Name ____

Algebra 1 Summer Review Packet

. Please review the notes for each section and complete all subsequent practice problems. Be sure to show all of your work. This packet must be completed in its entirety and be ready to be submitted on the first day of school.

I. Writing Algebraic Expressions

In **algebraic expressions,** letters such as x and w are called variables. A variable is used to represent an unspecified number or value.

Practice: Write an algebraic expression for each verbal expression.

1. Four times a number decreased by twelve ________________
2. Three more than the product of five and a number ______________
3. The quotient of two more than a number and eight ______________
4. Seven less than twice a number _____________________

II. Order of Operations

To evaluate numerical expressions containing more than one operation, use the rules for order of operations. The rules are often summarized using the expression **PEMDAS**

Examples:

Parentheses (Grouping Symbols)	$[(7-4)^2+3]+15$	$\frac{(9-7)^2+6}{11-6}$
Exponents	$= [3^2+3]+15$	$= \frac{2^2+6}{5}$
Multiply or Divide, from left to right	$= [9+3]+15$	$= \frac{4+6}{5}$
Add or Subtract, from left to right	$= 12+15$	$= \frac{10}{2}$
		$= 5$

Practice: Evaluate each expression.

1. $250 \div [5(3 \bullet 7 + 4)]$

2. $\frac{5^2 \cdot 4 - 5 \cdot 4^2}{5(4)}$

3. $\frac{1}{2} \cdot 26 - 3^2$

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

5. $5 + \left[30 - (6-1)^2\right]$

6. $\frac{2 \cdot 4^2 - 8 \div 2}{(5+2) \cdot 2}$

Evaluating Algebraic Expressions

To evaluate algebraic expressions, first replace the variables with their values. Then, use order of operations to calculate the value of the resulting numerical expression.

Example: Evaluate $x^2 - 5(x - y)$ if $x = 6$ and $y = 2$

$$\begin{aligned} x^2 - 5(x - y) &= (6)^2 - 5(6 - 2) \\ &= (6)^2 - 5(4) \\ &= 36 - 5(4) \\ &= 36 - 20 \\ &= 16 \end{aligned}$$

Practice: Evaluate each expression.

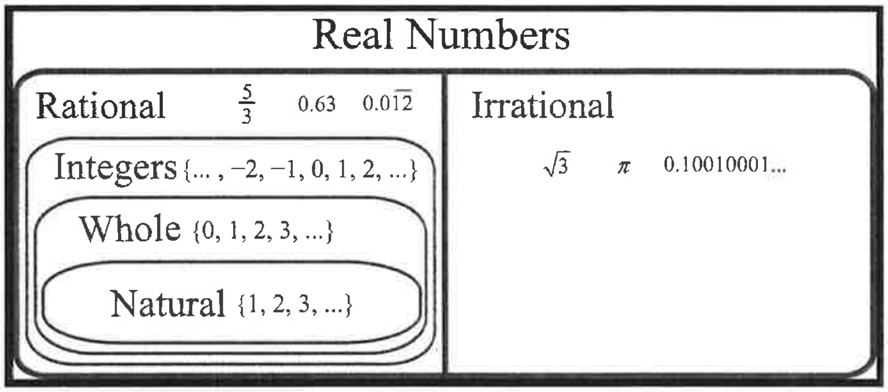
1. $5x^2 - y$ when $x = 4$ and $y = 24$

2. $\dfrac{3xy - 4}{7x}$ when $x = 2$ and $y = 3$

3. $(z \div x)^2 + \dfrac{4}{5}x$ when $x = 2$ and $z = 4$

4. $\dfrac{y^2 - 2z^2}{x + y - z}$ when $x = 12$, $y = 9$, and $z = 4$

The Real Number System



The **Real** number system is made up of two main sub-groups **Rational numbers** and **Irrational numbers.**

The set of rational numbers includes several subsets: **natural numbers, whole numbers, and integers.**

- **Real Numbers-** any number that can be represented on a number-line.
  - **Rational Numbers-** a number that can be written as the ratio of two integers (this includes decimals that have a definite end or repeating pattern)
    Examples: $2, -5, \frac{-3}{2}, \frac{1}{3}, 0.253, 0.\overline{3}$
    - **Integers-** positive and negative whole numbers and 0
      Examples: $-5, -3, 0, 8$ ...
    - **Whole Numbers** – the counting numbers from 0 to infinity
      Examples: { 0, 1, 2, 3, 4, ...}
    - **Natural Numbers-** the counting numbers from 1 to infinity
      Examples: { 1, 2, 3, 4... }
  - **Irrational Numbers-** Non-terminating, non-repeating decimals (including π, and the square root of any number that is not a perfect square.)
    Examples: 2π, $\sqrt{3}$, $\sqrt{23}$, 3.21211211121111....

Practice: Name all the sets to which each number belongs.

1. -4.2 ______________________
2. $3\sqrt{5}$ ______________________
3. $\frac{5}{3}$ ______________________
4. 9 ______________________
5. $\sqrt{16}$ ______________________
6. $-\frac{8}{2}$ ______________________

Properties of Real Numbers

Following are properties of Real Numbers that are useful in evaluating and solving algebraic expressions.

Additive Identity	For any number a, $a + 0 = a$.
Multiplicative Identity	For any number a, $a \cdot 1 = a$.
Multiplicative Property of 0	For any number a, $a \cdot 0 = 0$.
Multiplicative Inverse Property	For every number $\frac{a}{b}$, $a, b \neq 0$, there is exactly one number $\frac{b}{a}$ such that $\frac{a}{b} \cdot \frac{b}{a} = 1$.
Reflexive Property	For any number a, $a = a$.
Symmetric Property	For any numbers a and b, if $a = b$, then $b = a$.
Transitive Property	For any numbers a, b, and c, if $a = b$ and $b = c$, then $a = c$.
Substitution Property	If $a = b$, then a may be replaced by b in any expression.

Commutative Properties	For any numbers a and b, $a + b = b + a$ and $a \cdot b = b \cdot a$.
Associative Properties	For any numbers a, b, and c, $(a + b) + c = a + (b + c)$ and $(ab)c = a(bc)$.

Practice: Name the property illustrated in each equation.

1. $3 \bullet x = x \bullet 3$ ______________________________

2. $3a + 0 = 3a$ ______________________________

3. $2r + (3r + 4r) = (2r + 3r) + 4r$ ____________________

4. $5y \bullet \frac{1}{5y} = 1$ ______________________________

5. $9a + (-9a) = 0$ ____________________________

6. $(10b + 12b) + 7b = (12b + 10b) + 7b$ ____________________

7. $5x + 2 = 5x + 2$ ________________________

8. If $9 + 4 = 13$ and $13 = 2 + 11$ then $9 + 4 = 2 + 11$ ____________________

9. If $x = 7$ then $7 = x$ __________________

10. $3 \bullet 1 = 3$ ______________________

The Distributive Property

The Distributive Property states for any number *a, b,* and *c*:

1. $a(b+c) = ab + ac$ or $(b+c)a = ba + ca$
2. $a(b-c) = ab - ac$ or $(b-c)a = ba - ca$

Practice: Rewrite each expression using the distributive property.

1. $7(h - 3)$

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

3. $(5x - 9)4$

4. $\frac{1}{2}(14 - 6y)$

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

6. $\frac{1}{4}(16x - 12y + 4z)$

7. $(9 - 2x + 3xy) \cdot -4$

8. $0.3(40a + 10b - 5)$

Combining Like-Terms

Terms in algebra are numbers, variables or the product of numbers and variables. In algebraic expressions terms are separated by addition (+) or subtraction (-) symbols. Terms can be combined using addition and subtraction if they are **like-terms**.

Like-terms have the same variables to the same power.

Example of like-terms: $5x^2$ and $-6x^2$

Example of terms that are **NOT** like-terms: $9x^2$ and $15x$

Although both terms have the variable ***x****, they are not being raised to the same power*

To combine like-terms using addition and subtraction, add or subtract the numerical factor

Example: Simplify the expression by combining like-terms

$$8x^2+9x-12x+7x^2 = (8+7)x^2+(9-12)x$$
$$= 15x^2+-3x$$
$$= 15x^2-3x$$

Practice: Simplify each expression

1. $5x-9x+2$

2. $3q^2+q-q^2$

3. $c^2+4d^2-7d^2$

4. $5x^2+6x-12x^2-9x+2$

5. $2(3x-4y)+5(x+3y)$

6. $10xy-4(xy+2x^2y)$

Solving Equations with Variables on One-Side

To solve an equation means to ***find the value*** of the variable. We solve equations by isolating the variable using opposite operations.

Opposite Operations:
Addition (+) & Subtraction (–)
Multiplication (x) & Division (÷)

Please remember...
to do the same step on each side of the equation.

Always check your work by substitution!

Example:
Solve.

$3x - 2 = 10$	
$+2 \quad +2$	Isolate 3x by adding 2 to each side.
$\frac{3x}{3} = \frac{12}{3}$	Simplify Isolate x by dividing each side by 3.
$x = 4$	Simplify

Check your answer.

$3(4) - 2 = 10$	Substitute the value in for the variable.
$12 - 2 = 10$	Simplify
$10 = 10$	Is the equation true? If yes, you solved it correctly!

Practice: Solve each equation.

1. $98 = b + 34$

2. $-14 + y = -2$

3. $8k = -64$

4. $\frac{2}{5}x = 6$

5. $14n - 8 = 34$

6. $8 + \frac{n}{12} = 13$

7. $\frac{3k - 7}{5} = 16$

8. $-\frac{d}{6} + 12 = -7$

IX. Solving Equations with Variables on Each-Side:

To solve an equation with the same variable on each side, write an equivalent equation that has the variable on just one side of the equation. Then solve.

Example **Solve $4(2a - 1) = -10(a - 5)$.**

$4(2a - 1) = -10(a - 5)$	Original equation
$8a - 4 = -10a + 50$	Distributive Property
$8a - 4 + 10a = -10a + 50 + 10a$	Add 10a to each side.
$18a - 4 = 50$	Simplify.
$18a - 4 + 4 = 50 + 4$	Add 4 to each side.
$18a = 54$	Simplify.
$\frac{18a}{18} = \frac{54}{18}$	Divide each side by 18.
$a = 3$	Simplify.

The solution is 3.

Practice: Solve each equation.

1. $5+3r=5r-19$

2. $8x+12=4(3+2x)$

3. $-5x-10=2-(x+4)$

4. $6(-3m+1)=5(-2m-2)$

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

Ratios and Proportions

Solve Proportions If a proportion involves a variable, you can use cross products to solve the proportion. In the proportion $\frac{x}{5} = \frac{10}{13}$, x and 13 are called **extremes.** They are the first and last terms of the proportion. 5 and 10 are called **means.** They are the middle terms of the proportion. In a proportion, the product of the extremes is equal to the product of the means.

Means-Extremes Property of Proportions	For any numbers a, b, c, and d, if $\frac{a}{b} = \frac{c}{d}$, then $ad = bc$.

Example 1:

$$\frac{x}{5} = \frac{10}{13}$$

$$x \cdot 13 = 5 \cdot 10$$

$$13x = 50$$

$$\frac{13x}{13} = \frac{50}{13}$$

$$x = \frac{50}{13}$$

Example 2:

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

$$4(x+1) = 3 \cdot 4$$

$$4x + 4 = 12$$
$$-4 \quad -4$$

$$4x = 8$$

$$\frac{4x}{4} = \frac{8}{4}$$

$$x = 2$$

Practice: Solve each proportion.

1. $\frac{x}{21} = \frac{3}{63}$

2. $\frac{-3}{x} = \frac{2}{8}$

3. $\frac{0.1}{2} = \frac{0.5}{x}$

4. $\frac{9}{y+1} = \frac{18}{54}$

5. $\frac{a-8}{12} = \frac{15}{3}$

6. $\frac{3+y}{4} = \frac{-y}{8}$

Solving For a Specific Variable

Solve for Variables Sometimes you may want to solve an equation such as $V = \ell wh$ for one of its variables. For example, if you know the values of V, w, and h, then the equation $\ell = \frac{V}{wh}$ is more useful for finding the value of ℓ. If an equation that contains more than one variable is to be solved for a specific variable, use the properties of equality to isolate the specified variable on one side of the equation.

Example 1 **Solve $2x - 4y = 8$ for y.**

$$2x - 4y = 8$$
$$2x - 4y - 2x = 8 - 2x$$
$$-4y = 8 - 2x$$
$$\frac{-4y}{-4} = \frac{8 - 2x}{-4}$$
$$y = \frac{8 - 2x}{-4} \text{ or } \frac{2x - 8}{4}$$

The value of y is $\frac{2x - 8}{4}$.

Example 2 **Solve $3m - n = km - 8$ for m.**

$$3m - n = km - 8$$
$$3m - n - km = km - 8 - km$$
$$3m - n - km = -8$$
$$3m - n - km + n = -8 + n$$
$$3m - km = -8 + n$$
$$m(3 - k) = -8 + n$$
$$\frac{m(3 - k)}{3 - k} = \frac{-8 + n}{3 - k}$$
$$m = \frac{-8 + n}{3 - k}, \text{ or } \frac{n - 8}{3 - k}$$

The value of m is $\frac{n - 8}{3 - k}$. Since division by 0 is undefined, $3 - k \neq 0$, or $k \neq 3$.

Practice: Solve each equation or formula for the variable specified.

1. $15x + 1 = y$ for x

2. $x(4 - k) = p$ for k

3. $7x + 3y = m$ for y

4. $P = 2l + 2w$ for w

Solving Word Problems

Translate each word problem into an algebraic equation, using x for the unknown, and solve. Write a "**let x =**" for each unknown; write an equation; solve the equation; substitute the value for x into the let statements(s) to answer the question.

For Example:

Kara is going to Maui on vacation. She paid $325 for her plane ticket and is spending $125 each night for the hotel. How many nights can she stay in Maui if she has $1200?

Step 1: What are you asked to fine? Let variables represent what you are asked to find.

How many nights can Kara stay in Maui?

Let x = The number of nights Kara can stay in Maui

Step 2: Write an equation to represent the relationship in the problem.

$325 + 125x = 1200$

Step 3: Solve the equation for the unknown

$$
\begin{aligned}
325 + 125x &= 1200 \\
-325 \qquad &\quad -325 \\
125x &= 875 \\
x &= 7
\end{aligned}
$$

Kara can spend 7 nights in Maui

Practice: Write an algebraic equation to model each situation. Then solve the equation and answer the question.

1. A video store charges a one-time membership fee of $11.75 plus $1.50 per video rental. How many videos did Stewart rent if he spends $72.00?

2. Darel went to the mall and spent $41. He bought several t-shirts that ach cost $12 and he bought 1 pair of socks for $5. How many t-shirts did Darel buy?

3. Nick is 30 years less than 3 times Ray's age. If the sum of their ages is 74, how old are each of the men?

4. Three-fourths of the student body attended the pep-rally. If there were 1230 students at the pep rally, how many students are there in all?

5. Sarah drove 3 hours more than Michael on their trip to Texas. If the trip took 37 hours, how long did Sarah and Michael each drive?

6. Bicycle city makes custom bicycles. They charge $160 plus $80 for each day that it takes to build the bicycle. If you have $480 to spend on your new bicycle, how many days can it take Bicycle City to build the bike?

EXPONENTS

Exponents are used to write long multiplications in a short way. The exponent will tell you how many times the number or variable needs to be multiplied. In this case the variable is 'a'.

Examples: $(6)(6) = 6^2$ $a \cdot a \cdot a \cdot a = a^4$

In exponential notation, the number or variable being multiplied several times is called the **base**. The exponent, or number that tells you how many times you need to multiply, is called the **power**.

2^3 → 2 is the base, and 3 is the power

Exponents are mostly used when dealing with variables, or letters, since it is easier and simpler to write x^4 than $x \cdot x \cdot x \cdot x$. Also, letters are used for they represent an unknown number, and so, the term: *variable.*

There are a few rules used for simplifying exponents:

Zero Exponent Rule – Any number or letter raised to the zero power is always equal to 1.

Example: $3^0 = 1$ $a^0 = 1$

Product Rule – When multiplying the same base, the exponents are added together.

Example: $x^3 \cdot x^4$ ← Same base, *x*, add the exponents, 3 + 4 = 7

$x^3 \cdot x^4 = x^7$

Quotient Rule – When dividing the same base, subtract the exponents.

Example: $\frac{x^5}{x^2}$ ← Same base, *x*, subtract the exponents, 5 – 2 = 3

$\frac{x^5}{x^2} = x^3$

Power Rule – When the operation contains parentheses, multiply the exponent in the inside with the exponent on the outside.

Example: $(y^6)^2$ ← Multiply the exponents, $6 \times 2 = 12$

$(y^6)^2 = y^{12}$

When there is a fraction inside the parentheses, the exponent **multiplies on the current power of the** numerator and the denominator. However, this rule does not apply if you have a sum or difference within the parentheses; in that case a different rule will apply.

Examples: $\left(\frac{3}{4}\right)^2 = \frac{3^2}{4^2} = \frac{9}{16}$ $\left(\frac{x^3}{y^2}\right)^4 = \frac{(x^3)^4}{(y^2)^4} = \frac{x^{12}}{y^8}$

! Be careful: $\left(\frac{a+b}{c+d}\right)^2$ is not the same as $\frac{a^2+b^2}{c^2+d^2}$!

In fact: $\left(\frac{a+b}{c+d}\right)^2 = \left(\frac{a^2+2ab+b^2}{c^2+2cd+d^2}\right)$

Negative Signs – If the negative sign is outside the parentheses, perform the operations inside the parentheses and carry out the negative sign to the final answer.

Example: $-(3)^3 = -(3)(3)(3) = -(27) = -27$

However, if the negative sign is inside the parentheses, the negative sign will be affected by the exponent.

Example: $(-3)^3 = (-3)(-3)(-3) = -27$

If the negative sign is inside the parentheses and the exponent is an even number, the answer will be positive. If the exponent is an odd number, then the answer will be negative.

Examples: $-(2)^3 = -8$ ← Since the negative sign is outside the parentheses, carry it out to the final answer.

$(-5)^2 = (-5)(-5) = 25$ ← Since the negative sign is inside the parentheses, it needs to be carried out through the operation.

$(-4)^2 = (-4)(-4) = 16$ ← Even number of exponents, *positive answer.*

$(-4)^3 = (-4)(-4)(-4) = -64$ ← Odd number of exponents, *negative answer.*

Negative Exponents – Whenever the problem or the answer to the problem contains negative exponents, they need to be changed to positive. An answer with negative exponents will most likely be counted wrong. To change negative exponents into positive exponents, get the reciprocal fraction. In simpler words, if the negative exponent is on the top, move it down; if the negative exponent is on the bottom, move it up.

Examples: x^{-2} ← Get the reciprocal, or move the negative exponent down.

$$x^{-2} = \frac{x^{-2}}{1} = \frac{1}{x^2}$$

$5y^{-3}$ ← Get the reciprocal of only the base with the negative exponent, the number stays in its place.

$$5y^{-3} = \frac{5y^{-3}}{1} = \frac{5}{y^3}$$

$\frac{a^2}{b^{-4}}$ ← Get the reciprocal of the base with the negative exponent, the base with the positive exponent stays in its place.

$$\frac{a^2}{b^{-4}} = \frac{a^2 \cdot b^4}{1} = a^2 \cdot b^4$$

EXPONENTS – EXERCISES

Simplify:

1. $x^5 \cdot x^7$

2. x^0 (for $x \neq 0$)

3. $(a+b)^0$ (for $a+b \neq 0$)

4. 5^{-3}

5. $\dfrac{2^2}{2^3}$

6. $(3x)^2$

7. $\left(\dfrac{5}{2}\right)^{-2}$

8. $\left(\dfrac{5}{2}\right)^{2}$

9. $(x^3)^2$

10. $\dfrac{x^2 y}{xy}$

11. $(3^2)^{-2}$

12. $9 \cdot 9^2$

13. $-(a^2)^4$

14. $(-a^2)^4$

15. $\dfrac{c^7 \cdot c \cdot c^2}{c^5 \cdot c^2 \cdot c^3}$

16. $(a^2b^2c^2)^3(-ab)^4$

17. $(a^{-1})^{-1}$

18. $(4a^2b)^2(3a^2b^3)^3$

19. $\left(\dfrac{x^3}{x^2}\right)^{3}$

20. $\left(\dfrac{1}{k}\right)^{-2}$

21. $(a^2x^{-3})^2$

22. $\dfrac{(a^2x^{-3})^2}{(a^4b^{-1})^3}$

23. $(-1)^5$

24. $(-1)^9$

25. $\left(\dfrac{8}{27}\right)^{-\frac{2}{3}}$

Factoring Practice

I. Greatest Common Factor (GCF)

Find the GCF of the numbers.

18, 30
$18 = 2 \cdot 3 \cdot 3$
$30 = 2 \cdot 3 \cdot 5$
$2 \cdot 3 = 6$
6 = GCF

1. 12, 18
2. 10, 35
3. 8, 30
4. 16, 24
5. 28, 49
6. 27, 63
7. 30, 45
8. 48, 72

II. Greatest Common Monomial Factor

Factor, write prime if prime.

$$12a^3b + 15ab^3 = 3ab(4a^2 + 5b^2)$$

1. $6x + 3$
2. $24x^2 - 8x$
3. $6x - 12$
4. $2x^2 + 8x$
5. $4x + 10$
6. $10x^2 + 35x$
7. $10x^2y - 15xy^2$
8. $12x^2 - 9x + 15$
9. $3n^3 - 12n^2 - 30n$
10. $9m^2 - 4n + 12$
11. $2x^3 - 3x^2 + 5x$
12. $13m + 26m^2 - 39m^3$
13. $17x^2 + 34x + 51$
14. $18m^2n^4 - 12m^2n^3 + 24m^2n^2$

III. Factoring the Difference of Two Squares

$$a^2 - 36 = (a + 6)(a - 6)$$
$$3x^2 - 48 = 3(x^2 - 16) = 3(x + 4)(x - 4)$$

Factor, write prime if prime.

1. $x^2 - 1$
2. $x^2 - 9$
3. $x^2 + 4$
4. $x^2 - 25$
5. $9y^2 - 16$
6. $4x^2 - 25$
7. $9x^2 - 1$
8. $a^2 - x^2$
9. $25 - m^2$
10. $x^2 - 16y^2$
11. $25m^2 - n^2$
12. $-x^2 + 16$
13. $36m^2 - 121$
14. $2x^2 - 8$
15. $25 + 4x^2$
16. $4a^2 - 81b^2$
17. $12x^2 - 75$
18. $a^2b - b^3$
19. $-98 + 2x^2$
20. $5x^2 - 45y^2$
21. $9x^4 - 4$
22. $16x^4 - y^2$

IV. Factoring Perfect Square Trinomials

$$x^2 - 14x + 49 = (x-7)^2$$

Factor, write prime if prime.

1. $x^2 + 8x + 16$
2. $x^2 - 16x + 64$
3. $y^2 + 12y + 36$
4. $a^2 - 10a + 25$
5. $16y^2 + 8y + 1$
6. $9x^2 - 6x + 1$
7. $25x^2 + 10x + 1$
8. $n^2 - 14n + 49$
9. $81x^2 - 90x + 25$
10. $4y^2 - 20y + 25$
11. $25a^2 + 60a + 36$
12. $16 + 40x + 25x^2$
13. $16x^2 + 24x + 9$
14. $49x^2 - 14x + 1$
15. $9y^2 - 30y + 25$
16. $n^2 + 2n + 4$
17. $b^2 + 2b + 1$
18. $36x^2 + 84x + 49$
19. $81 - 18x + x^2$
20. $4 - 12y + 9y^2$

V. Special Factoring - Challenge

Factor, write prime if prime.

1. $a^2 - 36$
2. $9x^2 - 49$
3. $169m^2 - 4u^2$
4. $x^2y^2 - 9z^4$
5. $\frac{1}{4}x^2 - 25y^2$
6. $\frac{1}{9}x^2 - 16$
7. $64 - a^4b^4$
8. $y^6 - 100$
9. $\frac{4}{9}x^2y^2 - \frac{25}{36}z^2$
10. $y^8 - 81$
11. $1 - 8u + 16u^2$
12. $a^2b^2 + 6ab + 9$
13. $x^2 + 2xy + y^2$
14. $4x^2 + 12xy + 9y^2$
15. $100h^2 + 20h + 1$
16. $9a^2 - 24a + 16$
17. $4a^3 + 8a^2 + 4a$
18. $5c + 20c^2 + 20c^3$
19. $(x+4)^2 - (y+1)^2$
20. $(x-1)^2 - 10(x-1) + 25$

VI. Factoring Trinomials: $x^2 + bx + c$

$$x^2 + 7x + 10 = (x)^2 + (2+5)x + (2)(5) = (x+2)(x+5)$$

Factor, write prime if prime.

1. $x^2 + 6x + 8$
2. $c^2 + 5c + 6$
3. $y^2 - 9y + 14$
4. $x^2 - 10x + 16$
5. $a^2 + 12a + 27$
6. $x^2 - 14x + 24$
7. $x^2 - 15x + 36$
8. $y^2 + 21y + 54$
9. $m^2 + 13m - 36$
10. $x^2 - 8x + 15$
11. $y^2 - 4y - 32$
12. $x^2 - x - 6$
13. $y^2 + 3y - 18$
14. $b^2 + 7b - 18$
15. $a^2 + a - 56$
16. $c^2 - 4c - 12$
17. $x^2 - 9x - 36$
18. $y^2 + 4y - 21$
19. $x^2 - 22x - 75$
20. $x^2 - 3x - 40$
21. $45 + 14y + y^2$
22. $x^2 - 13x + 36$

VII. ...More Factoring Trinomials: $x^2 + bx + c$

$$k^2 - k - 20 = (k)^2 + (4 + -5)k + (4)(-5) = (k+4)(k-5)$$

Factor, write prime if prime.

1. $x^2 + 7x + 12$
2. $m^2 + 10m + 21$
3. $y^2 - 7y - 8$
4. $x^2 - 6x + 5$
5. $x^2 + 4x - 32$
6. $x^2 - 2x - 15$
7. $x^2 - 6x + 8$
8. $y^2 + 9y + 18$
9. $3 - 4t + t^2$
10. $v^2 + 12v + 20$
11. $51 - 20k + k^2$
12. $a^2 - 14ab + 24b^2$
13. $y^2 + 6y - 72$
14. $x^2 - 11xy - 60y^2$
15. $15r^2 + 2rs - s^2$
16. $3x^2 + 21xy - 54y^2$ (Hint: Check for GCF)
17. $x^2 - 5xy - 6y^2$
18. $x^2 + 8xy + 12y^2$
19. $y^2 - 7xy + 10x^2$
20. $a^2 - 11ab - 60b^2$

VIII. Factoring Trinomials: $ax^2 + bx + c$

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

Factor, write prime if prime.

1. $2x^2 - 5x - 3$
2. $3x^2 + 10x - 8$
3. $2y^2 + 15y + 7$
4. $7a^2 - 11a + 4$
5. $5n^2 + 17n + 6$
6. $4y^2 + 8y + 3$
7. $3x^2 + 4x - 7$
8. $2x^2 + 13x + 15$
9. $9y^2 + 6y - 8$
10. $6x^2 - 7x - 20$
11. $2n^2 - 3n - 14$
12. $5n^2 + 2n + 7$
13. $10x^2 + 13x - 30$
14. $12y^2 + 7y + 1$
15. $2n^2 + 9n - 5$
16. $2x^2 + 7x + 6$
17. $5a^2 - 42a - 27$
18. $15x^2 - 28x - 32$
19. $8a^2 - 10a + 3$
20. $2y^2 - 3y - 20$

IX. ...More Factoring Trinomials: $ax^2 + bx + c$

Factor, write prime if prime.

1. $3x^2 + 4x + x$
2. $5z^2 + 7z + 2$
3. $2n^2 - 11n + 5$
4. $3z^2 + z - 2$
5. $5h^2 - 2h - 7$
6. $8s^2 - 10st + 3t^2$
7. $6x^2 + 19x + 15$
8. $28a^2 + 5ab - 12b^2$
9. $2a^2 + 7ab - 15b^2$
10. $12x^2 + 17x + 6$
11. $4a^2 - 4ab - 5b^2$
12. $56y^2 + 15y - 56$
13. $12x^2 - 29xy + 14y^2$
14. $64x^2 + 32xy - 21y^2$
15. $16x^2 + 56xy + 49y^2$
16. $18x^2 - 57x + 35$

X. Factoring: Putting It All Together

$$5x^2 + 20x - 60 = 5(x^2 + 4x - 12) = 5(x + 6)(x - 2)$$

Factor Completely, write prime if prime.

1. $2x^2 - 8$
2. $2x^2 + 8x + 6$
3. $3n^2 + 9n - 30$
4. $6x^2 - 26x - 20$
5. $2x^2 + 12x - 80$
6. $5t^2 + 15t + 10$
7. $8n^2 - 18$
8. $14x^2 + 7x - 21$
9. $4x^2 + 16x + 16$
10. $18x + 12x^2 + 2x^3$
11. $2x - 2xy^2$
12. $3t^3 - 27t$
13. $24a^2 - 30a + 9$
14. $10x^2 + 15x - 10$
15. $3x^2 - 42x + 147$
16. $4x^4 - 4x^2$