



# MATH

TEACHER'S GUIDE

▶ **8th Grade**

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# MATH 800

## Pre-Algebra

### Teacher's Guide

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# **Unit 801**

# **The Real Number System**

**Answer Keys  
and  
Alternate Test**

# 1. Relationships

## SUBSETS OF THE REAL NUMBER SYSTEM

1.1  $\pi$

1.2 an irrational number

1.3 a whole number

1.4 an irrational number

1.5 rational

1.6 3.14159...

1.7

rational Numbers	1/3
integers	5
whole numbers	0
natural numbers	56
irrational numbers	1.17513698

## USING VARIABLES

1.8 an expression

1.9 a variable

1.10 a variable

1.11 a formula

1.12

18  $ab$

6  $c + 4$

2  $\frac{a}{b}$

3  $a - b$

4  $2c$

1  $b \div 3$

5  $a - 1$

8  $6 + c$

$$ab = (6)(3) = 18$$

$$c + 4 = 2 + 4 = 6$$

$$\frac{a}{b} = \frac{6}{3} = 2$$

$$a - b = 6 - 3 = 3$$

$$2c = 2 \cdot 2 = 4$$

$$b \div 3 = 3 \div 3 = 1$$

$$a - 1 = 6 - 1 = 5$$

$$6 + c = 6 + 2 = 8$$

1.13 12 in.<sup>2</sup>

$$A = \frac{1}{2}bh = \frac{1}{2}(3)(8) = 12$$

1.14  $mn$

$$m - n = 8 - 4 = 4$$

$$\frac{n}{1} = \frac{4}{1} = 4$$

$$\frac{1}{2}m = \frac{1}{2} \cdot 8 = 4$$

$$mn = 8 \cdot 4 = 32$$

1.15 50

$$i = prt = (1000)(.05)(1) = 50$$

1.16  $4 + y$

1.17 If  $r = 3$  and  $t = 5$ , then  $d = 8$ .

## THE NUMBER LINE

1.18 True

1.19 False

$-|-37|$  means the opposite of the absolute value of  $-37$ . The absolute value of  $-37$  is  $37$ , and the opposite of  $37$  is  $-37$ .

1.20 False

$-(-49)$  means the opposite of  $-49$ , which is  $49$ .

1.21 True

1.22 True



1.23  $-|-9|$ ,  $-|9|$ , the opposite of nine

1.24  $|-61|$ , the opposite of  $-61$ , the distance from zero to  $-61$ ,  $-(-61)$

1.25  $-(-45)$

1.26 the opposite of 9

1.27  $|-93| = -93$

1.28 point D

1.29 the opposite of 15

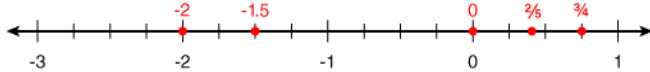
1.30  $-N$

## COMPARING RATIONAL NUMBERS

**1.31**  $r \geq s$

$|-13| = 13$ , so  $s = 13$ . Substitute the values in for  $r$  and  $s$ . 12.5 is not greater than or equal to 13.

**1.32**  $-2, -1.5, 0, \frac{2}{5}, \frac{3}{4}$



**1.33** 1.01

**1.34**  $-0.1$

In fraction form,  $-0.1$  is  $-\frac{1}{10}$ . When comparing negative numbers, the number with the larger absolute value is actually smaller because it is further to the left of zero.  $-\frac{1}{7} < -\frac{1}{10}$  because  $-\frac{1}{7}$  has the larger absolute value.

**1.35**  $2 \geq 8$

**1.36** Buffalo

$-8$  is the furthest to the left on the number line, so it has the smallest value, and Buffalo has the coldest temperature.

**1.37** Tyrell

When comparing negative numbers, the number with the largest absolute value is the smallest number because it is the furthest to the left from zero.  $-18$  has the largest absolute value, so Tyrell won.

**1.38**  $\frac{3}{2}$  and  $1\frac{9}{10}$

Written as decimals,  $\frac{3}{2}$  and  $1\frac{9}{10}$  are 1.5 and 1.9, respectively.  $1.5 < 1.75 < 1.9$ .

**1.39** 2.6

The number line is divided into fifths. Point A is located at  $2\frac{3}{5}$ , or 2.6.

**1.40**  $P < -1$

Point P is between  $-1$  and  $-2$ , so it is greater than  $-2$ , but less than  $-1$ .

**1.41**  $A > D$

Point A is to the right of Point D on the number line, so Point A is greater than Point D.

## SELF TEST 1: RELATIONSHIPS

1.01  $<, \leq, \neq$

1.02  $>, \geq, \neq$

1.03  $\leq, \geq, =$

1.04 3.14159...

Rational numbers can be expressed as fractions, or as decimals that end or repeat.

1.05 The opposite of  $-45$  is equal to the absolute value of  $-45$ .

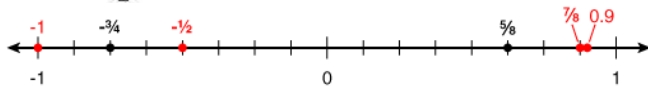
- a.  $45 = 45$  is true.
- b.  $-45 = 45$  is false.
- c.  $-45 = 45$  is false
- d.  $45 \neq 45$  is false

1.06 Tyrone

1.07 If a number is an integer, then it is irrational.

Integers are rational, not irrational.

1.08  $-\frac{1}{2}$



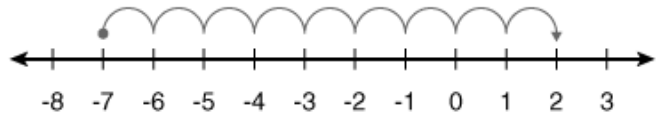
1.09  $|-5| = -5$

The absolute value of  $-5$  is  $5$ .

1.010 It is a false statement, because  $-15$  is less than  $-12$ .

$-12$  is to the right of  $-15$  on the number line, so it is greater than  $-15$ .

1.011 9



1.012 an irrational number

$\pi$  never ends or repeats.

1.013  $-a = c$

$-a$  (or positive  $a$ ) is greater than  $c$ , not equal to  $c$ .

1.014  $-5, 0, 0.8, 1, 1\frac{1}{2}$

1.015  $\frac{h}{g}$

$$h - g = 12 - 4 = 8$$

$$h \div g = 12 \div 4 = 3$$

$$h \div 3 = 12 \div 3 = 4$$

$$g + 1 = 4 + 1 = 5$$

1.016 a constant

1.017  $V = 144$

$$V = (24)(6) = 144$$



## 2. Other Forms

### PROPERTIES OF THE REAL NUMBERS

#### 2.1

**commutative property of addition**

$$(-14) + 81 = 81 + (-14)$$

**multiplicative inverse**

$$\frac{13}{17} \cdot \frac{17}{13} = 1$$

**associative property of addition**

$$101 + (29 + 417) = (101 + 29) + 417$$

**distributive property**

$$\frac{1}{3}(24 + 15) = \frac{1}{3} \cdot 24 + \frac{1}{3} \cdot 15$$

**additive identity**

$$-72 + 0 = -72$$

**2.2**  $7 \cdot (3 \cdot 5) = (7 \cdot 3) \cdot 5$

The associative property of multiplication is used to change how factors are grouped.

associative property of addition

$$[38 + 677] + (-38)$$

$$[677 + 38] + (-38) \text{ [commutative property of addition]}$$

$$677 + [38 + (-38)] \text{ [associative property of addition]}$$

$$677 + 0 \text{ [additive inverse]}$$

$$677 \text{ [additive identity]}$$

**2.3** the multiplicative inverse of  $\frac{3}{4}$

The product of multiplicative inverses is always 1.

**2.4** commutative

The commutative property is used to change the order of addends.

**2.9** commutative property of multiplication, multiplicative identity, multiplicative inverse

$$\frac{2}{7} \cdot 53 \cdot \frac{7}{2}$$

$$53 \cdot \frac{2}{7} \cdot \frac{7}{2}$$

[commutative property of multiplication]

$$53 \cdot 1$$

[multiplicative inverse]

$$53$$

[multiplicative identity]

**2.5** Step 3

The additive identity is 0.

**2.6** distributive

Using the distributive property,  $5(10 + 4) = 5 \cdot 10 + 5 \cdot 4 = 50 + 20$ .

**2.7**  $3(x + 5) = 3 \cdot x + 3 \cdot 5$

The distributive property states that  $a(b + c) = ab + ac$ .

**2.8** additive identity, additive inverse, commutative property of addition,

## EXPONENTS

2.10 81

2.11  $14^2$

2.12  $2^6$

2.13 1

2.14 He is incorrect because he multiplied the bases.

By the multiplication rule, keep the base the same and add the exponents.

2.15 16

2.16  $7^8$

2.17  $2^{m+n}$

2.18  $\frac{4^5}{4^2}$   
 $\frac{4^2}{4^5} = 4^{2-5} = 4^{-3}$   
 $\frac{1}{4^3} = 4^{-3}$   
 $\frac{4^5}{4^2} = 4^{5-2} = 4^3$

2.19  $\frac{1}{125}$   
 $5^{-3} = \frac{1}{5^3} = \frac{1}{125}$

2.20  $\frac{1}{6^2}$   
 $6^{-2} = \frac{1}{6^2}$

2.21 8  
 $\frac{2^1}{2^4} = 2^{-3} = \frac{1}{2^3} = \frac{1}{8}$

## SCIENTIFIC NOTATION

2.22  $3.935 \times 10^5$

Move the decimal 5 places to the left. The original number is greater than 1, so the exponent is positive.

2.23  $10^{-1}$

Multiplying by a power of ten with a negative exponent will result in a smaller number.

2.24  $1 \times 10^5$

2.25 29,000

To multiply by  $10^4$ , move the decimal 4 places to the right.

2.26 Hannah is not correct because the exponent should be -6.

The original number was smaller than 1, so the exponent should be negative.

2.27  $6 \times 10^7$

Written out, 60 million is 60,000,000. Move the decimal 7 places to the left. The original number is larger than 1, so the exponent is positive.

2.28  $1.2 \times 10^{-4}$

Written in standard form,  $1.2 \times 10^4$  is 12,000.

2.29 multiplying by  $10^4$

Multiplying by a power of 10 with a positive exponent moves the decimal to the right.

**2.30**  $1 \times 10^{-3}$

Numbers in scientific notation have the form: a number greater than or equal to 1 but less than 10 times a power of 10.

**2.31**  $y = -3$

The decimal was moved 3 places. In standard form, the number is less than 1, so the exponent is negative.

## SELF TEST 2: OTHER FORMS

**2.01**  $-7 + (19 + 5) = (-7 + 19) + 5$

The associative property states that addends may be grouped differently and still yield the same result.

**2.02**  $6.5 \times 10^5$

To get a number between 1 and 10, move the decimal 5 places to the left.

**2.03**  $5 \cdot 5 \cdot 5 \cdot 5$

By the division rule, subtract the exponents. So,  $5^4 = 5 \cdot 5 \cdot 5 \cdot 5$

**2.04**  $\frac{1}{9}$

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

**2.05** 0.000307

The exponent is negative, so move the decimal 4 places to the left.

**2.06** commutative property of addition

Use the commutative property to change the order of the addends.

**2.07**  $15^3$

By the division rule, subtract the exponents. So,  $15^7 \div 15^4 = 15^{7-4} = 15^3$

**2.08**  $2^0$

The multiplicative identity is 1. The power of any number to an exponent of zero is equal to 1.

**2.09**  $2^4$

Monday:  $2 = 2^1$

Tuesday:  $4 = 2^2$

Wednesday:  $8 = 2^3$

Thursday:  $16 = 2^4$

**2.010** He should have written  $1 \times 10^6$ .

One million equals 1,000,000. To get a number between 1 and 10, move the decimal 6 places to the left. Written in scientific notation, the number should be in the form: a number greater than or equal to 1 but less than  $10 \times$  a power of 10.

**2.011** He is incorrect because he should have only 5 factors of 3.

By the multiplication rule, add the exponents. So,  $3^3 \cdot 3^2 = 3^5 = 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 = 243$ .

**2.012** 16,300

Move the decimal 4 places to the right.

**2.013** distributive property

$$3 \cdot 0.40 + 5 \cdot 0.40 = (3 + 5) \cdot 0.40$$

**2.014** distributive property

$$4 \cdot 7 \cdot \frac{1}{4}$$

$$4 \cdot \frac{1}{4} \cdot 7 \quad \text{commutative property of multiplication}$$

$$1 \cdot 7 \quad \text{multiplicative inverse}$$

$$7 \quad \text{multiplicative identity}$$

**2.015** 16

$$\frac{1}{n^2} = \frac{1}{4^2} = \frac{1}{16}$$

$$n^{-2} = \frac{1}{n^2} = \frac{1}{16}$$

**2.016** Answers may vary. One possible answer could look like this:

$$-5 + (5 + 3)$$

$$(-5 + 5) + 3 \quad \text{associative property of addition}$$

$$0 + 3 \quad \text{additive inverse}$$

$$3 \quad \text{additive identity}$$

## 3. Simplifying

### SQUARE ROOTS

- 3.1** False  
50 is not a perfect square.
- 3.2** False  
8 is not between  $7^2$  and  $9^2$ . It is between  $2^2$  and  $3^2$ .
- 3.3** True  
 $4^2 = 16$ , and  $\sqrt{16} = 4$ .
- 3.4** 8
- 3.5** 3.1  
10 is between 9 and 16, so  $\sqrt{10}$  is between  $\sqrt{9}$  and  $\sqrt{16}$ .
- 3.6** 16 and 25  
If  $\sqrt{n} = 4.2$ , then  $n = 4.2^2$ , or 17.64.
- 3.7** 3 and 4  
12 is between 9 and 16, so  $\sqrt{12}$  is between  $\sqrt{9}$  and  $\sqrt{16}$ .
- 3.8** 49  
If  $\sqrt{x} = 7$ , then  $x = 7^2$ , or 49.
- 3.9**  $\sqrt{2}$   
Two is not a perfect square, so its square root must be irrational.
- 3.10**  $\sqrt{19}$   
Nineteen is not a perfect square, so its square root cannot be rational.
- 3.11** 0.6  
 $(0.6)^2 = 0.36$
- 3.12** 1.5  
 $(1.5)^2 = 2.25$
- 3.13**  $\sqrt{38}$   
No perfect square goes into 38.
- 3.14**  $5\sqrt{3}$   
 $\sqrt{75} = \sqrt{25} \cdot \sqrt{3} = 5\sqrt{3}$
- 3.15** He is incorrect because he did not use the largest perfect square.  
 $\sqrt{128} = \sqrt{64} \cdot \sqrt{2} = 8\sqrt{2}$
- 3.16**  $3\sqrt{6}$   
 $\sqrt{54} = \sqrt{9} \cdot \sqrt{6} = 3\sqrt{6}$

## ORDER OF OPERATIONS

**3.17** False

$$2 \cdot 5^2 = 2 \cdot 25 = 50$$

**3.18** True

$$7 + 20 = 27$$

**3.19** False

$$\frac{16}{5} = 3\frac{1}{5}$$

**3.20** False

$$5(4)^2 = 5(16) = 80$$

**3.21** True

$$\sqrt{169} = 13$$

**3.22**  $7 + 5(4) \div 2$

Simplify the parentheses first.

**3.23** 30

$$26 - 8 + 12$$

$$18 + 12$$

$$30$$

**3.24**  $9 + 25$

$$3^2 + 5^2$$

$$9 + 25$$

**3.25** division

$$5 \cdot 2^3 \div 10$$

$$5 \cdot 8 \div 10$$

$$40 \div 10 = 4$$

**3.26** 20

$$\frac{40}{2} = 20$$

**3.27** It is wrong because the subtraction should have been done before the addition.

Do addition and subtraction from left to right.

**3.28** parentheses, exponents, multiply and divide, add and subtract

**3.29**  $3^2 + 5 \cdot 2 = 28$

$$3^2 + 5 - 2 = 9 + 5 - 2 = 14 - 2 = 12$$

$$3^2 - 5 + 2 = 9 - 5 + 2 = 4 + 2 = 6$$

$$3^2 \cdot 5 + 2 = 9 \cdot 5 + 2 = 45 + 2 = 47$$

$$3^2 + 5 \cdot 2 = 9 + 5 \cdot 2 = 9 + 10 = 19$$

**3.30** 17

$$28 - 12 + \sqrt{4} \div 2$$

$$28 - 12 + 2 \div 2$$

$$28 - 12 + 1$$

$$16 + 1 = 17$$

**3.31** 18

$$(15 - 11)^2 + \sqrt{64} \div 4$$

$$(4)^2 + 4 \div 8$$

$$16 + 2 = 18$$

**SELF TEST 3: SIMPLIFYING****3.01**

4  $\sqrt{16}$

15  $\sqrt{2.25}$

8  $6^2 \div 9 \cdot 2$

1  $\frac{12-2}{6+4}$

5  $\sqrt{16+9}$

9  $63 \div 3^2 + |2|$

$\sqrt{16} = 4$ , because  $4^2 = 16$ .

$\sqrt{2.25} = 1.5$ , because  $1.5^2 = 2.25$

$6^2 \div 9 \cdot 2 = 36 \div 9 \cdot 2 = 4 \cdot 2 = 8$

$\frac{12-2}{6+4} = \frac{10}{10} = 1$

$\sqrt{16+9} = \sqrt{25} = 5$

$63 \div 3^2 + |2| = 63 \div 9 + |2| = 7 + 2 = 9$

**3.02** 13

$36 \div 6 \cdot 2 + 1$

$6 \cdot 2 + 1$

$12 + 1$

13

**3.03**  $\sqrt{6}$ 

Six is not a perfect square.

**3.04** exponent

1. Multiply inside the parentheses.

2. Exponent.

**3.05**  $\sqrt{9}$ 

Nine is a perfect square.

**3.06** She needs to subtract  $5 - 3$  first.

Following the order of operations, parentheses come before exponents.

**3.07** 3 and 4Thirteen is between 9 and 16, so  $\sqrt{13}$  is between  $\sqrt{9}$  and  $\sqrt{16}$ .**3.08**  $\sqrt{20}$ The number is irrational, so it can't be 4.5.  $4^2$  is 16, and  $5^2$  is 25, so the number must be between  $\sqrt{16}$  and  $\sqrt{25}$ **3.09**  $\sqrt{17}$ 

Seventeen is not a perfect square.

**3.010** 9

$2^3 + \sqrt{64} \div 8$

$8 + 8 \div 8$

$8 + 1 = 9$

**3.011** 80 and 90If  $\sqrt{x} = 9$ , then  $x = 9^2 = 81$ .**3.012**  $\sqrt{30}$  can't be simplified.

No perfect squares go into 30.

**3.013** 0.4

$0.4^2 = 0.16$

**3.014** division

1. Subtract inside the parentheses.

2. Exponent.

3. Divide

**3.015** 5

$3 + (4)^2 \div 8$

$3 + 16 \div 8$

$3 + 2$

## 4. Review

**4.1** True

**4.2** False

$$-(-21) = 21$$

**4.3** False

Negative two is to the right of -5 on the number line, so it is larger.

**4.4** False

$$6^2 = 36 = 6 \cdot 6$$

**4.5** False

Zero is the additive identity; one is the multiplicative identity.

**4.6** True

**4.7** False

$$8^{10} \div 8^5 = 8^{10-5} = 8^5$$

**4.8** True

$\sqrt{12}$  is between  $\sqrt{9}$  and  $\sqrt{16}$ .

**4.9**  $\sqrt{10}$

Ten is not a perfect square.

**4.10**  $2\frac{1}{2}, 2\frac{3}{4}$   
 $2\frac{3}{5} = 2.6$

**4.11** -3

The distance could be in either direction. Moving five units left on the number line (from two) would be -3. Moving five units right on the number line (from two) would be seven.

**4.12**  $P > -1$

$$P = -0.5$$

**4.13**  $3(10 + 5) = 30 + 15$

$$3(10 + 5) = 3 \cdot 10 + 3 \cdot 5 = 30 + 15$$

**4.14**  $\frac{1}{9}$

$$3^{-2} = \frac{1}{3^2} = \frac{1}{3 \cdot 3}$$

**4.15** 0.00027 grams

Move the decimal 4 places to the left.

**4.16**  $3\sqrt{2}$

$$\sqrt{18} = \sqrt{9} \cdot \sqrt{2} = 3\sqrt{2}$$

**4.17** 3

The two exponents must add to equal six.

**4.18** a constant

**4.19** 25

$$27 - 4^2 \div 2 + (11 - 5)$$

$$27 - 4^2 \div 2 + 6$$

$$27 - 16 \div 2 + 6$$

$$27 - 8 + 6$$

$$19 + 6$$

$$25$$



**4.20** associative property of multiplication

$(\frac{2}{3} \cdot \frac{3}{2}) \cdot 5$ . Change the grouping using the associative property.

**4.21** irrational numbers

Seven is rational, so it can't be irrational.

## MATH 801 LIFE PAC TEST: THE REAL NUMBER SYSTEM

1. =

2. <

$$4.7 \times 10^{-3} = 0.0047$$

$$2^2 = 4$$

3. >

$$3^{-1} = \frac{1}{3}$$

$$\frac{1}{3} > \frac{1}{4}$$

4. >

$\sqrt{18}$  is between 4 and 5.

5. =

$$7.15 \times 10^5 = 715,000$$

6.

commutative property

$$37 \cdot 2 \cdot (-5 + 5 + \frac{1}{2})$$

inverse property of addition

$$37 \cdot 2 \cdot (0 + \frac{1}{2})$$

identity property of addition

$$37 \cdot 2 \cdot \frac{1}{2}$$

inverse property of multiplication

$$37 \cdot 1$$

identity property of multiplication

$$37$$

7. A

11.  $\sqrt{3}$

8. multiply 5 factors of 3

$$3^5 = 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3$$

The square root of a number that is not a perfect square is always irrational. Three is not a perfect square.

9.  $-1\frac{1}{5} < -1.5$

$$-1\frac{1}{5} = -1.2, \text{ which is greater than } -1.5.$$

12. 9

$$57 - 6^2 \div (2 + 1) \cdot 4$$

$$57 - 6^2 \div 3 \cdot 4$$

$$57 - 36 \div 3 \cdot 4$$

$$57 - 12 \cdot 4$$

$$57 - 48$$

$$9$$

10. greater than 4 and less than 5

$\sqrt{x}$  is between  $\sqrt{16}$  and  $\sqrt{25}$ , or 4 and 5.

13. 102,500

Move the decimal five places to the right.

14. Mary

In order from lowest to highest score – Mary, Ling, Wei, Mia.

15. additive identity

Adding zero, or the additive identity, to any number does not change the number.

16. 13

$$2^2 + 3^2 = 4 + 9 = 13$$

17.  $-2, \sqrt{5}, 4, 3^2$

$\sqrt{5}$  is between 2 and 3.  
 $3^2 = 9$

18. 6

By the division rule, nine minus  $n$  must equal three.

19.  $|-5|$

All of the expressions equal  $-5$  except  $|-5|$ .

20.  $2 \times 10^{-1}$

$P = \frac{1}{5}$ , or 0.2. Written in scientific notation, 0.2 is  $2 \times 10^{-1}$ .

21.  $R \geq Q$

22.  $1.2 \times 10^{-2}$

Integers include both negative and positive whole numbers.

$$\sqrt{49} = 7$$

$$-3^0 = -1$$

$$1.2 \times 10^{-2} = 0.012$$

$$\frac{18}{3} = 6$$

23. 10



24. 4,096

$$4^1 \cdot 4^5 = 4^{1+5} = 4^6$$

25.  $4\sqrt{3}$

$$\sqrt{48} = \sqrt{16} \cdot \sqrt{3} = 4\sqrt{3}$$

26. a variable

27.  $C = 16\pi$

$$C = 2\pi r = 2\pi(8) = 16\pi$$

- 28.** Answers will vary, but should include the following points.

When you write a number in scientific notation, the first part is a number greater than or equal to 1 and less than 10, while the second part is a power of 10.

When you convert a number from standard form to scientific notation, the number of places the decimal moves determines the number of the exponent. If the decimal is moved to the left, then the exponent is positive. If the decimal is moved to the right, then the exponent is negative.

Alternative description: If in standard form the number is less than 1, the exponent of 10 is negative. If in standard form the number is greater than 1, the exponent of 10 is positive.

# MATH 801

ALTERNATE LIFE PAC TEST



Score \_\_\_\_\_

NAME \_\_\_\_\_

DATE \_\_\_\_\_

Complete the following activities (4 points, each numbered activity).

1.  $|-13| \geq -(-13)$

- True  
 False

2.  $3 < 4^0$

- True  
 False

3.  $0.012 = 1.2 \times 10^{-3}$

- True  
 False

4.  $\sqrt{49} > 3 + 32 \div 2^3$

- True  
 False

5.  $2 < \sqrt{6}$

- True  
 False

6. Match the name of the number property used to get to each step from the previous step.

\_\_\_\_\_  $[-5 + (\frac{1}{2} + 5)] \cdot 2$

\_\_\_\_\_  $[-5 + (5 + \frac{1}{2})] \cdot 2$

\_\_\_\_\_  $[(-5 + 5) + \frac{1}{2}] \cdot 2$

\_\_\_\_\_  $[0 + \frac{1}{2}] \cdot 2$

\_\_\_\_\_  $\frac{1}{2} \cdot 2$

\_\_\_\_\_  $1$

commutative property

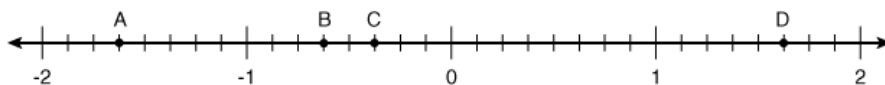
associative property

inverse property of multiplication

identity property of addition

inverse property of addition

7. Which of the points best represents the location of  $-\frac{5}{8}$  on the number line?

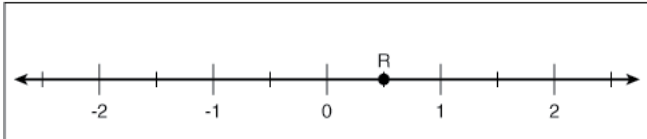
 A B C D

8.  $2^3 \cdot 2^4$  is equal to \_\_\_\_.
- seven factors of two  12 factors of two
- two factors of seven  two times 12
9. Which of the following statements is true?
- $1.7 < 1\frac{1}{2}$    $\frac{3}{4} \leq \frac{7}{8}$    $-1\frac{1}{2} < -1.5$    $0.01 > 0.1$
10. If  $x = 45$ , then  $\sqrt{x}$  is between \_\_\_\_.
- 4 and 5  6 and 7  22 and 23  44 and 46
11. All of the following are irrational *except* \_\_\_\_.
- $\sqrt{15}$   3.14829...   $\sqrt{18}$    $1.\overline{45}$
12. Simplify  $|-3| + 6 \div (4 - 1) \cdot 8$ .
- 8  13  19  24
13. Written in standard form, a number is 10,250. In scientific notation, the number is \_\_\_\_.
- $1.025 \times 10^3$    $1.025 \times 10^{-4}$    $10.25 \times 10^3$    $1.025 \times 10^4$
14. The following score card shows the scores for a golf game. If the lowest score wins, who came in last place?
- | Player | Score |
|--------|-------|
| Wei    | +1    |
| Mary   | -5    |
| Ling   | -3    |
| Mia    | +2    |
- Wei
- Mary
- Ling
- Mia
15. If  $3 \cdot N = 1$ , then  $N$  is the \_\_\_\_.
- additive inverse  multiplicative inverse
- additive identity  multiplicative identity
16. If  $m = 3$  and  $n = 2$ , then  $m^2 - n^2$  is equal to \_\_\_\_.
- 1  2  5  13
17. Which of the following lists is in order from least to greatest?
- 3, -1,  $\sqrt{10}$ ,  $2^2$   -3, -1,  $2^2$ ,  $\sqrt{10}$
- 1, -3,  $2^2$ ,  $\sqrt{10}$   -1, -3,  $\sqrt{10}$ ,  $2^2$

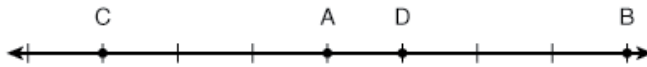
18.  $5^3 \div 5^6$  is equal to \_\_\_\_.
- $5^{\frac{1}{2}}$         $\frac{1}{25}$         $\frac{1}{5^3}$         $5^3$

19. Which of the following is equal to  $|-7|$ ?
- the opposite of 7       -7
- $-|7|$         $-(-7)$

20. Which of the following best represents R on the graph shown?



- $2^{-1}$         $2^0$         $2^1$         $2 \times 10^{-1}$
21. Which of the following is a true statement based on the graph shown?



- $A \geq D$         $B > C$         $D < C$         $A = B$
22. Which of the following expressions *cannot* be written as a natural number?
- $|-8|$         $\frac{5}{2}$         $2 + 3 \cdot 0$         $1.2 \times 10^2$
23. What is the distance between -5 and 4?
- 9       1       9       11
24. If  $4^3 \cdot 4^3 = m^6$ , then  $m$  is \_\_\_\_.
- 1       4       8       16
25. What is  $\sqrt{40}$  in simplified form?
- $5\sqrt{8}$         $4\sqrt{10}$
- $2\sqrt{10}$         $\sqrt{40}$  can't be simplified.

26. Evaluate  $A = \frac{1}{2}bh$ , for  $b = 8$  and  $h = 4$ .  
 16                       24                       32                       42
27.  $3k$  is an example of  
 a constant                       a term                       variable
28. One of your friends missed the class on scientific notation. Describe how you would explain to your friend what it means for a number to be in scientific notation and how to convert a number from scientific notation to standard form.



## MATH 801 ALTERNATE TEST: THE REAL NUMBER SYSTEM ANSWER KEY

1. True  
 $|-13| = 13$   
 $-(-13) = 13$

2. False  
 $4^0 = 1$

3. False  
 $1.2 \times 10^{-3} = 0.0012$

4. False  
 $\sqrt{49} = 7$   
 $3 + 32 \div 8 = 3 + 4 = 7$

5. True  
 $\sqrt{6}$  is between 2 and 3.

6.

commutative property

$$[-5 + (5 + \frac{1}{2})] \cdot 2$$

associative property

$$[(-5 + 5) + \frac{1}{2}] \cdot 2$$

inverse property of addition

$$[0 + \frac{1}{2}] \cdot 2$$

identity property of addition

$$\frac{1}{2} \cdot 2$$

inverse property of multiplication

$$1$$

7. B

11.  $1.\overline{45}$

8. seven factors of two

Decimals that repeat are rational.

$$2^3 \cdot 2^4 = (2 \cdot 2 \cdot 2) \cdot (2 \cdot 2 \cdot 2 \cdot 2) = 2^7$$

12. 19

9.  $\frac{3}{4} \leq \frac{7}{8}$

$$|-3| + 6 \div (4 - 1) \cdot 8$$

$$3 + 6 \div 3 \cdot 8$$

$$3 + 2 \cdot 8$$

$$3 + 16$$

$$19$$

$$\frac{3}{4} = \frac{6}{8}, \text{ which is less than } \frac{7}{8}.$$

10. 6 and 7

13.  $1.025 \times 10^4$

$\sqrt{45}$  is between  $\sqrt{36}$  and  $\sqrt{49}$ , or between 6 and 7.

To get a number between 1 and 10, move the decimal 4 places to the left.

14. Mia  
In order from lowest to highest score—Mary, Ling, Wei, Mia.

15. multiplicative inverse  
Multiplying by the inverse, or reciprocal, of three gives a result of one.

16. 5  
 $3^2 - 2^2 = 9 - 4 = 5$

17. -3, -1,  $\sqrt{10}$ ,  $2^2$   
 $\sqrt{10}$  is between 3 and 4.  
 $2^2 = 4$

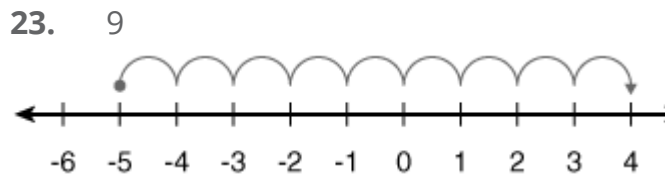
18.  $\frac{1}{5^3}$   
 $5^3 \div 5^6 = 5^{3-6} = 5^{-3} = \frac{1}{5^3}$

19. -(-7)  
 $|-7| = 7$

20.  $2^{-1}$   
 $R = \frac{1}{2} = 2^{-1}$

21.  $B > C$

22.  $\frac{5}{2}$   
Natural numbers are counting numbers beginning at 1.  
 $|-8| = 8$   
 $\frac{5}{2} = 2.5$   
 $2 + 3 \cdot 0 = 2$   
 $1.2 \times 10^2 = 120$



24. 4  
When multiplying with like bases, add the exponents and keep the base the same.

25.  $2\sqrt{10}$   
 $\sqrt{40} = \sqrt{4} \cdot \sqrt{10} = 2\sqrt{10}$

26. 16  
 $A = \frac{1}{2}bh = \frac{1}{2}(8)(4) = 4(4) = 16$

27. a term

28. Answers will vary, but should include the following points.

When you write a number in scientific notation, the first part is a number greater than or equal to 1 and less than 10, while the second part is a power of 10.

When you convert a number from scientific notation to standard form, the exponent tells you how many places to move the decimal.

If the exponent is positive, move the decimal to the right. If the exponent is negative, move the decimal to the left.



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