1.7. Multiplication I

Example 1: Find the sum of the number 5 that repeats four times.

$$5 + 5 + 5 + 5 = 20$$

five plus five plus five plus five is equal to twenty

the number five is **repeated** FOUR times

Example 2: Find the sum of the number 2 that repeats five times.

$$2 + 2 + 2 + 2 + 2 = 10$$

two plus two plus two plus two plus two is equal ten

the number two is **repeated** FIVE times

Practice 1: Find the sum of the number 1 that repeats 15 times

$$1 + 1 + 1 + 1 + 1 \ + 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 = 15$$

Practice 2: Find the sum of the number 3 that repeats 2 times

$$3 + 3 = 6$$

Practice 3: Find the sum of the number 6 that repeats 3 times

$$6 + 6 + 6 = 18$$

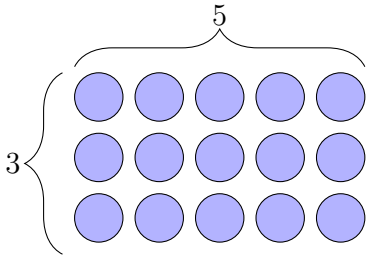
Practice 4: Find the sum of the number 3 that repeats 6 times

$$3 + 3 + 3 + 3 + 3 + 3 = 18$$

How to Write Repeated Addition?

Multiplication is repeated addition.
Multiplying 3 by 5 means adding 5 **three** times.

$$3 \cdot 5 \;=\; 5+5+5 \;=\; 15$$



There are two common symbols for multiplication: $(\cdot)$ and $(\times)$.

Since $(\times)$ symbol is similar to the letter "x", we prefer usage of $(\cdot)$.

Example 3: Write the following addition as multiplication: $5+5+5$.

$$5+5+5 \;=\; 3 \cdot 5$$

Read $3 \cdot 5$ as "three times five".

Practice 5: Write the following sums as multiplications. Use the symbol $\cdot$ to denote multiplication.

a) $1+1+1+1 = 4 \cdot 1$

b) $2+2+2 = 3 \cdot 2$

c) $3+3+3+3+3+3+3 = 7 \cdot 3$

d) $202+202+202 = 3 \cdot 202$

Practice 6: Write the following sums as multiplications. Use the symbol $\times$ to denote multiplication.

a) $1+1+1 = 3 \times 1$

b) $4+4+4 = 3 \times 4$

c) $8+8+8 = 3 \times 8$

d) $108+108+108+108 = 4 \times 108$

Multiplication Tables

ones
$1 \cdot 1 = 1$
$1 \cdot 2 = 2$
$1 \cdot 3 = 3$
$1 \cdot 4 = 4$
$1 \cdot 5 = 5$
$1 \cdot 6 = 6$
$1 \cdot 7 = 7$
$1 \cdot 8 = 8$
$1 \cdot 9 = 9$
$1 \cdot 10 = 10$

twos
$2 \cdot 1 = 2$
$2 \cdot 2 = 4$
$2 \cdot 3 = 6$
$2 \cdot 4 = 8$
$2 \cdot 5 = 10$
$2 \cdot 6 = 12$
$2 \cdot 7 = 14$
$2 \cdot 8 = 16$
$2 \cdot 9 = 18$
$2 \cdot 10 = 20$

threes
$3 \cdot 1 = 3$
$3 \cdot 2 = 6$
$3 \cdot 3 = 9$
$3 \cdot 4 = 12$
$3 \cdot 5 = 15$
$3 \cdot 6 = 18$
$3 \cdot 7 = 21$
$3 \cdot 8 = 24$
$3 \cdot 9 = 27$
$3 \cdot 10 = 30$

fours
$4 \cdot 1 = 4$
$4 \cdot 2 = 8$
$4 \cdot 3 = 12$
$4 \cdot 4 = 16$
$4 \cdot 5 = 20$
$4 \cdot 6 = 24$
$4 \cdot 7 = 28$
$4 \cdot 8 = 32$
$4 \cdot 9 = 36$
$4 \cdot 10 = 40$

fives
$5 \cdot 1 = 5$
$5 \cdot 2 = 10$
$5 \cdot 3 = 15$
$5 \cdot 4 = 20$
$5 \cdot 5 = 25$
$5 \cdot 6 = 30$
$5 \cdot 7 = 35$
$5 \cdot 8 = 40$
$5 \cdot 9 = 45$
$5 \cdot 10 = 50$

sixes
$6 \cdot 1 = 6$
$6 \cdot 2 = 12$
$6 \cdot 3 = 18$
$6 \cdot 4 = 24$
$6 \cdot 5 = 30$
$6 \cdot 6 = 36$
$6 \cdot 7 = 42$
$6 \cdot 8 = 48$
$6 \cdot 9 = 54$
$6 \cdot 10 = 60$

sevens
$7 \cdot 1 = 7$
$7 \cdot 2 = 14$
$7 \cdot 3 = 21$
$7 \cdot 4 = 28$
$7 \cdot 5 = 35$
$7 \cdot 6 = 42$
$7 \cdot 7 = 49$
$7 \cdot 8 = 56$
$7 \cdot 9 = 63$
$7 \cdot 10 = 70$

eights
$8 \cdot 1 = 8$
$8 \cdot 2 = 16$
$8 \cdot 3 = 24$
$8 \cdot 4 = 32$
$8 \cdot 5 = 40$
$8 \cdot 6 = 48$
$8 \cdot 7 = 56$
$8 \cdot 8 = 64$
$8 \cdot 9 = 72$
$8 \cdot 10 = 80$

nines
$9 \cdot 1 = 9$
$9 \cdot 2 = 18$
$9 \cdot 3 = 27$
$9 \cdot 4 = 36$
$9 \cdot 5 = 45$
$9 \cdot 6 = 54$
$9 \cdot 7 = 63$
$9 \cdot 8 = 72$
$9 \cdot 9 = 81$
$9 \cdot 10 = 90$

tens
$10 \cdot 1 = 10$
$10 \cdot 2 = 20$
$10 \cdot 3 = 30$
$10 \cdot 4 = 40$
$10 \cdot 5 = 50$
$10 \cdot 6 = 60$
$10 \cdot 7 = 70$
$10 \cdot 8 = 80$
$10 \cdot 9 = 90$
$10 \cdot 10 = 100$

Practice 7: Multiply by 1.

a) $2 \times 1 = 2$

b) $5 \cdot 1 = 5$

c) $4 \cdot 1 = 4$

d) $1 \times 1 = 1$

e) $20 \times 1 = 20$

f) $40 \cdot 1 = 40$

Practice 8: Multiply.

a) $6 \cdot 2 = 12$

b) $4 \cdot 2 = 8$

c) $7 \cdot 2 = 14$

d) $2 \cdot 2 = 4$

e) $1 \cdot 2 = 2$

f) $9 \cdot 2 = 18$

g) $10 \cdot 2 = 20$

h) $5 \cdot 2 = 10$

i) $2 \cdot 4 = 8$

j) $2 \cdot 3 = 6$

k) $2 \cdot 5 = 10$

l) $2 \cdot 7 = 14$

m) $2 \cdot 8 = 16$

n) $2 \cdot 6 = 12$

o) $2 \cdot 1 = 2$

p) $2 \cdot 10 = 20$

Practice 9: Multiply.

a) $3 \cdot 6 = 18$

b) $3 \cdot 3 = 9$

c) $3 \cdot 1 = 3$

d) $3 \cdot 2 = 6$

e) $3 \cdot 4 = 12$

f) $2 \cdot 3 = 6$

g) $3 \cdot 3 = 9$

h) $5 \cdot 3 = 15$

i) $4 \cdot 3 = 12$

j) $6 \cdot 3 = 18$

Practice 10: Multiply.

a) $8 \cdot 2 = 16$

b) $2 \cdot 6 = 12$

c) $2 \cdot 5 = 10$

d) $1 \cdot 7 = 7$

e) $5 \cdot 2 = 10$

f) $2 \cdot 4 = 8$

g) $2 \cdot 10 = 20$

h) $5 \cdot 1 = 5$

i) $9 \cdot 2 = 18$

j) $2 \cdot 3 = 6$

k) $2 \cdot 7 = 14$

l) $1 \cdot 5 = 5$

m) $7 \cdot 1 = 7$

n) $2 \cdot 2 = 4$

o) $10 \cdot 2 = 20$

p) $2 \cdot 9 = 18$

q) $3 \cdot 3 = 9$

r) $6 \cdot 2 = 12$

s) $3 \cdot 1 = 3$

t) $2 \cdot 8 = 16$

Practice 11: Multiply.

a) $9 \cdot 1 = 9$

b) $2 \cdot 1 = 2$

c) $9 \cdot 2 = 18$

d) $2 \cdot 4 = 8$

e) $2 \cdot 8 = 16$

f) $1 \cdot 8 = 8$

g) $1 \cdot 10 = 10$

h) $3 \cdot 3 = 9$

i) $3 \cdot 1 = 3$

j) $2 \cdot 7 = 14$

k) $2 \cdot 2 = 4$

l) $1 \cdot 2 = 2$

m) $1 \cdot 9 = 9$

n) $2 \cdot 6 = 12$

o) $2 \cdot 3 = 6$

p) $10 \cdot 1 = 10$

q) $8 \cdot 2 = 16$

r) $4 \cdot 1 = 4$

s) $4 \cdot 3 = 12$

t) $3 \cdot 5 = 15$

Some Cool Properties

- Any number multiplied by 1 gives the same number.
- If we switch the numbers we multiply, the result stays the same.
- Multiplication by zero always gives zero.

Example 4: Three times nothing is still nothing:

$$3 \cdot 0 = 0 + 0 + 0 = 0$$

Multiplication by 1

Example 5:

$$5 \cdot 1 = 5$$

Any number multiplied by one gives the same number.

Practice 12: Multiply.

a) $19 \cdot 1 = 19$

b) $18 \times 1 = 18$

c) $201 \cdot 1 = 201$

d) $1239 \cdot 1 = 1239$

e) $100 \times 1 = 18$

f) $23 \cdot 1 = 23$

g) $a \cdot 1 = a$

h) $523 \cdot 1 = 523$

Practice 13: Multiply.

a) $1 \cdot 19 = 19$

b) $1 \cdot 18 \times 1 = 18$

c) $1 \cdot 201 = 201$

d) $1 \cdot 1239 = 1239$

e) $1 \cdot 100 \times 1 = 18$

f) $1 \cdot 23 = 23$

g) $1 \cdot a = a$

h) $1 \cdot 523 = 523$

Multiplication is Commutative

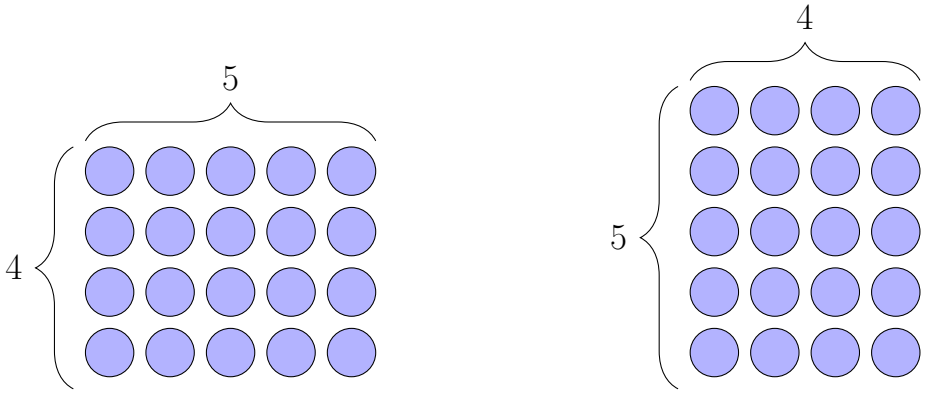
Example 6: Observe. Think. Notice. Remember.

2×3 $\qquad$ 3×2

$2 \times 3 = 6$ $\qquad$ $3 \times 2 = 6$

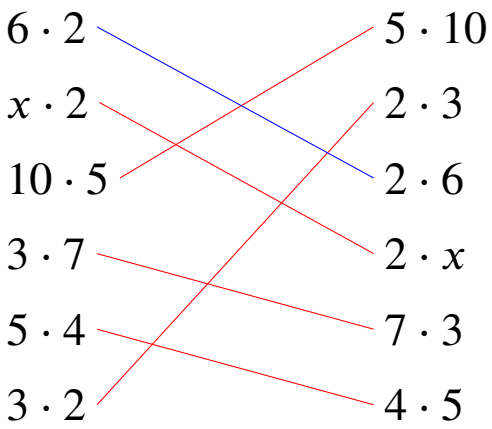
$$2 \times 3 = 3 \times 2 = 6$$

When two numbers are multiplied, changing their order will give us the same result.



$$4 \cdot 5 = 5 \cdot 4$$

Practice 14: Connect the same products.



Practice 15: Complete:

a) $2 \cdot 8 = 8 \cdot$ 2

b) $5 \cdot 2 =$ 2 $\cdot 5$

c) $25 \cdot 18 = 18 \cdot$ 25

d) $3 \cdot x = x \cdot$ 3

The numbers that are multiplied are called **factors**.

The result of the multiplication is called a **product**.

$$\text{factor A} \cdot \text{factor B} = \text{product}$$

Practice 16: In $5 \cdot 9 = 45$, the factors are:

a. 5

b. 9

c. 45

Practice 17: Complete:

a) $6 \cdot 9 = 9 \cdot$ 6

b) $1 \cdot 8 =$ 8 $\cdot 1$

c) $102 \cdot 47 = 47 \cdot$ 102

d) $a \cdot b = b \cdot$ a

Example 7: Hey! What do I do if there are three multiplication **factors**?

$$5 \cdot 2 \cdot 2 \;=\; 2 \cdot 5 \cdot 2 \;=\; 2 \cdot 2 \cdot 5$$

Changing the order does not change the **product** (result of multiplication).

Practice 18: Rearrange factors. List all possibilities.

a) $1 \cdot 2 \cdot 3 = 1 \cdot 3 \cdot 2 = 2 \cdot 1 \cdot 3 = 2 \cdot 3 \cdot 1 = 3 \cdot 1 \cdot 2 = 3 \cdot 2 \cdot 1$

b) $4 \cdot 2 \cdot 3 = 4 \cdot 3 \cdot 2 = 2 \cdot 4 \cdot 3 = 2 \cdot 3 \cdot 4 = 3 \cdot 4 \cdot 2 = 3 \cdot 2 \cdot 4$

c) $1 \cdot 2 \cdot x = 1 \cdot x \cdot 2 = 2 \cdot 1 \cdot x = 2 \cdot x \cdot 1 = x \cdot 1 \cdot 2 = x \cdot 2 \cdot 1$

Multiplication by Zero

Any number multiplied by zero gives zero.

Example 8:

$$2 \cdot 0 = 0 + 0 = 0$$
$$0 \cdot 2 = 0$$

Practice 19: Multiply.

a) $0 \cdot 2 = 0$

b) $0 \cdot 5 = 0$

c) $0 \cdot 3 = 0$

d) $0 \cdot 10 = 0$

e) $2 \cdot 0 = 0$

f) $9 \cdot 0 = 0$

g) $10 \cdot 0 = 0$

h) $5 \cdot 0 = 0$

Practice 20: Multiply.

a) $1 \cdot 6 = 6$

b) $4 \cdot 3 = 12$

c) $2 \cdot 10 = 20$

d) $4 \cdot 0 = 0$

e) $4 \cdot 4 = 16$

f) $3 \cdot 0 = 0$

g) $2 \cdot 6 = 12$

h) $7 \cdot 1 = 7$

i) $7 \cdot 2 = 14$

j) $4 \cdot 5 = 20$

k) $3 \cdot 6 = 18$

l) $1 \cdot 5 = 5$

m) $9 \cdot 0 = 0$

n) $9 \cdot 2 = 18$

o) $1 \cdot 2 = 2$

p) $3 \cdot 3 = 9$

q) $5 \cdot 2 = 10$

r) $9 \cdot 1 = 9$

s) $8 \cdot 1 = 8$

t) $2 \cdot 1 = 2$