Understanding Integers and the Number Line

Name: _____	Date: _____	Score: _____ / 18

Welcome to integer world! An **integer** is any whole number—positive, negative, or zero—and it tells you both an *amount* and a *direction*. Think of temperatures above or below zero, elevations above or below sea level, or money gained versus money lost—integers are everywhere. On a number line, positives sit to the **right** of zero and negatives sit to the **left**, and every integer has an opposite that is the same distance from zero in the other direction. Once you can picture this, comparing integers and working with them in addition, subtraction, and beyond gets much, much easier.

Key Concepts & Quick Review

Integers: $\{\ldots, -3, -2, -1, 0, 1, 2, 3, \ldots\}$ **Positive** integers are to the right of 0; **Negative** integers are to the left of 0.

Opposite of n: $-n$ **Opposite of $-n$:** $-(-n) = n$ **Zero:** neither positive nor negative

Opposites are equally far from 0.

Examples

① Write an integer for: "A submarine descends **300 feet below** sea level."

Think It Through: The key phrase here is *below sea level*. Sea level is our zero point, so anything below zero is negative. The number 300 tells us how far down the submarine is, and the negative sign tells us the direction. So 300 feet below sea level is written as -300.

Answer: -300

② Point A is located at -8 on the number line. Point B is the opposite of point A. What is the distance between points A and B?

Think It Through: Start by finding the opposite of -8. The opposite is 8, so point B is at 8. On the number line, point A is 8 units to the left of zero and point B is 8 units to the right of zero. Since the points are on opposite sides of zero, add those distances: $8 + 8 = 16$ units.

Answer: 16 *units*

Practice Problems

Simplify each expression.

1. $-(-6) =$ _____
2. $-(-14) =$ _____
3. $-(-(-3)) =$ _____
4. $-(-(-(-8))) =$ _____
5. $-(-25) =$ _____
6. $-(-(-11)) =$ _____
7. $-(-(-(-5))) =$ _____
8. $-(-19) =$ _____
9. $-(-(-7)) =$ _____
10. $-(-(-(-20))) =$ _____
11. $-(-33) =$ _____
12. $-(-(-(-4))) =$ _____
13. $-(-(-16)) =$ _____
14. $-(-(-(-9))) =$ _____
15. $-(-42) =$ _____

Study Tips

- Two negatives always cancel: $-(-n) = n$. Count the minus signs — even count gives positive, odd count gives negative.
- The opposite of zero is zero: $-(0) = 0$.
- On any number line, moving **left** decreases the value; moving **right** increases it.

Word Problems

16. Marcus and his sister are playing a golf-themed board game where each player's score is tracked relative to par. Marcus's score is 5 strokes *under* par and his sister's score is 3 strokes *over* par. Write an integer for each score. In golf, the player with the *lower* score wins — who is winning, and by how many strokes?

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17. A weather station records a high temperature of $12°$F for one afternoon. That same night, the low temperature is the exact opposite of the afternoon high. During the early morning, the temperature drops an additional 7 degrees below the overnight low. Write an integer for the overnight low and for the early-morning temperature. By how many degrees did the temperature change from the afternoon high to the early-morning reading?

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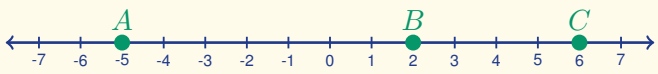
18. Three points are plotted on the number line shown here. Identify the integer for each point, find the opposite of point B, and find the distance from point A to point C.



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Answer Keys

1) 6
2) 14
3) -3
4) 8
5) 25
6) -11
7) 5
8) 19
9) -7
10) 20
11) 33
12) -4
13) -16
14) 9
15) 42
16) Marcus -5, Sister $+3$; Marcus wins by 8 strokes.
17) Low $-12°$F; early morning $-19°$F; change $31°$F
18) $A = -5$; $B = 2$; $C = 6$; opposite of B: -2; distance A to C: 11

Step-by-Step Explanations

Strategy: For Understanding Integers and the Number Line, use the number line as the home base: locate the value, decide whether the problem asks for an opposite or a distance, and only then simplify. The strongest work shows the direction of the move before giving the number.

Practice 1: $-(-6) =$ **Answer:** 6
Read the outside negative as "take the opposite"; the opposite of -6 is 6.

Practice 15: $-(-42) =$ **Answer:** 42
Read the outside negative the same way; the opposite of -42 is 42.

Word-problem notes:

16. Answer: Marcus -5, Sister $+3$; Marcus wins by 8 strokes.
"Under par" means negative, so Marcus's score is -5. "Over par" means positive, so his sister's score is $+3$. In golf, the lower score wins, and -5 is less than $+3$ because it is farther left on the number line. To find how far apart the scores are, compute $3 - (-5) = 3 + 5 = 8$.

17. Answer: Low $= -12°$F; early morning $= -19°$F; change $= 31°$F
The opposite of 12 is -12, so the overnight low is $-12°$F. Then the temperature drops 7 more degrees, so $-12 - 7 = -19°$F. To find the total change from $12°$F to $-19°$F, count the drop to zero and then below zero: $12 + 19 = 31$ degrees. So the temperature dropped $31°$F altogether.

18. Answer: $A = -5$; $B = 2$; $C = 6$; opposite of B is -2; distance A to $C = 11$.
Read each integer directly from the number line: A is at -5, B is at 2, and C is at 6. The opposite of 2 is -2. To find the distance between A and C, count the units from -5 to 6: that is 5 units to reach 0, then 6 more units to reach 6, for a total of 11 units.

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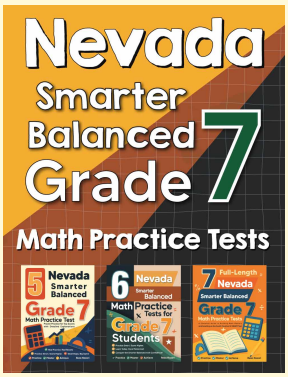

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