3.3 & 3.4 Whole Number Multiplication and Division

Multiplication & Division--binary operations

Properties of Multiplication (with Whole numbers):

1. Closure--
2. Commutativity--
3. Associativity--
4. Multiplicative Identity--
5. Distributivity--
6. Multiplication Property of Zero--

Multiplication Approaches:

Repeated Addition	Rectangular Array	Cartesian Product

Ex Use mental math strategies and the multiplication properties to simplify these expressions.

$31(74) + 39(74)$

$25(90)$

$47(9)$

$20_3(11_3)$

$41_7(6_7)$

Division

Partitive

Measurement

Ex: Classify each of the following division problems as examples of either partitive or measurement division.

(a) A certain airplane climbs at a rate of 300 feet per second. At this rate, how long will it take the plane to reach a cruising altitude of 27,000 feet?

(b) A group of 15 friends pooled equal amounts of money to buy lottery tickets for a $1,987,005 jackpot. If they win, how much should each friend receive?

(c) Shauna baked 54 cookies to give to her friends. She wants to give each friend a plate with 6 cookies on it. How many friends can she give cookies to?

Division Approaches:

Repeated Subtraction	Set Model	Missing Factor Model

The Division Algorithm:

Given any whole numbers a and b with (b not equal to 0), there exist whole numbers q (quotient) and r (remainder) such that

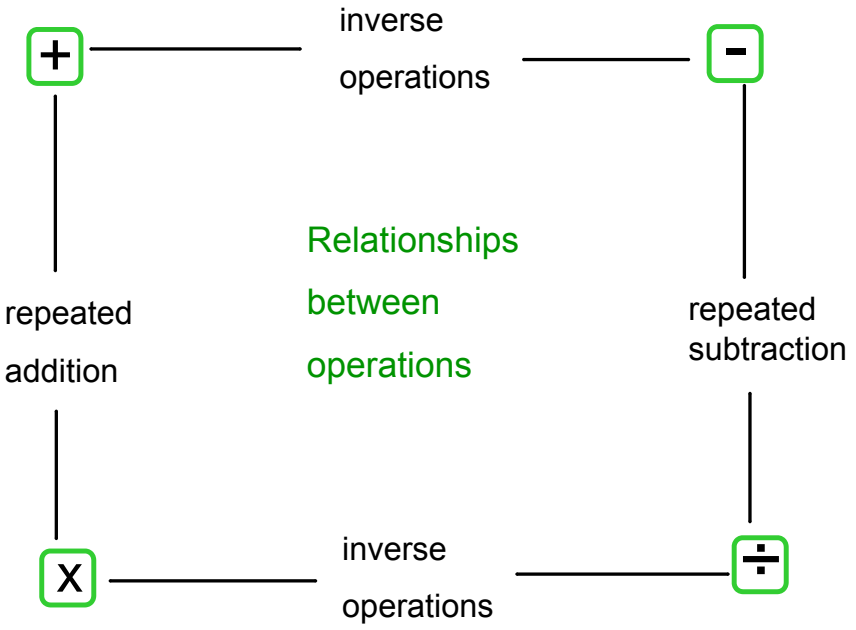
$a = bq + r$ with $0 \leqq r < b$.

(Vocabulary: When a is divided by b and the remainder is zero, then we can say "a is divisible by b" or "b is a divisor of a" or "b divides a.")

Ex: 69 ÷ 9

Ex. When the marching band was placed in rows of 5, one member was left over. When the members were placed in rows of 6, there was still one member left over. However, when they were placed in rows of 7, nobody was left over. What is the smallest number of members in the band?

Inverse Operations:



Four-Fact Families:

Use 3x8=24

Division by zero is undefined!!

Order of Operations Reminder:

Multiplication

(a) base pieces

(b) chip abacus

(c) horizontal format

(d) intermediate algorithm

(e) lattice method

(f) area model

(g) standard algorithm

Division

(a) base pieces

(b) chip abacus

(c) scaffolding method

(d) intermediate algorithm

More examples:

1. $223_5 \times 42_5$

2. $301_7 - 265_7$

3. $225_6 \times 341_6$

4. $3214_5 \div 42_5$

5. $12210_3 \div 201_3$

6. $101101_2 \div 11_2$

7. $360E_{12} \times 19T_{12}$

8. $307_8 \times 254_8$

Exponents: $a^m = \underbrace{a(a)(a)(a)....(a)}_{\text{m times}}$ (repeated multiplication)

Rules of Exponents:

$a^m a^n = a^{m+n}$

$(a^m)^n = a^{mn}$

$a^m b^m = (ab)^m$

$a^m \div a^n = a^{m-n}$

$a^0 = 1$, if $a \neq 0$

What is 0^0?

Examples: Simplify.

(a) $(5^7)^2$

(b) $2^5 2^4$

(c) $3^2 4^2$

(d) $2^7 \div 2^3$

(e) 5^0