Part 1

Physics Math Exercises

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Lesson 4 Adding Integers

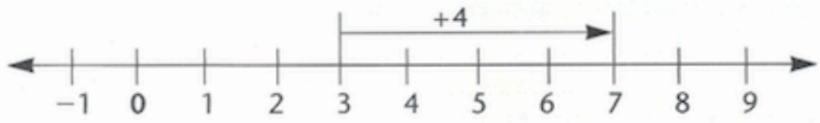
Addend
A number that is added to one or more numbers

Addition
The arithmetic operation of combining numbers to find their sum or total

Sum
The answer to an addition problem

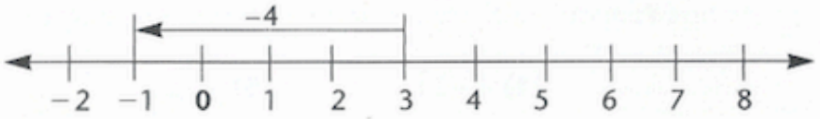
Adding a positive to a positive makes the result more positive.

EXAMPLE $3 + 4 =$ ■
Start at 3, move 4 units to the right. Since you stopped at 7, $3 + 4 = 7$.



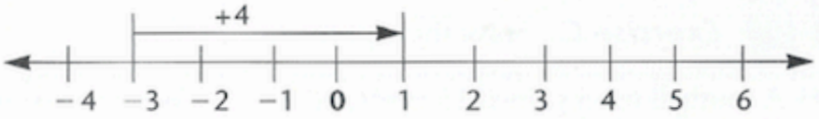
Adding a negative to a positive makes the result more negative.

EXAMPLE $3 + (-4) =$ ■
Start at 3, move 4 units to the left. Since you stopped at −1, $3 + (-4) = -1$.



Adding a positive to a negative makes the result more positive.

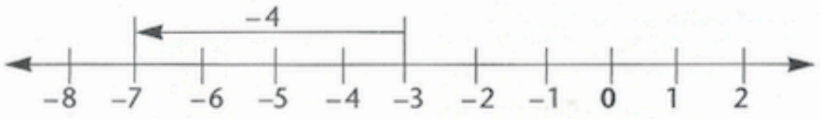
EXAMPLE $-3 + 4 =$ ■
Start at −3, move 4 units to the right. Since you stopped at 1, $-3 + 4 = 1$.



Addition is combining numbers to form a total. Each number being added is an **addend.** The answer is the **sum.**

Adding a negative to a negative makes the result more negative.

EXAMPLE $-3 + (-4) =$ ■
Start at −3, move 4 units to the left. Since you stopped at −7, $-3 + (-4) = -7$.



Exercise A Find each sum.

1) $5 + 8$
2) $-9 + (-3)$
3) $-4 + 8$
4) $2 + 7$
5) $-10 + 2$
6) $-8 + (-6)$
7) $-5 + 3$
8) $6 + 9$
9) $-2 + (-2)$
10) $6 + (-10)$
11) $-4 + (-2)$
12) $3 + 2$
13) $5 + (-9)$
14) $-7 + (-4)$
15) $3 + (-3)$

Exercise B Find each temperature.

16) $-5°F + 4°F$
17) $-8°F + 6°F$
18) $13°F + 7°F$
19) $4°F + (-4)°F$
20) $-15°F + (-9)°F$
21) $-3°F + 11°F$
22) $6°F + (-15)°F$
23) $-5°F + 15°F$
24) $2°F + (-10)°F$

Exercise C Find each temperature.

25) $-5°C + (-5)°C$
26) $9°C + 7°C$
27) $-4°C + 10°C$
28) $3°C + (-3)°C$
29) $7°C + -18°C$
30) $-2°C + (-9)°C$

Calculator Practice

The [+/-] key on your calculator changes the sign of the number entered. You can use the [+/-] key to add integers.

EXAMPLES $5 + -6$

Press 5 [+] 6 [+/-] [=] -1

$-4 + 8$

Press 4 [+/-] [+] 8 [=] 4

Exercise D Find each sum using a calculator.

31) $651 + -821$
32) $-725 + -265$
33) $658 + -427$
34) $326 + 989$
35) $-951 + 458$

See page 392 for sample solutions to problems 1, 16, 25, and 31.

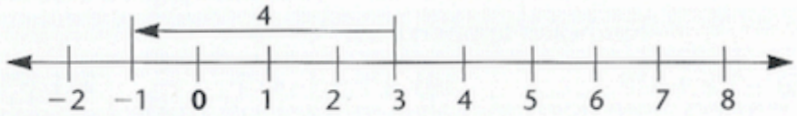
Lesson 5 Subtracting Integers

Difference
The answer to a subtraction problem

Subtraction
The arithmetic operation of taking one number away from another to find the difference

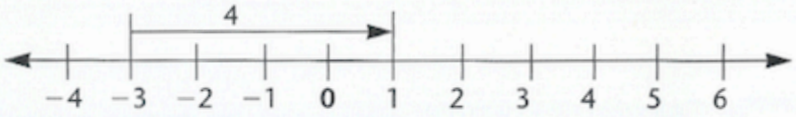
Subtracting a positive from a positive makes the result less positive or more negative, so you move to the left.

EXAMPLE 3 – (+4) = ■ Start at 3, move 4 units to the left. Since you stopped at –1, 3 – (+4) = –1.
Note: 3 – (+4) = –1 gives the same result as 3 + (–4) = –1 because 4 and –4 are opposites.



Subtracting a negative from a negative makes the result less negative or more positive, so you move to the right.

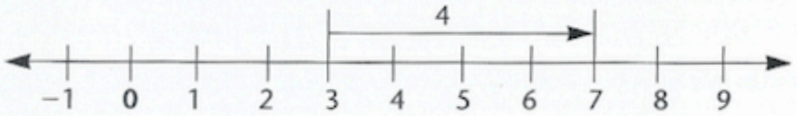
EXAMPLE –3 – (–4) = ■ Start at –3, move 4 units to the right. Since you stopped at +1, –3 – (–4) = 1.
Note: –3 – (–4) = 1 gives the same result as –3 + 4 = 1 because –4 and 4 are opposites.



Subtracting a negative from a positive makes it less negative or more positive, so you move to the right.

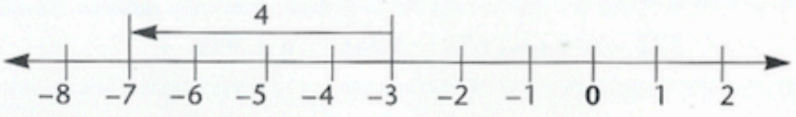
Subtraction and addition are opposite arithmetic operations. In addition, two (or more) numbers are combined. In subtraction, one number is taken away from another number. The answer is the **difference.**

EXAMPLE 3 – (–4) = ■ Start at 3, move 4 units to the right. Since you stopped at +7, 3 – (–4) = 7.



Subtracting a positive from a negative makes it less positive or more negative, so you move to the left.

EXAMPLE –3 – (+4) = ■ Start at –3, move 4 units to the left. Since you stopped at –7, –3 –4 = –7.



In Summary:

$3-(+4)=-1$	is the same as	$3+(-4)=-1$
$-3-(-4)=1$	is the same as	$-3+4=1$
$3-(-4)=7$	is the same as	$3+4=7$
$-3-(+4)=-7$	is the same as	$-3+(-4)=-7$

Rule To subtract in algebra, add the opposite.
$3-(+4)=3+(-4)$
$a-(+b)=a+(-b)$

Exercise A Rewrite each subtraction expression as an addition expression. Solve the new expression.

1) $5-(+4)$
2) $8-2$
3) $-5-(-6)$
4) $-9-(-8)$
5) $-7-(+5)$
6) $-3-5$
7) $-3-(-10)$
8) $11-(+6)$
9) $8-(-1)$
10) $4-3$
11) $-6-(+2)$
12) $7-3$

Exercise B Find each difference.

13) $9-6$
14) $-5-(-8)$
15) $8-(-8)$
16) $-5-(+10)$
17) $12-(-3)$
18) $-7-(-3)$
19) $7-(+9)$
20) $-6-6$
21) $3-6$
22) $-3-(+5)$
23) $5-8$
24) $-7-(+6)$
25) $6-(-9)$
26) $-10-(-7)$
27) $8-2$

Problem Solving

Exercise C Solve these problems.

28) The record high temperature for Pennsylvania is 111°F. The record low is −42°F. What is the difference between the high and low?

29) What is the difference between Montana's record low of −70°F and New York's record low of −52°F?

30) Lake Eyre, Australia, has an elevation of −52 feet, while Lake Torrens, Australia, has an elevation of 92 feet. What is the difference between the elevations?

See page 392 for sample solutions to problems 1, 13, and 28.

Lesson 6 Multiplying Integers

Factors
Numbers that are multiplied in a multiplication problem

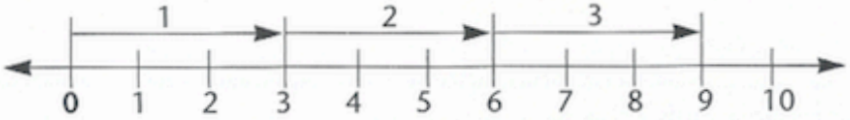
Multiplication
The arithmetic operation of adding a number to itself many times

Product
The answer to a multiplication problem

In algebra, "3 times 3" is written as (3)(3) and "3 times n" is written as $3n$. You know that (3)(3) = 9. You can think of this as three groups of three.

EXAMPLE (3)(3) = 9

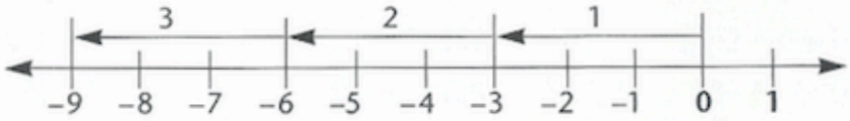
Start at zero and count by 3's on the number line.



Rule (Positive) • (Positive) = (Positive)

EXAMPLE (3)(–3) = ■

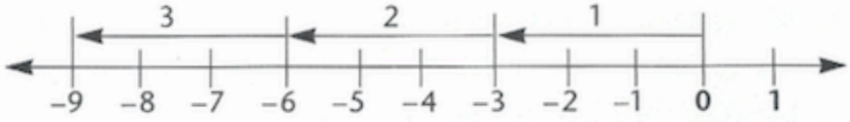
Start at zero and count by –3 on the number line.
(3)(–3) means three groups of negative three.
(–3) + (–3) + (–3). Therefore, (3)(–3) = –9.



Rule (Positive) • (Negative) = (Negative)

EXAMPLE (–3)(3) = ■

Treat this the same as (3)(–3).
(–3)(3) means three groups of (–3) or
(–3) + (–3) + (–3). Therefore, (–3)(3) = –9.



Rule (Negative) • (Positive) = (Negative)

In **multiplication**, you simply add a number many times. The order in which you multiply two **factors** does not change the **product.**

EXAMPLE This leaves only one other case, namely (–3)(–3) or a (Negative) (Negative). This case cannot be shown on the number line. The product is 9. You need to solve exercises such as these using the following rule:

Rule (Negative) • (Negative) = (Positive)

So, (–3)(–3) = 9

Exercise A Find each product.

1) (7)(8)
2) (–4)(–3)
3) (–5)(6)
4) (9)(–8)
5) (9)(9)
6) (–5)(–9)
7) (5)(12)
8) (–4)(13)
9) (6)(–10)
10) (3)(9)
11) (–7)(–9)
12) (–7)(3)
13) (8)(3)
14) (–9)(2)
15) (–6)(–5)
16) (–8)(–2)
17) (5)(–10)
18) (15)(4)
19) (–4)(5)
20) (–11)(–8)

Exercise B Tell whether each product is positive, negative, or zero.

21) (–34)(–63)
22) (67)(–326)
23) (–487)(–351)
24) (–400)(205)
25) (0)(–345)
26) (800)(–72)
27) (–771)(–522)
28) (389)(399)

Problem Solving

Exercise C Solve these problems.

29) One side of a ship has marks spaced three feet apart. Four marks are underwater. How many feet of the ship are underwater?

30) Explain why (–3)(0) cannot equal –0.

See page 392 for sample solutions to problems 1, 21, and 29.

Lesson 7 Dividing Positive and Negative Integers

Dividend
A number that is divided

Division
The arithmetic operation that finds how many times a number is contained in another number

Divisor
The number by which you are dividing

Quotient
The answer to a division problem

Division is the arithmetic operation that finds how many times a number is contained in another number. The answer is the **quotient.**

EXAMPLE $30 \div 6 = 5$

divisor — $6\overline{)30}$ — 5 — quotient; dividend

Division and multiplication are opposite operations. Multiplying 3 by 4, then dividing the product by 4 gets you back to 3: $(3)(4) = 12$ and $12 \div 4 = 3$. You can use this information to discover the rules for division with negatives.

EXAMPLES

Multiplication		Division
$(3)(4) = 12$	and	$12 \div 4 = 3$
Rule $(+)(+) = (+)$		$(+) \div (+) = (+)$
$(3)(-4) = -12$	and	$(-12) \div (-4) = 3$
Rule $(+)(-) = (-)$		$(-) \div (-) = (+)$
$(-3)(4) = -12$	and	$(-12) \div (4) = (-3)$
Rule $(-)(+) = (-)$		$(-) \div (+) = (-)$
$(-3)(-4) = 12$	and	$(12) \div (-4) = (-3)$
Rule $(-)(-) = (+)$		$(+) \div (-) = (-)$

Division is the opposite of multiplication. A **dividend** is divided by a **divisor** to find a quotient.

Rules Like signs create positive products and quotients.
Unlike signs create negative products and quotients.

Writing About Mathematics

Explain how to check division problems using multiplication. Then write about ways you can use division and multiplication in daily activities.

Exercise A Find each quotient.

1) $42 \div 6$
2) $-12 \div 4$
3) $16 \div (-4)$
4) $-25 \div (-5)$
5) $81 \div 9$
6) $-36 \div (-6)$
7) $-54 \div (-9)$
8) $48 \div 8$
9) $-56 \div 7$
10) $-8 \div (-4)$
11) $0 \div (-1)$
12) $40 \div (-5)$
13) $50 \div 5$
14) $-40 \div (-40)$
15) $21 \div 3$
16) $32 \div (-8)$
17) $64 \div 8$
18) $21 \div (-3)$
19) $-18 \div (-6)$
20) $-72 \div 9$

Exercise B Tell whether each quotient is positive, negative, or zero.

21) $2226 \div (-42)$
22) $-3458 \div 19$
23) $676 \div (-26)$
24) $5402 \div (73)$
25) $-8514 \div (-33)$
26) $121 \div (-11)$
27) $-3563 \div 7$
28) $0 \div (-21)$

Exercise C Write + or – in each ■ to make each statement true.

29) ■ $21 \div 3 = 7$
30) ■ $30 \div 3 = -10$

See page 393 for sample solutions to problems 1, 21, and 29.