4}{15} \quad \Rightarrow \quad 10x+20<15x-8 \quad \Rightarrow \quad 10x<15x-28 \quad \Rightarrow$

$-5x<-28 \quad \Rightarrow \quad x>\frac{28}{5} \quad \Rightarrow \quad \left(\frac{28}{5},\infty\right)$

19. $A=P+Prt \quad \Rightarrow \quad \frac{A-P}{Pt}=\frac{Prt}{Pt} \quad \Rightarrow \quad r=\frac{A-P}{Pt} \qquad (Pt\neq 0)$

21. $y = mx + b \quad \Rightarrow \quad y - mx = b \quad \Rightarrow \quad b = y - mx$

23. $S = \dfrac{a}{1-r} \quad \Rightarrow \quad S(1-r) = a \quad \Rightarrow \quad S - Sr = a \quad \Rightarrow \quad \dfrac{-Sr}{-S} = \dfrac{a-S}{S} \quad \Rightarrow$

$r = \dfrac{S-a}{S} \qquad (S \neq 0)$

25.
$$\begin{aligned} -[2x-(3-x)] &= 4x-11 \\ -[2x-3+x] &= 4x-11 \\ -[3x-3] &= 4x-11 \\ -3x+3 &= 4x-11 \\ -3x &= 4x-14 \\ -7x &= -14 \\ x &= 2 \end{aligned}$$

$$\Rightarrow \quad \begin{aligned} -[2(2)-(3-2)] &\stackrel{?}{=} 4(2)-11 \\ -[4-1] &\stackrel{?}{=} 8-11 \\ -3 &= -3 \end{aligned}$$

27.
$$\begin{aligned} 2-x-x^2 &= 1-(x-1)^2 \\ 2-x-x^2 &= 1-x^2+2x-1 \\ 2-x &= 2x \\ 2 &= 3x \\ \tfrac{2}{3} &= x \end{aligned}$$

$$\Rightarrow \quad \begin{aligned} 2-\tfrac{2}{3}-\tfrac{4}{9} &\stackrel{?}{=} 1-\left(\tfrac{2}{3}-1\right)^2 \\ \tfrac{18}{9}-\tfrac{6}{9}-\tfrac{4}{9} &\stackrel{?}{=} 1-\tfrac{1}{9} \\ \tfrac{8}{9} &= \tfrac{8}{9} \end{aligned}$$

29.
$$\begin{aligned} \frac{x-5}{4} &= 1+\frac{x-9}{12} \\ 3(x-5) &= 12+x-9 \\ 3x-15 &= 3+x \\ 2x &= 18 \\ x &= 9 \end{aligned}$$

$$\Rightarrow \quad \begin{aligned} \tfrac{9-5}{4} &\stackrel{?}{=} 1+\tfrac{9-9}{12} \\ \tfrac{4}{4} &\stackrel{?}{=} 1+0 \\ 1 &= 1 \end{aligned}$$

31. $|4-x| = 1$

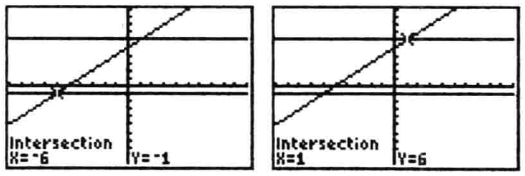
$$\begin{aligned} 4-x &= 1 \\ -x &= -3 \\ x &= 3 \end{aligned} \quad \text{or} \quad \begin{aligned} 4-x &= -1 \\ -x &= -5 \\ x &= 5 \end{aligned} \quad \Rightarrow \quad \begin{aligned} |4-3| &\stackrel{?}{=} 1 \\ 1 &= 1 \end{aligned} \quad \text{or} \quad \begin{aligned} |4-5| &\stackrel{?}{=} 1 \\ |-1| &\stackrel{?}{=} 1 \\ 1 &= 1 \end{aligned}$$

33. $|2x+1| = 3$

$$\begin{aligned} 2x+1 &= 3 \\ 2x &= 2 \\ x &= 1 \end{aligned} \quad \text{or} \quad \begin{aligned} 2x+1 &= -3 \\ 2x &= -4 \\ x &= -2 \end{aligned} \quad \Rightarrow \quad \begin{aligned} |2\cdot 1+1| &\stackrel{?}{=} 3 \\ |3| &\stackrel{?}{=} 3 \\ 3 &= 3 \end{aligned} \quad \text{or} \quad \begin{aligned} |2\cdot -2+1| &\stackrel{?}{=} 3 \\ |-3| &\stackrel{?}{=} 3 \\ 3 &= 3 \end{aligned}$$

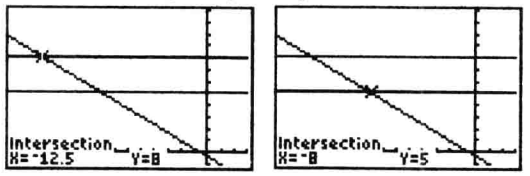
35. $-1 \le x+5 \le 6 \quad \Rightarrow \quad -6 \le x \le 1 \quad \Rightarrow \quad [-6,1]$

X:[-10,10] Y:[-10,10]



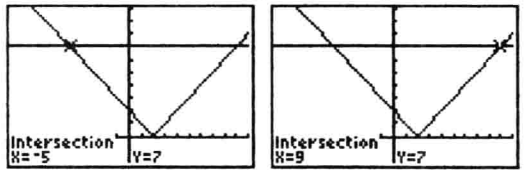
37. $5 \le \dfrac{2x+1}{-3} < 8 \quad \Rightarrow \quad -24 < 2x+1 \le -15 \quad \Rightarrow \quad -25 < 2x \le -16 \quad \Rightarrow$
$-\frac{25}{2} < x \le -8 \quad \Rightarrow \quad \left(-\frac{25}{2}, -8\right]$

X:[-15,3] Y:[-1,12]



39. $|x-2| < 7 \quad \Rightarrow \quad -7 < x-2 < 7 \quad \Rightarrow \quad -5 < x < 9 \quad \Rightarrow \quad (-5,9)$

X:[-10,10] Y:[-2,10]



41. $|2x+2| \ge 4$

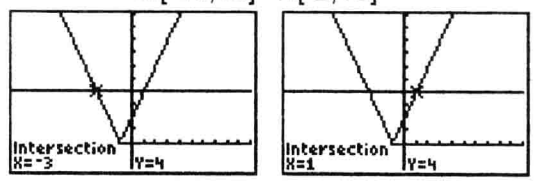
$2x+2 \ge 4$ $\qquad$ $2x+2 \le -4$

$2x \ge 2$ or $2x \le -6$

$x \ge 1$ $\qquad$ $x \le -3$

$(-\infty,-3], [1,\infty)$

X:[-10,10] Y:[-2,10]



43. $A = P + Prt \quad \Rightarrow \quad A = P(1+rt) \quad \Rightarrow \quad \dfrac{A}{1+rt} = P \quad \Rightarrow \quad P = \dfrac{A}{1+rt}$

45. $x^2y - 3x - 2z^3y = 1 \quad \Rightarrow \quad x^2y - 2z^3y = 1 + 3x \quad \Rightarrow \quad y(x^2 - 2z^3) = 1 + 3x \quad \Rightarrow$

$$y = \frac{1+3x}{x^2 - 2z^3}$$

Note: For exercises 47 - 52, a 1 indicates a true statement and a 0 indicates a false statement. You can find $<, \leq, >, \geq, =$ under the TEST menu (2nd MATH).

47. $6.310x - 8 < 1.60x - .011$

$4.710x < 7.989$

$x < 1.696$

```
7.989/4.71
        1.696178344
Ans→X
        1.696178344
6.310X-8<1.60X-0
.011
                    1
```

49. $7.61(x - 4.5) \leq 3.01x - 3.7$

$7.61x - 34.245 \leq 3.01x - 3.7$

$4.6x \leq 30.545$

$x \leq 6.640$

```
30.545/4.6
        6.640217391
Ans→X
        6.640217391
7.61(X-4.5)≤3.01
X-3.7
                    1
```

51. $\frac{6x}{7} + \frac{5}{9} = \frac{8}{11}$

$99(6x) + 77(5) = 63(8)$

$594x + 385 = 504$

$594x = 119$

$x = .2$

```
119/594
        .2003367003
Ans→X
        .2003367003
(6X)/7+5/9=8/11
                    1
```

53. (a) $3x - 6 = 21$ (b) $4x - 8 = 61$ (c) $x - 42 < 20$

Section 0.3 - Solving Application Problems with Linear Equations, Page 30

1. Guess that Ed is 20, then Carol would be 40 because Carol is twice as old. If Ed is 20 and Carol is 40, their difference is 20 which is too much. If you try 15 and 30, it is still too much.

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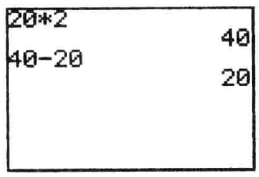
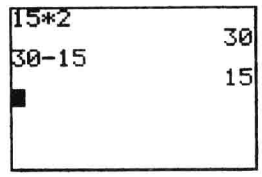




Let x = age of Ed and $2x$ = age of Carol.

$x = 2x - 10 \quad \Rightarrow \quad -x = -10 \quad \Rightarrow \quad x = 10 \quad \Rightarrow$ Ed is 10, Carol is 20.

3. Let the width be 2 inches, then the length is 5 inches and the perimeter is 10 inches which it too small. Try a width of 5 inches and length of 17 inches that yields a perimeter of 44 inches which is too big.

Let x = width and $4x - 3$ = length.

$P = 2l + 2w$

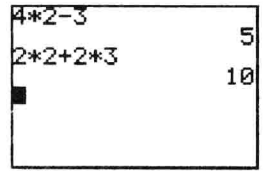
$38 = 2(4x - 3) + 2x$

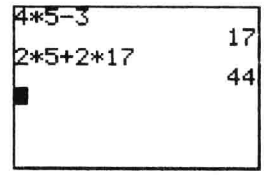
$38 = 8x - 6 + 2x$

$38 = 10x - 6$

$44 = 10x$

$x = 4.4 \quad \Rightarrow$ Width = 4.4in Length = 14.6 in





5. Guess Ralph's weight to be 85 kg ($54 + 3 \cdot 85 = 309$). This is too big. When we try 80, we find that this is too small ($54 + 3 \cdot 80 = 294$).

Let x = Ralph' weight.

$54 + 3x = 300 \quad \Rightarrow \quad 3x = 246 \quad \Rightarrow \quad x = 82$ kg

7. Let x = amount drained and replaced.

$.1(4 - x) + 1(x) = .25(4) \quad \Rightarrow \quad .4 - .1x + x = 1.0 \quad \Rightarrow \quad .9x = .6 \quad \Rightarrow$

$x = \frac{6}{9} = \frac{2}{3}$ gallon.

9. Break even is when Revenue = Cost Selling price = 6 $\Rightarrow$ Revenue = $6x$

Variable cost = 2 and fixed cost = 37,500 $\Rightarrow$ Cost = $2x + 37,500$

$6x = 2x + 37,500 \quad \Rightarrow \quad 4x = 37,500 \quad \Rightarrow \quad x = 9375$ ties. Answer is: (a).

11. Let x = amount in government securities and $27,000 - x$ = amount in junk bonds.
Yearly interest $= .07x + .10(27,000 - x) = 2700 - .03x$

13. Selling price = 5 Revenue = selling price × quantity sold $= 5x$.

15. Supply $p = 20 + 2x$

17. This year's profit - $P > 620,000$

19. Refinery I = 200 barrels, Refinery II = 2(200)=400 barrels
In x days: $600x$ barrels produced by both.

21. Let x = amount invested at 8% and $2000 - x$ = amount invested at 10%.
$.08x + .10(2000 - x) = 180 \quad \Rightarrow \quad .08x + 200 - .10x = 180 \quad \Rightarrow \quad -.02x = -20$
x = \$1000 at 8% and $2000 - 1000$ = \$1000 at 10%

23. $40(1.60) + 60(1.20)$ = \$136.00 if sold separately.
$\frac{136}{100} = 1.36$ average price per pound Charge at least \$1.36.

25. $2(g_1) + 4(g_2) = 2g_1 + 4g_2$ = amount of drug X.

27. If x = mental age, $IQ = \dfrac{x}{CA} \cdot 100 = \dfrac{100x}{10} = 10x$

29. $(20,000)(.10) = 2000$ increase each year. Population in t years $= 20,000 + 2000t$.

31. $F = \dfrac{9}{5}C + 32 \quad \Rightarrow \quad 5F = 9C + 160 \quad \Rightarrow \quad 5F - 160 = 9C \quad \Rightarrow \quad C = \dfrac{5F - 160}{9}$

33. If x = amount of cereal then $.04x = 8 \quad \Rightarrow \quad x = \dfrac{8}{.04} = 200$ grams recommended.

35. (a) Natural: $\{2\}$
(b) Integer: $\{-2, 0, 2\}$
(c) Rational: $\{-2, -\frac{1}{2}, 0, 2\}$
(d) Irrational: $\{-\sqrt{2}, \frac{1}{\sqrt{2}}, \sqrt{2}\}$
(e) Negative: $\{-2, -\frac{1}{2}, -\sqrt{2}\}$
(f) Real: $A = \{-2, -\frac{1}{2}, -\sqrt{2}, 0, \frac{1}{\sqrt{2}}, \sqrt{2}, 2\}$

Section 0.4 - Graphing Linear Equations and Inequalities, Page 39

1. (a) (2,4) - Quadrant I

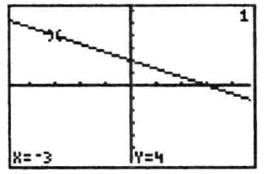
   (b) $(-5, 6)$ - Quadrant II

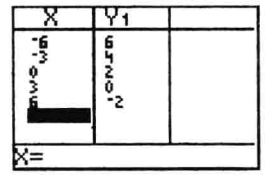
   (c) $(-3, 2)$ - Quadrant II

   (d) (4,1) - Quadrant I

3. (a) $2x + 3y = 6 \quad \Rightarrow \quad y = -\frac{2}{3}x + 2$ Points: $(-6, 6), (-3, 4), (0, 2), (3, 0), (6, -2)$

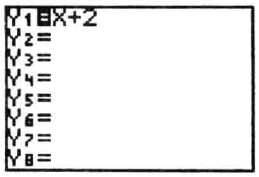
X:[-4.7,4.7] Y:[-6.2,6.2]

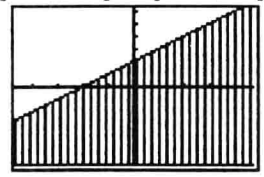


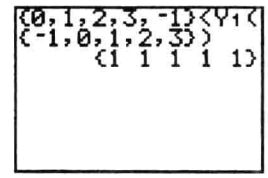


(b) $y < x + 2$ Points: $(-1, 0), (0, 0), (0, 1), (1, 1), (1, 2)$

X:[-4.7,4.7] Y:[-6.2,6.2]

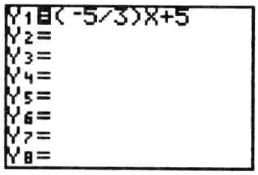


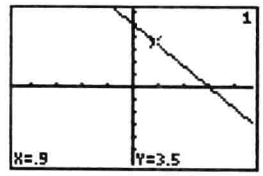


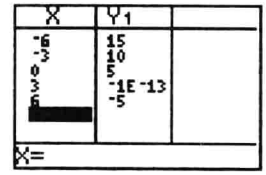


(c) $15 - 3y = 5x \quad \Rightarrow \quad y = -\frac{5}{3}x + 5$ Points: $(6, 15), (-3, 10), (0, 5), (3, 0), (6, -5)$

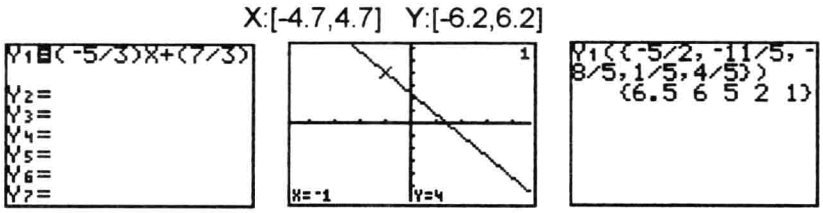
X:[-4.7,4.7] Y:[-6.2,6.2]



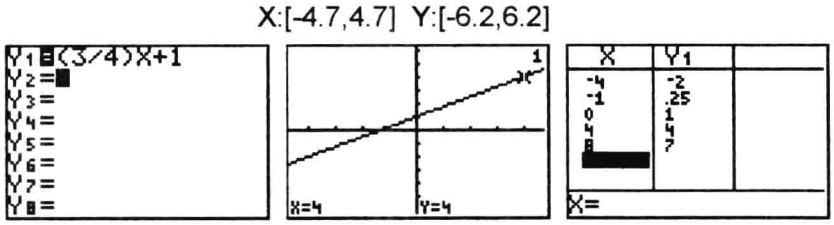




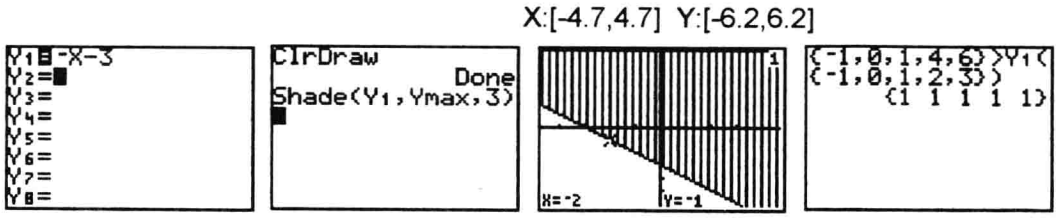
(d) $5x + 3y = 7 \quad \Rightarrow \quad y = -\frac{5}{3}x + \frac{7}{3}$ Points: $(-1, 4), \left(0, \frac{7}{3}\right), \left(1, \frac{2}{3}\right), \left(3, \frac{8}{3}\right), \left(6, -\frac{2}{3}\right)$



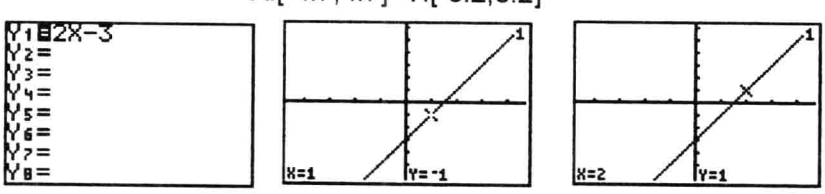
(e) $\frac{3}{4}x + y = 2y - 1 \quad \Rightarrow \quad y = \frac{3}{4}x + 1$ Points: $(-4,-2)\,,\left(-1,\frac{1}{4}\right),(0,1),(4,4),(8,7)$



(f) $x + y + 3 > 0 \quad \Rightarrow \quad y > -x - 3$ Points:$(-1,0),(0,0),(1,0),(1,1),(2,2)$

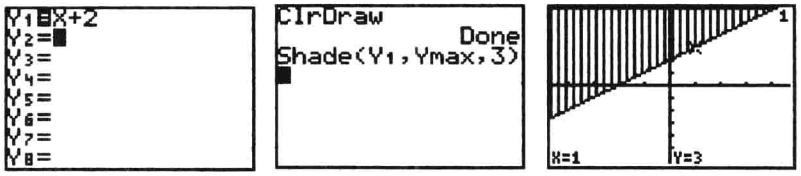


5. (a) $y = 2x - 3$



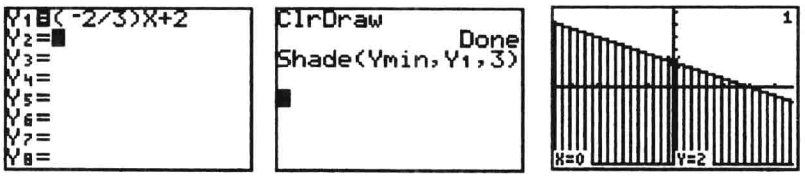
(b) $y > x + 2$

X:[-4.7,4.7] Y:[-6.2,6.2]



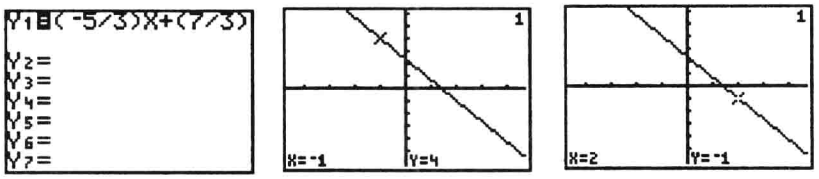
(c) $2x + 3y < 6$

X:[-4.7,4.7] Y:[-6.2,6.2]



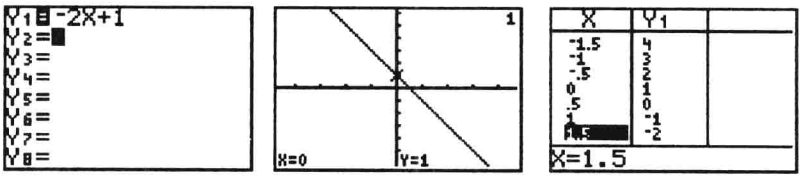
(d) $5x + 3y = 7$

X:[-4.7,4.7] Y:[-6.2,6.2]

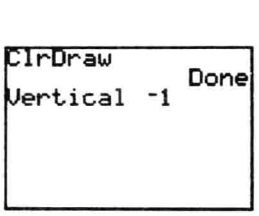


(e) $2x + y = 1$

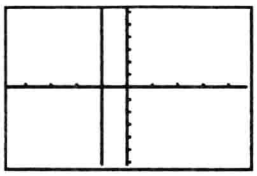
X:[-4.7,4.7] Y:[-6.2,6.2]



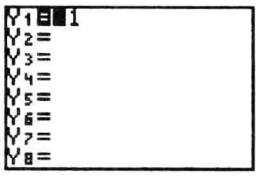
(f) $x + 1 = 0$



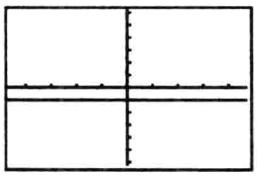
X:[-4.7,4.7] Y:[-6.2,6.2]



(g) $y + 1 = 0$

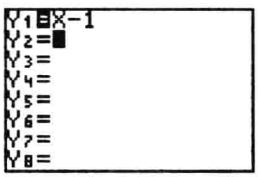


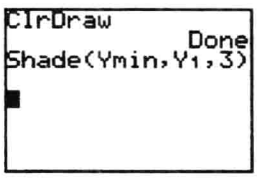
X:[-4.7,4.7] Y:[-6.2,6.2]

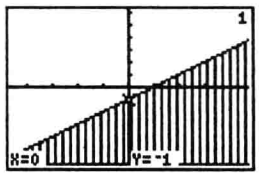


(h) $y \leq x - 1$

X:[-4.7,4.7] Y:[-6.2,6.2]

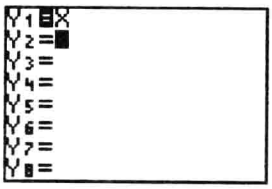


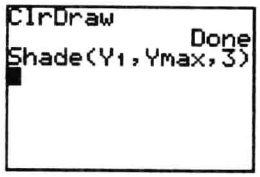


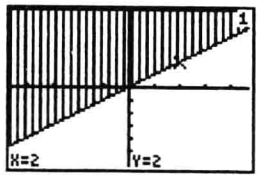


(i) $y > x$

X:[-4.7,4.7] Y:[-6.2,6.2]







(j) $y = 2x$

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