Name_____ Date_____

Simple Algebra

Directions: Solve each equation.

1) $20b = 22$ _____

2) $89 + y = 34$ _____

3) $x - 84 = 23$ _____

4) $n \div 9 = 7$ _____

5) $100 = 4a$ _____

6) $x + 102.4 = 231.4$ _____

7) $73 = a - 39$ _____

8) $31 + 99 = 82 + y$ _____

9) $x - 34 = 1008$ _____

10) $x + 23 = 65$ _____

11) $x + 123 = 103 + 93$ _____

12) $32.45 + y = 98.39$ _____

13) $x - 74 = 223$ _____

14) $117.6 = 9.8a$ _____

Name_____ Date_____

Algebra: Addition and Subtraction Equations

Directions: Solve each equation.

1) 31.5 = a - 34.4 _____

2) 42 + y = 57 _____

3) x + 76.31 = 164.89 _____

4) 23 + y = 119 _____

5) x - 32 = 49 _____

6) x + 19.98 = 30.14 _____

7) 44.58 + y = 114.05 _____

8) 45 + y = 98 _____

9) x + 23 = 92 _____

10) x - 9 = 26 _____

11) 36 = a - 10 _____

12) 36 = a - 64 _____

13) 96 + y = 187 _____

14) x + 72 = 142 _____

Adding Polynomials of a Single Variable

To add polynomials, identify terms with common exponents and combine them into a single term, summing the coefficients:

$$(2x^2+x+3)+(x^2+5x+1)=2x^2+x^2+x+5x+3+1$$
$$=3x^2+6x+4$$

Now try these questions on your own

1. $(x+1)+(x^2+x)=$

2. $(4x^4+2x+11)+(-3x^2+x)+(x^4-2)=$

3. $(2x^3-7x^4+7x^5)+(11x^3-4x^4-x)=$

4. $(9y+y^2+3y^3)+(9y^2+y^3+3y^4)+(9y^3+y^4+3y^5)=$

5. $(-2x-3x^2)+(1-5x+8x^2)=$

6. $(-x^2+2x+5x^7)+(2x^6-x^7)=$

7. $(-x+5)+(2x^2+4)+(6x-2x^2)=$

8. $(2z+3z^5+5z^2)+(z+2)=$

9. $(3s-s^5+4s^6)+(-3s+2s^5)=$

10. $(2x^2+2x)+(3x^3+3x)+(4x^4+4x)=$

Subtracting Polynomials of a Single Variable

When subtracting polynomials, it's important to keep in mind that subtracting a polynomial is the same as adding it's negative.

$$(2x^2+5x+7)-(x^2-3x+12)$$
$$=(2x^2+5x+7)+(-x^2+3x-12)$$
$$=x^2+8x-5$$

Now try these questions on your own.

1) $(3x^2-2x+10)-(3x^2+3x+1)=$

2) $(y-y^2)-(2y-2y^2)-(3+y)=$

3) $(2w^3-3w^2+4)-(-2w^2+7w+1)=$

4) $(-x^7+10x+7)-(9x^7-4x-1)=$

5) $(x^4+3x^3-2x-19)-(-x^5+4x^4-3x-3)=$

6) $(-2x^2+9x+1)-(x^2+4)=$

7) $(2a^3-3a^2+a)-(2a^3-3a^2+a+1)=$

8) $(z+1)-(z^2+2)-(z^2-z)=$

9) $(3h^4-8h-7)-(2h^4-2h+1)=$

10) $(-2x^{11}-3x^4)-(-2x^{11}-3x^{10}-2x^3-3x^4)=$

Exponent Laws

There are a few "shortcuts" we can take when performing operations involving numbers with a common base, but different exponents. The three exponent laws covered in this section are:

$\frac{x^a}{x^b} = x^{a-b}$	$(x^a)(x^b) = x^{a+b}$	$(x^a)^b = x^{ab}$
Division Rule	Multiplication Rule	Exponent Rule

Let's look at a quick example of each to see exactly what these rules are saying.

Examples:

$\frac{5^6}{5^2} = 5^{6-2} = 5^4$. Since 5 is the "base" in the expression in the numerator **and** denominator, we can keep the same base and simply **subtract** the exponents to get our answer.

$(3^2)(3^7) = 3^{2+7}$. This is similar to the last example. We have a common base (namely 3), but this time, we're multiplying the values. So, we keep the same base and **add** the exponents.

$(13^4)^5 = 13^{4\times5} = 13^{20}$. In this case, we have 13^4 all raised to the fifth power. Instead of multiplying out 13^4 and then raising it to the fifth power, we can take a shortcut and simply **multiply** the exponents.

Now, try these on your own:

1. $(2^3)(2^7)(2^2) =$

2. $\dfrac{(12^8)}{(12^4)} =$

3. $(6^2)(6^9) =$

4. $(3^6)(3^2)^2 =$

5. $((5^2)^3)^2 =$

6. $(3^5)(9) =$

(Hint: Try writing 9 as a power of 3)

7. $\dfrac{(5^2)(5^8)}{5^3} =$

8. $\dfrac{2^8}{4^3} =$

(Hint: Try writing 4 as a power of 2)

9. $\left(\frac{(15^{16})}{(15^{11})}\right)^{4} =$

10. $\frac{(5^{3})(4^{8})}{(4^{3})(5^{2})} =$

Multiplying Polynomials by a Single Term

To multiply a polynomial of any size by a single term, you take the single term and multiply if by each term of the polynomial.

This is easier to express through an example.

$$4xy(x^2+3xy+2)$$
$$=(4xy)(x^2)+(4xy)(3xy)+(4xy)(2)$$
$$=4x^3y+12x^2y^2+8xy$$

Notice that we multiply the $4xy$ term by each of the terms of the polynomial individually.

Try these on your own.

1. $4k(k^2+2k+1)=$
2. $3(x^2+2x+1)=$
3. $(-x)(-3x^2-2x+y)=$
4. $(-2x)(x-2z+33)=$
5. $(-5z)(z^4-2z^3+2+z)=$
6. $xy(4k+2x^2-1-3xy)=$
7. $2x^2(3x+5y-1)=$

8. $7xyz(2xy + xz - 4) =$

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

10. $(2x^2yz^3)(-3y + 4xz - z - 2yx) =$

2-8

NAME _____ DATE _____

Practice

Student Edition
Pages 119–125

Square Roots and Real Numbers

Find each square root. Use a calculator if necessary. Round to the nearest hundredth if the result is not a whole number or a simple fraction.

1. $\sqrt{144}$
2. $\sqrt{225}$
3. $-\sqrt{0.06}$
4. $-\sqrt{\frac{100}{49}}$
5. $\sqrt{\frac{1}{16}}$
6. $\pm\sqrt{1444}$
7. $\pm\sqrt{2.2}$
8. $-\sqrt{1.44}$
9. $\sqrt{0.0625}$
10. $-\sqrt{\frac{4}{289}}$
11. $\sqrt{3.06}$
12. $\pm\sqrt{2401}$
13. $-\sqrt{4900}$
14. $\sqrt{\frac{3136}{25}}$
15. $-\sqrt{11.4}$
16. $\sqrt{3364}$
17. $\sqrt{0.906}$
18. $-\sqrt{22.58}$
19. $\pm\sqrt{8376}$
20. $-\sqrt{\frac{1}{196}}$
21. $\sqrt{59{,}312}$

Evaluate each expression. Use a calculator if necessary. Round to the nearest hundredth if the result is not a whole number.

22. $-\sqrt{a}$, if $a = 400$
23. $\sqrt{b}$, if $b = 313$
24. $\sqrt{st}$, if $s = 10$ and $t = 22$
25. $-\sqrt{m + n}$, if $m = 12$ and $n = 4$
26. $\sqrt{c + d}$, if $c = 33$ and $d = 51$
27. $\sqrt{de}$, if $d = 19$ and $e = 6$
28. $-\sqrt{\frac{16}{a}}$, if $a = 16$
29. $\pm\sqrt{b - a}$, if $b = 6$ and $a = 2$
30. $\sqrt{mn}$, if $m = 45$ and $n = 3$
31. $-\sqrt{d + e}$, if $d = 0$ and $e = 9$

Name the set or sets of numbers to which each real number belongs. Use N for natural numbers, W for whole numbers, Z for integers, Q for rational numbers, and I for irrational numbers.

32. $-\sqrt{1849}$
33. $\sqrt{29}$
34. $-\frac{2}{5}$
35. $0.676767\cdots$
36. -2
37. $\frac{0}{2}$
38. $0.333333\cdots$
39. $\sqrt{93}$
40. -20

3-1

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Practice

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Pages 144–149

Solving Equations by Using Addition and Subtraction

Solve each equation. Then check your solution.

1. $13 + c = -38$

2. $w + 14 = -8$

3. $4.2 = n + 7.3$

4. $y + (-10) = 6$

5. $y - 7 = 8$

6. $-13 = 5 + x$

7. $19 - k = 32$

8. $x - 4 = 6$

9. $-12 = 7 - h$

10. $-15 = u + (-5)$

11. $j - (-17) = 36$

12. $-10 - a = -17$

13. $y - (-1.5) = 0.5$

14. $k + (-4.21) = -19.3$

15. $52 = 41 - u$

16. $s + (-28) = 0$

17. $\frac{9}{10} = k + \frac{7}{10}$

18. $-\frac{7}{8} - x = -\frac{7}{12}$

Define a variable, write an equation, and solve each problem. Then check your solution.

19. A number decreased by 14 is -46. Find the number.

20. Thirteen subtracted from a number is -5. Find the number.

21. A number increased by -56 is -82. Find the number.

22. The sum of a number and 67 is -34. Find the number.

3-2

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Practice

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Pages 150–154

Solving Equations by Using Multiplication and Division

Solve each equation. Then check your solution.

1. $-6d = -42$
2. $-7t = 49$
3. $32z = 896$
4. $8k = 36$
5. $18e = -216$
6. $0.26f = 0.0312$
7. $\frac{c}{4} = 16$
8. $-18 = \frac{m}{6}$
9. $31 = -\frac{1}{6}m$
10. $6 = \frac{4}{-7}t$
11. $-\frac{5}{8}w = -9$
12. $\frac{3}{5}x = 15$
13. $-12 = \frac{2}{3}z$
14. $\frac{c}{-7} = -13$
15. $\frac{5}{9}h = -10$
16. $-\frac{3}{5}s = -40$
17. $5n = 2\frac{3}{4}$
18. $-3x = 1\frac{1}{2}$

Define a variable, write an equation, and solve each problem. Then check your solution.

19. Eight times a number is 216. What is the number?
20. Negative seven times a number is 1.477. Find the number.
21. One third of a number is 8.5. What is the number?
22. Four thirds of a number is 4.82. What is the number?

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Practice

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Pages 168–172

Solving Equations with the Variable on Both Sides

Solve each equation. Then check your solution.

1. $4x - 9 = 7x + 12$

2. $6y - 3 = 6y + 8$

3. $8m + 13 = 13 + 8m$

4. $8n - 13 = 13 - 8n$

5. $\frac{x + 3}{2} = 15$

6. $\frac{2r - 3}{3} = \frac{3}{5}$

7. $1.4f + 1.1 = 8.3 - f$

8. $0.4r - 1.2 = 0.3r + 0.6$

9. $\frac{1}{2}d + \frac{3}{8} = -2d$

10. $\frac{3}{5}x - 2 = 6 + \frac{1}{4}x$

11. $\frac{5}{2}t - t = 3 + \frac{3}{2}t$

12. $4.2z = -4(0.6z - 1.2)$

13. $-3(b - 8) - 5 = 9(b + 2) + 1$

14. $8p - 5(p + 3) = (7p - 1)3$

15. $-4(2 - 3x) = 7 - 2(x - 3)$

16. $2(a - 8) + 7 = 5(a + 2) - 3a - 19$

Write an equation and solve. Then check your solution.

17. Twice a number increased by 12 is equal to 31 less than three times the number. Find the number.

18. Eight minus two times a number is equal to the number plus 17. Find the number.

19. Twice the greater of two consecutive odd integers is 13 less than three times the lesser. Find the integers.

20. The perimeter of a rectangle is 24 inches. Find the dimensions if its length is 3 inches greater than its width.

3-6

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Practice

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Pages 173–177

Solving Equations and Formulas

Solve for x.

1. $7x = t$

2. $\frac{x - c}{2} = d$

3. $ax - c = b$

4. $fx + 3y = 2z$

5. $e = rx$

6. $2p = kx - q$

Solve for y.

7. $ry + s = tx - m$

8. $x + 3y = 1$

9. $x - 2y = 1$

10. $\frac{2}{3}y + k = j$

11. $5(2a + y) = 3b$

12. $\frac{2}{3}y + a = a + b$

Write an equation and solve for the variable specified.

13. Five more than a number x is six less than twice a number y. Solve for x.

14. One fourth of a number x is three more than three times a number y. Solve for x.

15. Five times a number x minus 9 is two thirds of a number y. Solve for y.

Multiplying Binomials using FOIL

FOIL is the name given to the method used when multiplying two binomials (polynomials with two terms). FOIL stands for **F**irst, **I**nside, **O**utside, Last.

Suppose we were multiplying together:

$$(a+b)(c+d)$$

FOIL tells us that we need to start by multiplying the **first** terms of $(a+b)$ and $(c+d)$. This would give us ac.

Next, we need to multiply the **outside** terms, this would give us ad.

Now, we multiply the **inside** terms giving bc.

And finally, we multiply the **last** terms giving bd.

We sum each of these together to get a final answer of:

$$ac+ad+bc+bd$$

Just remember **FOIL**, and you should be in good shape!

When doing these questions, remember $a \times a = a^2$, not $2a$. Also, if you multiply two negative numbers or two positive numbers, the answer will be positive. If you multiply two numbers where one is positive and one is negative, the answer will be negative.

Try these questions:

1. $(5+b)(2+b) =$
2. $(2a+c)(3c+b) =$

3. $(mn - m^2)(-n + m) =$
4. $(5k + 3b)(b + 2k) =$
5. $(-5k - 3b)(-b - 2k) =$
6. $(-2a + 3b)(a^2b + b^2a) =$
7. $(x^6 + 9xy)(-x - 4y) =$
8. $(k^4 + 2kn)(-7k + kn^2) =$
9. $(3z - 3z^2)(2z + 2z^3) =$
10. $(2xyz + 6x^2yz^2)(xy + 1 + xz) =$

Difference of Squares

"Difference of Squares" is the name of a type of shortcut you can take when multiplying two binomials if they have certain properties. Namely, if you are multiplying something of the form:

$$(a+b)(a-b)$$

Notice that the two binomials are exactly the same **except** for the sign of the last term. One is negative, the other is positive. So, what's the shortcut? Look what happens when we use the FOIL method to multiply them out:

$$= a^2 + ba - ab - b^2$$

$$= a^2 - b^2$$

The middle two terms cancel and we're left with the first term of the binomial squared minus the second term of the binomial squared: hence the name, difference of squares.

You can only use this short cut if you have two binomials of the form above. If you don't have it in this form, you can't use the shortcut!

Here are some problems for you to try

1. $(4a-3b)(4a+3b) =$
2. $(kx+5)(kx-5) =$
3. $(2a^3-b^2)(2a^3+b^2) =$
4. $(3a+5x)(3a-5x) =$

5. For this question, look at each equation below and tell whether the difference of squares method can be used or not. If it can't be used, explain why. If it can be used, calculate the answer.

   a. $(x+y)(x-2y)$

   b. $(x+y)(x^2-y^2)$

   c. $(x-2y)(2x+y)$

   d. $(x-y)(y-x)$

   e. $(x-y)(y+x)$

6. $(11s-1)(11s+1) =$

7. $(8q+3pq)(8q-3pq) =$

8. $(mn+5n^2)(-5n^2+mn) =$

9. $(4xyz-2xy)(4xyz+2xy) =$

10. $(x-y)(x+y)(x^2+y^2) =$

(Hint: Multiply the first two binomials, then multiply the result with the second binomial)