

Real Numbers

Real numbers are divided into two types, rational numbers and irrational numbers

I. Rational Numbers:

- Any number that can be expressed as the quotient of two integers. (fraction).
- Any number with a decimal that repeats *OR* terminates.
- Subsets of Rational Numbers:

A. Integers: rational numbers that contain no fractions or decimals.
{..., -2, -1, 0, 1, 2, ...}

B. Whole Numbers: all positive integers and the number 0.
{0, 1, 2, 3, ... }

C. Natural Numbers (counting numbers): all positive integers (not 0).
{1, 2, 3, ... }

II. Irrational Numbers:

- Any number that cannot be expressed as a quotient of two integers (fraction).
- Any number with a decimal that does non-repeating *and* non-terminal (doesn't repeat and doesn't end).
- Most common example is π .

Write all the sets each number belongs to:

a) $\frac{1}{2}$ _____

b) 7 _____

c) -9 _____

d) π _____

e) 0 _____

f) .5 _____

g) $\sqrt{16}$ _____

h) $\sqrt{17}$ _____

i) $\frac{20}{7}$ _____

j) $\frac{20}{5}$ _____

Properties

1) Commutative Properties of Addition and Multiplication:

- The order in which you add or multiply does not matter.

$$a + b = b + a \quad \text{and} \quad a \cdot b = b \cdot a$$

- Examples:

$$2 + 4 = 4 + 2 \quad 5 \cdot 6 = 6 \cdot 5$$

2) Symmetric Property:

- If $a + b = c$, then $c = a + b$
- If , then

3) Reflexive Property:

- $a + b = a + b$
- Nothing changes

4) Associative Properties of Addition and Multiplication.

- The grouping of addition and multiplication does not matter. (Parenthesis)
- Examples:

$$2 + (4 + 7) = 13 \quad \text{and} \quad (2 + 4) + 7 = 13 \quad 4 \cdot (6 \cdot 2) = 48 \quad \text{and} \quad (4 \cdot 6) \cdot 2 = 48$$

5) Transitive Property:

- If $a = b$ and $b = c$, then $a = c$.
- If, and, then
- If $8 \cdot 2 = 16$ and $16 = 4^2$, then $8 \cdot 2 = 4^2$.

6) Distributive Property:

- $a(b + c) = ab + ac$ and $a(b - c) = ab - ac$
- Examples:

$$3(7 + 2) = 3(7) + 3(2) = 21 + 6 = 27$$

$$5(9 - 6) = 5(9) - 5(6) = 45 - 30 = 15$$

7) Additive Identity:

- When zero is added to any number or variable, the sum is the number or variable.
- $a + 0 = a$

8) Multiplicative Identity:

- When any number or variable is multiplied by 1, the product is the number or variable.
- $a \cdot 1 = a$

9) Multiplicative Property of Zero:

- When any number or variable is multiplied by zero, the product is 0.
- $a \cdot 0 = 0$

A. Complete the Matching Column (put the corresponding letter next to the number)

- | | |
|---|-------------------------------------|
| ___1) $26 + 0 = 26$ | a) Reflexive |
| ___2) $22 \cdot 0 = 0$ | b) Additive Identity |
| ___3) $3(9 + 2) = 3(9) + 3(2)$ | c) Multiplicative identity |
| ___4) If $32 = 64 \div 2$, then $64 \div 2 = 32$ | d) Associative Property of Mult. |
| ___5) $32 \cdot 1 = 32$ | e) Transitive |
| ___6) $9 + 8 = 8 + 9$ | f) Associative Property of Add. |
| ___7) If $32 + 4 = 36$ and $36 = 6^2$, then $32 + 4 = 6^2$ | g) Symmetric |
| ___8) $16 + (13 + 8) = (16 + 13) + 8$ | h) Commutative Property of Addition |
| ___9) $6 \cdot (2 \cdot 12) = (6 \cdot 2) \cdot 12$ | i) Multiplicative property of zero |
| ___10) $6 \cdot 10 = 6 \cdot 10$ | j) Distributive |

B. Complete the Matching Column (put the corresponding letter next to the number)

- | | |
|--|-------------------------------------|
| ___11) If $5 + 6 = 11$, then $11 = 5 + 6$ | a) Reflexive |
| ___12) $22 \cdot 0 = 0$ | b) Additive Identity |
| ___13) $3(9 - 2) = 3(9) - 3(2)$ | c) Multiplicative identity |
| ___14) $6 + (3 + 8) = (6 + 3) + 8$ | d) Associative Property of Mult. |
| ___15) $54 + 0 = 54$ | e) Transitive |
| ___16) $16 - 5 = 16 - 5$ | f) Associative Property of Addition |
| ___17) If $12 + 4 = 16$ and $16 = 4^2$, then $12 + 4 = 4^2$ | g) Symmetric |
| ___18) $3 \cdot (22 \cdot 2) = (3 \cdot 22) \cdot 2$ | h) Commutative Property of Addition |
| ___19) $29 \cdot 1 = 29$ | i) Multiplicative property of zero |
| ___20) $6 + 11 = 11 + 6$ | j) Distributive |

C.

21) Which number is a whole number but not a natural number?

- a) -2 b) 3 c) $\frac{1}{2}$ d) 0

22) Which number is an integer but not a whole number?

- a) -5 b) $\frac{1}{4}$ c) 3 d) 2.5

23) Which number is irrational?

- a) π b) 4 c) $.18754786$ d) $\frac{2}{5}$

24) Give an example of a number that is rational, but not an integer. _____

25) Give an example of a number that is an integer, but not a whole number. _____

26) Give an example of a number that is a whole number, but not a natural number. _____

27) Give an example of a number that is a natural number, but not an integer. _____

Properties Worksheet:

A. Complete the Matching Column (put the corresponding letter next to the number)

- | | |
|--|---|
| 1) If $18 = 13 + 5$, then $13 + 5 = 18$ | a) Reflexive |
| 2) $6 \cdot (2 \cdot 5) = (6 \cdot 2) \cdot 5$ | b) Additive Identity |
| 3) $5(7 + 2) = 5(7) + 5(2)$ | c) Multiplicative identity |
| 4) $15 + (10 + 3) = (15 + 10) + 3$ | d) Associative Property of Multiplication |
| 5) $50 \cdot 1 = 50$ | e) Transitive |
| 6) $7 \cdot 4 = 4 \cdot 7$ | f) Associative Property of Addition |
| 7) $13 + 0 = 13$ | g) Symmetric |
| 8) $11 + 8 = 11 + 8$ | h) Commutative Property of Multiplication |
| 9) If $30 + 34 = 64$ and $64 = 8^2$, then $30 + 34 = 8^2$ | I) Multiplicative property of zero |
| 10) $11 \cdot 0 = 0$ | j) Distributive |
-
- 11) Which property is represented by: $5 + (4 + 7x) = (5 + 4) + 7x$?
- | | |
|---------------------------------|--------------------------|
| a) Associative Property of Add. | c) Distributive Property |
| b) Commutative Property of Add. | d) Symmetric Property |
-
- 12) Which property is illustrated by $5(a + 6) = 5(a) + 5(6)$
- a) associative prop. of add. b) distributive c) transitive d) symmetric
-
- 13) What is the formula for area of a rhombus?
- a) $A = lh$ b) $A = \frac{1}{2} h(b_1 + b_2)$ c) $A = \frac{1}{2} d_1d_2$ d) $A = lwh$
-
- 14) What property is represented by: If $4 + 14 = 18$ and $18 = 6 \cdot 3$, then $14 + 4 = 6 \cdot 3$?
- | | |
|------------------------|---------------------------------|
| a) Symmetric Property | c) Commutative Property of Add. |
| b) Transitive Property | d) Awesome Property |
-
- 15) Which property is represented by: $3 + 9 = 9 + 3$?
- | | |
|------------------------|---------------------------------|
| a) Transitive Property | c) Reflexive Property |
| b) Symmetric Property | d) Commutative Property of Add. |
-
- 16) Which property is represented by: If $3 + 11 = 14$, then $14 = 3 + 11$?
- | | |
|---------------------------------|-----------------------|
| a) Transitive Property | c) Reflexive Property |
| b) Commutative Property of Add. | d) Symmetric Property |
-
- 17) Write a statement that illustrates the Additive Identity property: _____
- 18) Write a statement that illustrates the Multiplicative Identity property: _____
- 19) Write a statement that illustrates the Symmetric property: _____
- 20) Write a statement that illustrates the Associative Prop.of Add.:_____

Q1 Quiz 1 Review:

1) Which number is a rational number but not an integer?

- a) -6 b) 0 c) $\frac{5}{8}$ d) none

2) Which number is an integer but not a natural number?

3) Which number is an integer, but not rational?

- a) π b) 4 c) -0.25 d) none

4) Which number is whole, but not natural?

- a) 0 b) 4 c) $.75$ d) none

5) Which number is natural, but not whole?

- a) $\frac{1}{4}$ b) 4 c) 0 d) none

6) Give an example of a number that is rational, but not an integer. _____

7) Give an example of a number that is an integer, but not a whole number. _____

8) Give an example of a number that is a whole number, but not a natural number. _____

9) Give an example of a number that is a whole number, but not an integer. _____

10) Give an example of a number that is rational, but not a whole number. _____

11) Write all the sets each number belongs to:

a) -0.45 _____ b) π _____

c) -5 _____ d) 0 _____

e) 8 _____ f) $.5$ _____

g) $\sqrt{81}$ _____ h) $\sqrt{5}$ _____

i) $\frac{1}{3}$ _____ j) -2.6 _____

- 12) Which number is a rational number, but not an integer?
 a. 2 b. $\frac{2}{3}$ c. 0 d. $-\frac{10}{5}$
- 13) Which number is irrational?
 a. -2 b. $\frac{1}{2}$ c. 0 d. π
- 14) Which number is a whole number, but not an integer?
 A) $-\frac{6}{2}$ b. $\frac{5}{8}$ c. 0 d. none
- 15) Which number is an integer, but not a whole number?
 A) -7 b. 0 c. 6 d. none
- 16) Which number is a whole number, but not a natural number?
 a. -2 b. $\frac{1}{2}$ c. 0 d. π

- 17) Write a statement that illustrates the Distributive property: _____
- 18) Write a statement that illustrates the Commutative Property of Addition: _____
- 19) Write a statement that illustrates the Reflexive property: _____
- 20) Write a statement that illustrates the Symmetric property: _____

Complete the Matching Column (put the corresponding letter next to the number)

- | | |
|---|-------------------------------------|
| 21) $2(14 - 3) = 2(14) - 2(3)$ | a) Reflexive |
| 22) $22 + 0 = 22$ | b) Additive Identity |
| 23) $15 + 4 = 15 + 4$ | c) Multiplicative identity |
| 24) $5 \cdot 0 = 0$ | d) Associative Property of Mult. |
| 25) $7 \cdot (9 \cdot 6) = (7 \cdot 9) \cdot 6$ | e) Transitive |
| 26) $9 + 8 = 8 + 9$ | f) Associative Property of Addition |
| 27) $3 + (5 + 12) = (3 + 5) + 12$ | g) Symmetric |
| 28) If $11 + 4 = 15$, and $3 \cdot 5 = 15$, then $11 + 4 = 3 \cdot 5$ | h) Commutative Property of Add. |
| 29) If $4 + 3 = 7$, then $7 = 4 + 3$ | I) Multiplicative property of Zero |
| 30) $12 \cdot 1 = 12$ | j) Distributive |

Complete the Matching Column

- | | |
|---|---|
| 31) $6 \cdot (2 \cdot 5) = (6 \cdot 2) \cdot 5$ | a) Reflexive |
| 32) $11 \cdot 0 = 0$ | b) Additive Identity |
| 33) $13 + 0 = 13$ | c) Multiplicative identity |
| 34) If $30 + 34 = 64$ and $64 = 8^2$, then $30 + 34 = 8^2$ | d) Associative Property of Multiplication |
| 35) $50 \cdot 1 = 50$ | e) Transitive |
| 36) $(6 \cdot 2) \cdot 5 = (6 \cdot 2) \cdot 5$ | f) Commutative Property of Addition |
| 37) $5(8 + 4) = 5(8) + 5(4)$ | g) Symmetric |
| 38) $19 + 8 = 8 + 19$ | h) Commutative Property of Multiplication |
| 39) If $12 = 18 - 6$, then $18 - 6 = 12$ | I) Multiplicative property of zero |
| 40) $7 \cdot 4 = 4 \cdot 7$ | j) Distributive |

Circle Each Correct Answer:

- 41) Which property is represented by $7(12 - 8) = 84 - 56$?
 a) associative b) commutative
 c) distributive d) symmetric
- 42) Which property is represented by $x + y = y + x$?
 a) commutative prop of add. b) symmetric
 c) reflexive d) associative prop. of add.
- 43) Which number is irrational?
 a) $\sqrt{9}$ b) .25 c) 0 d) $\sqrt{10}$
- 44) Which number is rational, but not an integer?
 a) $-4/2$ b) $-3/2$ c) 0 d) none
- 45) Which property is illustrated by If $6 + 5 = 11$, then $11 = 6 + 5$?
 a) commutative prop of add. b) symmetric c) reflexive d) transitive
- 46) Which property is illustrated by $7 + 2 = 7 + 2$?
 a) commutative prop of add. b) symmetric
 c) reflexive d) associative prop. of add.
- 47) Write a statement that illustrates the Associative Prop. of Mult: _____
- 48) Write a statement that illustrates the Mult. Prop. of Zero: _____

Answer Key:

#	answer						
1	c						
2	c						
3	d						
4	a						
5	d						
6	0.4	many acceptable answers					
7	-6	many acceptable answers					
8	0	only acceptable answer					
9	none	all whole numbers are integers					
10	0.5	many acceptable answers					
11a	rational						
b	irrational						
c	rational, integer						
d	rational, integer, whole						
e	rational, integer, whole, natural						
f	rational						

g	rational, integer, whole, natural					
h	irrational					
i	rational					
j	rational					
12	b					
13	d					
14	d					
15	a					
16	c					
17	$6(4 + 3) = 6(4) + 6(3)$			Many acceptable answers		
18	$3 + 10 = 10 + 3$			Many acceptable answers		
19	$7 - 3 = 7 - 3$			Many acceptable answers		
20	If $9 + 2 = 11$, then $11 = 9 + 2$			Many acceptable answers		
21	j					
22	b					
23	a					
24	i					
25	d					
26	h					
27	f					
28	e					
29	g					
30	c					
31	d					
32	i					
33	b					
34	e					
35	c					
36	a	It looks like Associative, but nothing changed so it is reflexive				
37	j					
38	f					
39	g					
40	h					

Packet #1

41	c						
42	a						
43	d						
44	b						
45	b						
46	c						
47	$(6 \cdot 2) \cdot 5 = 6 \cdot$ $(2 \cdot 5)$			Many acceptable answers			
48	$5 \cdot 0 = 0$			Many acceptable answers			

Simplifying and Combining Like Terms

$$\begin{array}{ccc} & \text{Exponent (2)} & \\ \text{Coefficient (4)} & 4x^2 & \text{Variable (or Base) (x)} \end{array}$$

* Write the coefficients, variables, and exponents of:

a) $8c^2$

b) $9x$

c) y^8

d) $12a^2b^3$

Like Terms: Terms that have identical variable parts {same variable(s) and same exponent(s)}

When simplifying using addition and subtraction, combine "like terms" by keeping the "like term" and adding or subtracting the numerical coefficients.

Examples:

$$3x + 4x = 7x$$

$$13xy - 9xy = 4xy$$

$$12x^3y^2 - 5x^3y^2 = 7x^3y^2$$

Why can't you simplify?

$$4x^3 + 4y^3$$

$$11x^2 - 7x$$

$$6x^3y + 5xy^3$$

Simplify:

1) $7x + 5 - 3x$

2) $6w^2 + 11w + 8w^2 - 15w$

3) $(6x + 4) + (15 - 7x)$

4) $(12x - 5) - (7x - 11)$

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

6) $11a^2b - 12ab^2$

WORKING WITH THE DISTRIBUTIVE PROPERTY

Example:

$$3(2x - 5) + 5(3x + 6) =$$

Since in the order of operations, multiplication comes before addition and subtraction, we must get rid of the multiplication before you can combine like terms. We do this by using the distributive property:

$$3(2x - 5) + 5(3x + 6) =$$

$$3(2x) - 3(5) + 5(3x) + 5(6) =$$

$$6x - 15 + 15x + 30 =$$

Now you can combine the like terms:

$$6x + 15x = 21x$$

$$-15 + 30 = 15$$

Final answer: $21x + 15$

Normally we don't write out the work with all those steps. Your actual work will look like this:

$$3(2x - 5) + 5(3x + 6) =$$

$$6x - 15 + 15x + 30 =$$

$$21x + 15$$

Practice Problems:

Simplify:

1) $(5x - 4) + (3 - 4x)$

2) $(7x^4 - 6x^3 + 4x^2 - 11x + 5) - (9x^4 + x^3 + 8x^2 - 13x - 4)$

3) $3(5x - 3) + 6(2x + 4)$

Packet #1

4) $7(2x^2 - 6x + 2) + 3(-5x^2 + 14x - 4)$

5) $9(7x^2 - 5x + 9) - 7(8x^2 - 3x + 12)$

6) $6(3x^3 - 4x^2 + 11x - 5) - 10(-2x^3 - 6x^2 + 6x + 7)$

7) $4(2x^2 + 6x + 5) - 8(x^2 + 3x - 5)$

8) $12(3x^2 - 6x + 9) - 9(4x^2 - 8x - 12)$

9) $5(6x^3 - 4x^2 + 11) - 6(5x^2 + 9)$

10) $10(3x^4 - 5x^3 + 7x^2 - 10x + 6) - 5(6x^4 - 10x^3 - 14x^2 - 20x + 12)$

Q1 Quiz 2 Review Sheet

1) $(8x + 9) + (7x - 11)$

2) $(6x - 3) + (9 - 7x)$

3) $(13x - 7) - (21x - 9)$

4) $(16x + 5) - (11x - 7)$

5) $7(3x + 4) + 5(4x - 7)$

6) $6(15 - 6x) + 11(4x - 8)$

7) $3(12x - 4) - 5(8x + 7)$

8) $4(8x + 5) - 10(5x + 2)$

9) $6(4x^2 - x + 7) + 8(3x^2 - 2x - 6)$

10) $10(3x^2 - 5x + 3) + 6(5x^2 - 4)$

11) $4(5c^2 - 9c - 6) - 6(3c^2 - 6c + 4)$

12) $12(3x^2 - 6x + 9) - 9(4x^2 - 8x + 12)$

13) $9(5x^2 - 3x + 2) + 4(4x^2 - 7x + 1)$

14) $10(4x^2 - 3x + 8) - 8(5x^2 - 4x + 9)$

Answer Key (1-14):

- | | | | | |
|-----------------------|-----------------|--------------|------------------------|--------------|
| 1) $15x - 2$ | 2) $-x + 6$ | 3) $-8x + 2$ | 4) $5x + 12$ | 5) $41x - 7$ |
| 6) $8x + 2$ | 7) $-4x - 47$ | 8) $-18x$ | 9) $48x^2 - 22x - 6$ | |
| 10) $60x^2 - 50x + 6$ | 11) $2c^2 - 48$ | 12) 0 | 13) $61x^2 - 55x + 22$ | 14) $2x + 8$ |

Multiplying and Dividing Monomials

Multiplication:

$$3^2 = 3 \cdot 3 = 9 \quad 4 \cdot 4 = 4^2 = 16 \quad 4^3 = (4)(4)(4) = 64 \quad (5)(5)(5)(5)(5)(5) = 5^6 = 15,625$$

The same goes for variables:

$$x \cdot x = x^2$$

$$x^2 \cdot x^3 = (x)(x) \cdot (x)(x)(x) = x^5$$

(The only difference is you can't simplify x^2 like you did $3^2 = 9$. You must leave it as x^2 .)

When multiplying monomials you must deal with the coefficients.

Coefficients: **Multiply the coefficients.**

Variables: When multiplying the **variables** of monomials you **keep the base and add the exponents**. (Remember if there is no exponent written, the exponent is 1.)

Look at the previous example: $x^1 \cdot x^1 = x^{(1+1)} = x^2$

Simplify: $(3xy^5)(4x^2y^3)$

$$(3xy^5)(4x^2y^3) = (3)(4)(x)(x^2)(y^5)(y^3) = 12 [x^{(1+2)}][y^{(5+3)}] = \mathbf{12x^3y^8}$$

Do now:

1) $(-6x^2y^7)(-9x^5y)$

2) $(-4x^3y^5)^2$

3) $(-2xy^8)^3$

Division:

$$6^4/6^2 = \frac{(6)(6)(6)(6)}{(6)(6)} \rightarrow \text{cancel} \rightarrow \frac{\cancel{(6)}\cancel{(6)}(6)(6)}{\cancel{(6)}\cancel{(6)}} = (6)(6) = 6^2 = 36$$

$$x^3/x = \frac{(x)(x)(x)}{(x)} \rightarrow \text{cancel} \rightarrow \frac{(x)(x)\cancel{(x)}}{\cancel{(x)}} = (x)(x) = x^2$$

Just like multiplying, when dividing monomials you must deal with the coefficients.

Coefficients : **Divide the coefficients.**

Variables: When dividing the **variables** of monomials you **keep the base and subtract the exponents.**

Look at the previous example: $x^3/x = x^{3-1} = x^2$

Simplify: $(12xy^5)/(4xy^3) =$

$$12/4 = 3 \quad x^{1-1} = x^0 \quad y^{5-3} = y^2$$

What is x^0 equal to? : _____ Any number or variable with an exponent of 0 = ? _____

Final answer = _____

Do Now:

4) $\frac{48x^5y^{12}z^5}{64x^3y^5z^5}$

5) $\frac{35x^2y^5z}{20x^4y^3z^2}$

6) $\frac{(3x^4y^5z)^3}{18x^3y^{14}z^7}$

7) $(2x^5yz^6)^5(-3x^2y^{-3}z^{-15})^2$

Show all steps!

1) Multiply:

a) $(5x^3y^2z^{11})(12xy^7z^{-4})$

b) $(9x^5y^2z^4)^3$

c) $(4x^3y^7z^6)^4(3x^8y^{-5}z^{-12})^2$

2) Multiply:

a) $(6x^3y^2z^{-12})(11x^5y^{-3}z^7)$

b) $(8x^5y^{-2}z^4)^4$

c) $(3x^6y^5z^8)^3(5x^{-9}y^5z^{-15})^2$

3) Divide:

$$a) \frac{27x^3y^2z^5}{9x^3y^5z^4}$$

$$b) \frac{(4x^4y^5z)^3}{16x^4y^{13}z^4}$$

$$c) \frac{(2x^5yz^6)^5}{(4x^{11}y^5z^{14})^2}$$

4) Divide:

$$a) \frac{45x^3y^9z^5}{18x^6y^5z}$$

$$b) \frac{24x^8y^{12}z^9}{72x^{10}y^{12}z^8}$$

$$c) \frac{32x^5y^{12}z^{28}}{8x^7y^{-12}z^{14}}$$

$$5) \frac{(3x^5y^8z^5)^5}{(9x^{14}y^{20}z^{12})^2}$$

$$6) \frac{(6x^5y^4z^6)^3}{(12x^7y^8z^9)^2}$$

$$7) 5a(8a^2 - 6a + 3) - 3a(11a^2 - 10a - 5) \quad 8) 8b(7b^2 - 4b + 2) - 5(6b^2 + 3b - 1)$$

$$9) 7x(4x^2 - 11x + 3) - 4x(8x^2 - 18x + 5) \quad 10) 5x(7x^2 - 6x + 4) - 3x(10x^2 - 7x - 1)$$

$$11) 6y^2(5y^3 - 4y^2 + 8y - 7) - 8y(3y^3 + 6y^2 - 5y - 9)$$

When MULTIPLYING monomials you _____ the coefficients and _____ the exponents.

When DIVIDING monomials you _____ the coefficients and _____ the exponents.

1) $(3x^9y)(6x^{11}y^4)$

2) $\frac{36x^9y^6z^5}{12x^9y^6z^4}$

3) $(7x^2yz^3)^3$

4) $\frac{45x^4y^3z^7}{18x^6y^{-3}z^5}$

5) $\frac{(4x^5yz^3)^3}{(2x^3y^6z^{-2})^5}$

6) $(5x^2y^2z^{-4})(2x^{-5}y^3z)^3$

Packet #1

$$7) (6x^7y^4z^3)^2(2x^{-5}y^3z)^3$$

$$8) \frac{(9x^2y^5z^{-11})^2}{(3x^{-2}y^2z^4)^5}$$

$$9) \frac{(6x^2y^5z^3)^2}{(2x^{-3}y^2z^2)^5}$$

$$10) 4x(9x^2 - 15x - 12) - 12x(3x^2 + 5x - 4) \quad 11) 3y^2(5y^3 - 4y^2 + 8y - 7) - 7y(3y^3 + 6y^2 - 5y - 9)$$

Answer Key:

$$1) 18x^{20}y^5 \quad 2) 3x^{18}z \quad 3) 343x^6y^3z^9 \quad 4) \frac{5y^6z^2}{2x^2} \quad 5) \frac{2z^{19}}{y^{27}} \quad 6) \frac{40y^{11}}{x^{13}z} \quad 7) \frac{288y^{17}z^9}{x}$$

$$8) \frac{x^{14}}{3z^{42}} \quad 9) \frac{9x^{19}}{8z^4} \quad 10) -120x^2 \quad 11) 15y^5 - 33y^4 - 18y^3 + 14y^2 + 63y$$

Q1 Quiz 3 Review:

Multiplication

$$1) (10x^3y^{11}z^8)(-11xy^7z^3)$$

$$2) (7x^3yz^6)^3$$

$$3) (2x^3y^5z^6)^4(5x^6y^9z^{-12})^2$$

$$4) (-6x^4y^2z^{-5})^3(-8x^5y^{-3}z^8)^2$$

$$5) (4xy^4z^8)^3(9x^9y^5z^{-10})^2$$

Division:

$$6) \frac{42x^5y^4z^5}{63x^{-5}y^4z^9}$$

$$7) \frac{(4x^2yz^5)^3}{16x^7y^{-3}z^{10}}$$

$$8) \frac{(2x^4y^2z^6)^5}{(4x^7y^3z^{10})^3}$$

$$9) \frac{(9x^3y^5z^8)^2}{(3xy^2z^{-3})^5}$$

$$10) \frac{(8x^{-6}y^4z^5)^3}{(10x^9y^{-6}z^2)^2}$$

$$11) 10x(3x^2 - 5x + 6) - 6x(5x^2 + 8x + 10) \quad 12) 3x(7x^2 + 6x - 4) - 8(10x^2 - 7x - 1)$$

Answer Key:

$$1) -110x^4y^{18}z^{11} \quad 2) 343x^9y^3z^{18} \quad 3) 400x^{24}y^{38} \quad 4) -13,824x^{22}z \quad 5) 5,184x^{21}y^{22}z^4$$

$$6) \frac{2x^{10}}{3z^4} \quad 7) \frac{4y^6z^5}{x} \quad 8) \frac{y}{2x} \quad 9) \frac{xz^{31}}{3} \quad 10) \frac{128y^{24}z^{11}}{25x^{36}} \quad 11) -98x^2 \quad 12) 21x^3 - 62x^2 + 44x + 8$$

Multiplying binomials:

We have a special way of remembering how to multiply binomials called FOIL:

F: first $x \bullet x = x^2$ $(x + 7)(x + 5)$

O: outer $x \bullet 5 = 5x$

I: inner $7 \bullet x = 7x$ $x^2 + 5x + 7x + 35$ (then simplify)

L: last $7 \bullet 5 = 35$ $x^2 + 12x + 35$

Multiplying Binomials: Use all three methods (Double Distribute, FOIL, and “boxes”) to find the product:

1) $(3x - 2)(4x + 7)$:
Double Distribute

FOIL

Boxes

2) $(9x - 2)(x + 7)$
Double Distribute

FOIL

Boxes

3) $(7x - 3)^2$
Double Distribute

FOIL

Boxes

4) $(2x + 9)^2$
Double Distribute

FOIL

Boxes

5) $(7x - 11)(4x - 3)$
Double Distribute

FOIL

Boxes

6) $(6x - 7)(7x + 8)$
Double Distribute

FOIL

Boxes

Multiplying Binomials: Do each problem only once using whichever method you choose:

1) $(x - 5)(x + 4)$

2) $(x - 6)(x - 3)$

3) $(x + 4)(x + 7)$

4) $(x + 3)(x - 7)$

5) $(3x - 5)(2x + 8)$

6) $(11x - 7)(5x + 3)$

7) $(4x - 9)(9x + 4)$

8) $(x - 2)(x + 2)$

9) $(x - 2)(x - 2)$

10) $(x - 2)^2$

11) $(5x - 4)^2$

12) $(3x + 2)^2$

Multiplying Binomials: Use all three methods (Double Distribute, FOIL, and “boxes”) to find the product:

1) $(9x + 4)(2x - 9)$:
Double Distribute

FOIL

Boxes

2) $(4x + 3)(12x + 5)$:
Double Distribute

FOIL

Boxes

3) $(11x + 2)^2$
Double Distribute

FOIL

Boxes

4) $(8x - 5)^2$
Double Distribute

FOIL

Boxes

Multiplying a *TRINOMIAL* by a binomial:

$$13) (4x^2 - 3x + 6)(2x - 7)$$

Method 1: Split, distribute, and combine like terms:

$$2x(4x^2 - 3x + 6) - 7(4x^2 - 3x + 6)$$

Method 2: Box Method:

$$\begin{array}{r} 4x^2 - 3x + 6 \\ \hline 2x - 7 \end{array}$$

Do now:

14) $(5x^2 + 6x - 8)(9x + 4)$

15) $(7x^2 - 3x - 4)(6x^2 + 2x - 5)$

16) $(4x - 3)^3$

Multiplying Polynomials

1) $(5x + 8)(9x - 7)$

2) $(6x - 5)(4x - 3)$

3) $(5x - 2)^2$

3) $(5x - 2)^3$

4) $(7x + 3)^3$

5) $(2x^2 + 5x + 4)(8x + 3)$

6) $(6x^2 - 4x - 3)(2x^2 - 3x - 1)$

7) $(5x^2 - 6x + 1)(4x^2 - 9)$

8) $(7x^2 - 6x + 4)(8x^2 + 5x - 2)$

Q1 Quiz 5 Review:

1) $6x(9x^2 - 4x + 8) + 4x(6x^2 + 12x - 9)$

2) $8x^2(7x^2 - 3x - 12) - 6x(4x^2 - 16x - 3)$

3) $(x + 8)(x - 7)$

4) $(x - 9)(x - 12)$

5) $(x - 4)(x + 7)$

6) $(x - 11)^2$

7) $(5x - 4)^2$

8) $(3x + 4)^3$

9) $(3x^2 - 5x + 3)(5x - 4)$

10) $(4x^2 - 7x + 2)(10x^2 - 3x - 5)$

11) $(3x + 2)^3$