Math 7 Unit 1 worksheet: Subtracting integers (answer key)

ANSWERS AT A GLANCE

1. (a) −20 (b) 26 (c) −13 (d) 8 (e) −28 (f) 120
2. (a) −7 (b) 5 (c) 7 (d) −5 (e) −15 (f) 0
3. (a) −11 (b) −16 (c) −7
4. (a) −15 (b) 11
5. (a) −7 (b) −23 (c) Yes; work a string of subtractions from left to right, or rewrite every subtraction as an addition first.
6. (a) 7 (b) No. $a - b$ is positive when a is to the right of b on the number line, negative when a is to the left of b, and zero when $a = b$.
7. (a) 60 − (−41) = 101 degrees (b) −101; the minus sign says Wellington, New Zealand lies 101 degrees farther south.
8. (a) −9 (b) −9 − (−5) = −4 (c) Taking away −1s does the same as adding + 1s.

WORKED SOLUTIONS

1. Find each difference. Write each subtraction as an addition first.

(a) $-6 - 14$ (b) $17 - (-9)$ (c) $5 - 18$ (d) $-23 - (-31)$ (e) $-40 - (-12)$

(f) $72 - (-48)$

ANSWER

(a) −20 (b) 26 (c) −13 (d) 8 (e) −28 (f) 120

SOLUTION

(a) −6 − 14 = −6 + (−14) = −20

(b) 17 − (−9) = 17 + 9 = 26

(c) 5 − 18 = 5 + (−18) = −13

(d) −23 − (−31) = −23 + 31 = 8

(e) −40 − (−12) = −40 + 12 = −28

(f) 72 − (−48) = 72 + 48 = 120

2. Fill in each blank with an integer to make the statement true.

(a) $5 - \square = 12$ (b) $\square - 9 = -4$ (c) $-3 - \square = -10$

(d) $\square - (-8) = 3$ (e) $-11 - \square = 4$ (f) $\square - 14 = -14$

ANSWER

(a) −7 (b) 5 (c) 7 (d) −5 (e) −15 (f) 0

SOLUTION

(a) Subtracting a number gave a result 7 more than 5, so the number subtracted is negative: 5 − (−7) = 5 + 7 = 12.

(b) The first number is the difference plus the number subtracted: −4 + 9 = 5. Check: 5 − 9 = 5 + (−9) = −4.

(c) −3 − 7 = −3 + (−7) = −10.

(d) The first number is 3 + (−8) = −5. Check: −5 − (−8) = −5 + 8 = 3.

(e) The result is 15 more than −11, so the number subtracted is −15: −11 − (−15) = −11 + 15 = 4.

(f) The first number is −14 + 14 = 0. Check: 0 − 14 = −14.

3. Simplify. Rewrite every subtraction as an addition, then add.

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(a) $12 - (-4) - 20 - 7$ (b) $-9 + 15 - (-3) - 25$ (c) $-30 - (-30) - 8 - (-1)$

ANSWER

(a) −11 (b) −16 (c) −7

SOLUTION

(a) 12 + 4 + (−20) + (−7). Positives: 12 + 4 = 16. Negatives: −20 + (−7) = −27. Total: 16 + (−27) = −11.

(b) −9 + 15 + 3 + (−25). Positives: 15 + 3 = 18. Negatives: −9 + (−25) = −34. Total: 18 + (−34) = −16.

(c) −30 + 30 + (−8) + 1. The first two are a zero pair, so the total is −8 + 1 = −7.

4. Two students rewrote a subtraction as an addition and made a mistake. Find each mistake and give the correct difference.

(a) Isaac wrote −6 − 9 = 6 + (−9) = −3.

(b) Yuna wrote 4 − (−7) = 4 + (−7) = −3.

ANSWER

(a) −15 (b) 11

SOLUTION

(a) Isaac changed the sign of the first number as well. Only the number being subtracted is replaced by its opposite, and −6 keeps its sign: −6 − 9 = −6 + (−9) = −15.

(b) Yuna changed the subtraction to an addition but did not replace −7 by its opposite. The opposite of −7 is 7: 4 − (−7) = 4 + 7 = 11.

5. Let $p = -8$, $q = 7$ and $r = -8$.

(a) Evaluate $(p - q) - r$.

(b) Evaluate $p - (q - r)$.

(c) Does the way a subtraction is grouped change its value? Use (a) and (b) to answer, and say what this means for working out a string of subtractions.

ANSWER

(a) −7 (b) −23 (c) Yes; work a string of subtractions from left to right, or rewrite every subtraction as an addition first.

SOLUTION

(a) Parentheses first: −8 − 7 = −8 + (−7) = −15. Then −15 − (−8) = −15 + 8 = −7.

(b) Parentheses first: 7 − (−8) = 7 + 8 = 15. Then −8 − 15 = −8 + (−15) = −23.

(c) Yes. The same three numbers in the same order gave −7 and −23, so subtraction is not associative: moving the parentheses can change the answer. A string of subtractions must be worked from left to right, or every subtraction rewritten as an addition first; after that the additions may be grouped in any way.

6. Daniel says that when you subtract one negative integer from another, the answer is always negative.

(a) Find −2 − (−9).

(b) Is Daniel right? Explain when the difference $a - b$ of two negative integers is positive, when it is negative and when it is zero.

ANSWER

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(a) 7 (b) No. $a - b$ is positive when a is to the right of b on the number line, negative when a is to the left of b, and zero when $a = b$.

SOLUTION

(a) $-2 - (-9) = -2 + 9 = 7$.

(b) No: part (a) is a difference of two negative integers that is positive. The difference $a - b$ answers "what do I add to b to reach a?" If a is to the right of b (closer to zero, like -2 and -9), you add a positive amount, so $a - b$ is positive. If a is to the left of b, you add a negative amount, so $a - b$ is negative; for example $-9 - (-2) = -9 + 2 = -7$. If $a = b$, the difference is 0.

7. Latitude tells how far north or south of the equator a place is, in degrees. Take latitudes north of the equator as positive and latitudes south of it as negative. To the nearest degree, Oslo, Norway lies at 60° and Wellington, New Zealand lies at −41°.

(a) Write a subtraction for how many degrees farther north Oslo, Norway lies than Wellington, New Zealand, and find it.

(b) Find the latitude of Wellington, New Zealand minus the latitude of Oslo, Norway. What does the sign of this answer tell you?

ANSWER

(a) $60 - (-41) = 101$ degrees (b) −101; the minus sign says Wellington, New Zealand lies 101 degrees farther south.

SOLUTION

(a) How much farther north one place is than another is its latitude minus the other's:

$$60 - (-41) = 60 + 41 = 101$$

Oslo, Norway lies 101 degrees farther north.

Check on a number line: from −41 up to 0 (the equator) is 41 degrees, and from 0 up to 60 is 60 more, so the gap is 41 + 60 = 101 degrees.

(b) $-41 - 60 = -41 + (-60) = -101$. Swapping the order gives the opposite of (a). The answer is negative, so Wellington, New Zealand lies not farther north at all but 101 degrees farther south.

8. A balloon starts with no overall electric charge: it has as many protons, each with charge + 1, as electrons, each with charge −1, so its charge is 0. Rubbing it on a wool sweater moves 9 electrons onto the balloon. Later a metal doorknob takes 5 of those electrons away.

(a) What is the balloon's charge after the rubbing?

(b) Write a subtraction for the balloon's charge after the doorknob, and find it.

(c) Explain why taking electrons away made the charge go up.

ANSWER

(a) −9 (b) $-9 - (-5) = -4$ (c) Taking away −1s does the same as adding + 1s.

SOLUTION

(a) Nine electrons add 9 charges of −1: $0 + (-9) = -9$.

(b) The doorknob takes away 5 charges of −1, which is subtracting −5:

$$-9 - (-5) = -9 + 5 = -4$$

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(c) Think of the charges as counters. Before the doorknob, 9 extra filled counters (−1 each) sit on the balloon. Taking 5 of them away leaves only 4 extra negatives, so the charge is less negative, which is higher. Subtracting −5 has the same effect as adding 5.

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