Name: _____ Date: _____ Math 9/10 Honors

Lesson 0.3 – Introduction to Variables

Some quantities in life will vary with time and place, like the temperature outside, your age and your height, etc. In algebra, a **variable** is a symbol (usually a letter) that stands in for an unknown value. A variable is a quantity that can be changed and is not fixed. We usually use x and y as our variables, but we can use any letter. A number in front of a variable is called a **coefficient** and a number by itself is called a **constant.**

I. Evaluating Variable Expressions at a Given Value

1. Replace the variable with a number and evaluate:
   (a) $3x$, when $x = 2$. _____
   (b) $5y$, when $y = 7$. _____
   (c) $2z + 1$, when $z = 4$. _____
   (d) $2x - 3y$, when $x = 5$ and $y = 2$. _____
   (e) $4y + 2z$, when $y = 3$ and $z = 5$. _____
   (f) $3x^2 + 2x - 1$, when $x = 4$. _____
   (g) $3x + 2y$, when $x = 2$ and $y = 5$. _____
   (h) $4x - 3y$, when $x = 3$ and $y = 2$ _____
   (i) $5y^2 + 3y + 1$, when $y = 2$. _____

II. Modeling Situations with Variables

2. Write an equation for the given situation using a variable:
   (a) The sum of some number n and eight. _____
   (b) Four times some number x. _____
   (c) Five less than a number m. _____
   (d) The cost of a shirt is $20. If you buy n shirts, how much will you spend in total? _____
   (e) A car travels at a speed of 60 miles per hour. If it travels for t hours, how far will it go? _____
   (f) A rectangle has a length of 5 meters and a width of w meters. What is its area in terms of w? _____
   (g) If the price of a book is $15, and you buy x number of books, what will be the total cost? _____

III. Combining Like Terms – *2 apples + 3 apples = 5 apples.* *2x + 3x = 5x*

3. Simplify the following expressions by combining like terms:
   (a) $3x + 4x - 2x$ _____
   (b) $5y - 2y + 7y - 3y$ _____
   (c) $2a + 3b + 4a - 5b$ _____
   (d) $6x^2 + 3x^2 - 2x^2$ _____
   (e) $4y^3 - 2y^3 + y^3$ _____
   (f) $2x + 3y - x - 4y$ _____
   (g) $2a + 3b - 4a + 5b$ _____
   (h) $5x^2 - 2x^2 + 7x - 3x$ _____
   (i) $3y^3 - 2y^3 + 5y^2 - 3y^2 + y$ _____
   (j) $2a^{2b} + 3ab^2 - 4a^{2b} + 5ab^2$ _____
   (k) $3a^2 - 2b^2 + 5a^2 - 3b^2 + a - b$ _____

4. Simplify the following expressions by distributing and combining like terms.
   (a) $3(2x+4)$ _____
   (b) $4(3y-2)-2(2y+1)$ _____
   (c) $2x(x+3)+3(2x-1)$ _____
   (d) $3(x+2)-4(x-1)$ _____
   (e) $4(2a+3b)-2(3a-b)$ _____
   (f) $2(4x^2+3x)-3(2x^2-x)$ _____
   (g) $3(x+2)-2(x-3)+4(2x+1)$ _____
   (h) $2(a+3b)-3(2a-b)+4(3a+2b)$ _____
   (i) $3(x+2y)+2(x-y)$ _____
   (j) $4(2a-b)-2(3a+4b)+5(2a+3b)$ _____
   (k) $2(x+3y)-3(x-y)+4(2x+y)$ _____
   (l) $3(4x^2-2x)-2(3x^2+4x)+5(2x^2-x)$ _____
   (m) $4(3a+2b)-2(2a-3b)+3(4a-b)$ _____

5. Simplify the following rational expressions using property of exponents.
   (a) $\frac{18x^6}{27x^4}$ _____
   (b) $\frac{3x^2}{12x}$ _____
   (c) $\frac{10a^3b}{-15ab^3}$ _____
   (d) $\frac{36k^3m}{24k^4mn^5}$ _____
   (e) $\frac{12x^2}{9x^2y}$ _____
   (f) $\frac{42x^2}{-36x^3}$ _____
   (g) $\frac{16a^2b^3c^4}{20a^7b^2c^2}$ _____
   (h) $\frac{120x^3y}{25xy^5}$ _____
   (i) $\frac{-16x^2y^7}{12x^5y^3z^4}$ _____
   (j) $\frac{3x^2+6x}{2x}$ _____
   (k) $\frac{5y^3-10y^2+5y}{y^2}$ _____
   (l) $\frac{6x^2+9x}{3x}$ _____

6. Add or subtract the following rational expressions.
   (a) $\frac{9}{15x}+\frac{2}{15x}$ _____
   (b) $\frac{5x}{7}-\frac{2x}{7}$ _____
   (c) $\frac{4x}{2x+3}+\frac{7}{2x+3}$ _____
   (d) $\frac{2}{5x+9}+\frac{x}{5x+9}$ _____
   (e) $\frac{5}{8a}-\frac{2}{8a}$ _____
   (f) $\frac{7}{x-5}-\frac{4}{x-5}$ _____
   (g) $\frac{y}{y^2-9}+\frac{5}{y^2-9}$ _____
   (h) $\frac{8}{2x^2}+\frac{3}{2x^2}$ _____
   (i) $\frac{2}{x+1}+\frac{1}{x+1}$ _____
   (j) $\frac{x-1}{3x+4}+\frac{2x+9}{3x+4}$ _____
   (k) $\frac{5x}{3x^2}-\frac{4}{3x^2}$ _____
   (l) $\frac{7x+4}{x^2+3x+2}-\frac{3x-2}{x^2+3x+2}$ _____

7. Add or subtract these rational expressions. Show your common denominators.

(a) $\frac{5}{8}-\frac{3}{8x}$ _____

(b) $\frac{2}{4x+12}+\frac{7}{x+3}$ _____

(c) $\frac{5}{4x}+\frac{3}{2x}$ _____

(d) $\frac{5}{x}-\frac{2}{y}$ _____

(e) $\frac{1}{2x}+\frac{1}{3y}$ _____

(f) $\frac{2}{3x}+\frac{1}{3y}$ _____

(g) $\frac{2}{3x}-\frac{3}{4y}$ _____

(h) $\frac{7}{5x}-\frac{6}{7y}$ _____

(i) $\frac{3}{4x}+\frac{1}{6y}-\frac{5}{8x}$ _____

(j) $\frac{2}{3x}-\frac{4}{5y}+\frac{1}{2x}$ _____

(k) $\frac{4}{5x}-\frac{3}{4y}-\frac{2}{3x}+\frac{5}{6x}$ _____

(l) $\frac{1}{2x}+\frac{1}{3y}-\frac{5}{6x}-\frac{1}{4y}$ _____

(m) $\frac{3}{7x}-\frac{5}{12y}+\frac{2}{3x}-\frac{1}{4y}$ _____

(n) $\frac{2}{3x}+\frac{4}{5y}-\frac{7}{8x}-\frac{3}{4y}$ _____

8. Simplify the following expressions with only positive exponents.

(a) $(3a^2)^3$ _____

(b) $(3n^4)^4$ _____

(c) $(3x^4)^4$ _____

(d) $(6b^2)^2$ _____

(e) $(7y^4)^2$ _____

(f) $(3ab^4)^4$ _____

(g) $(2x^4y^4)^3$ _____

(h) $(5mn^3)^3$ _____

(i) $(x^2y^2)^2$ _____

(j) $(6yx^4)^2$ _____

(k) $(u^4v^3)^2$ _____

(l) $(2x^4y^4)^4$ _____

(m) $(3x^2\cdot 2x^2)^2$ _____

(n) $(2p^3\cdot 2p)^2$ _____

(o) $(4n^3\cdot n^2)^2$ _____

(p) $(3x\cdot 2x)^2$ _____

(q) $(4x^4\cdot x^4)^3$ _____

(r) $(4n^4\cdot n)^2$ _____

9. Rewrite the following expressions with positive exponents.

(a) a^{-3} _____

(b) x^2c^{-4} _____

(c) $\frac{1}{x^{-3}}$ _____

(d) $-4x^{-2}$ _____

(e) $a^{-3}c^0x^4$ _____

(f) $\frac{8c^{-2}}{d}$ _____

(g) $\frac{-10a^{-1}}{c^{-2}}$ _____

(h) $\frac{(-2)^0r^{-2}}{x^{-3}}$ _____

(i) $5^{-2}x^2$ _____

(j) $(-4)^2a^{-2}$ _____

(k) $\frac{(-2)^{-3}a^4}{b^{-2}}$ _____

(l) $\frac{x^4b^{-1}}{3^{-2}a^2}$ _____

(m) $\frac{4^{-2}x^2c^{-3}}{5^{-2}b^{-2}}$ _____

(n) $\frac{(-2)^{-3}a^{-4}c}{4^{-2}xe^{-3}}$ _____

10. Simplify the following expressions with positive exponents in the final answer.

(a) $\frac{(3a^4b^2)(6ab^3)}{9a^3b^4}$ _____

(b) $\frac{(4m^4n^2)(6m^2n^4)}{-3m^6n^6}$ _____

(c) $\frac{(-9x^3y^6)(8x^7y^4)}{(2x^3y^3)(-6x^3y)}$ _____

(d) $\frac{(-7a^2b^4)(4a^3b^5)}{(-2ab^2)^3}$ _____

(e) $\frac{(2xy^2)^3(3x^5y^4)}{4x^2y^5}$ _____

(f) $\frac{(-3p^2q^5)(-4pq^3)^2}{8p^4q^4}$ _____

(g) $\frac{(-5x^4y^5)^2(2xy^2)^3}{(10x^3y^8)^2}$ _____

11. Simplify the following monomial radical expressions:

(a) $\sqrt{16x^2}$ _____

(b) $\sqrt{25y^4}$ _____

(c) $\sqrt{4a^4}$ _____

(d) $\sqrt{36x^3}$ _____

(e) $\sqrt{49y^2z^4}$ _____

(f) $\sqrt{16x^3y^4}$ _____

(g) $\sqrt{25a^2b^4c^6}$ _____

(h) $\sqrt{9x^4y^6}$ _____