Section 2.2
Equations: Multiplication and Division

An equation is an open statement that has one or more unknowns, also called variables.

Example: $4x = 12$ or $\frac{x}{3} = 8$

Equations are solved by the use of inverse rules (see page 16). The value of the unknown is found because inverse rules undo what the equation states. A typical inverse rule says multiplications are undone by divisions and divisions by multiplications. Therefore, the first equation above is:

$$\frac{4x}{4} = \frac{12}{4}$$

Where the multiplication $4x$ was undone by division

$$x = 3$$

Notice that by undoing (dividing) 4 on the left with another 4, we are forced to divide by 4 on the right side of the equation to keep the equation balanced (equal). The value of x is then exposed as $\frac{12}{4} = 3$.

In the second equation above, the variable x is being divided by 3, therefore, to undo it, both the left and right-hand of the equation must be multiplied by 3.

$$\frac{x}{3}(3) = 8\,(3)$$

$x = 24$ The result is that the 3s on the left cancel and the answer is $8(3) = 24$

Example:

$$5x = 35$$
$$\frac{5x}{5} = \frac{35}{5}$$
$$x = 7$$

Example:

$$54 = -6y$$
$$\frac{54}{-6} = \frac{-6}{-6}y$$
$$-9 = y$$

Example:

$$-12a = -48$$
$$\frac{-12a}{-12} = \frac{-48}{-12}$$
$$a = 4$$

From page 28

1. Remove double signs and all parentheses, leaving only numbers and one sign between numbers.
   —If the signs are the same, turn both signs into one positive sign.
   —If the signs are different, turn both signs into one negative sign.
2. Find answer by moving right and left on the number line.

The example in page 27 becomes: $-12 + 9 + 14 - 7 - 11 - 8 + 5 + 16 - 2 = 4$

Multiplication and Division

Multiplication is noted with an ×, dot $(2 \cdot 3)$, or parenthesis, like in 3(4) = 12. Division is noted with a slash (/), fraction line (–), or ÷.

1. $9 \times 8 = 72$ same signs, answer positive
2. $12 \cdot -3 = -36$ different signs, answer negative
3. $-4(-7) = 28$ same signs, answer positive
4. $(8)-5 = -40$ different signs, answer negative
5. $-12/4 = -3$ different signs, answer negative
6. $\frac{-2.4}{-8} = 0.3$ same signs, answer positive
7. $84 \div (-12) = -7$ different signs, answer negative
8. $\frac{52}{13} = 4$ same signs, answer positive

If you look carefully at the answers of the eight multiplication and division examples above, one conclusion seems clear: *Answers are positive when the signs of both numbers are the same, and negative when they are not.*

*Chorus from *Signs*. © 1970, 2002 Five Man Electrical Band

Practice:
Solve.

1. $4x = 16$
2. $8y = 48$
3. $-2a = 22$
4. $21 = -7b$
5. $-4x = -32$
6. $\frac{x}{4} = 3$
7. $\frac{x}{12} = -5$
8. $-6 = \frac{x}{8}$
9. $\frac{a}{-9} = 13$
10. $\frac{b}{-15} = -7$
11. $8x = 64$
12. $7y = 98$
13. $-7a = 42$
14. $140 = -70b$
15. $-6x = -72$
16. $\frac{x}{7} = 6$
17. $\frac{x}{3} = -341$
18. $-4 = \frac{x}{23}$
19. $\frac{a}{-8} = 5$
20. $\frac{b}{-11} = -1$
21. $8x = 56$
22. $12y = 132$
23. $-3a = 321$
24. $438 = -219b$
25. $-13x = -65$
26. $\frac{x}{17} = 34$
27. $\frac{x}{14} = -6$
28. $-5 = \frac{x}{7}$
29. $\frac{a}{-12} = 24$
30. $\frac{b}{-22} = -9$
31. $24x = 168$
32. $24y = 480$
33. $-3a = 105$
34. $135 = -45b$
35. $-16x = -320$
36. $\frac{x}{7} = 30$
37. $\frac{x}{17} = -8$
38. $-2 = \frac{x}{84}$
39. $\frac{a}{-11} = 33$
40. $\frac{b}{-33} = -17$
41. $6x = 45$
42. $82y = 148$
43. $-9a = 351$
44. $222 = -22b$
45. $-15x = -750$
46. $\frac{x}{14} = 2$
47. $\frac{x}{9} = -55$
48. $-4 = \frac{x}{19}$
49. $\frac{a}{-13} = 8$
50. $\frac{b}{-8} = -71$
51. $33x = 165$
52. $5y = 435$
53. $-a = 88$
54. $15 = -85b$
55. $-33x = -66$
56. $\frac{x}{5} = 315$
57. $\frac{x}{13} = -52$
58. $-10 = \frac{x}{32}$
59. $\frac{a}{-8} = 67$
60. $\frac{b}{-6} = -27$
61. $17x = 51$
62. $23y = 92$
63. $-3a = 102$
64. $240 = -20b$
65. $-9x = -153$
66. $\frac{x}{6} = 44$
67. $\frac{x}{3} = -71$
68. $-18 = \frac{x}{20}$
69. $\frac{a}{-7} = 11$
70. $\frac{b}{-6} = -27$
71. $\frac{b}{-3} = 13$
72. $\frac{b}{-6} = -28$
73. $31x = 124$
74. $52y = 130$
75. $-13a = 26$
76. $425 = -85b$
77. $-5x = -50$
78. $\frac{x}{15} = 26$
79. $\frac{x}{7} = -54$