CHAPTER 2 - NUMBER EXPRESSIONS

2.1 ORDER OF OPERATIONS (BEDMAS)

Centuries ago, it was decided by mathematicians from all over the world that all nations must follow the same rules when calculating number questions. This was decided so that all answers for the same questions from different countries would be the same. The rules, or **ORDER OF OPERATIONS** that these mathematicians decided to follow are as follows:

1. Do the calculations appearing in the **parentheses** first.
2. Do any calculations that involve **exponents** next.
3. Calculate the **multiplication** and **division** next.
4. Do the **addition** and **subtraction** last.

One method we use to remember the order in which we do mathematical operations is to use the acronym (first letter of each word) **BEDMAS** as shown in the chart below.

B	E	D	M	A	S
BRACKETS	EXPONENTS	DIVIDE	MULTIPLY	ADD	SUBTRACT

The examples below show the procedure followed solving questions involving multiple operations.

1. If **addition** and **subtraction** occur in the same expression, perform the operations in the order in which they occur.

EXAMPLE: $\underline{11 + 4} - 5 + 2$
$\underline{15 - 5} + 2$
$10 + 2 = 12$

2. If **multiplication** and **addition** or **subtraction** occur together, perform the operation of multiplication first.

EXAMPLE: $16 + \underline{3 \times 4} - \underline{2 \times 3} + 3$
$\underline{16 + 12} - 6 + 3$
$\underline{28 - 6} + 3$
$22 + 3 = 25$

3. If **division** and **addition** or **subtraction** occur together, perform the operation of division first.

EXAMPLE: $9 + \underline{16 \div 4} - 2$
$\underline{9 + 4} - 2$
$13 - 2 = 11$

4. If **multiplication, division, addition** or **subtraction** occur together, first perform the multiplication and division in the order they occur and then perform the **addition** and **subtraction.**

EXAMPLE: $\underline{6 \times 4} \div 8 + 5$
$\underline{24 \div 8} + 5$
$3 + 5 = 8$

5. If **brackets** occur in a number expression, perform whatever operation is enclosed in the brackets first, then follow the rules above.

EXAMPLE: $12 \div \underline{(9 - 5)} \times 2$
$\underline{12 \div 4} \times 2$
$3 \times 2 = 6$

6. If a **line** such as we use in division or fractions occurs in a number expression, evaluate the numerator (top part) and the denominator (bottom part) before dividing.

EXAMPLE: $\dfrac{7 \times 4 + 2}{2 + 3 \div 3} = \dfrac{30}{3} = 10$

A. Calculate each of the following using the rules for order of operations.

1. $19 + 7 - 6 + 10$
2. $36 \div (3 \times 3) + 4$
3. $36 \div 12 + 15 - 8$
4. $23 + 15 - 9 \times 3$
5. $144 \div 12 \times 3$
6. $8 - 4 - 2 + 6$
7. $(6 - 5) \times 15 - 2$
8. $18 - 2 \times 9 + 15$
9. $25 + 37 - 8 - 15$
10. $7 \times (9 - 5) + 6$
11. $3 + 0 \times 5 + 14$
12. $46 \times 2 - 15 \times 2$
13. $6 \times 5 \div 2 \times 5$
14. $5 + 6 + 17 - 3$
15. $(60 - 6) \div 2$
16. $49 \div (11 - 4)$
17. $28 \div 4 + 3 \times 8 - 6$
18. $7 + 96 \div 3$
19. $100 \div 4 - 25$
20. $93 - 3 \times 30 - 3$
21. $3 \times (2 + 7) - 3$
22. $15 + 21 \div 3 - 3$
23. $19 + 36 - 15 \times 3$
24. $19 \times (6 - 6)$
25. $(9 \times 7) - (7 \times 9)$
26. $39 \div (10 + 3) - 3$
27. $16 \div 4 \times 3 - 5$
28. $9 \div 3 \times 3 + 1$
29. $(27 \div 3) \times 6$
30. $5 \times 4 \div 2$
31. $48 \div (6 - 2) - 8$
32. $36 \div 6 \times 2 + 4$
33. $30 \div 15 \times 8 + 10$
34. $5 + 3 \times 2 - 6$
35. $15 - 3 \times 4 + 3 \times 1$
36. $5 + 3 \times 2 - 4$
37. $10 + 3 \times 14 - 6$
38. $64 \div (16 \div 2)$
39. $8 \times 9 - 15 \div 5$
40. $49 + 8 \div 8 + 49$
41. $6 \times 3 + 5 \times 6$
42. $7 - 2 + 18 - 3$
43. $12 + 35 - 30 \div 6$
44. $8 - 3 + 3 - 8$
45. $56 \div 8 \times 4 \div 2$
46. $10 - 1 + 10 - 1$
47. $(4 + 14) \div (18 \div 2)$
48. $63 \div (7 - 4) + 99$

B. Calculate each of the following,

1. $\frac{7 + 8 + 9}{5 + 2 + 5}$

2. $\frac{20 + 4 - 8}{12 - 4}$

3. $\frac{37 - 15 + 8}{16 + 9 - 15}$

4. $\frac{5 \times 4 + 4}{3 \times 3 - 3}$

5. $\frac{50 \div 2 + 15}{4 + 32 \div 2}$

6. $\frac{(6 + 4) \times (3 + 2)}{(3 + 2) \times (4 + 1)}$

7. $\frac{17 - 9 + 4}{(20 + 8) \div 7}$

8. $\frac{9 + 24}{17 - 2 \times 3}$

9. $\frac{4 \times (6 - 3) \div 6}{(19 - 5) \div 7}$

10. $\frac{15 - 2 \times 3}{3 \times 3}$

11. $\frac{58 - 18 - 40}{7 \times 6 + 4}$

12. $\frac{48 + 5 - 19}{2 \times 8 + 1}$

13. $\frac{3 \times (15 - 3)}{6 \times (11 - 8)}$

14. $\frac{12 \times (7 + 5)}{64 \div (7 + 1)}$

15. $\frac{43 \times (3 - 1) + 6}{6 + 43 \times (3 - 1)}$

16. $\frac{24 - (6 + 3)}{3 \times (10 \div 2)}$

17. $\frac{59 - (2 + 26) - 10}{14 + 2 \times 7 - 21}$

18. $\frac{5 \times 9 \div 3 + 17}{64 - (18 + 14)}$

19. $\frac{100 - 10 - 10 - 10}{40 + 10 + 10 + 10}$

20. $\frac{(153 - 100) \times 2}{7 \times 7 + 4}$

21. $\frac{11 + 2 \div (5 - 4)}{35 \div 7 - 4}$

22. $\frac{18 + 9 \times 3 + 15}{27 - 28 \div 4}$

23. $\frac{(21 + 19) \times (15 - 13)}{(8 - 6) \times (27 - 23)}$

24. $\frac{14 + 7 - 9 \times 2}{(15 - 6) \div (14 - 11)}$

25. $\frac{2 \times 9 - 5 + 8 \div 4}{6 \times 5 \div 10}$

26. $\frac{63 \div 7 \times 7}{21 \div 3 \times 3}$

27. $\frac{16 \times (4 \div 4)}{16 \div (4 \div 4)}$

28. $\frac{16 \times 4 \times 4}{16 \div 4 \times 4}$

29. $\frac{14 \times (9 \div 3) + 12}{18 \div (26 - 24)}$

30. $\frac{44 \div (2 \times 5 + 1)}{38 \div (16 + 3)}$

2.2 SUBSTITUTION (SINGLE SYMBOL)

We can use symbols in an expression to take the place of a number and the result (answer) of the expression will depend upon what number we substitute for the symbol. Once we have substituted for the symbol, we use the rules of order of operations (**BEDMAS**) to calculate the value of the expression as shown in the examples below.

EXAMPLE #1

Evaluate the expression below if $\square = 6$

$3 + \square \times 9$

$3 + \mathbf{6} \times 9$

$3 + 54 = 57$

EXAMPLE #2

Evaluate the expression below if $\square = 7$

$3 + \square \times 9$

$3 + 7 \times 9$

$3 + 63 = 66$

A. Evaluate each expression by substitution.

1. $\square + 3 + \square$, if $\square = 2$

2. $6 \times 3 \times \square \times \square$, if $\square = 3$

3. $5 \times \square - 4$, if $\square = 5$

4. $7 - \square + 15$, if $\square = 4$

5. $8 \times \square - 9 + 3$, if $\square = 3$

6. $(\square \div 3) \times (\square \div 4)$, if $\square = 12$

7. $17 + \square - 2 \times \square$, if $\square = 10$

8. $2 \times \square + 8 \times \square$, if $\square = 8$

9. $3 \times \square + \square \div 4$, if $\square = 16$

10. $\square + 9 - \square$, if $\square = 9$

11. $(3 - \square) \times (\square + 3)$, if $\square = 0$

12. $12 + (\square - 12)$, if $\square = 25$

13. $\dfrac{3 \times \square}{\square - 4}$, if $\square = 7$

14. $\dfrac{\square + 9 + 2 \times \square}{6 \times \square}$, if $\square = 3$

15. $\dfrac{2 \times \square - (\square + 6)}{14 + \square}$, if $\square = 6$

16. $\dfrac{4 + 2 \times \square}{3 \times \square + 1}$, if $\square = 3$

17. $\dfrac{\square - \square + \square}{\square}$, if $\square = 9$

18. $\dfrac{6 + 4 \times \square}{\square + 2}$, if $\square = 0$

19. $\dfrac{\square \times \square \times \square}{\square - 2}$, if $\square = 6$

20. $\dfrac{\square \times \square \times 4}{2 \times \square}$, if $\square = 2$

B. For each question below find the number that makes each sentence correct.

1. $\square + 5 = 12$
2. $\square \times \square = 9$
3. $\square + 12 = 2 \times \square$
4. $\square + \square = 3 \times \square$
5. $2 \times \square - \square = 7$
6. $(\square \times \square) + 5 = 30$
7. $16 + \square + \square = 32$
8. $5 + \square \times 3 = 26$
9. $5 \times \square - \square = 0$
10. $4 \times \square + 3 \times \square = 42$

C. List the set of numbers that makes each sentence correct.

1. $\square < 5$
2. $14 < \square$
3. $5 \times \square = 18$
4. $\square$ is a three digit number
5. $4 \times \square < 12$
6. $\square$ can divide into 15
7. $\square + 18 = 30$
8. $\square > 7$
9. $4 + 7 + \square < 15$
10. $\square > 10$ but < 17

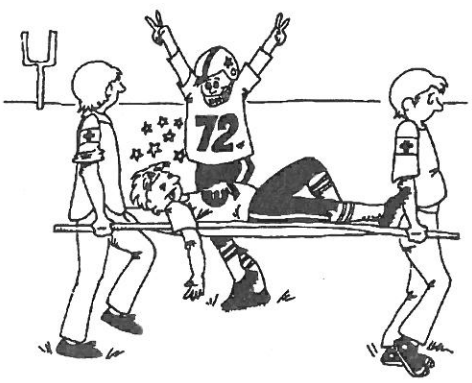
2.3 SUBSTITUTION (DOUBLE SYMBOLS)

Often in mathematics you will be asked to evaluate expressions in which two symbols are used instead of only one. Here, you must take special care to substitute the right variable for the appropriate symbol before you use the order of operations rules (**BEDMAS**). The examples below shows how this substitution is done.

EXAMPLE #1

Evaluate the expression below if $\square = 5$, and $\Diamond = 7$

$3 \times \square + 4 \times \Diamond$
$3 \times \mathbf{5} + 4 \times \mathbf{7}$
$15 + 28 = 43$



EXAMPLE #2

Evaluate the expression below if $\square = 0$, and $\Diamond = 10$

$\Diamond \div 2 - \square \div 8 + \Diamond \times 3$
$\mathbf{10} \div 2 - \mathbf{0} \div 8 + \mathbf{10} \times 3$
$5 - 0 + 30 = 35$

A. Evaluate each of the following by substitution.

1. $\square - \diamond$, if $\square = 5$ and $\diamond = 2$

2. $\square \times \diamond$, if $\square = 7$ and $\diamond = 12$

3. $\diamond + \square - 6$, if $\square = 8$ and $\diamond = 12$

4. $(2 \times \diamond) - (3 \times \square)$, if $\square = 4$ and $\diamond = 11$

5. $2 \times \square + 2 \times \diamond$, if $\square = 10$ and $\diamond = 3$

6. $(\square \div 4) \times (9 - \diamond)$, if $\square = 16$ and $\diamond = 5$

7. $\square \times \diamond - 16$, if $\square = 4$ and $\diamond = 9$

8. $\square \times (\diamond - 2)$, if $\square = 7$ and $\diamond = 6$

9. $\square \times (\diamond - 5)$, if $\square = 8$ and $\diamond = 11$

10. $48 \div (2 \times \square) + \diamond$, if $\square = 6$ and $\diamond = 3$

11. $(5 + \diamond) \times \square$, if $\square = 9$ and $\diamond = 5$

12. $2 + \square + 9 - \diamond$, if $\square = 4$ and $\diamond = 5$

13. $\dfrac{\square + \diamond}{3 + \diamond}$, if $\square = 9$ and $\diamond = 3$

14. $\dfrac{2 \times \square - 3 \times \diamond}{\square - (\diamond + 2)}$, if $\square = 8$ and $\diamond = 5$

15. $\dfrac{\square + \diamond}{\square - \diamond}$, if $\square = 12$ and $\diamond = 6$

16. $\dfrac{12 \times (\square - \diamond)}{\diamond + 9}$, if $\square = 11$ and $\diamond = 7$

17. $\dfrac{\square + 3 \times \diamond}{\diamond}$, if $\square = 4$ and $\diamond = 4$

18. $\dfrac{5 \times \square - 3 \times \diamond}{4 \times (\square - 1)}$, if $\square = 5$ and $\diamond = 3$

19. $\dfrac{\square + \diamond + 2}{\diamond}$, if $\square = 4$ and $\diamond = 2$

20. $\dfrac{\square \times \diamond}{\diamond \times \square}$, if $\square = 5$ and $\diamond = 35$

21. $\dfrac{3 \times \square + 2 \times \diamond}{\diamond}$, if $\square = 7$ and $\diamond = 3$

22. $\dfrac{\diamond + \diamond + \diamond - \square}{\square}$, if $\diamond = 6$ and $\square = 3$

B. For each question below, find the numbers or sets of numbers that will make each statement correct.

1. $\square - \diamond = 7$

2. $3 \times \square + 4 \times \diamond = 24$

3. $\square + \diamond = 8$

4. $2 \times \diamond + \diamond = 13$

5. $2 \times \diamond - 3 \times \diamond = 1$

6. $2 \times \diamond + 3 \times \diamond = 6$

7. $\square + \diamond = 7 + \square$

8. $\diamond = 3 \times \square$

9. $3 \times \diamond = 5 + \square$

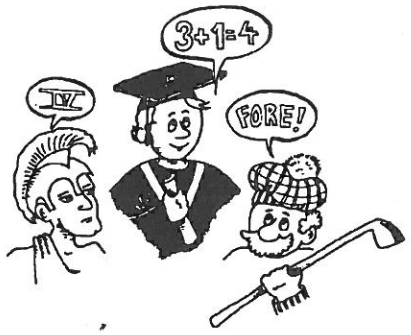
10. $(\square + \diamond) \div 2 = 2$

2.4 ALGEBRAIC SUBSTITUTION

As you progress through mathematics, algebra will become a more important part of your math studies. Letters will be used as replacements for numbers more and more often instead of symbols as we just finished doing.

Because an 'x' and a times sign (×) look almost exactly the same, we have attempted to eliminate the times sign when we write any algebraic expression. We use **brackets, dots,** or in some cases **nothing at all** between numbers and letters or both to indicate multiplication as shown in the examples below.

1. **3x** → means *three times x*
2. **xy** → means *x times y*
3. **(5)(z)** → means *five times z*
4. **a • b** → means *a times b*



When evaluating algebraic expressions, substitute numbers for the letters and then use the rules for order of operations (**BEDMAS**) to calculate each.

EXAMPLE #1

Evaluate 5ab, if a = 4 and b = 6

$$\begin{aligned} 5ab &= 5(4)(6) \\ &= 120 \end{aligned}$$

EXAMPLE # 2

Evaluate 3k + 7z, if k = 5 and z = 4

$$\begin{aligned} 3k + 7z &= 3(5) + 7(4) \\ &= 15 + 28 \\ &= 43 \end{aligned}$$

A. Evaluate each of the following by substituting the given number for each variable (letter).

1. x + 5 + x, if x = 4
2. (2x) + (5 - x), if x = 3
3. (a)(a) - (2)(a), if a = 5
4. (b + 5) ÷ (b - 5), if b = 6
5. m - (m - 4) - m, if m = 4
6. (z)(z) + (z ÷ 4), if z = 8
7. (y - 15) ÷ (y ÷ 4), if y = 20
8. 2(z - 9) + 7, if z = 10
9. m + m + 2m, if m = 2
10. (m)(m) - 2m, if m = 2
11. a - 3 + 2, if a = 7
12. (2n - 3 × 5) ÷ (n ÷ 3), if n = 15
13. p + 2p - 3p, if p = 4
14. 4g - g ÷ 5, if g = 30
15. 2q - (5 - q) - 4, if q = 4
16. (a)(a) - a + (a)(a), if a = 2
17. (3 + b) ÷ (12 - b), if b = 9
18. p - (p ÷ 3), if p = 3
19. (2y - 2y) ÷ y, if y = 3
20. (2d + 9 - d) ÷ (d + 1), if d = 3

B. Evaluate each of the following by substituting the given numbers for each variable.

1. $x + a + x + a$, if $x = 4$ and $a = 1$

2. $3bc$, if $b = 3$ and $c = 5$

3. $2x - 3z$, if $x = 7$ and $z = 1$

4. $(3)(m)(m) + n$, if $m = 3$ and $n = 4$

5. $w + 3z - 2w$, if $w = 5$ and $z = 6$

6. $2k + 3(m)(m) - 5$, if $k = 10$ and $m = 1$

7. $5(z)(z) - 15p$, if $z = 3$ and $p = 3$

8. $\frac{2y + y}{2xy + 4}$, if $x = 0$ and $y = 4$

9. $\frac{(x)(x) + b + b}{x + b + b}$, if $x = 4$ and $b = 1$

10. $3(s)(s) - 2r + 1$, if $s = 3$ and $r = 2$

11. $(x + 2z) - (2x + z)$, if $x = 2$ and $z = 5$

12. $23c - 4n$, if $c = 2$ and $n = 1$

13. $\frac{5(p)(p) + 2g - 3}{2p + g + 1}$, if $p = g = 2$

14. $\frac{a + b}{a - b} + \frac{2a + 2b}{2b + 2}$, if $a = 5$ and $b = 3$

15. $\frac{20m + 2mn}{4n + 1}$, if $m = 2$ and $n = 3$

16. $\frac{p + g - (p - g)}{2g}$, if $g = 4$ and $p = 5$

17. $5z^2 + y - 6$, if $y = 6$ and $z = 1$

18. $4 + 2ab + b^2$, if $a = 5$ and $b = 0$

19. $\frac{3z + 2y^2 + 1}{2z + 1}$, if $z = 7$ and $y = 2$

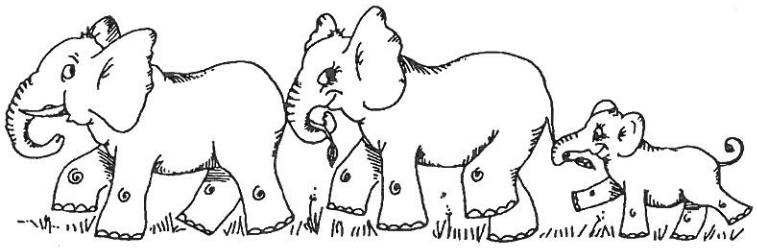
20. $\frac{a - b}{a} + \frac{a + b}{a}$, if $a = 5$ and $b = 5$

2.5 SEQUENCES AND FUNCTIONS

In mathematics we will often see long lists of numbers that have a certain order or pattern such as 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, and we call this a **sequence.**

To shorten the amount of writing that is required when we write a sequence, we often use three dots '• • •' to take the place of the part of the sequence that is left out. We can write the above sequence as 2, 4, 6, • • •, 26, 28.

If the three dots occur at the end of a sequence, this means *and so on*, making what we call an **infinite sequence,** which means that the sequence goes on forever. The set of **whole numbers** is an example of this: **W = 0, 1, 2, 3, 4, 5, • • •.**



A. Fill in the missing numbers for the following sequences.

1. 5, 6, 7, • • •, 11, 12, 13 _____
2. 3, 6, 9, • • •, 24, 27, 30 _____
3. 2, 4, 8, 16, 32, • • •, 256 _____
4. 14, 13, 12, • • •, 7, 6, 5 _____
5. 2, 3, 5, 8, 12, 17, • • •, 57 _____
6. 5, 5, 6, 6, 7, 7, • • •, 10 _____
7. 1, 2, 2, 3, 3, 3, • • •, 6 _____
8. 2, 3, 2, 4, 2, 5, • • •, 11 _____
9. 6, 10, 14, 18, • • •, 38 _____
10. 36, 35, 33, 30, • • •, 0 _____

B. What are the numbers that come next in these sequences.

1. 7, 8, 9, 10, • • •
2. 12, 10, 8, • • •
3. 14, 17, 20, • • •
4. 5, 10, 20, 40, • • •
5. 3, 9, 27, 81, • • •
6. 1, 2, 3, 5, 8, • • •
7. 4, 5, 6, 5, 6, 7, 6 • • •
8. 7, 11, 7, 22, 7, 44, 7, • • •
9. 3, 3, 6, 9, 15, 24, • • •
10. 1, 5, 2, 10, 3, 15, 4, • • •

A **function** is very similar to an algebraic substitution question. Only in this case we substitute different numbers for the same variable (letter) more than once. The example below shows how this is done.

EXAMPLE: Complete the function table below for the function $y = x + 8$

x	y = x + 8
0	_____
1	_____
2	_____
4	_____
7	_____

STEP # 1 *(substitution)*

x	y = x + 8
0	0 + 8
1	1 + 8
2	2 + 8
4	4 + 8
7	7 + 8

STEP # 2 *(final result)*

x	y = x + 8
0	8
1	9
2	10
4	12
7	15

A. Complete the function tables below according to the given function.

1.

x	y = x + 2
1	3
2	
3	
4	
5	

2.

x	y = x ÷ 4
8	
12	3
16	
24	
32	

3.

x	y = 2x + 4
1	6
2	
3	
4	
5	

4.

x	y = 2x
3	
4	8
5	
6	
7	

5.

x	y = x - 3
	4
	5
	6
	7
	8

6.

x	y = 3x
2	
3	
4	
5	
6	

B. Find the function that the sequence was made from and complete the function table.

1.

x	y = x - ?
1	0
2	
3	
4	
5	
6	

2.

x	y = ?
2	
3	12
4	13
5	
6	
7	

3.

x	y = x + ?
0	
3	5
5	
7	
9	
	11

4.

x	y = ?x
2	
4	8
6	
8	
10	
12	

5.

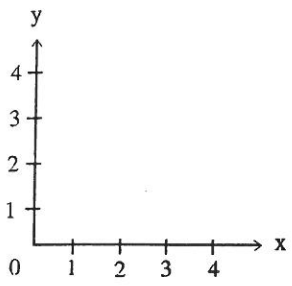
x	y = ?
2	10
	35
16	80
	65
1	
4	

6.

x	y = x ÷ ?
15	
20	
	7
40	8
60	
	9

2.6 GRAPHING ALGEBRAIC FUNCTIONS

We can graphically represent all mathematical functions. The procedure we follow is to first complete a **function table**, and then convert the values on the table to **ordered pairs** or **coordinates**.



The **'x'** value is always our first number and the **'y'** value is always our second number in our ordered pair.

The next step is to draw a horizontal number line and label this the **'x' - axis**, and also draw a vertical number line and call this the **'y' - axis** as shown on the left. We then take our ordered pairs and **plot** them on our set of axis and connect the points.

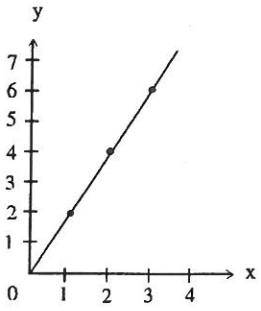
The example below shows the steps we follow when graphing a function.

Function → **Completed Table** → **Coordinates** → **Graph**

x	y = 2x
0	
1	
2	
3	

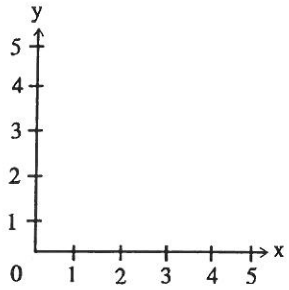
x	y = 2x
0	0
1	2
2	4
3	6

(x,y)
(0,0)
(1,2)
(2,4)
(3,6)



A. Plot the following ordered pairs on the given grid (set of axis).

1. (4,2)
2. (1,3)
3. (0,3)
4. (1,4)
5. (5,0)
6. (4,5)
7. (3,2)
8. (3,5)
9. (1,2)
10. (0,0)



B. Plot and join the following points in the order they appear using straight line segments.

(0,14) (11,3) Lift pencil (5,15) (6,14) (7,11) (10,8) (11,6) (12,5) (11,3) (11,2) (12,1) (12,2) (13,1) (13,2) (14,3) Lift pencil (13,2) (14,1) (15,2) (16,3) (21,3) Lift pencil (12,6) (16,4) (21,3) Lift pencil (16,6) (19,6) Lift pencil (19,7) (22,9) Lift pencil (21,10) (23,12) Lift pencil (24,11) (22,7) (22,5) (21,3) (21,1) (22,2) Lift pencil (23,4) (22,3) (23,1) (24,3) (25,3) Lift pencil (26,6) (25,5) (25,2) (27,4) (32,7) Lift pencil (26,3) (32,3) Lift pencil (29,14) (28,12) (32,6) (32,9) (29,14) (30,15) (32,11) (32,9) Lift pencil (32,11) (33,9) (32,16) (31,19) (29,23) (30,19) (30,15) Lift pencil (6,14) (11,12) (16,16) (17,20) (17,28) (19,30) Lift pencil (17,20) (18,18) (21,15) (28,12) (29,23) (22,30) (20,31) (17,32) (16,33) (13,34) (12,36) (9,33) Lift pencil (11,35) (8,35) (6,34) (3,32) (2,33) (1,35) (0,32) (1,29) (0,28) (1,21) (1,19) (3,16) (6,15) (7,14) (8,14) (10,15) (10,16) (7,20) (5,22) (5,20) Lift pencil (10,16) (13,16) (15,18) (16,20) (16,23) (14,27) (12,29) (10,30) (9,30) (6,27) (5,23) (4,24) (3,28) Lift pencil (1,30) (2,29) (3,26) (2,26) (1,24) (2,22) (3,19) (4,18) (5,19) (5,18) (7,17) (8,18) Lift pencil (5,18) (6,18) (7,19) (7,20) (5,19) Lift pencil (3,26) (4,23) (3,22) (2,23) (2,24) (3,24) (4,23) Lift pencil (6,27) (8,27) (9,26) (10,23) (9,21) (8,21) (7,22) (6,25) (7,26) (9,26) Lift pencil (7,23) (8,22) (9,22) (9,23) (8,24) (7,23) Lift pencil (13,32) (13,34) Lift pencil

C. Complete the following function charts and draw a graph of each.

1.

x	y = 2x
0	
1	
2	
3	
4	

2.

x	y = 3x - 1
1	
2	
3	
4	
5	

3.

x	y = 2x + 5
0	
1	
2	
3	
4	

4.

x	y = x + 6
0	
1	
2	
3	
4	

5.

x	y = 3x - 2x
0	
1	
2	
3	
4	

6.

x	y = 8x + 2
0	
1	
2	
3	
4	

2.7 NUMBER EXPRESSIONS REVIEW

A. Evaluate each of the following.

1. $4 \times (9 - 5) + 16 \div 4$
2. $(n + 2n) \div n$, if $n = 5$
3. $(8 - 2) \times (4 + 3) \times (5 - 1)$
4. $2m + 4m^2 + 5 - 15$, if $m = 2$
5. $(49 \div 7) \times (56 \div 8)$
6. $xy + 3x - 2y$, if $x = 4$, $y = 5$
7. $\dfrac{13 - 2 \times 6 + 4}{28 \div 7 - 3}$
8. $\dfrac{z(w - 4)}{w}$, if $w = 4$ and $z = 6$
9. $3x + 2x$, if $x = 4$
10. $(3a - b)(a + 3b)$, if $a = 2$, $b = 3$
11. $\dfrac{(4 + 9) \times 2}{28 \div 7 - 3}$
12. $\dfrac{mn + m^2 + n^2}{n}$, if $m = 2$, $n = 1$
13. $2x - x + (x + 5)$, if $x = 12$
14. $x^2 + 2y$, if $x = 3$, $y = 4$

B. Evaluate each by substitution.

1. $x + 2y$, if $x = 1$, $y = 4$
2. $(p)(q)(p)(q)$, if $p = 3$, $q = 4$
3. $y^2 - y + 6$, if $y = 4$
4. $(6 \div q) \div (8 \div r)$, if $q = 3$, $r = 4$
5. $y + z - 6 + 2z$, if $y = 4$, $z = 2$
6. $3w - z$, if $w = z = 8$
7. $mn - 3n$, if $m = 5$, $n = 2$
8. $2p - 3q + p$, if $p = 5$, $q = 2$
9. $\dfrac{m + n}{m - n}$, if $m = 6$, $n = 4$
10. $5a - ab + 7$, if $a = 5$, $b = 3$

C. Evaluate each using the order of operations rules (BEDMAS).

1. $\frac{4 + 6}{2 \times 5} + \frac{3 \times 7 + 9}{3 \times 5} - \frac{6 \times 4}{4 \times 3}$

2. $\frac{2 + 6 \div 3 + 19 + 2}{17 - (6 + 9) + 3} - \frac{32 + 8}{5 + 3}$

3. $\frac{16 \times (19 - 15)}{24 \div (7 - 4)} + \frac{49 \div (14 \div 2)}{15 - (2 + 6)}$

4. $\frac{2 \times 19}{2 \times 8 + 3} + \frac{14 - 5}{(3 - 2) \times 3} + \frac{35 + 19}{3 \times 9}$

5. $\frac{3 \times 17}{21 \div 7} - \frac{6 + 9 \div 3 \times 2}{72 \div (4 + 8)}$

6. $\frac{32 + (2 \times 14)}{3 \times 2 \times (20 \div 2)} + \frac{7 \times 9 - 4 \times 5}{2 \times 11 + 3 \times 7}$

7. $\frac{129 - 3 + 14}{5 \times 7 \times 2} - \frac{108 - 7 \times 9}{60 - 3 \times 5}$

8. $\frac{6 + 14}{2 + 8} - \frac{7 + 15}{11 + 11} + \frac{6 \times 9}{108 \div 2} - \frac{7 \times 7}{98 \div 2}$

9. $\frac{(14 + 9) - (6 + 7)}{105 \div (15 + 6)} + \frac{37 + 3}{20}$

10. $\frac{101}{(2 \times 50) + 1} + \frac{(6 - 2) \times (5 - 3)}{(9 - 7) \times (21 - 19)}$

D. Solve each of the following problems.

1. Find the average of 4260, 3524, 3856 and 1496.

2. A theatre has 45 seats in each of its 56 rows on the main floor and 30 seats in each of its 34 rows in the balcony. What is the seating capacity of this theatre?

3. Howard needs a new battery and four new tires. If the battery costs $68 and each new tire costs $98, how much will Howard spend if he buys the battery and the four tires?

E. Insert the appropriate brackets to make each statement correct.

1. $7 \times 9 - 5 + 6 = 34$

2. $7 + 16 - 3 \div 39 - 9 - 10 = 1$

3. $44 \div 2 \times 5 + 1 = 4$

4. $4 \times 9 \div 3 + 12 = 24$

5. $5 - 2 \times 1 + 4 \div 6 = 4$

F. Fill in the missing numbers to complete the following sequences.

1. 2, 6, 4, 12, 6, 18, 8, • • •, 36 _____

2. 12, 24, 48, 96, • • •, 384 _____

3. 13, 26, 39, • • •, 117 _____

4. 6, 12, 18, • • •, 42 _____

5. 14, 28, 42, • • •, 98 _____

G. Name the three numbers that should come next in sequences below.

1. 7, 8, 7, 9, 7, 10, 7, • • •
2. 10, 1, 9, 2, 8, 3, • • •
3. 8, 3, 8, 6, 8, 9, 8, • • •
4. 25, 26, 24, 27, 23, 28, • • •
5. 1, 3, 2, 6, 3, 9, 4, • • •
6. 1, 4, 9, 16, 25, • • •

H. Complete each function table below.

1.

x	y = 2x
0	
1	
2	
3	
6	
12	
19	

2.

x	y = 9 - x
1	
7	
4	
6	
9	
0	
3	

3.

x	y = 3x + 2
2	
3	
4	
7	
9	

4.

x	y = 2x + ?
1	8
2	10
3	12
4	
5	

I. Draw a graph of the function y = 12 - 2x in the space provided below.

CHAPTER 4 - EQUATIONS USING WHOLE NUMBERS

4.1 SOLVING TYPE I EQUATIONS

When solving **Type I** equations algebraically, we use the opposite operation that is shown to determine what value our **variable** (letter) has. Addition is the opposite operation of subtraction, and multiplication is the opposite operation of division. There are 4 kinds of Type I equations that we will be solving and the examples below show how each type is solved.

TYPE 1 (ADDITION)

$x + 7 = 9$
$x = 9 - 7$
$x = 2$

TYPE 1 (SUBTRACTION)

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

TYPE 1 (MULTIPLICATION)

$7x = 35$
$\frac{7x}{7} = \frac{35}{7}$
$x = 5$

TYPE 1 (DIVISION)

$\frac{x}{3} = 8$
$x = 24$

(Note that in each case above we removed the number beside the letter by using the opposite operation. But when we have a division type question we do a special type of opposite operation called **cross-multiplication** *as the arrows indicate.)*

A. Solve the following showing all steps.

1. $x + 6 = 7$
2. $x - 8 = 12$
3. $3x = 24$
4. $9 + x = 16$
5. $\frac{x}{8} = 21$
6. $7x = 56$
7. $8x = 176$
8. $x + 6 = 53$
9. $x - 15 = 2$
10. $\frac{x}{15} = 2$
11. $12x = 144$
12. $x - 18 = 30$
13. $18x = 72$
14. $6 + x = 6$
15. $\frac{x}{9} = 10$
16. $x + 8 = 12$
17. $x + 12 = 12$
18. $5 + x = 30$
19. $6x = 354$
20. $\frac{x}{7} = 3$
21. $35x = 140$
22. $x + 9 = 13$
23. $x - 9 = 36$
24. $x - 5 = 17$
25. $\frac{x}{9} = 0$
26. $x - 3 = 158$
27. $x + 7 = 42$
28. $x - 9 = 6$

B. Extra Practice. Solve the following.

1. $n + 7 = 17$	2. $6n = 30$	3. $x - 59 = 93$	4. $\frac{x}{5} = 24$
5. $n - 9 = 8$	6. $2n = 8$	7. $x + 23 = 67$	8. $\frac{x}{9} = 8$
9. $n - 5 = 6$	10. $4n = 28$	11. $x - 7 = 11$	12. $\frac{x}{8} = 12$
13. $n + 3 = 8$	14. $\frac{n}{5} = 11$	15. $x + 9 = 17$	16. $\frac{x}{7} = 13$
17. $n + 12 = 19$	18. $8x = 56$	19. $a + 7 = 9$	20. $27x = 81$
21. $n - 5 = 9$	22. $\frac{x}{3} = 8$	23. $n + 20 = 39$	24. $\frac{n}{7} = 7$
25. $x - 3 = 16$	26. $15x = 60$	27. $n - 6 = 7$	28. $\frac{x}{9} = 7$
29. $x + 3 = 37$	30. $24x = 96$	31. $x - 8 = 15$	32. $11x = 77$
33. $x - 1 = 12$	34. $6x = 96$	35. $n + 3 = 15$	36. $\frac{n}{2} = 9$
37. $x + 1 = 11$	38. $3x = 51$	39. $\frac{n}{6} = 12$	40. $n + 3 = 15$

4.2 SOLVING TYPE II EQUATIONS

When solving a **Type II** equation, you will be required to complete two opposite operations. Always do the opposite of any addition or subtraction first, then proceeed to do the inverse operation of any multiplication or division, as shown in the examples below.

EXAMPLE #1

$5x - 7 = 8$
$5x = 8 + 7$
$5x = 15$
$\frac{5x}{5} = \frac{15}{5}$
$x = 3$

EXAMPLE #2

$\frac{x}{8} + 3 = 12$
$\frac{x}{8} = 12 - 3$
$\frac{x}{8} = \frac{9}{1}$
$x = 72$

A. Solve the following.

1. $3x + 5 = 35$
2. $7x - 6 = 15$
3. $\frac{x}{4} + 2 = 7$
4. $6x - 3 = 45$
5. $\frac{x}{6} - 3 = 6$
6. $2x + 4 = 8$
7. $9x - 3 = 60$
8. $\frac{x}{4} + 5 = 11$
9. $4x - 10 = 30$
10. $\frac{x}{3} - 2 = 8$
11. $6x - 3 = 15$
12. $\frac{x}{3} - 5 = 1$
13. $7x - 3 = 25$
14. $\frac{x}{7} - 2 = 4$
15. $6x + 2 = 14$
16. $12x + 12 = 156$
17. $\frac{x}{5} - 2 = 10$
18. $6x - 4 = 14$
19. $\frac{x}{3} + 2 = 3$
20. $4x + 7 = 95$
21. $6x + 3 = 33$

B. Extra Practice. Solve the following.

1. $5a + 6 = 16$
2. $3x + 1 = 16$
3. $2y + 4 = 10$
4. $4x + 5 = 17$
5. $\frac{x}{6} - 3 = 8$
6. $7x + 5 = 26$
7. $4x - 3 = 17$
8. $\frac{x}{2} + 5 = 9$
9. $5x + 2 = 17$
10. $3x - 8 = 1$
11. $6x + 2 = 44$
12. $\frac{x}{2} - 5 = 7$
13. $8x + 5 = 29$
14. $14x - 38 = 116$
15. $15x + 20 = 95$
16. $7z - 22 = 27$
17. $\frac{x}{5} + 6 = 9$
18. $8x + 2 = 26$
19. $12n - 11 = 133$
20. $4n + 8 = 36$
21. $25x + 14 = 139$
22. $9x + 2 = 65$
23. $2x + 5 = 9$
24. $1x - 5 = 9$
25. $\frac{x}{2} + 9 = 10$
26. $3x + 6 = 15$
27. $20x - 7 = 73$
28. $6x - 25 = 29$
29. $\frac{x}{3} - 8 = 2$
30. $6x + 2 = 2$
31. $\frac{x}{6} + 5 = 12$
32. $3x - 5 = 1$
33. $6x + 6 = 6$
34. $x - 8 = 7$
35. $\frac{x}{7} + 3 = 8$
36. $7x - 5 = 23$
37. $9x + 5 = 32$
38. $14x - 3 = 25$
39. $2x - 5 = 19$

4.3 SOLVING TYPE III EQUATIONS

When you are solving a **Type III** equation, you will first be required to collect and place all the **variables** (letters) on the left side of the equal sign or equation, and all the **constants** (numbers) on the right side of the equal sign or equation.

If an '*x*' term is on the right side of the equal sign, bring it over to the left side by using the inverse (opposite) sign. Likewise if a number is being added or subtracted on the left side of an equation, bring it over to the right side by using the inverse (opposite) sign as shown in the two examples below.

EXAMPLE #1

$$\begin{aligned} 4x - 3 &= 2x + 13 \\ 4x - \mathbf{2x} &= 13 + \mathbf{3} \\ 2x &= 16 \\ \frac{2x}{2} &= \frac{16}{2} \\ x &= 8 \end{aligned}$$

EXAMPLE #2

$$\begin{aligned} 3x + 5x + 7 - 4x &= 19 + 1x \\ 3x + 5x - 4x - \mathbf{1x} &= 19 - \mathbf{7} \\ 3x &= 12 \\ \frac{3x}{3} &= \frac{12}{3} \\ x &= 4 \end{aligned}$$

A. Solve the following.

1. $7x + 2 = 5x + 8$
2. $6x + 4x + 2x = 48$
3. $4x + 5x = 81$
4. $3x - 4 = 2x + 9$
5. $7x - 8 = 3x + 4$
6. $2x + 5x = 21$
7. $7x - 3x + 2x = 36$
8. $6x + 2x = 48$
9. $10x - 3 = 5x + 7$
10. $4x - 7 = 3x + 9$
11. $7x - 8 = 2x + 12$
12. $4x - 3x + 5x = 96$
13. $2x + 3x + 4x = 72$
14. $5x + 2 = 3x + 18$
15. $7x - 9 = 3x + 31$
16. $4x - 8 = 3x + 5$
17. $4x - 3x + 2x = 51$
18. $5x + 6 = 3x + 14$
19. $3x - 5 = 2x + 7$
20. $9x + 2 = 5x + 30$
21. $6x + 5x - 2x = 63$
22. $4x + 3x = 7$
23. $5x + 2 = 3x + 2$
24. $8x - 5 = 7x + 10$

B. Extra Practice. Solve the following.

1. $6x + 5 = 2x + 13$
2. $10x + 75 - 5x = 110$
3. $4x + 3 + 5x - 2 = 64$
4. $4x + 2 = 3x + 8$
5. $6x - 4 = 2x + 100$
6. $4x - 3 = 29$
7. $5x + 7 = 3x + 9$
8. $9x - 3 = 4x + 22$
9. $8x - 3 = 2x + 9$
10. $35x - 10 = 32x + 20$
11. $18x + 3 = 2x + 51$
12. $4x - 3 = 2x + 9$
13. $8x - 5 = 3x + 5$
14. $9x - 4 = 2x + 10$
15. $7x - 5 = 3x + 11$
16. $6x + 5 = 2x + 13$
17. $3x - 5 + 2x = 75$
18. $4x + 5x - 8x = 10$
19. $7x - 2 = 3x + 10$
20. $6x - 3 = 2x + 5$
21. $16x + 2 = x + 32$
22. $x + x + x + 3 = 15$
23. $7x + 8 - 2x = 23$
24. $7x + 2x - 3x + 5 = 47$
25. $6x + 11 + 5x = 66$
26. $7x + 4 - 5x = 30$
27. $8x + 5 + 3x + 2 = 95$
28. $6x - 3 = 4x + 9$
29. $9x - 8 = 3x + 4$
30. $4x - 3x + 5x - 7 = 11$

4.4 SOLVING TYPE IV EQUATIONS

Identification of a **Type IV** equation is quite simple because these equations contain one or more sets of brackets. Since brackets mean multiplication in mathematics, solving a Type IV equation requires you to first multiply everything on the inside of the set of brackets by the number on the outside of the brackets. The rest of the procedure is the same as if you had a Type II or Type III equation. The examples below show the steps in the procedure.

EXAMPLE #1

$$\begin{aligned} 3(x + 7) &= 39 \\ 3x + 21 &= 39 \\ 3x &= 39 - 21 \\ 3x &= 18 \\ \frac{3x}{3} &= \frac{18}{3} \\ x &= 6 \end{aligned}$$

EXAMPLE #2

$$\begin{aligned} 4(2x - 5) &= 2(3x + 6) \\ 8x - 20 &= 6x + 12 \\ 8x - 6x &= 12 + 20 \\ 2x &= 32 \\ \frac{2x}{2} &= \frac{32}{2} \\ x &= 16 \end{aligned}$$

A. Solve the following.

1. $3(x + 2) = 12$
2. $4(x + 5) = 300$
3. $4(x - 3) = 20$
4. $3(x + 5) = 2(x + 9)$
5. $4(x + 3) = 2(x + 8)$
6. $7(x - 3) = 3(2x + 6)$
7. $6(x - 5) = 30$
8. $4(2x - 3) = 28$
9. $6(5x - 3) = 2(2x + 4)$
10. $4x - 2 = 3(x + 1)$
11. $3(x + 5) = 2(x + 10)$
12. $7(x) - 5 = 2(x + 10)$
13. $3(x - 5) = 2(x + 6)$
14. $7(x - 3) = 5(x + 5)$
15. $3(x - 5) = 2(x + 3)$
16. $2(x + 4) + 5(x + 3) = 100$
17. $4(2x + 2) = 5(x + 7)$
18. $5(3x - 2) = 4(x + 14)$
19. $8(x + 2) = 6(x + 3)$
20. $3(x + 5) + 2(x - 4) = 27$

B. Extra Practice. Solve the following.

1. $4(x + 1) = 12$
2. $5(x + 2) = 30$
3. $7(x - 2) = 21$
4. $5(x - 3) = 4(x + 6)$
5. $3(x + 7) + 2(x - 5) = 36$
6. $4(x + 5) + 2(x - 3) = 20$
7. $4(x + 5) = 3(x + 12)$
8. $2(x - 9) = x + 10$
9. $3(x - 5) = 2(x + 6)$
10. $9(x - 2) = 6(x + 2)$
11. $4(x + 5) + 2(x - 6) = 62$
12. $3(x + 2) = x + 8$
13. $7(2x + 5) = 3(4x + 19)$
14. $(x + 5) = 7$
15. $3(x - 6) = 12$
16. $3(5x - 2) = 9$
17. $2(x + 6) = x + 12$
18. $7(6x + 2) = 7(3x + 5)$
19. $5(x - 6) = 2(x + 3)$
20. $7(x + 3) = 3(x + 7)$
21. $6(x + 3) + 5(x + 3) = 88$
22. $2(x + 5) + 3(x + 6) = 53$
23. $2(x + 2) = (x + 5)$
24. $5(3x + 6) + 2(x + 3) = 70$
25. $x + 5 + 2(x + 3) = 20$
26. $10(x + 2) = 9(x + 6)$

4.5 SOLVING RATIO TYPE EQUATIONS

A **Ratio Type** equation is classified as one in which there are two *'fractions'*, one on either side of the equal sign. To solve these equations we first have to use the procedure known as **cross-multiplication**. Here we multiply either the top left of the equation by the bottom right of the equation or we multiply the top right of the equation by the bottom left of the equation. We place one result on the right side of the equation and the other result on the left side of the equation. We then proceed as we would in a Type II, III or IV question as shown in the examples below.

EXAMPLE #1

$$\frac{x}{6} = \frac{3}{2}$$
$$2(x) = 6(3)$$
$$2x = 18$$
$$\frac{2x}{2} = \frac{18}{2}$$
$$x = 9$$

EXAMPLE #2

$$\frac{3x + 5}{4} = \frac{7}{2}$$
$$2(3x + 5) = 4(7)$$
$$6x + 10 = 28$$
$$6x = 28 - 10$$
$$6x = 18$$
$$\frac{6x}{6} = \frac{18}{6}$$
$$x = 3$$

A. Solve the following.

1. $\frac{x}{2} = \frac{10}{4}$

2. $\frac{x}{6} = \frac{5}{3}$

3. $\frac{4}{x} = \frac{9}{36}$

4. $\frac{x}{7} = \frac{12}{14}$

5. $\frac{6}{x} = \frac{9}{12}$

6. $\frac{9}{10} = \frac{90}{x}$

7. $\frac{4}{3} = \frac{72}{x}$

8. $\frac{x + 12}{3} = \frac{5 + x}{2}$

9. $\frac{3x - 6}{6} = \frac{2x + 3}{5}$

10. $\frac{4x + 6}{2} = \frac{7x + 30}{5}$

11. $\frac{3x + 5}{2} = \frac{7x + 5}{3}$

12. $\frac{3(x - 2)}{4} = \frac{2(x + 3)}{4}$

13. $\frac{12(x + 5)}{2} = \frac{3(x + 20)}{1}$

14. $\frac{5(x + 2)}{3} = \frac{9(x - 2)}{5}$

15. $\frac{6(x + 2)}{4} = \frac{8(x + 1)}{5}$

16. $\frac{3x}{3} = \frac{60}{15}$

17. $\frac{4(x + 2)}{4} = \frac{2(x - 4)}{1}$

18. $\frac{7x - 3}{5} = \frac{5x + 3}{4}$

19. $\frac{7x}{2} = \frac{x}{12}$

20. $\frac{3 + x}{6} = \frac{x - 5}{3}$

4.6 EQUATIONS REVIEW (TYPES I - II - III - IV - RATIO)

A. Solve the following.

1. $\frac{6x}{3} = \frac{5x}{2}$
2. $7x - 3 = 18$
3. $6(3x - 5) = 4(4x + 10)$
4. $2x - 3 = 15$
5. $7x - 8 = 5x + 12$
6. $4x + 2 = 10$
7. $\frac{5}{7} = \frac{x}{7}$
8. $5(2x + 3) = 7(x + 3)$
9. $\frac{x}{3} + 4 = 9$
10. $5x + 3 = 19 + 3x$
11. $x + 6 = 10$
12. $\frac{4x}{3} = \frac{8}{6}$
13. $6x - 2 = 3x + 10$
14. $\frac{x}{6} = \frac{24}{36}$
15. $5(3x - 4) = 7(2x + 6)$
16. $3x - 5 = 7$
17. $\frac{x}{7} - 8 = 10$
18. $15x - 4 = 3x + 8$
19. $\frac{x}{4} = 9$
20. $4x + 50 = 1x + 80$
21. $2(4x + 6) = 3(6 + 2x)$
22. $7x + 45 = 2x + 90$
23. $3x + 20 = 50$
24. $\frac{7(3x + 9)}{2} = \frac{6(2x + 31)}{4}$
25. $x - 142 = 10$
26. $16x + 2 = 9x + 51$
27. $2(4x + 8) = 128$

B. Extra Practice. Solve the following.

1. $\frac{x}{5} - 3 = 8$
2. $10y - 8 = 5y + 62$
3. $2x - 18 = 54$
4. $\frac{x}{7} = \frac{8}{4}$
5. $3(2x + 5) = 5(x + 20)$
6. $\frac{x - 6}{3} = \frac{2x + 4}{8}$
7. $x + 3 = 3$
8. $18x + 18 = 9x + 36$
9. $2x - 7 = 1x + 9$
10. $4x + 8 = 16$
11. $\frac{x + 1}{1} = \frac{5(2x + 3)}{11}$
12. $8(x - 2) = 5(x + 1)$
13. $3x + 2x - 4x + 5x = 18$
14. $\frac{x}{7} - 10 = 21$
15. $\frac{8}{10} = \frac{36}{x}$
16. $4(2x - 8) = 3(2x + 6)$
17. $12x + 8 = 7x + 48$
18. $\frac{3(2x + 5)}{12} = \frac{75}{4}$
19. $\frac{3}{m} = \frac{9}{12}$
20. $2a + 3 = 15$
21. $3x - 8 = 10$
22. $\frac{y}{5} + 8 = 20$
23. $4x = 1000$
24. $3x + 2x = 5$
25. $\frac{2(3x - 9)}{1} = \frac{5(x + 8)}{1}$
26. $17x - 15x + 26 = 30 - 2$

CHAPTER 5 - TRANSLATION

5.1 - MATHEMATICS ← → ENGLISH

Learning the language of mathematics is the same as learning a whole new language complete with nouns, verbs, adjectives, adverbs, phrases, sentences, etc. and all the rules for grammar.

A list of some of the symbols, phrases and sentences that you will be using are listed below to assist you in translating from English to mathematics and vice versa.

MATHEMATICS	ENGLISH EQUIVALENT
+	plus, add, increase, greater than, larger, augment
–	subtract, minus, negative, decrease, less than, reduce, diminish
×	times, of, multiply
÷	divided, goes into, a certain number of parts
=	equal, equal to, is, results in, gives you, makes
x, a, q, t, p, y, z, n, d, g, m, etc.	a number, an age, a quantity, a mass, a volume, a certain amount, etc.
3y	three times a number, a number tripled
x + 2	a number increased by two, two larger than a number, etc.
z – 5	a number decreased by five, five less than a number, a number reduced by five, etc.
4x + 3 = 8	Four times a number plus three equals eight.
(x)(x)	a number times itself, a number squared

A. Write English phrases for the following mathematical phrases.

1. x + 6

2. 6 + b

3. 5n

4. 5n + 2

5. (2y)(12)

6. 5 – m

7. 12 – 2p

8. 6 + x + 3x

9. $\frac{a}{5}$ + 6

10. 15 – q + 19

B. Write English phrases for the following mathematical expressions or sentences.

1. $3x - 2 = 10$
2. $4(n)$
3. $n + 16 = 32$
4. $5 - 2n = 15$
5. $3x - 2$
6. $2x - 7 = 3$
7. $n + 5$
8. $5 + n$
9. $x - 7$
10. $7 - x$

C. Write a mathematical phrase or sentence for each of the following. (DO NOT SOLVE)

1. Sixteen is added to a number _____
2. A certain number increased by eight _____
3. A number doubled _____
4. A number increased by nine is equal to twelve _____
5. The sum of fourteen and a number is twenty-eight _____
6. Fifteen reduced by a number _____
7. A number subtracted from fifty-four is forty _____
8. The difference between a number and twenty-four is eleven _____
9. Twelve is added to twice a certain number _____
10. A number tripled _____
11. A number divided by three is equal to seven _____
12. If you decrease a number by nine, the result is thirteen _____
13. A certain number less five, is two _____
14. Eighteen greater than a number will be twenty-six _____
15. A number plus twice the same number is twenty-four _____
16. A certain number is tripled when fourteen is added _____
17. A number tripled is diminished by six _____
18. If an unknown number is divided by eight, the quotient is six _____
19. A number diminished by seven is twenty-five _____
20. The product of seven and a number is thirty-five _____
21. One half of an unknown number is increased by nine _____
22. Three times a number equals the number increased by four _____
23. Three times a number less six is twelve _____
24. Five more than a number is seven less than four times a number _____

5.2 SOLVING NUMBER PROBLEMS

When we solve a problem that involves looking for a specific number and we use an equation to do this, we usually use four steps. The steps and an example are shown below.

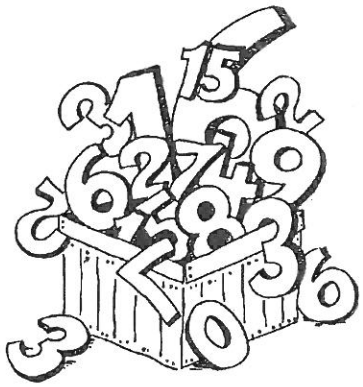
1. Identify what you are looking for and give it a name. (Usually 'x')
2. Translate the English sentence into a mathematical sentence. (An equation)
3. Solve the equation that you created.
4. Answer the question with a final statement.

EXAMPLE: Six times a number increased by four is equal to thirty-four. What is the number?

Let x equal the unknown number.

$$6x + 4 = 34$$
$$6x = 34 - 4$$
$$6x = 30$$
$$\frac{6x}{6} = \frac{30}{6}$$
$$x = 5$$

$\therefore$ the number is equal to 5.



A. Solve the following problems and **show all steps.**

1. A number increased by fourteen is equal to seventy-seven. What is the number?

2. A number diminished by nine is equal to nineteen. What is the number?

3. Eleven times a number is four thousand nine hundred sixty-one. What is the number?

4. Twice a certain number decreased by seven is equal to forty-three. What is the number?

5. A number divided by four is equal to fifty-two. What is the number?

6. The sum of eight times a number and fourteen is equal to seventy-eight. What is the number?

7. Nine plus the product of an unknown number and four is sixty-nine. What is the number?

8. The sum of eighteen and a number times three is forty-two. What is the number?

B. Extra Practice. Solve the following.

1. If you multiply a number by four and add eight to the product, the result is twenty. What is the number?

2. A number is equal to the product of eleven and twelve, increased by twenty-one. What is the number?

3. A certain number doubled, increased by nine, is twenty-one. What is the number?

4. Twenty-six, increased by what number, will result in forty-eight?

5. Twice a number decreased by fourteen is thirty. What is the number?

6. If you divide a number by three and subtract four from the quotient, the result is two. Find this number.

7. Three numbers are $2x$, $x + 1$ and $x + 2$. Their sum is thirty-one. Find the three numbers.

8. Three times a certain number equals the number increased by four. What is the number?

9. One-half of a number plus two is fourteen. What is the number?

10. If a number is divided by eight and seven is added to the quotient, the result is fifteen. What is the number?

5.3 SOLVING VARIOUS TYPES OF PROBLEMS

To solve most problems mathematical in nature, we can use the same approach that we used when we solved number problems. **(4 step method)**

1. Identify what you are looking for.
2. Write an equation.
3. Solve the equation.
4. Answer the question.

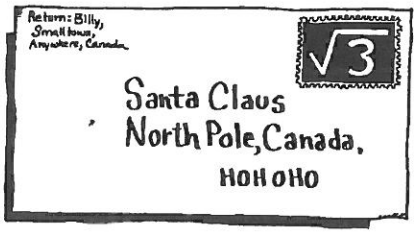
The example below shows how the 4 step method is used when solving a mathematical problem.

EXAMPLE: Mark Enderly is a philatelist (a collector of stamps). Last June at a cost of $35 per stamp, he purchased twelve stamps. How much did the stamps cost?

Let x = the total cost of the stamps.

$x = (35)(12)$
$x = 420$

∴ Mark paid $420 for the stamps.



A. Solve the following problems.

1. The average amount of snow Halifax receives every winter is 210 cm. If by mid-January, 125 cm of snow has already fallen, how much more snow can the people of Halifax expect this winter?

2. Stephen ran a distance of 135 km in fifteen days. What is the average number of kilometres he ran per day?

3. When Jim was born he was 63 cm tall. Two years later he was 82 cm tall. How many centimetres has he grown?

4. Harold purchased three VCR tapes for $8 each. The sales tax and the GST amounted to $4. How much change did he get back if he gave the clerk a $50 bill?

5. Of the three prairie provinces (Alberta, Saskatchewan and Manitoba), Manitoba produces a total of 3 200 000 t of wheat per year. Alberta produces twice this amount and Saskatchewan produces twice as much as Alberta does. How many tonnes of wheat does the province of Saskatchewan produce each year?

6. Jessica needed sixteen more candy canes than she already had to give to her friends as Christmas presents. After she bought these candy canes, she had thirty-five. How many did she have to start with?

7. In the 1981 Canadian census, it was found that the population of the North-West Territories was 45 740. The population was comprised of 16 090 men (18 years of age and older), 16 980 women (18 years of age and older), 5970 boys and a number of girls. How many girls lived in the NWT in 1981?

B. Extra practice. Solve the following.

1. The Ortegas started out with 812 kg of beef in their butcher shop. At the end of the day they still had 318 kg of beef left. How much beef did they sell this particular day?

2. Clark has $530 in his wallet. If he has nine, twenty dollar bills, and twenty-nine, ten dollar bills, and the rest are five dollar bills, how many five dollar bills does he have?

3. Darlene caught four salmon having a total mass of 56 kilograms. What was the average mass of each fish?

4. Mathew had a $20 bill. After buying two hamburgers at $3 each, three orders of fries at $1 each and four beverages at $1 each, how much money does he have left?

5. Mr. Lee is planting rose bushes around his garden. The perimeter (distance around) of his garden is 46 metres. How many rose bushes will he need if he plants three rose bushes every metre?

6. The Mackenzie-Peace River in Canada is 4241 kilometres long. The Nile River in Africa is 6671 kilometres long and the Amazon River in South America is 6437 kilometres long. How much longer is the Amazon River than the Mackenzie-Peace River?

7. Macpherson Junior High School has 638 students. The school is purchasing new math textbooks for each student at a cost of $23 per book. What is the total cost of the books?

8. If a book contains 3 469 385 letters of the alphabet and the average word is five letters long, how many words would you expect to find in this book?

9. Grant Collegiate is purchasing 18 soccer balls for the phys-ed department. If each ball is priced a $21, how much will the soccer balls cost?

10. Mr. Wai's car travels 7 kilometres on one litre of gasoline. How much gasoline will Mr. Wai's car need to travel 889 kilometres?

11. Candace has eight more quarters than dimes. If she has thirty-seven dimes, how many quarters does she have?

12. In Mount Waialeale, Hawaii, the annual rainfall is approximately 11 700 mm. What is the average amount of rainfall Mount Waialeale receives per week?

13. Adam rented four movies for the weekend. The first two movies each had 127 minutes of playing time and the third movie had 113 minutes of playing time. If it took 504 minutes to view all four movies, what was the playing time of the fourth movie?

14. Marcy earns $8 per hour working part-time at a supermarket. How much will she earn in five days if she work four hours each day?

15. A restaurant used 76 dozen eggs a week. If the average family uses six eggs per week, how many weeks does it take this family to use the same number of eggs that the restaurant uses in one week?

5.4 TRANSLATION & PROBLEM SOLVING REVIEW

A. Translate each of the following mathematical statements into English.

1. $5x$
2. $x - 45$
3. $5 + x$
4. $(z)(z)$
5. $7x = 35$
6. $\frac{x}{7}$
7. $x + 18 = 21$
8. $x - 12$
9. $2x + 3$
10. $2x - 6$
11. $x + 5$
12. $6x - 3$
13. $12 - x = 4$
14. $16 = 20 - 3x$
15. $2x + 4 = 10$

B. Translate each of the following into mathematical statements. Do Not Solve.

1. A number doubled.
2. One-half a number increased by two.
3. One-third of an unknown number.
4. Eight increased by one-quarter of the number.
5. Seven times a number increased by six is forty-one.
6. A number plus twice a number is one hundred fifty.

C. Solve the following problems using the four step method.

1. A number plus three times a number is sixty. What is the number?
2. Three times a number plus seven equals forty-three. What is the number?
3. If we take eight times a number and subtract nine, we get forty-seven. Find the number.
4. When we add five to twice a number we get twenty-five. What is the number?
5. What is the cost of 14 m^2 of carpet at \$23 per metre squared?
6. The product of two numbers is 53 500. If one number is 250, what is the other number?

D. Evaluate each of the following by substitution.

1. $2x + 6x + 4$, if $x = 3$
2. $5x + 3xy - 2$, if $x = 2$, $y = 7$
3. $9 + x + 7x - 2x + 7$, if $x = 3$
4. $2x + 5y - 12$, if $x = 11$, $y = 2$