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1a. Order of Operations

PEMDAS is an acronym that provides a good way to remember your order of operation.

It means: "*Please Excuse My Dear Aunt Sallie*"

P: Work within parenthesis first

E: Expand numbers raised to a power

MD: Multiply or Divide, whichever comes first

AS: Add or Subtract, whichever comes first

Example: $[3^2 + (2^3 - 4) + 30 \div 10 \text{x} 2]$

Solution

$$[9 + (8 - 4) + 30 \div 10\text{x}2] = [9 + 4 + 30 \div 10\text{x}2] = [9 + 4 + 3\text{x}2] = [9 + 4 + 6]$$

1. $2^4 - 3(3^2 - 8)$
2. $(4^2 + 10)4 - 10(5^2 - 20)$
3. $4^2 - 4(5^2 - 32 \div 8 \text{ x } 4)$
4. $(8 \text{ x } 5 \div 10 + 2)(2^5 - 8^2 \div 2)$
5. $5^2 + -3[6 + -2(20 + -15)]$
6. $[4^3 + -10(30 - 8 \text{ x } 5)]$
7. $[15 - 3(4^2 - 10) + 25 \div 5\text{x}15]$
8. $\{10 - 5[20 - 2(3^2 + 1)]\}$
9. $|-32| + 32$
10. $|4^2 - 8| + |3^2 + -1|$

1b. Evaluation of Algebraic Expressions

Use parenthesis to replace variable(s) by given value(s). Then use order of operation to simplify.

Evaluate for $5x^2 - y$ for x = -2 and y = 3

Solution

$$5(-2)^2 - (3) = 5*4 - 3 = 20 - 3 = 17$$

Evaluate for a = 2 b = -4

1. $5a + b^2$
2. $\frac{(a - b)}{2a}$

3. $3a + 5(a – b)$

4. $(2a +b)(3a – b)$

5. $2a^2 –ab + b$

6. $ab –3b/a$

7. $2(a + 5)$

8. $ab -3a + 3a$

9. $\frac{a + b + 2ab}{b +2a -3ab}$

10. $\frac{3a – 2b}{4a + b}$

Using Formulas

11. $P = 2L + 2W$

Find P for L = 2in and W = 4in

12. $A = ½bh$

Find A if b = 6cm and h = 5cm

13. $V = lwh$

Find l=4, w=5, and h=4

14. $A = ½(b_1 + b_2)h$

Compute A for $b_1 = 12$, $b_2 = 10$, h=6

1c. Simplification of Algebraic Expression by Combining Like terms

Example 1:

Simplify **3a** + 5b **– 6a** +2b

Solution: **-3a** + 7b

Example 2:

Simplify 3**ab²** –4ab +6**ab²** +6ab

Solution 9**ab²** + 2ab

Simplify

1. $6x + -4y -5y + 10x$

2. $3xy -2y + -2xy +2y$

3. $4x^2 + 5x – 3x^2 -4x$

4. $2xy^2 + 3x^2y +4xy^2 -3x^2y$

5. $3\pi +6\pi -5\pi$

6. $2\pi r^2 +3\pi r -\pi r^2 +2\pi r$

7. $(x^2 + 3) + (3x^2 + 3)$

8. $(3y^2 + 7) – (2y^2 + 4)$

Combining Like Terms (cont.)

9. $(x^3 + 4x^2y - y^2) + (3x^2y + y^2)$

10. $(y^3 - 4xy^2 + 2x^2y) - (y^3 - 4xy^2)$

11. 2AB + 3CD –AB -2CD

12. 3CD -2AB + 2CD -4AB

1d. Translating Verbal Phrases into Algebraic Expressions

1. A number increased by 2
2. Four times a number, increased by 3
3. 3 less than twice a number
4. Twice the sum of a number and 7
5. Jordan weighs 90 *lbs*. If Charles is x *lbs* heavier, write an Algebraic expression that represents Charles' weight.
6. Mary is y years old. Tom is 5 years older. Write an expression that represents Tom's age.
7. 8 more than the product of 3 times a number
8. 4 less than twice the sum of x and 5

9. Paul and Martha saved $100 together. If Paul's portion is x, Write an expression that represents Martha's.

10. Betty weighs 130 *lbs*. What's Betty's weight after loosing x *lbs*?

2. Solving Linear Equations

2a. Properties of Equality

Addition Property: If a = b, then a + c = b + c

Example: If x – 2 = 10, then x -2 + 2 = 10 + 2 and x = 12

Subtraction Property: If a = b, then a – c = b – c

Example: If x + 5 = 8, then x + 5 -5 = 8 – 5 and x = 3

Multiplication Property: If a = b, then a•c = b•c

Example: If $\frac{x}{4} = 3$, then $(4)\frac{x}{4} = (4)3$ and x = 12

Division Property of equality

: If a = b, then a÷ c = b÷c

Example: If 2t = 14, then $\frac{1}{2} \cdot 2t = \frac{1}{2} \cdot 14$, and x = 7

Reflexive Property of equality: a = a Example: -6 = -6

Symmetric Property of equality:

If a = b, then b = a

Example: If x = -6, then -6 = x

Transitive Property of equality

If a = b and b = c, then a = c

Example: If x = 6 and y = 6, then x = y

From 1 – 5, name the property used in each situation

1. If x – 1 = 7 , then x = 8
2. If 7y = 14, then y = 2
3. If 18 = $\frac{1}{3}$x, then x = 54
4. If y = x + 4 and y = 3x – 5, then x + 4 = 3x- 5
5. If k + 5 = 8, then k = 3

For #6 – 10, write the property of equality that justifies each step

6. 3x + 2 = 14

   3x = 12

   x = 4

7. 30 = 8 – 11x

   22 = -11x

   - 2 == x

8. -4k + 3 = 15

   -4k = 12

   k = -3

9. 5y – 4 = 21

   5y = 25

   y = 20

10. $\frac{1}{3}$m -3 = 4

    $\frac{1}{3}$m = 7

    m = 21

2b. One step equations

Example #1

Solve and check: x -5 = 4
Solution
Add 5 to both sides
X -5 +5= 4 +5
X = 9

Check: Substitute 9 for x
9 – 5 = 4
4 = 4

Example #2

Solve and check: 27 = 9y
Solution
Divide both side by 9
27/9 = 9y/9
3 = y

Check: Substitute 3 for y
27 = (9)(3)
27 = 27

1. y + 5 = 6

2. 8 = x – 5

3. 7x = 14

4. 9 = 18k

5. $\frac{m}{4} = 20$

6. $\frac{2p}{3} = 6$

7. 0 = r – 8

8. –q = 9

2c. Multiple Step Equations

Rule: a) Use inverse operation to bring the variable on one side of the equal sign and the constant on the other side

b) Multiply both sides by the reciprocal of the coefficient of the variable

Solve: 3m + 5 = 35
Solution
Subtract 5 from both sides
3m + 5 -5 = 35 -5
3m = 30
(1/3)3m = (1/3)30
m = 10

Solve 8a + 56 = 14a + 26
Solution
8a + 56 -56 = 14a + 26 – 56
8a = 14a – 30
8a -14a = 14a -14a -30
-6a = -30
(-1/6)(-6a) = (-1/6)(-30)
a = 5

Solve and Check

9. 5a + 17 = 47

10. 16 – z = 12

11. 15x + 14 = 19

12. 32 -7b = 4

13. 1/2a + 7 = 17
14. 8 = 18 + 2y
15. 4t + 8 = 8
16. 5y + 15 = 0
17. 2/3x - 1/9= 4/9
18. 1/3 = m/4 + 2/3
19. .2p + - .3 = .5
20. 1.2a – 5.6 = 1.6
21. 5d + 2d = 14
22. 5d + 3 = 2d + 15
23. 10x -4 = 6 + 5x
24. 5y = 4(y + 2)
25. 5(6y -2) =50
26. x + (12 – x) = 38
27. 6(3x – 2) + 8 = 43
28. 6d – 12 –d = 9d + 53 + d
29. 5m – 2(m – 5) = 17
30. 7r – (6r – 5) = 7
31. 10a – (3a – 11) = 5a +12
32. 22s – 2(5s + 4) = 10s + 4

2d. Solve real world problems using linear equations

Procedure:

1. Select a variable to represent the basic unknown
2. Represent all other unknown in terms of that variable
3. Translate the word problem into an Algebraic equation\
4. Solve the equation
5. Check your solution

Paul traveled ¼ of a distance that Ben traveled. If Paul traveled 12 miles, how far did Ben travel?

Solution

Let d = distance Ben traveled

Then 1/4d = distance Paul traveled

The equation is 1/4d = 12

Solving the equation: (4/1(1/4d) = (4/1)12

d = 48 miles

Exercises

1. If 7 subtracted from a number, the result is 46, find the number.
2. Ten less than a number is 42, find the number.
3. After Bob spent $.25, he had $1.85 left. How much money did he have?
4. Eight years ago, Joe was 8 years old. How old is she now?
5. A piece of rug was sold for $2860 after the price rose $225. What was its original price?

6. Kunta traveled 5 times as far as Mobutu. If Kunta traveled 150 miles, how far did Mobutu travel?

7. If Jeffrey earned $900 in three week, what was his weekly salary?

8. Jordan has walked ¼ of the distance from his home to school. If he has walked ½ mile, find the distance from his home to school.

9. In a local high school parking lot, the number of unrestricted parking spaces is 12 more than 7 times the number of spaces reserved for the handicapped. If there are 6452 parking spaces altogether, how many are set aside for the handicapped?

10. Ms Winfrey needs $215 to buy a digital camera. She has only $65. in her account. If she saves $15 every week, how long will it take her to accumulate the $150?

3. Solving Inequalities

3a. One step and Multi-step inequalities

Linear inequalities are solved by the same method Linear equations are solved. However, any time both sides of the inequality is multiplied or divided by a negative number, the inequality sign is reversed.

Example

Solve and graph -3x + 5 < 20

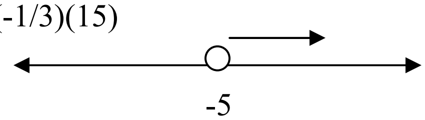
Solution:

-3x + 5 -5 < 20 -5

-3x < 15

(-1/3)(-3x) < (-1/3)(15)

x > -5



1. $y - \frac{1}{2} \geq 2$
2. 3x + 2 < 11
3. 5y – 4 > 21
4. 30 ≥ 6k + 6
5. 3 – 2x ≥ 9
6. 5 – m > 1
7. -6y < 12
8. 10 > -5k
9. 5x + 3x -4 > 4
10. 4(x – 1) > 16
11. 6x + 2 – 8x < 14
12. 2(2x + 1) ≥ 3x + 8
13. 8x > 5(2x + 4)
14. 12r –(8r – 20) < 12
15. -3(4x – 2) ≤ 2(3 + 2x)
16. 8x – 2(2x + 3) ≤ 0

17. $5y \geq 10 + 2(3y - 4)$

18. $\frac{x}{3} - 1 \leq \frac{x}{2} + 3$

19. $\frac{2}{3}x + 9 \geq \frac{1}{3}(x + 12)$

20. $12(\frac{1}{4} + \frac{x}{3}) > 15$

3b. Real world problems

21. Twice a number, increased by 6 is less than 48. What numbers satisfy this condition?

22. Three times a number is less than five times the number, increased by 24. What numbers satisfy this condition?

23. If Jessica loses 7 pounds, she will still weigh over 138. What is Jessica's weight now?

24. Joe told Rony: Twice the amount of my weekly allowance increased by $8 is less than $50. How much money could Joe have?

25. Twice the sum of a number and 8 is greater than 16. What numbers can satisfy this condition?

26. Easy ride charges $35 per day, plus $0.32 per mile driven. If Jesse rents a car for 1 day, what distance can he travel and keep his total rental charge under $60?

27. Five times a number, decreased by 24, is greater than 3 times the number. What numbers satisfy this condition?

28. A pair a shoes can be sold for at least $180 when it is reduced by 20% of its present price. What is the present Price of the shoes?

29. The larger of two integers is four times the smaller. The sum of the two integers is less than twenty. Find the largest possible values for the integers.

4. Linear Functions and their Graphs

Method #1: Isolate y (*i.e. Rewrite the equation as $y = mx + b$*), then make a table of ordered pairs

Method #2: Isolate y, then use m and b to graph the line.

Method #3: Use the x and the y-intercept (i.e. *Substitute 0 for y and solve for y, then substitute 0 for x and solve for x*)

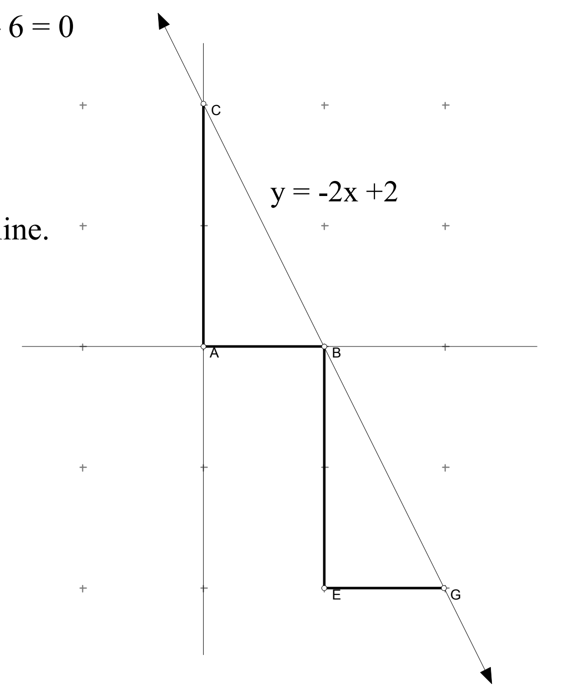
4a. Use a table of values and draw a graph of the points

1. $y = 3x + 1$
2. $x + y = 8$
3. $3y = 6x - 18$
4. $y + 2x = 8$
5. $4x - y = 6$
6. $6x + 2y = 8$
7. $2x + y = 5$
8. $3x - y = 4$
9. $2x + 3y = 6$

4b. Graph the linear function using the slope and the y –intercept.

10. $y = 2x + 3$
11. $y = -3x$
12. $y = \frac{2}{3}x$
13. $y = x - 2$
14. $2y = 4x + 6$
15. $4x - y = 3$
16. $2x - 3y - 6 = 0$
17. $3x + y = 4$
18. $3y = 4x + 9$

4c. Graphing by the slope-intercept method
Procedure:
1. Rewrite the equation into the form $y = mx + b$
2. Plot the first point using b as the y-intercept.
3. Use the slope, find two or more points on the line.
4. Draw the line that passes through the points.



4d. Parallel and Perpendicular Lines
- **Parallel lines** have the same slope
- **Perpendicular lines** have slopes that are negative reciprocal of each other.

Write an equation f the line whose slope and y-intercept are respectively:

14. 2 and 7
15. -4 and 2
16. -3 and 0
17. 2/3 and -2
18. 0 and 5

Write and equation of a line that has slope m and that passes through (x, y)

19. $m = 2$, (1, 4)
20. $m = -1$, (0, 5)
21. $m = ½$, (-2, 3)
22. $m = 0$, (4, -5)
23. $m = \infty$, (5, 0)
24. $m = 0$, (5, -4)

25. m = 2, (0, 3) 26. m = ∞, (-1, 6)

Write an equation of the line that is:

27. parallel to the line y = 3x -5 and whose y-intercept is 6
28. parallel to the line y = -2x and whose y-intercept is -2
29. parallel to the line x – y = 3 and that passes through the origin.
30. perpendicular to y = 2x and whose y-intercept is 7
31. perpendicular to y = 2/3x + 1 and that passes through (2, 0)
32. perpendicular to 2x –y = 10 and that passes through the origin.
33. parallel to y = 5 and that passes through the point (4, -1)y + y
34. perpendicular to y = -1 and that passes through (0, 4)

5. Midpoint and Distance Formulas

M= (x + x $\left(\frac{\quad}{\quad} \quad \frac{\quad}{\quad} \right)$ Distance: $d = \sqrt{\left(x_2 - x_1\right)^2 + \left(y_2 - y_1\right)^2}$

Find the length of the segment that joins each given pair of points and midpoint

1. (4, 1) and (1, 1)
2. (0, 4) and (-2, 4)
3. (-3, 2) and (6, 1)
4. (-4, -1) and (0, -3)
5. (0, 0) and (2, 4)
6. (-2, 4) and (2, 4)
7. A circle whose center is at the origin passes through (3. 2). Find the length of its radius.
8. A triangle has its vertices at (0,0), (5, 0), and (-2, -2). Find its perimeter.

6. Simplifying and Combining Radicals

Example: Write $\sqrt{108}$ in simplest radical form

Procedure: Express the number in terms of a perfect –square and another factor $\sqrt{36 \bullet 3}$
Then remove the perfect square from under the radical by taking its square root $6\sqrt{3}$

Example #2: $4\sqrt{50}$

Procedure: Once a factor has been removed from the radical sign, multiply it with the number that was previously outside of the radical.

$$4\sqrt{25 \bullet 2} = 4 \bullet 5\sqrt{2} = 20\sqrt{2}$$

Example #3: $4\sqrt{3} - 2\sqrt{2} + 5\sqrt{3} - 3\sqrt{2}$

Procedure: Like radicals are radicals that have the same index and same radicand.

$9\sqrt{3}-5\sqrt{2}$

Write each expression in simplest radical form.

1. $\sqrt{8}$
2. $\sqrt{75}$
3. $\sqrt{72}$
4. $\sqrt{48}$
5. $\sqrt{200}$
6. $4\sqrt{50}$
7. $3\sqrt{125}$
8. $5\sqrt{150}$
9. $\sqrt{3}+\sqrt{3}$
10. $2\sqrt{3}+3\sqrt{3}$
11. $4\sqrt{2}-8\sqrt{3}-5\sqrt{2}+10\sqrt{3}$
12. $3\sqrt{50}-5\sqrt{18}$
13. $5\sqrt{27}-\sqrt{108}+2\sqrt{75}$
14. $\sqrt{12}-\sqrt{48}+\sqrt{3}$
15. $5\sqrt{8}-3\sqrt{18}+\sqrt{3}$
16. $\sqrt{98}-4\sqrt{8}+3\sqrt{128}$
17. $4\sqrt{18}-\frac{3}{4}\sqrt{32}-\frac{1}{2}\sqrt{8}$

7. Multiplying and Dividing Radicals

7a. Multiplying Radicals

Procedure: $\sqrt{a}\bullet\sqrt{b}=\sqrt{ab}$

Example #1: $\sqrt{3}\bullet\sqrt{5}=\sqrt{15}$

Example #2: $(5\sqrt{2})\bullet(4\sqrt{3})=20\sqrt{6}$

Example #3: $\sqrt{3}(2+\sqrt{3})=2\sqrt{3}+\sqrt{9}=2\sqrt{3}+3$

Example #4: $(\sqrt{2}+2)(\sqrt{2}-2)=\sqrt{4}-2\sqrt{2}+2\sqrt{2}-4=-2$

Exercises

1. $\sqrt{7}\bullet\sqrt{7}$
2. $3\sqrt{2}\bullet5\sqrt{2}$
3. $2\sqrt{18}\bullet3\sqrt{8}$
4. $\sqrt{60}\bullet\sqrt{5}$
5. $5\sqrt{x}\bullet4\sqrt{x}$
6. $\sqrt{5x}\bullet\sqrt{7x}$
7. $3(\sqrt{2}+3)$
8. $\sqrt{5}(\sqrt{5}+\sqrt{2})$
9. $2\sqrt{3}(2\sqrt{3}-2\sqrt{3})$
10. $5\sqrt{5}(3\sqrt{5}-1)$
11. $(\sqrt{5}-3)(\sqrt{5}+3)$
12. $(2+\sqrt{3})(2-\sqrt{3})$
13. $\sqrt{3}(2+2\sqrt{3}+\sqrt{12})$
14. $(\sqrt{5}-2\sqrt{3})(\sqrt{5}-1)$
15. $(2\sqrt{3}-\sqrt{2})\bullet4\sqrt{3}$

7b Dividing Radicals

Procedure: To divide two monomials square roots:

1. Divide the coefficients to find the coefficient of the quotient.
2. Divide the radicands to find the radicand of the quotient of the quotient.
3. If possible, simplify the result.

Example #1: $\frac{8\sqrt{48}}{4\sqrt{2}} = \frac{8}{4}\sqrt{\frac{48}{2}} = 2\sqrt{24} = 2\sqrt{4 \bullet 6} = 2 \bullet 2\sqrt{6} = 4\sqrt{6}$

Example #2: $\frac{\sqrt{6x^3}}{\sqrt{2x}} = \sqrt{\frac{6x^3}{2x}} = \sqrt{3x^2} = x\sqrt{3}$

Example #3: $\frac{\sqrt{21}+\sqrt{35}}{\sqrt{7}} = \frac{\sqrt{21}}{\sqrt{7}} + \frac{\sqrt{35}}{\sqrt{7}} = \sqrt{\frac{21}{7}} + \sqrt{\frac{35}{7}} = \sqrt{3}+\sqrt{5}$

Example #4; $\frac{5}{\sqrt{2}} = \frac{5}{\sqrt{2}} \bullet \frac{\sqrt{2}}{\sqrt{2}} = \frac{5\sqrt{2}}{\sqrt{4}} = \frac{5\sqrt{2}}{2}\ or\ \tfrac{2}{3}\sqrt{2}$

Exercises

1. $\frac{\sqrt{72}}{2}$
2. $\frac{\sqrt{250}}{\sqrt{10}}$
3. $\frac{\sqrt{32}}{\sqrt{8}}$
4. $\frac{9\sqrt{6}}{3\sqrt{6}}$
5. $\frac{8\sqrt{3a}}{2\sqrt{a}}$
6. $\frac{20\sqrt{50}}{4\sqrt{2}}$
7. $\frac{\sqrt{8}+\sqrt{16}}{\sqrt{2}}$
8. $\frac{\sqrt{125}-\sqrt{10}}{\sqrt{5}}$
9. $\frac{6\sqrt{27}+12\sqrt{15}}{3\sqrt{3}}$
10. $\frac{20\sqrt{15}+12\sqrt{15}}{4\sqrt{3}}$
11. $\frac{1}{\sqrt{2}}$
12. $\frac{\sqrt{2}-1}{\sqrt{2}}$
13. $\frac{4\sqrt{3}+2}{\sqrt{3}}$

8. Factoring

8a. Common Monomial Factor

Procedure: to factor a polynomial whose terms have a common monomial factor
1. Find the greatest monomial that is a factor of each term of the polynomial
2. Divide the polynomial by the monomial factor. The quotient is the other factor.
3. Express the polynomial as the indicated product of the two factors.

Example: factor 5x + 5y   Solution: 5(x + y)
Example: factor $\frac{1}{4}na + \frac{1}{4}pa - \frac{1}{4}qa$ Solution: $\frac{1}{4}a(n+p-q)$

8b. Difference of two squares $a^2 - b^2 = (a-b)(a+b)$

8b. Perfect Square Binomials $a^2 + 2ab + b^2 = (a+b)(a+b) = (a+b)^2$

$a^2 - 2ab + b^2 = (a-b)(a-b) = (a-b)^2$

8c. Product of two Binomials in the form ax^2 + bx + c

Example: factor $2x^2$ + 11 x +5

1. Multiply the first coefficient by the last (2)(5) = 10
2. Find all the factors of 10: (1)(10) or (2)(5)
3.. Find the pair that can be added to equal the middle coefficient “b”: (1)(10)
4. Replace the middle term by these two numbers: $2x^2$ **+ 1x + 10x** + 5
5. Factor the first two terms, then the last two terms: **x**(2x + 1) **+ 5**(2x +1)
6. Since (2x +1) is common, your final answer becomes **(2x + 1)**(x +5)

Exercises

1. 8x + 16
2. 6x + 36
3. 18 + 3x
4. $3x^2$ +x
5. $10y^2$ +100y
6. c^2 + c
7. $\pi r^2 + \pi rl$
8. $\pi r^2 + 2\pi rh$
9. $y^2 - 49$
10. $t^2 - 81$
11. $25 - x^2$
12. $16d^2 - a^2$
13. $a^2b^2 - 144$
14. $25y^2 - 49$
16. $x^2 - 6x + 9$
17. $k^2 + 12k + 36$
18. $2x^2$ + 5x + 2
19. $3x^2$ + 10x + 3
20. $6x^2$ +5x – 4
21. $4x^2$ + 7x + 3

9. Solving a System of Linear Equations Graphically

1. Use any method *(x and y-intercept, Slope and y-intercept, or table of values)* to draw the graph of each line
2. Find the point of intersection of the two lines
3. Check the solution by substitution.

9a. Solve Graphically

1. y = 2x
   y = 3x – 3
2. x + y = 4
   x + y = 0
3. 2y = 8
   y = -4
4. x + y = -4
   x – y = 6
5. y = 2x + 4
   2x = y – 5
6. 3x + y = -1
   x + 3y = -11
7. y = 1/3x – 3
   2x + y = 4

8. x = y + 5
6x – 3y = 15

9. 5x – 3y = 9
5y = 13 – x

10. y + 2x + 4 = 0
y =2x + 4

11. y = x - 8
x – 4y = 5

12. x – 5y = 15
x – 5y = 10

Eliminating One Variable by Addition

Procedure:

1. Both equations must be in standard form: ax + by = c
2. The coefficients of one variable must be opposites. If necessary, apply the multiplication property of equality to one or both equations to make this so.
3. When the coefficients of one variable are opposites, add the two equations to eliminate that variable. Solve the resulting equation.
4. After one value has been determined, substitute in any relation containing both variables to determine the second value.
5. Check in each of the given equations.

Eliminating One Variable by Substitution

Procedure:

1. One equation must be in function form, y = f(x)
2. Substitute f(x) for y in the other equation.
3. Solve the resulting equation for x.
4. Substitute the value of x into the equation y = f(x) and solve for y.
5. Check in each of the given equations.

9b. Solve by Substitution

1. y = x
x + y = 14

2. x = y
2x + 3y = 15

3. x = 4y
2x + 3y = 22

4. a = -2b
5a – 3b = 13

5. x = 5 – y
x – y = 1

6. y = x – 2
3x – y =16

7. r – s = 7
3r – 2s = 18

8. x + y = 0
3x + 2y = 5

9. 3a = 4b
4a – 5b = 2

10. 10t + u = 24
t – u = 2t – 4u

11. x + y = 500
y = 1.5x

12. 2x + 3y = 7
4x - 5y = 25

9c. Solve by Addition

1. $x + y = 12$
   $x - y = 4$

2. $a + b = 13$
   $a - b = 5$

3. $3x + y = 16$
   $2x + y = 11$

4. $c - 2d = 14$
   $c + 3d = 9$

5. $8a + 5b = 9$
   $2a - 5b = -4$

6. $-2m + 4n = 13$
   $6m + 4n = 9$

7. $4r + 3s = 29$
   $2r - 3s = 1$

8. $a - \frac{2}{3}b = 4$
   $\frac{3}{5}a + b = 15$

9. $2a = 3b$
   $\frac{2}{3}a - \frac{1}{2}b = 2$

9d. Solving verbal problems that have two unknowns

Procedure:
1. Use two different variables to represent the different unknown quantities.
2. Translate two relationships from the problem into a system of two equations.
3. Solve the system of equations to determine the answer(s) to the problem.
4. Check the answer(s) in the original word problem.

Solve the problems below by using two variables

1. The sum of two numbers is 105. The smaller number is 5 less than the larger number. Find the numbers.

2. Mrs. Sweeny is 7 times as old as her daughter. Eight years from now, she will be three times her daughter's age. How old are they now?

3. Antonio collects nickels and quarters. His bank now holds 30 coins amounting to $5.10. How many of each coin does he have?

4. Njema has 3 times as much money as Katsiagenis. The have a total of $76 between them. How much money does each have?

5. The Perimeter of a rectangle is 50 cm. The difference between the length and the width of the rectangle is 9cm. Find the dimensions of the rectangle.

6. In a two digit number, the sum of the digits is 10 and the difference of the digits is 4. Find the number if the tens' digit is larger than the units' digit.

7. The perimeter of a rectangle is 110 ft. Find its dimensions if the length is 5 ft less than twice the width.

8. Mrs. Reagan left $25,000 to be divided between her son and daughter. The son received $5000 less than the daughter. How much did each receive?

9. The sum of Pedro and Maria's age is 60 years. Ten years ago, Pedro was 3 times as old as Maria was then. How old is each now?

10. Henry bought 100 stamps for $29.10. Some were $0.33 stamps. The rest were $0.20 stamps. How many of each kind did he buy?

11. Club P and club Q have a total of 52 members. If Club P were to increase to 4 times its present membership, and Club Q to decrease its membership by 1/8, their total combines membership would consist of 108 members. How many members are in each club presently?

10. Solve quadratic equations by factoring or by the quadratic formula

Example: $3x^2 + 14x = -8$

By Factoring

Express in the form $ax^2 + bx + c = 0$.

$3x^2 + 14x + 8 = 0$

$(3x + 2)(x + 4) = 0$

$3x + 2 = 0$ or $x = -4$

By quadratic formula

For $ax^2 + bx + c = 0$,

$$X = \frac{-c \pm \sqrt{b^2 - 4ac}}{2a}$$

Similarly, in $3x^2 + 14x + 8 = 0$,

$$X = \frac{-14 \pm \sqrt{14^2 - 4(3)(8)}}{2(3)} = \frac{-14 \pm 10}{6}$$

Thus $x = -2/3$ or $x = -4$

Solve

1. $x^2 + 5x - 6 = 0$
2. $c^2 - 6c + 8 = 0$
3. $a^2 - 169 = 0$
4. $2x^2 = 8x$
5. $-x^2 = 5x - 6$
6. $\frac{x}{7} = \frac{5}{x}$
7. $9x^2 - 5x - 4 = 0$
8. $2k^2 = k + 10$
9. $v^2 + 25 = 10v$
10. $\frac{x^2}{2} - \frac{x}{2} = 1$
11. $\frac{a^2}{4} = a - 1$
12. $c + 3 = \frac{10}{c}$
13. $(y - 6)^2 = 20$
14. $s(s + 5) = 14$
15. $(x - 3)^2 = x - 1$
16. $6x^2 + 11x + 2 = 0$

17. $15 + 4x^2 = 17x$

18. $(x - 5)(x + 6) = 0$

19. $y^2 = 4(2y - 3)$

20. $-2k = 7 - 5$

Answer Key

1a. Order of Operation

1. 13
2. 54
3. -20
4. 0
5. 3000
6. 164
7. 72
8. 10
9. 64
10. 16

1b. Evaluation of Algebraic Expression

1. 26
2. 1.5
3. 36
4. 0
5. 12
6. 2
7. 14
8. -8
9. -.75
10. 3.5
11. 12in
12. 15cm
13. $80u^2$
14. h = 6, A=66

1c. Simplification by Combining like terms

1. $16x - 9y$
2. xy
3. x^2+x
4. $6xy^2$
5. 4π
6. $\pi r^2 + 5\pi r$
7. $4x^2 + 6$
8. $y^2 + 3$
9. $x^3 + 7x^2 y$
10. $2x^2 y$
11. AB +CD
12. 5CD-6AB

1d. Verbal Phrases into Algebraic Expressions

1. n + 2
2. 4x + 3
3. 2n – 3
4. 2(n + 7)
5. 90 + x
6. y + 5
7. 3n + 8
8. 2(x + 5) – 4
9. 100 – x
10. 130 –x

2. Solving Linear Equations

2a. Properties of equality

1. Addition property of equality
2. Division property of equality
3. Multiplication property of equality
4. Transitive property
5. Substitution property
6. Substitution Property of equality/Division property of equality
7. Substitution Property of equality/Division property of equality
8. Subst. prop. Of eq./Div. prop. Of eq.
9. Add. Prop. Of Eq./ Div. prop. of eq.
10. Add. Prop. of eq./Mult. Prop. of eq.

2b**. One-step equation**

1. y = 1
2. x = 13
3. x = 2
4. $k = \frac{1}{2}$
5. m = 80
6. p = 9
7. r = 8
8. q = -9

2c. Multiple step equation

9. a = 6
10. z = 4
11. x = 1/3
12. b = 4
13. a = 20
14. y = -5
15. t =0
16. y = -3
17. x = 10/3
18. m =$-1\frac{1}{3}$
19. p = 4
20. a = 6
21. d = 2
22. d = 6
23. x = 2
24. y = 8
25. y = 2
26. undefined
27. $x = 2\frac{11}{18}$ or $\frac{47}{18}$
28. d = -13
29. $2\frac{1}{3}$

30. r = 2
31. a = ½
32. s = 6

Answer Key (cont)

2d Linear equation application

1. n = 53
2. n =52
3. x = 2.10
4. x = 16
5. x = 2635
6. 30 miles
7. $300 per week
8. 2 miles
9. 805 handicap parking spaces
10. 10weeks

Solving Inequalities

1. $y \geq 2.5$
2. $x < 3$
3. $y > 5$
4. $k \leq 4$
5. $x \leq -3$
6. $m < 4$
7. $y > -2$
8. $k > -2$
9. $x > 1$
10. $x > 5$
11. $x > -6$
12. $x \geq 6$
13. $x < -2$
14. $r < 8$
15. $x \leq 0$
16. $x \leq 1.5$
17. $y \leq -2$
18. $x \geq -24$
19. $x \geq -15$
20. $x > 3$

3b Real world with inequalities

21. $n < 21$
22. $n > -12$
23. $w > 145$
24. $x < 21$
25. $n > 0$
26. $m < 79\ 1/8$
27. $n > 12$
28. $x \geq 225$
29. $x < 4$

Linear Functions and their Graphs

Section 4a through 4c show on separate sheet

4d. Parallel and Perpendicular Lines

14. y = 2x + 7
15. y = -4x + 2
16. y = -3x
17. $y = \frac{2}{3}x - 2$
18. y = 5
19. y = 2x + 2
20. y =-x + 5
21. y = .5x + 4
22. y = -5
23. x = 5
24. y = -4
25. y = 2x + 3
26. x = -1
27. y = 3x + 6
28. y = -2x – 2
29. y = -x
30. $y = -\frac{1}{2}x + 7$
31. $y = -\frac{3}{2}x + 3$
32. $y = -\frac{1}{2}x$
33. y = -1
34. x = 0

Midpoint and Distance Formula

1. d = 3, (2.5, 1)
2. d = 2, (-1, 4)
3. d = 9.06, (1.5, 1.5)
4. d = 5, (-2, -4.5)
5. d = 4.47, (1, 2)
6. d = 16, (0, 4)
7. r = 3.61
8. p = 8.11

Answer Key (cont)

Simplifying Radicals

1. $2\sqrt{2}$
2. $5\sqrt{3}$
3. $6\sqrt{2}$
4. $4\sqrt{3}$
5. $10\sqrt{2}$
6. $20\sqrt{2}$

7. $15\sqrt{3}$
8. $25\sqrt{6}$
9. $2\sqrt{3}$
10. $2\sqrt{3}$
11. $-\sqrt{2}+2\sqrt{3}$
12. 0

13. $19\sqrt{3}$
14. $-\sqrt{3}$
15. $\sqrt{2}+\sqrt{3}$
16. $23\sqrt{2}$
17. $8\sqrt{2}$

Multiplying Radicals

1. 7
2. 30
3. 72
4. $10\sqrt{3}$
5. 20x
6. $x\sqrt{35}$

7. $3\sqrt{2}+9$
8. $5+\sqrt{10}$
9. 0
10. $75 - 5\sqrt{5}$
11. 4
12. 1

13. $12 + 2\sqrt{3}$
14. $5-\sqrt{5}-2\sqrt{15}+2\sqrt{3}$
15. $24 - 4\sqrt{6}$

Dividing Radicals

1. $3\sqrt{2}$
2. 5
3. 2
4. 3
5. $4\sqrt{3}$
6. 25

$$\frac{12-2\sqrt{3}}{3}$$

7. $2 + 2\sqrt{2}$
8. $5 - \sqrt{2}$
9. $6 + 4\sqrt{5}$
10. $8\sqrt{5}$

11. $\frac{\sqrt{2}}{2}$
12. $\frac{2-\sqrt{2}}{2}$
13.

8. Factoring

1. 8(x + 2)
2. 6(x + 6)
3. 3(9 + x)
4. x(3x + 1)
5. 10y(y + 10)
6. c(c + 1)
7. $\pi r(r+l)$

8. $\pi r(r+2h)$
9. (y – 7)(y + 7)
10. (t – 9)(t + 9)
11. (5 – x)(5 + x)
12. (4d – a)(4d + a)
13. (ab –12)(ac + 12)
14. (25y – 7)(25 + 7)

15. $(x-3)^2$
17. $(k+6)^2$
18. (2x + 1)(x + 2)
19. (3x + 1)(x + 3)
20. (2x – 1)(3x + 4)
21. (4x + 3)(x + 1)

Answer Key (cont)

9a Solve Graphically

1. (3. 6)
2. inconsistent
3. inconsistent
4. (1, -5)
5. inconsistent
6. (1, -4)
7. (3, -2)
8. (0, -5)
9. (3, 2)
10. (-2, 0)
11. (9, 1)
12. Inconsistent

9b Solve by Substitution

1. (7, 7)
2. (3, 3)
3. (8, 2)
4. (2, -1)
5. (3, 2)
6. (7, 5)
7. (4, -3)
8. (5, -5)
9. (8, 6)
10. (2.32, .77)
11. 200, 300)
12. (5, -1)

9c Solve by Addition

1. (8, 4)
2. (9, 4)
3. (5, 1)
4. (12, -1)
5. (.5, 1)
6. (-.5, 3)
7. (5, 3)
8. (10, 9)
9. (6, 4)

9c. Solving verbal problems that have two unknowns

1. (50, 55)
2. (28, 4)
3. (12, 8)
4. (57, 19)
5. (17, 8)
6. (7, 3)
7. (35, 20)
8. (10000, 15000)
9. (40, 20)
10. (70, 30)
11. (18.72, 33.28)

10. Solve Quadratic equations by factoring or by the quadratic formula

1. x = 1, -6
2. c = 4, 2
3. a = 13, -13
4. x = 4, 0
5. x = -6, 1
6. x= $\pm\sqrt{35}$
7. x = 1, -.44
8. k = 2.5, -2
9. v = 5, 5
10. x = 2, -1
11. a = 2, 2
12. c = 2, -5
13. y = 10.47, 1.53
14. s = 2, -7
15. x = 5, 2
16. x = -.2, -1.63
17. x = 3, 1.25
18. x = 5, -6
19. y = 7.16, .84
20. k = 1.4, -1