June 2013

Mathematics Review Notes for Parents and Students

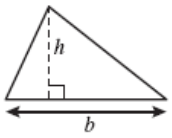
Grade 8 Mathematics
1st Nine Weeks, 2013-2014

SUFFOLK
PUBLIC SCHOOLS

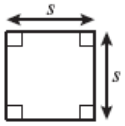
Julie A. Byrd, Suffolk Public Schools

Grade 8 Mathematics Formula Sheet
2009 *Mathematics Standards of Learning*

Geometric Formulas

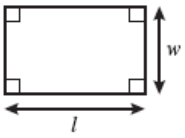


$A = \frac{1}{2}bh$



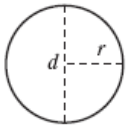
$p = 4s$

$A = s^2$



$p = 2l + 2w$

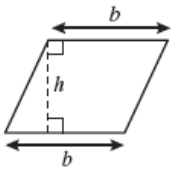
$A = lw$



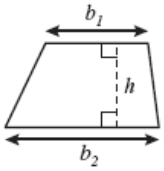
$C = 2\pi r$

$C = \pi d$

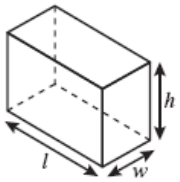
$A = \pi r^2$



$A = bh$

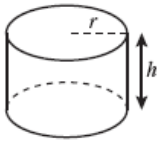


$A = \frac{1}{2}h(b_1 + b_2)$



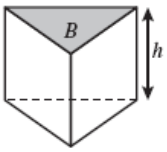
$V = lwh$

$S.A. = 2lw + 2lh + 2wh$



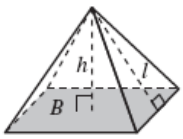
$V = \pi r^2 h$

$S.A. = 2\pi r^2 + 2\pi rh$



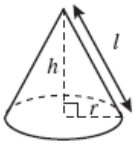
$V = Bh$

$S.A. = hp + 2B$



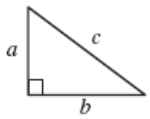
$V = \frac{1}{3}Bh$

$S.A. = \frac{1}{2}lp + B$



$V = \frac{1}{3}\pi r^2 h$

$S.A. = \pi r^2 + \pi rl$



$a^2 + b^2 = c^2$

Abbreviations

milligram	mg
gram	g
kilogram	kg
milliliter	mL
liter	L
kiloliter	kL
millimeter	mm
centimeter	cm
meter	m
kilometer	km
square centimeter	cm^2
cubic centimeter	cm^3

ounce	oz
pound	lb
quart	qt
gallon	gal.
inch	in.
foot	ft
yard	yd
mile	mi.
square inch	sq in.
square foot	sq ft
cubic inch	cu in.
cubic foot	cu ft

Area	A
Area of Base	B
Circumference	C
Perimeter	p
Surface Area	$S.A.$
Volume	V

Pi

$\pi \approx 3.14$

$\pi \approx \frac{22}{7}$

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Content Review:
Standards of Learning in Detail

Grade 8 Mathematics: First Nine Weeks
2013-2014

-This resource is intended to be a guide for parents and students to improve content knowledge and understanding. The information below is detailed information about the Standards of Learning taught during the 1st grading period and comes from the *Mathematics Standards of Learning Curriculum Framework, Grade 8* issued by the Virginia Department of Education. The Curriculum Framework in its entirety can be found at the following website:

http://www.doe.virginia.gov/testing/sol/frameworks/mathematics_framewks/2009/framewk_math8.pdf

SOL 8.5
The student will
(a) determine whether a given number is a perfect square; and
(b) find the two consecutive whole numbers between which the square root lies.

The square root of a number is that number which when multiplied by itself equals the number. Whole numbers have both positive and negative roots.

Example 1: The square root of 16 is 4 and -4.

$\sqrt{16} = \pm 4$ ($4 \cdot 4 = 16$ and $-4 \cdot -4 = 16$)

Example 2: The square root of 100 is 10.

$\sqrt{100} = \pm 10$ ($10 \cdot 10 = 100$ and $-10 \cdot -10 = 100$)

Example 3: The square root of 225 is 15.

$\sqrt{225} = \pm 15$ ($15 \cdot 15 = 225$ and $-15 \cdot -15 = 225$)

A perfect square is a whole number whose square root is a whole number.

Example 1: $\sqrt{16} = 4$; thus, 16 is a perfect square.

Example 2: $\sqrt{100}$ = 10; thus, 100 is a perfect square.

Example 3: $\sqrt{225}$ = 15; thus, 225 is a perfect square.

Any whole number other than a perfect square has a square root that lies between two consecutive whole numbers.

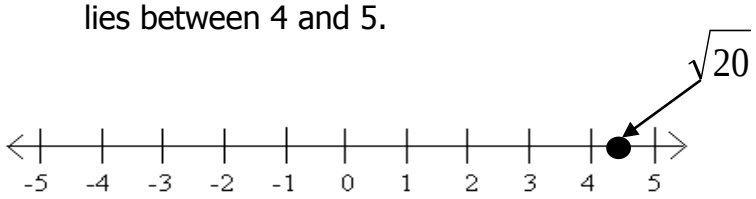
Example: $\sqrt{20}$ = ?

20 is not a perfect square.

The square root of 20 lies between 4 and 5.

Here's how to find the answer:

The square root of 20 is 4.4721359… so the square root of 20 lies between 4 and 5.



You can also think about it like this:

$\sqrt{16}$ = 4 and $\sqrt{25}$ = 5 because 4 × 4 = 16 and 5 × 5 = 25

So the square root of 20 lies between 4 and 5.

The square root of a whole number that is not a perfect square is an irrational number (e.g., $\sqrt{2}$ is an irrational number). An irrational number cannot be expressed exactly as a ratio.

Released Test Items from the Virginia Standards of Learning,
Grade 8 Mathematics Test
Answers are located on the last page of the booklet.

SOL 8.5 (Perfect Squares and Square Roots)

1 **Which of the following describes a square root of 41 ?**

F Between 5 and 6
G Between 6 and 7
H Between 20 and 21
J Between 40 and 42

2 **Which number is a perfect square?**

F 6
G 9
H 12
J 15

3 **The square root of which of the following integers is between 7 and 8 ?**

F 49
G 52
H 64
J 65

4 **Between which two whole numbers is $\sqrt{33}$?**

F 32 and 34
G 16 and 17
H 6 and 7
J 5 and 6

5 **Which of the following numbers is a perfect square?**

F 36
G 28
H 22
J 14

SOL 8.5 (Perfect Squares and Square Roots)

6 **Which has a value between 2 and 3 ?**

F $\sqrt{12}$

G $\sqrt{8}$

H $\sqrt{3}$

J $\sqrt{2}$

7 **Which number is a perfect square?**

A 2
B 5
C 25
D 52

8 **Which of the following is a perfect square?**

F 5
G 10
H 11
J 16

9 **Which number is a perfect square?**

A 1
B 2
C 5
D 8

SOL 8.1b
The student will

b) compare and order decimals, fractions, percents, and numbers written in scientific notation.

- Scientific notation is used to represent very large or very small numbers.

- A number written in scientific notation is the product of two factors: a decimal greater than or equal to one but less than 10 multiplied by a power of 10.

  To go from standard form to scientific notation, move the decimal until only one number is in front of the decimal. The number in front of the decimal cannot be zero. The number of places that the decimal is moved becomes the exponent. If the decimal is moved to the left, the exponent is positive. If the decimal is moved to the right, the exponent is negative.

  Example 1: The following is a number and the same number shown in scientific notation:

  310,000
  310,000. (If there is no decimal, assume that it is at the end of the number.)
  310,000. = 3.1×10^5

  Example 2: The following is a number and the same number shown in scientific notation:

  $0.000031 = 3.1 \times 10^{-5}$

- A number followed by a percent symbol (%) is equivalent to that number with a denominator of 100.

  Example: $30\% = \frac{30}{100} = \frac{3}{10} = 0.3$

- Percents can be expressed as fractions with a denominator of 100.

  Example: $75\% = \frac{75}{100} = \frac{3}{4}$

- Percents can be expressed as decimals.

  Example: $38\% = \frac{38}{100} = 0.38$

- A fraction can be rewritten as an equivalent fraction with a denominator of 100, and thus, as a decimal or percent.

Example 1: $\frac{3}{5} = \frac{60}{100} = 0.60 = 60\%$

Example 2: $\frac{3}{8} = 0.375 = 37.5\%$

To order numbers expressed in multiple forms:

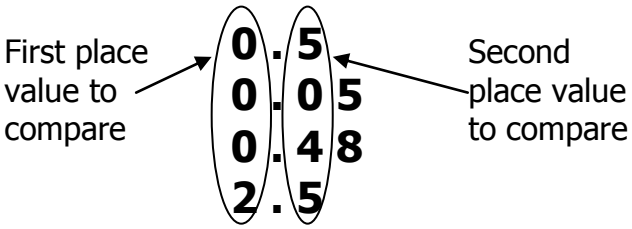
- First, change all numbers to their decimal form.
- Second, line up all numbers by the decimal point.
- Finally, order numbers by comparing the same place value.

Example: Order the following numbers from greatest to least: ½, 0.05, 4.8 x 10^{-1}, 250%

- First, change all numbers to their decimal form.
  - ½ = 1 ÷ 2 = 0.5
  - 0.05 (already a decimal)
  - 4.8 x 10^{-1} = 0.48
  - 250% = 250 ÷ 100 = 2.5
- Second, line up all numbers by the decimal point.

0.5
0.05
0.48
2.5

- Finally, order numbers by comparing the same place value.



In the ones place value, the largest number is 2, therefore that number has the greatest value.

In the tenths place value, the largest number is 5 (from 0.5), therefore that number has the second greatest value. The next largest is 4, so that number will be third, and the final number will be 0.05.

Arranged from greatest to least then:
250%, ½ , 4.8 x 10^{-1}, 0.05

Released Test Items from the Virginia Standards of Learning,
Grade 8 Mathematics Test
Answers are located on the last page of the booklet.

8.1b (Compare and Order Fractions, Decimals, Percents, and Scientific Notation)

1 **Which number is *less than* 22,874 ?**

F 2.18×10^4
G 2.55×10^4
H 2.43×10^5
J 1.78×10^6

2 **Which of these is a true statement?**

A $2 \times 10^{-2} > 2 \times 10^2$
B $3.1 \times 10^3 = 3{,}100$
C $2.5 \times 10^{-2} = 250$
D $0.235 < 2.35 \times 10^{-2}$

3 **Which list of numbers is ordered from *greatest* to *least* ?**

A $3.84 \times 10^9,\ 6.13 \times 10^6,\ 4.72 \times 10^4,\ 7.76 \times 10^2$

B $3.84 \times 10^9,\ 4.72 \times 10^4,\ 6.13 \times 10^6,\ 7.76 \times 10^2$

C $7.76 \times 10^2,\ 6.13 \times 10^6,\ 4.72 \times 10^4,\ 3.84 \times 10^9$

D $7.76 \times 10^2,\ 4.72 \times 10^4,\ 6.13 \times 10^6,\ 3.84 \times 10^9$

4 $5.78 \times 10^5 =$

F 57,800,000
G 578,000
H 0.0000578
J 0.00000578

8.1b (Compare and Order Fractions, Decimals, Percents, and Scientific Notation)

5 What is 102,000,000 expressed in scientific notation?

A 1.02×10^{9}
B 1.02×10^{8}
C 1.02×10^{7}
D 1.02×10^{6}

6 Which statement is true?

A $0.09 > \frac{7}{8}$

B $6\% < 0.09$

C $\frac{7}{8} < 8.0 \times 10^{-3}$

D $8.0 \times 10^{-3} > 6\%$

7 What is 901,000 written in scientific notation?

A 9.01×10^{-5}
B 9.01×10^{-3}
C 9.01×10^{3}
D 9.01×10^{5}

8.1b (Compare and Order Fractions, Decimals, Percents, and Scientific Notation)

8 Which list is ordered from *least* to *greatest*?

F $\frac{1}{3}$, $\frac{3}{5}$, 30%

G $\frac{3}{5}$, $\frac{1}{3}$, 30%

H 30%, $\frac{1}{3}$, $\frac{3}{5}$

J $\frac{1}{3}$, 30%, $\frac{3}{5}$

9 Which number is *not* equivalent to the other three?

A 0.8×1^2

B 8×10^2

C 80×10^1

D 800×1^1

10 Which number has the *least* value?

F 7.63×10^4

G 3.55×10^6

H 9.98×10^3

J 1.05×10^5

11 Which of the following has a different value than the others?

A $\frac{6}{8}$

B $\frac{3}{4}$

C 50%

D 0.75

SOL 8.2
The student will describe orally and in writing the relationship between the subsets of the real number system.

- The set of natural numbers is the set of counting numbers.

  Example: The following set is the set of natural numbers.

  {1, 2, 3, 4...}

- The set of whole numbers is the set of all the natural numbers and zero.

  Example: The following set is the set of whole numbers.

  {0, 1, 2, 3, 4...}

- The set of integers is the set of whole numbers and their opposites.

  Example: The following set is the set of integers.

  {…-4, -3, -2, -1, 0, 1, 2, 3, 4...}

- The set of rational numbers is the set of all numbers that can expressed as fractions in the form $\frac{a}{b}$ where a and b are integers and b does not equal zero.

  Rational numbers include terminating decimals and repeating decimals.

  Example: The following are rational numbers.

  $\sqrt{36}$ 0.252525… $0.\overline{8}$ $\frac{3}{8}$

The set of irrational numbers is the set of all non-repeating, non-terminating decimals. An irrational number cannot be expressed as an integer or the quotient of integers.

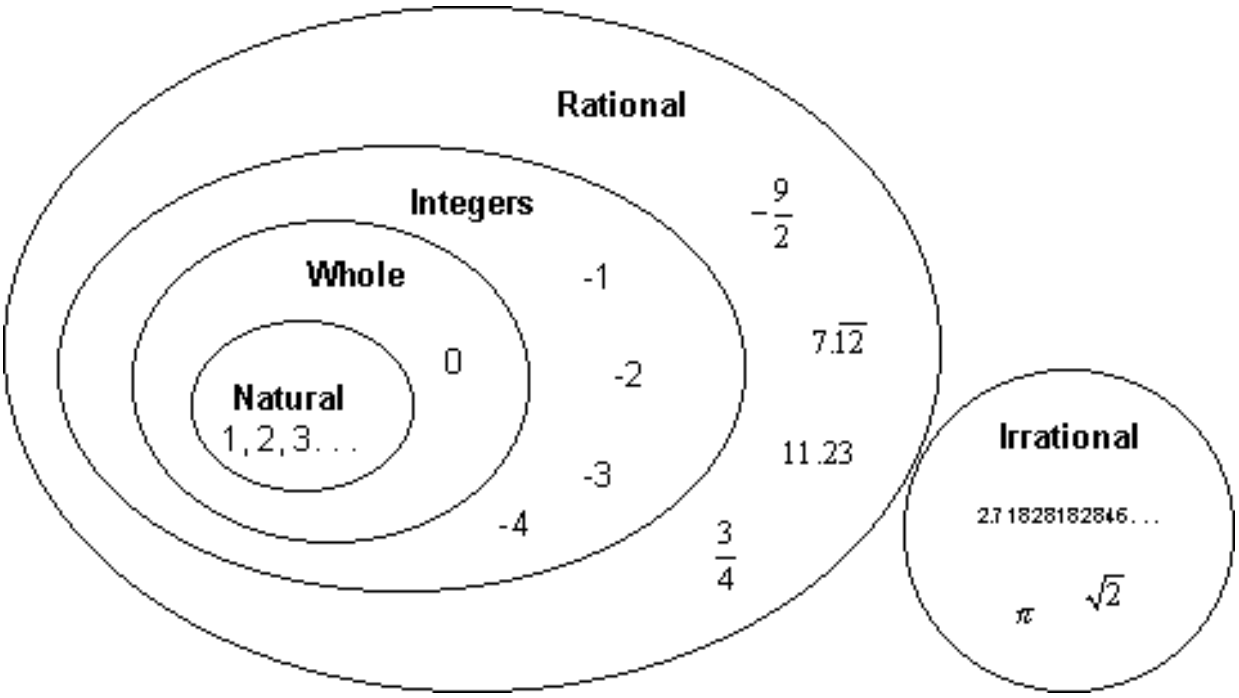
Example: The following are irrational numbers:

π $\sqrt{2}$ 1.732050808… $-\sqrt{7}$

The set of real numbers is the set of all rational and irrational numbers.

*The graphic organizer below demonstrates the relationships between and among the different sets of numbers that make up the real number system.

The Real Number System



- If a number belongs to the subset of natural, it also belongs to the subsets of whole, integer, rational, and real.
- If a number belongs to the subset of whole, it also belongs to the subsets of integer, rational, and real.
- If a number belongs to the subset of integer, it also belongs to the subset of rational and real.
- A number is either rational or irrational. It cannot belong to both subsets.

Released Test Items from the Virginia Standards of Learning,
Grade 8 Mathematics Test
Answers are located on the last page of the booklet.

SOL 8.2 (The Real Number System)

1 **Which of the following does *not* represent a rational number?**

F 0

G $2\frac{1}{2}$

H $\sqrt{3}$

J $\frac{-1}{10}$

2 **The set of whole numbers is *not* a subset of —**

F irrational numbers
G integers
H rational numbers
J real numbers

3 **Which of the following does *not* contain the number 24 ?**

A Integers
B Whole numbers
C Natural numbers
D Irrational numbers

4 **Which of the following is *not* a rational number?**

F -0.75
G 0
H $\sqrt{4}$
J $\sqrt{15}$

SOL 8.2 (The Real Number System)

5 Which set of numbers contains $\sqrt{5}$?

A Natural numbers
B Irrational numbers
C Integers
D Rational numbers

6 Which set contains $\sqrt{7}$?

F {Rational numbers}
G {Natural numbers}
H {Irrational numbers}
J {Integers}

7 Which subset of real numbers does *not* contain the number 1?

F Whole numbers
G Irrational numbers
H Integers
J Natural numbers

SOL Practice Items provided by the VDOE,
http://www.doe.virginia.gov/testing/sol/practice_items/mathematics/guides/gr_8_math
http://www.doe.virginia.gov/testing/sol/performance_analysis/index.shtml#math

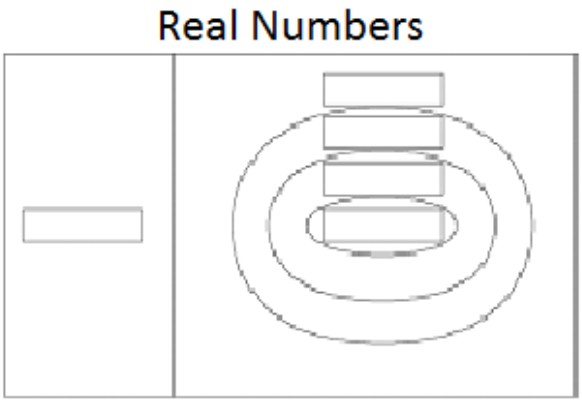
Answers are located on the last page of the booklet.

SOL 8.2 (The Real Number System)

8. Identify each integer.

$\sqrt{36}$	0.8	$\frac{-1}{6}$	-11	$\frac{75}{3}$

9. Identify the relationships between the subsets of the real number systerm using this Venn Diagram.



Integers
Irrational Numbers
Natural Numbers
Rational Numbers
Whole Numbers

10. **Which classifications of the real number system describe all numbers in the set? (Real, Rational, Irrational, Integer, Whole, Natural)**

A $\left\{0.5, -17, \frac{2}{3}, 4\frac{1}{8}, 9^2\right\}$

B $\{-\sqrt{25}, 0, 75\%\}$

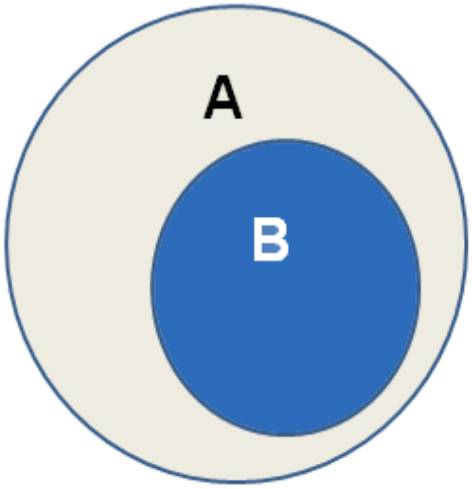
C $\left\{-1, 1, 0, \frac{14}{2}, \sqrt{25}\right\}$

D $\left\{208, \frac{1}{2}, \sqrt{1}\right\}$

E $\{7, 13, 19, 25\}$

F $\{\sqrt{3}, \pi, 0.341672 \ldots\}$

11. **This diagram represents the relationship between two sets of the real number system. Which classifications of the real number system could A and B represent?**



June 2013

Testing Information

Midpoint Test, 1st Nine Weeks

The Midpoint Test will include questions from standards 8.5, 8.1b, and 8.2 included in this booklet.

The 1st Nine Weeks Midpoint Test will be administered September 26th through October 1st, 2013. Check with your child's teacher for the specific testing date.

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SOL 8.1a
The student will

a) simplify numerical expressions involving positive exponents, using rational numbers, order of operations, and properties of operations with real numbers.

- An expression is a word used to designate any symbolic mathematical phrase that may contain numbers and/or variables. A variable is a letter used to represent a numerical value. **Expressions do not contain equal or inequality signs.**

  Example 1: The following is an expression: $3 + 2 \div 5$

  Example 2: The following is an expression: $x + 4 \times 10$

- A numerical expression contains only numbers and the operations on those numbers.

  Example 1: The following is a numerical expression: $8 + 10 \div 5$

  Example 2: The following is a numerical expression: $4^2 + 4 \times 10$

Expressions are simplified using the order of operations and the properties for operations with real numbers.

- The order of operations defines the order in which operations are performed to simplify an expression.

The order of operations is as follows:

First: Complete all operations within grouping symbols. If there are grouping symbols within other grouping symbols, do the innermost operation first. Typical grouping symbols include parentheses ( ), brackets [ ], and a fraction bar —. The square root symbol $\sqrt{\ }$ and the absolute value symbol | | should be treated as a grouping symbols as well.

Second: Evaluate all exponential expressions. (ex. 4^2)

Third: Multiply and/or divide in order from ***left to right***.

Fourth: Add and/or subtract in order from ***left to right.***

The following are examples of how to use the order of operations to solve numerical expressions.

Example 1: $15 - 9 \div (-3 \bullet 1)^2$

Step 1: $15 - 9 \div ((-3 \bullet 1))^2$

Step 2: $15 - 9 \div (-3)^2$

Step 3: $15 - 9 \div 9$

Step 4: $15 - 1$

Step 5: **The answer is 14.**

Example 2: $-\sqrt{16 + (-3 \cdot 5)} + 5$

Step 1: $-\sqrt{16 + (-3 \cdot 5)} + 5$

Step 2: $-\sqrt{16 + (-15)} + 5$

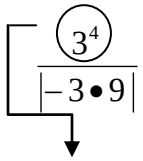
Step 3: $-\sqrt{1} + 5$

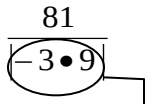
Step 4: $-1 + 5$

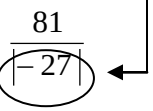
Step 5: **The answer is 4**

Example 3: $\dfrac{(6-3)^4}{|-3 \bullet 9|}$

Step 1: $\dfrac{(6-3)^4}{|-3 \bullet 9|}$

Step 2:  ($3^4 = 3 \cdot 3 \cdot 3 \cdot 3$)

Step 3: 

Step 4: 

Step 5: 

Step 6: **The answer is 3.**

- A power of a number represents repeated multiplication of the number.

  Example: $(-5)^3$ means $(-5) \cdot (-5) \cdot (-5)$.

  In this example, (–5) is the base, and 3 is the exponent.

  The base is the number that is multiplied, and the exponent represents the number of times the base is used as a factor.

- Any real number raised to the zero power is 1. The only exception to this rule is zero itself.

  Example 1: $15^0 = 1$

  Example 2: $8^0 = 1$

  Example 3: $49^0 = 1$

- Scientific calculators, graphing calculators, and some four-function calculators follow the rules of order of operations.

Released Test Items from the Virginia Standards of Learning,
Grade 8 Mathematics Test
Answers are located on the last page of the booklet.

SOL 8.1a (Simplifying Expressions)

1 **Which value is equivalent to the expression shown?**

$$-5(3 \cdot 2 - 4)$$

A -5
B -10
C -26
D -45

2 **What is the value of $4 - 3^3$?**

A -23
B -5
C 1
D 3

3 **According to the order of operations, which operation should be performed first to simplify the expression?**

$$12 + 2 \cdot 5^2 - 1$$

A $12 + 2$
B $5 - 1$
C $2 \cdot 5$
D 5^2

SOL 8.1a (Simplifying Expressions)

4 Which value is equivalent to $22 - 2^3$?

F 14
G 16
H 20
J 30

5 According to the order of operations, which operation should be performed first to evaluate the expression?

$$2 + 3 \cdot 20 + 8 \div 4 - 1$$

A $4 - 1$
B $8 \div 4$
C $20 + 8$
D $3 \cdot 20$

6 According to the order of operations, which operation should be performed first to simplify the following?

$$7 + 3^2 - 4 \div 2 - 1$$

F $7 + 3$
G $3^2 - 4$
H $2 - 1$
J 3^2

7 Which is equivalent to this expression?

$$(6-3)^4$$

A 1,280
B 81
C 12
D 7

SOL 8.4
The student will apply the order of operations to evaluate algebraic expressions for given replacement values of the variables. Problems will be limited to positive exponents.

- Algebraic expressions use operations with algebraic symbols (variables).

Example 1: The following is an algebraic expression:
$x + 4 \cdot 10$

Example 2: The following is an algebraic expression:
$(n - 2)^2 + n - 1$

Algebraic expressions are evaluated by replacing the variables with numbers and applying the order of operations to simplify the resulting expression.

**See SOL 8.1a on page 16 for applying the order of operations.*

The replacement values are the numbers that replace the variables in an algebraic expression.

Example 1: If $x = (-5)$, what is the value of this expression?

$x + 4 \cdot 10$

Step 1: $x + 4 \cdot 10$

Step 2: $(-5) + 4 \cdot 10$

Step 3: $-5 + 40$

Step 4: **The answer is 35.**

Example 2: What is the value of $(n - 2)^2 + n - 1$ when $n = 4$?

Step 1: $(n - 2)^2 + n - 1$

Step 2: $(4 - 2)^2 + 4 - 1$

Step 3: $2^2 + 4 - 1$

Step 4: $4 + 4 - 1$

Step 5: **The answer is 7.**

SOL 8.4 (Order of Operations for Given Replacement Values)

1 What is the value of $2(5-a)^2+7a$ when $a=2$?

A 16
B 20
C 32
D 50

2 What is the value of x^3+x^2+x when $x=3$?

A 9
B 18
C 21
D 39

3 What is the value of the following when $v=2$?

$$5(v-10)-7$$

A -47
B -7
C 7
D 47

4 What is the value of $3(x^2-4x)$ when $x=5$?

A 5
B 15
C 30
D 55

SOL 8.4 (Order of Operations for Given Replacement Values)

5 What is the value of the expression $5(a+b)-3(b+c)$ if $a=4$, $b=3$, and $c=2$?

A 20
B 18
C 14
D 10

6 Which expression has a value of 27 when n equals 2?

A $n+(4^3 \div 8)$
B $n+(4 \div 8)^3$
C $(n+4)^3 \div 8$
D $(n+4^3) \div 8$

7 The area (A) of a trapezoid can be found using the formula $A=\frac{1}{2}h(b_1+b_2)$. What is the area of a trapezoid if $b_1=8$ centimeters, $b_2=12$ centimeters, and $h=6$ centimeters?

A 32 cm²
B 48 cm²
C 54 cm²
D 60 cm²

8 What is the value of the following when $b=2$?

$$3^b+3$$

F 9
G 12
H 27
J 36

SOL 8.4 (Order of Operations for Given Replacement Values)

9 What is the value of $(n-2)^2+n-1$ when $n=4$?

F 7
G 9
H 15
J 17

10 If $x=8$, what is the value of this expression?

$$\frac{x}{4}-3$$

F $^{-}2.5$
G $^{-}1$
H 1
J 2.5

SOL Practice Items provided by the VDOE,
http://www.doe.virginia.gov/testing/sol/practice_items/mathematics/guides/gr_8_math
http://www.doe.virginia.gov/testing/sol/performance_analysis/index.shtml#math

Answers are located on the last page of the booklet.

Evaluate each expression.

11) $4a^2+3a-\frac{3}{2}$ when $a=-\frac{3}{4}$

12) $\frac{7}{9}x^3+5$ when $x=-3$

13) $\frac{3}{2}n\left(\frac{3}{4}n\right)^3$ when $n=8$

14. **What is the value of $2(c+5)+2c^2$ when $c = -1.2$?**

- **A** 19.12
- **B** 13.36
- **C** 10.48
- **D** 5.48

SOL 8.15
The student will

a) solve multi-step linear equations in one variable on one and two sides of the equation;
b) solve two-step linear inequalities and graph the results on a number line; and
c) identify properties of operations used to solve an equation.

- A multi-step equation is defined as an equation that requires the use of more than one different mathematical operation to solve (e.g., $2x + 3 = -4$).

Example 1: $2x + 3 = -5$ **Example 2:** $19 + 3x = 5x + 4$ **Example 3:** $4(x + 2) = 16$

- In an equation, the equal sign indicates that the value on the left is the same as the value on the right.

- To maintain equality, an operation that is performed on one side of an equation must be performed on the other side.

- The goal of any equation is to find the value of the variable. In order to do this, each side must be completely simplified. Then undo any addition or subtraction by doing the opposite operation. Next, undo any multiplication or division by doing the opposite operation.

Example 1:

$$\begin{array}{rcl} 2x + 3 & = & -5 \\ -3 & & -3 \\ \hline 2x & = & -8 \\ \overline{2} & & \overline{2} \\ x & = & -4 \end{array}$$

Example 2:

$$\begin{array}{rcl} 19 + 3x & = & 5x + 4 \\ -5x & & -5x \\ \hline 19 - 2x & = & 4 \\ -19 & & -19 \\ \hline -2x & = & -15 \\ \overline{-2} & & \overline{-2} \\ x & = & \frac{7}{2} \text{ or } 3\frac{1}{2} \end{array}$$

Example 3:

$$\begin{array}{rcl} 4(x + 2) & = & 16 \\ 4x + 8 & = & 16 \\ -8 & & -8 \\ \hline \frac{4x}{4} & = & \frac{8}{4} \\ x & = & 2 \end{array}$$

- A two-step inequality is defined as an inequality that requires the use of two different operations to solve (e.g., $3x - 4 > 9$).

Example 1: $\frac{x}{3} - 4 > 8$ **Example 2:** $2x + 4 < 12$

- The same procedures that work for equations work for inequalities. When both expressions of an inequality are multiplied or divided by a negative number, the inequality sign reverses.

Example 1:

$$\frac{x}{3} - 4 > 8$$
$$+4 \quad +4$$
$$\frac{x}{3} > 12$$
$$3\left(\frac{x}{3}\right) > (12)\,3$$
$$x > 36$$

x > 36 means that any number greater than 36 is a possible solution to this inequality.

Example 2:

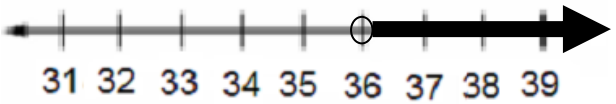
$$-2x + 4 \leq 12$$
$$-4 \quad -4$$
$$\frac{-2x}{-2} \leq \frac{8}{-2}$$
$$x \geq -4$$

Reverse the inequality symbol

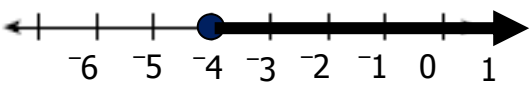
Why?

Because the expressions are being divided by a negative number.

To graph the solution to example 1 (**x > 36**) located at the top of the page, place an "open" (unshaded) circle on the number 4 and shade to the right, including the arrow.



To graph the solution to example 2 (**x ≥ ⁻4**) located at the top of the page, place an "closed" (shaded) circle on the number ⁻4 and shade to the right, including the arrow.



- The commutative property for addition states that changing the order of the addends does not change the sum.

  Example: $5 + 4 = 4 + 5$

- The commutative property for multiplication states that changing the order of the factors does not change the product.

  Example: $5 \cdot 4 = 4 \cdot 5$

- The associative property of addition states that regrouping the addends does not change the sum.

  Example: $5 + (4 + 3) = (5 + 4) + 3$

- The associative property of multiplication states that regrouping the factors does not change the product.

  Example: $5 \cdot (4 \cdot 3) = (5 \cdot 4) \cdot 3$

- **Subtraction and division are neither commutative nor associative.**

- The distributive property states that the product of a number and the sum (or difference) of two other numbers equals the sum (or difference) of the products of the number and each other number.

  Example 1: $5 \cdot (3 + 7) = (5 \cdot 3) + (5 \cdot 7)$

  Example 2: $5 \cdot (3 - 7) = (5 \cdot 3) - (5 \cdot 7)$

- Identity elements are numbers that combine with other numbers without changing the other numbers.

  The additive identity is zero (0).
  The multiplicative identity is one (1).
  ***There are no identity elements for subtraction and division.**

- The additive identity property states that the sum of any real number and zero is equal to the given real number.

  Example: The following demonstrates the additive identity property:
  $5 + 0 = 5$

- The multiplicative identity property states that the product of any real number and one is equal to the given real number.

  Example: The following demonstrates the multiplicative identity property:
  $8 \cdot 1 = 8$

- Inverses are numbers that combine with other numbers and result in identity elements.

  Example 1: $5 + (-5) = 0$

  Example 2: $\frac{1}{5} \cdot 5 = 1$

- The additive inverse property states that the sum of a number and its additive inverse always equals zero.

  Example: The following demonstrates the additive inverse property.
  $5 + (-5) = 0$

- The multiplicative inverse property states that the product of a number and its multiplicative inverse (or reciprocal) always equals one.

  Example: The following demonstrates the multiplicative inverse property.
  $4 \cdot \frac{1}{4} = 1$

- **Zero has no multiplicative inverse.**

- The multiplicative property of zero states that the product of any real number and zero is zero.

- **Division by zero is not a possible arithmetic operation.**

Released Test Items from the Virginia Standards of Learning,
Grade 8 Mathematics Test
Answers are located on the last page of the booklet.

SOL 8.15 (Multistep Equations and Inequalities)

1 **Which of the following is equivalent to the inequality $5x + 7 < 17$?**

A $5x < 10$
B $5x > 10$
C $5x < 24$
D $5x > 24$

2 **What value of n makes this equation true?**

$$4n + 9 = 6$$

A -7.50
B -0.75
C 3.75
D 10.50

3 **What is the solution to $\frac{n}{2} - 4 > 10$?**

F $n > 7$
G $n > 12$
H $n > 24$
J $n > 28$

SOL 8.15 (Multistep Equations and Inequalities)

4 **What real number property of multiplication is shown in this equation?**

$$3 \cdot 11 \cdot 10 = 3 \cdot 10 \cdot 11$$

A Inverse property
B Identity property
C Associative property
D Commutative property

5 **Which of the following expressions is equivalent to $4.1(8.5 - 6.2)$?**

F $8.5 - 4.1 \cdot 6.2$
G $4.1 \cdot 8.5 - 6.2$
H $4.1 \cdot 8.5 - 4.1 \cdot 6.2$
J $(4.1 + 8.5) - (4.1 + 6.2)$

6 **What value of n makes the equation true?**

$$\frac{2}{3}n + 4 = 10$$

F $14\frac{2}{3}$

G 9

H $5\frac{1}{3}$

J 4

SOL 8.15 (Multistep Equations and Inequalities)

7 What is the value of x in the following equation?

$$-4x + 2 = -14$$

A -4
B -3
C 3
D 4

8 What value of w makes the following true?

$$3w - 5 = 7$$

A -4
B -1
C 1
D 4

9 Which property is used in the following number sentence?

$$4(3 + n) = (4 \cdot 3) + (4 \cdot n)$$

A Distributive property
B Additive inverse property
C Associative property of addition
D Commutative property of addition

SOL 8.15 (Multistep Equations and Inequalities)

10 **Which of the following equations illustrates the multiplicative property of zero?**

A $10 \cdot 0 = 0$

B $10 + (^-10) = 0$

C $10(15 \cdot 0) = 10(0 \cdot 15)$

D $10(8 + 0) = 10 \cdot 8 + 10 \cdot 0$

11 **Which is *false*?**

F $35 \div (^-30 + 37) = (^-35 \div ^-30) + (^-35 \div 37)$

G $(^-891 + 345) - ^-78 = ^-891 + (345 - ^-78)$

H $^-5 \cdot (^-35 + 42) = (^-5 \cdot ^-35) + (^-5 \cdot 42)$

J $^-62 + 123 = 123 + ^-62$

12 **Which is one value of the set of x that makes the following true?**

$$7x + 3 > 17$$

A 0
B 1
C 2
D 3

SOL 8.15 (Multistep Equations and Inequalities)

13 What value for n makes the following sentence true?

$$5n = 8 + 3n$$

A $n = 4$

B $n = 2$

C $n = \frac{8}{3}$

D $n = \frac{8}{5}$

14 What value for w makes the equation true?

$$4w - 8 = 16$$

F -6

G -2

H 2

J 6

15 Which property is shown in the following number sentence?

$$\left(\frac{3}{4}x + 9\right) + 0 = \left(\frac{3}{4}x + 9\right)$$

F Multiplicative identity property

G Additive identity property

H Multiplicative inverse property

J Additive inverse property

SOL 8.15 (Multistep Equations and Inequalities)

16 **Which statement is *false*?**

A $-\frac{7}{1} = {}^{-}1$

B $7 \cdot 0 = 0$

C $7 + \left({}^{-}7\right) = 0$

D $7 \cdot {}^{-}1 = {}^{-}7$

17 **Anne's utility bills for three months were $59, $67, and $33. To add the utility bills mentally, Anne thought**

$$\text{“}\left(59+67\right)+33=59+\left(67+33\right).\text{”}$$

What property did Anne use?

A Inverse property of addition
B Identity property of addition
C Commutative property of addition
D Associative property of addition

18 **What is the solution to $\frac{x}{4}+10=34$?**

A 4
B 6
C 96
D 144

SOL 8.15 (Multistep Equations and Inequalities)

19 **What value of *x* makes the following statement true?**

$$19 = 5x + 4$$

A 23
B 15
C 4
D 3

20 **Which is one of the solutions to the following?**

$$2x + 4 < 12$$

F 6
G 5
H 4
J 3

21 **Which number sentence illustrates the commutative property of multiplication?**

A $14 + (13 \cdot 7) = 14 + (7 \cdot 13)$

B $14 + (13 \cdot 7) = 13 + (14 \cdot 7)$

C $14 + (13 \cdot 7) = 14 \cdot 13 + 14 \cdot 7$

D $14 + (13 \cdot 7) = (14 + 13) \cdot 7$

SOL 8.15 (Multistep Equations and Inequalities)

22 $\frac{1}{7} \cdot y = \frac{1}{7}$

If the number sentence is true, then y is the —

F additive identity
G additive inverse
H multiplicative identity
J multiplicative inverse

SOL Practice Items provided by the VDOE,
http://www.doe.virginia.gov/testing/sol/practice_items/mathematics/guides/gr_8_math
http://www.doe.virginia.gov/testing/sol/performance_analysis/index.shtml#math

Answers are located on the last page of the booklet.

23. What is one solution to 5x + 1 = 7? Your answer must be in the form of an improper fraction.

24. The first three steps of an equation Justin is solving is shown below:

STEP 1 $\frac{2}{5}x + 5 = 9$

STEP 2 $\frac{2}{5}x + 5 + (-5) = 9 + (-5)$

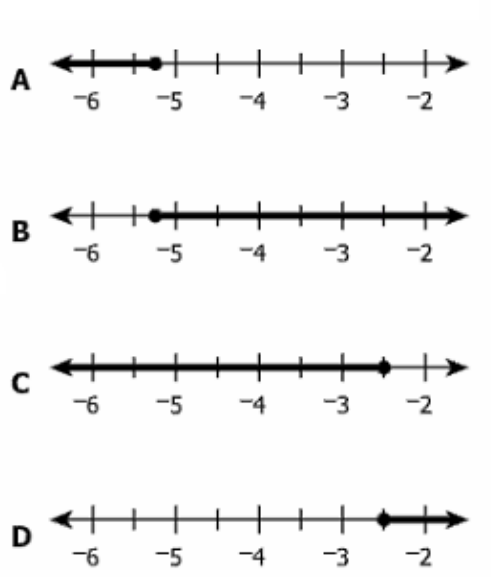
STEP 3: $\frac{2}{5}x + 0 = 9 + (-5)$

What property justifies the work between step 2 and step 3?

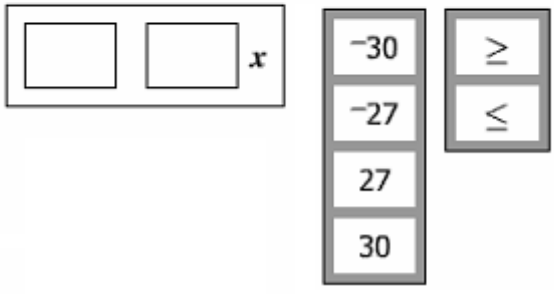
25. What value of p makes this equation true?

$$2p = \frac{-3p - 6}{4}$$

26. **Which graph best represents only the solutions to $-3a + \frac{1}{2} \leq 8$?**



27. What is the solution to $6 \geq \frac{1}{2}x + 21$?



28.

The steps used to solve an equation are shown.

Step 1: $9r = 54$

Step 2: $\left(\frac{1}{9}\right)9r = \left(\frac{1}{9}\right)54$

Step 3: $\left(\frac{1}{9} \cdot 9\right)r = \left(\frac{1}{9}\right)54$

Step 4: $1 \cdot r = \left(\frac{1}{9}\right)54$

Step 5: $r = \left(\frac{1}{9}\right)54$

Step 6: $r = 6$

What property justifies the work between Step 4 and Step 5 ?

- **A** Commutative property of multiplication
- **B** Associative property of multiplication
- **C** Inverse property of multiplication
- **D** Identity property of multiplication

29. What value of x makes this equation true?

$$\frac{-1}{4}x - 12 = x + 3$$

Solve each linear equation.

30) $2 + 13n = -8 + 8n$

31) $5(2.9 + x) = 8.3$

32) $\frac{k}{-5} + 7 = 22$

33) $-2m = 3(m - 10)$

34. **Graph the solution to $-5a - 7 \leq 12$ on a number line.**

35. **Graph the solution to $5 \leq -3w + 14$ on the number line.**

36. **Select each equation that illustrates the commutative property of multiplication. Select all equations that are correct.**

$5 \cdot (4 + 3) = (4 + 3) \cdot 5$ $\qquad$ $6(2 + 7) = 6(2) + 6(7)$

$(8 \cdot 3) \cdot (6) = (8) \cdot (3 \cdot 6)$

$12 \cdot \left(4\frac{3}{4}\right) = 12 \cdot (4) + 12 \cdot (\frac{3}{4})$ $\qquad$ $3\left(\frac{-2}{3}\right) = \left(\frac{-2}{3}\right)3$

37. **Which property best justifies the work between step 2 and step 3?**

Step 1	$5a = -15$	Given
Step 2	$\frac{1}{5} \cdot 5a = -15 \cdot \frac{1}{5}$	Multiplication Property of Equality
Step 3	$1 \cdot a = -15 \cdot \frac{1}{5}$	
Step 4	$a = -15 \cdot \frac{1}{5}$	Identity Property of Multiplication
Step 5	$a = -3$	Substitution

a) Identity Property of Multiplication
b) Inverse Property of Multiplication
c) Multiplication Property of Equality
d) Commutative Property of Multiplication

1st Nine Weeks Test

The 1st Nine Weeks Test will include questions from all standards included in this booklet.

The 1st Nine Weeks Test will be administered the week of October 28th, 2013. Check with your child's teacher for the specific testing date.

The following pages contain links to video clips, vocabulary sorts, and activities that can be used to review math information that is relevant for this grading period.

June 2013

Math Smarts!

Math + Smart Phone = Math Smarts!

Need help with your homework? Wish that your teacher could explain the math concept to you one more time? This resource is for you! Use your smart phone and scan the QR code and instantly watch a 3 to 5 minute video clip to get that extra help. (These videos can also be viewed without the use of a smart phone. Click on the links included in this document.)

Directions: Using your Android-based phone/tablet or iPhone/iPad, download any QR barcode scanner. How do I do that?

1. Open Google Play (for Android devices) or iTunes (for Apple devices).
2. Search for "QR Scanner."
3. Download the app.

After downloading, use the app to scan the QR code associated with the topic you need help with. You will be directed to a short video related to that specific topic!

It's mobile math help when you need it! So next time you hear, "You're always on that phone" or "Put that phone away!" you can say "It's homework!!!"

Access this document electronically on the STAR website through Suffolk Public Schools.
(http://star.spsk12.net/math/MSInstructionalVideosQRCodes.pdf)

PLEASE READ THE FOLLOWING:
This resource is provided as a refresher for lessons learned in class. Each link will connect to a YouTube or TeacherTube video related to the specific skill noted under "Concept." Please be aware that advertisements may exist at the beginning of each video.

Julie A. Byrd, Suffolk Public Schools

SOL	Link	QR Code
8.1	Scientific Notation (negative exponents begin at 3:00) https://www.youtube.com/watch?v=WwmJ5nMmigQ	
8.2	Subsets of the real number system https://www.youtube.com/watch?v=1bU0uY2XcJs	
8.2	Subsets of the real number system http://www.youtube.com/watch?v=9orS7coe2WI	
8.4	Applying the order of operations https://www.youtube.com/watch?v=oo5DAHo7NHY	
8.4	Applying the order of operations https://www.youtube.com/watch?v=SuivTXJmVPg	

SOL	Link	QR Code
8.4	Applying the order of operations to evaluate algebraic expressions http://www.youtube.com/watch?v=fZDWcU0i0o4	
8.5	Find the two consecutive whole numbers between which a square root lies http://www.youtube.com/watch?v=uzfRwwDMMfU	
8.15	Solve/Graph Multi-step Inequalities (includes variables on both sides) https://www.youtube.com/watch?v=4lJNFxd_Ijg	
8.15	Solving 2-step Equations variable on one side (starts at 0:00) and variable on both sides (starts at 6:45) https://www.youtube.com/watch?v=f2eZ0Dbh1U0	
8.15	Solving Equations with variables on both sides https://www.youtube.com/watch?v=gQdH5PKWrPQ	

SOL 8.5

perfect square	**Rational number whose square root is a whole number**
principal square root	**A positive square root**
radical sign	**The symbol used to indicate a nonnegative square root**
base	**The value used as a factor as many times as given by the exponent**
exponent	**The value that tells how many times the base is used as a factor**

SOL 8.2

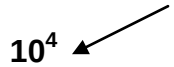
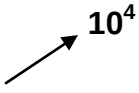
counting number	**{1, 2, 3, 4, . . .}**

Julie A. Byrd, Suffolk Public Schools

natural number	**{1, 2, 3, 4, . . .}**
irrational number	**A number that cannot be expressed as an integer or the quotient of integers.**
rational number	**A number that can be expressed as a fraction in the form *a/b* where *a* and *b* do not equal zero**
real number	**The set of all rational and irrational numbers**
repeating decimal	**A decimal whose digits repeat in groups of one or more**
subset	**Includes real numbers, rational numbers, irrational numbers, integers, whole numbers, and natural numbers.**
terminating decimal	**A decimal whose digits end. Every terminating decimal can be written as a fraction with a denominator of 10, 100, 1,000, and so on.**

whole number	**The set of all the natural numbers and zero: {0, 1, 2, 3, …}**
integer	**The set of whole numbers and their opposites {…-3, -2, -1, 0, 1, 2, 3, . .}**

SOL 8.1

exponents	**Represents repeated multiplication of the number.** 
order of operations	**Defines the order in which operations are performed to simplify an expression.**
expression	**A word used to designate any symbolic mathematical phrase that may contain numbers and/or variables.** ***Expressions*** *do not* ***contain an equal sign***
base	**The number that is multiplied in a power.** 

scientific notation	**A method used to write very large and very small numbers using the product of a number that is at least one but less than ten and a power of ten.**

SOL 8.4

replacement value	**The number that replaces the variables in an algebraic expression**
substitute	**Replace one variable in one equation with an expression derived from the other equation**

SOL 8.15

additive identity	**The sum of an addend and zero is zero. a + 0 = 0 + a = a**
associative property (x, +)	**The way in which three numbers are grouped when they are added or multiplied does not change their sum or product.**

commutative property (x, +)	**The order in which two numbers are added or multiplied does not change their sum or product.**
distributive property	**To multiply a sum by a number, multiply each addend of the sum by the number outside the parenthesis.**
multiplicative identity	**The product of a factor and one is the factor. $a \cdot 1 = 1 \cdot a = a$**

Released Test Answers (1st Nine Weeks)

SOL 8.5 (Perfect Squares and Square Roots)

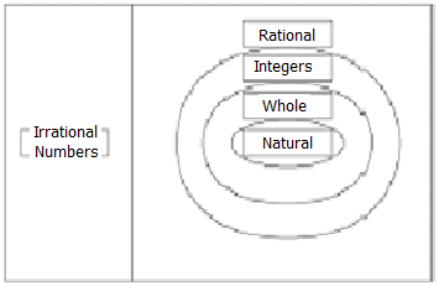
1. G
2. G
3. G
4. J
5. F
6. G
7. C
8. J
9. A

SOL 8.1b (Scientific Notation and Comparing and Ordering Rational Numbers)

1. F
2. B
3. A
4. G
5. B
6. B
7. D
8. H
9. A
10. H
11. C

SOL 8.2 (Real Number System)

1. H
2. F
3. D
4. J
5. B
6. H
7. G
8. 

9. 

10. A rational, real
    B rational real
    C integer, rational, real
    D rational, real
    E natural, whole, integer, rational, Real
    F irrational, real

11. Sample answers:
    A: Real B: rational
    A: Real B: Integer
    A: Rational B: Integer
    A: Rational B: Whole
    A: Integer B: Whole
    A: Whole B: Natural

SOL 8.1a (Order of Operations)

1. B
2. A
3. D
4. F
5. D
6. J
7. B

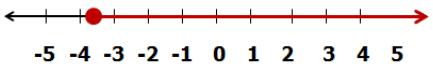
SOL 8.4 (Evaluating Algebraic Expressions)

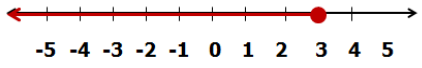
1. C
2. D
3. A
4. B
5. A
6. C
7. D
8. G
9. F
10. G
11. $\frac{-3}{2}$
12. -16
13. 2,592
14. C

SOL 8.15 (Multistep Equations and Inequalities)

1. A
2. B
3. J
4. D
5. H
6. G
7. D
8. D
9. A
10. A
11. F
12. D
13. A
14. J
15. G
16. A
17. D
18. C
19. D
20. J
21. A
22. H

SOL 8.15 (Multistep Equations and Inequalities) (continued)

23. $x=\frac{6}{5}$
24. Additive inverse property
25. $p = \frac{-6}{11}$
26. D
27. $-30 \geq x$
28. Identity property for multiplication
29. $x = -12$
30. $n = -2$
31. $x = -1.24$
32. $k = -75$
33. $m = 6$
34. 

$a \geq -3.8$
35. 

$3 \geq w$
36. $5 \cdot (4 + 3) = (4 + 3) \cdot 5$ $3\left(\frac{-2}{3}\right) = \left(\frac{-2}{3}\right)3$
37. B