Sect 11.1 – Properties of Real Numbers

Objective a: Algebraic Expressions

In Algebra, when there is a number that we do not know its value, we represent the number using a letter like x. Such letters are called variables. So, if we want to write three times an unknown number, we write 3•x or 3x. This is referred to as an expression.

A **Variable** is a letter that represents a number.

An **Expression** is combination of operations with numbers and letters.

Discuss what each expression means:

Ex. 1 $3x - 7yz$

Solution:
The variables are x, y and z.
The expression means to multiply three and the number for x minus seven times the number for y times the number for z.

Ex. 2 $-4x + 9y - t$

Solution:
The variables are x, y and t.
The expression means to multiply negative four and the number for x plus nine times the number for y minus the number for t.

Write an expression for each of the following:

Ex. 3 The voltage across a circuit is equal to the product of 0.15 and the resistance R. Write an expression for the voltage in terms of R.

Solution:
Since the voltage is the product of 0.15 and R, then our expression is: Voltage = 0.15R

Ex. 4 A concrete mix is to be made of 1 part cement, 2 parts water, 2 parts aggregate, and 3 parts sand. If p represents the amount in one part, write an expression for each component in terms of p.

Solution:
1 part cement: cement = 1p = p
2 parts water: water = 2p
2 parts aggregate: aggregate = 2p
3 parts sand: sand = 3p

Ex. 5 The inheritance I from an estate is to be divided evenly among seven people. Write an expression for each person's share in terms of I.

Solution:

The inheritance is to be divided evenly among 7 people:

Each Share = $I \div 7$

Ex. 6 The length of a certain rectangle is nine feet less than double the width w. Write an expression for the length in terms of w.

Solution:

Double the width means: $2w$

Nine feet less than means: -7

So, the length = $2w - 7$

Ex. 7 Katz's Katering Service expects that one fifth of the salad makings (m) ordered will be lost due to spoilage. Write an expression for the amount of salad making that will not be lost to spoilage in terms of m.

Solution:

if $\frac{1}{5}$ will be lost, then $1 - \frac{1}{5} = \frac{5}{5} - \frac{1}{5} = \frac{4}{5}$ will not be lost.

Thus, the amount of salad makings not lost = $\frac{4}{5}m$

Objective b: Evaluating expressions.

To find the value of an expression when the values of the variables are given, we first write each value of the variables in parenthesis. Next, we replace each variable with the given value for that variable in parenthesis. Finally, we follow the order of operations to find the value of the expression.

Use the given values below to find the value of each expression:

Ex. 8 $-7x + 4y$

$x = -3$ & $y = 4$

Solution:

$-7x + 4y = -7\boldsymbol{(-3)} + 4\boldsymbol{(4)}$

$= 21 + 4(4)$

$= 21 + 16$

$= 37$

Ex. 9 $-m - 8r$

$m = -0.6$ & $r = 0.08$

Solution:

$-m - 8r$

$= -\boldsymbol{(-0.6)} - 8\boldsymbol{(0.08)}$

$= 0.6 - 0.64$

$= 0.6 + (-0.64) = -0.04$

Ex. 10 $\frac{2}{3}T - \frac{3}{7}y + Q$

$T = \frac{3}{28}$, $y = \frac{3}{5}$, & $Q = \frac{5}{21}$

Solution:

$\frac{2}{3}T - \frac{3}{7}y + Q$

$= \frac{2}{3}\left(\frac{3}{28}\right) - \frac{3}{7}\left(\frac{3}{5}\right) + \left(\frac{5}{21}\right)$

$= \frac{1}{1}\left(\frac{1}{14}\right) - \frac{3}{7}\left(\frac{3}{5}\right) + \left(\frac{5}{21}\right)$

$= \frac{1}{14} - \frac{9}{35} + \frac{5}{21}$

The L.C.D. = 210

$= \frac{1\bullet 15}{14\bullet 15} + \left(-\frac{9\bullet 6}{35\bullet 6}\right) + \frac{5\bullet 10}{21\bullet 10}$

$= \frac{15}{210} + \left(-\frac{54}{210}\right) + \frac{50}{210}$

$= -\frac{39}{210} + \frac{50}{210}$

$= \frac{11}{210}$

Ex. 11 $\frac{\frac{4}{9}}{x} - y^2 - w$

$x = -\frac{12}{7}$, $y = -3$, & $w = -7$

Solution:

$\frac{\frac{4}{9}}{x} - y^2 - w$

$= \frac{\frac{4}{9}}{\left(-\frac{12}{7}\right)} - (-3)^2 - (-7)$

$= \frac{4}{9} \div \left(-\frac{12}{7}\right) - (9) - (-7)$

$= \frac{4}{9}\bullet\left(-\frac{7}{12}\right) - (9) - (-7)$

$= \frac{1}{9}\bullet\left(-\frac{7}{3}\right) - (9) - (-7)$

$= -\frac{7}{27} - (9) - (-7)$

$= -\frac{7}{27} + \left(-\frac{9}{1}\right) + \frac{7}{1}$

$= -\frac{7}{27} + \left(-\frac{9\bullet 27}{1\bullet 27}\right) + \frac{7\bullet 27}{1\bullet 27}$

$= -\frac{7}{27} + \left(-\frac{243}{27}\right) + \frac{189}{27}$

$= -\frac{250}{27} + \frac{189}{27} = -\frac{61}{27}$

Evaluate each formula using the given values:

Ex. 12 $A = p + prt$

$p = \$550$, $r = 0.08$, & $t = 0.75$

Solution:

$A = p + prt$

$A = (550) + (550)(0.08)(0.75)$

$A = 550 + 33 = \$583$

$A = \$583$

Ex. 13 $F = \frac{9}{5}C + 32$; $C = -25$

Solution:

$F = \frac{9}{5}C + 32$

$F = \frac{9}{5}(-25) + 32$

$F = \frac{9}{5}\left(-\frac{25}{1}\right) + 32$

$F = \frac{9}{1}\left(-\frac{5}{1}\right) + 32$

$F = -45 + 32 = -13^\circ F$