

Exercises

$-4, -2, -\sqrt{3}, \sqrt{6}, \sqrt{8},$
 $\sqrt{6}, -1, \sqrt{2}, \sqrt{7}, \sqrt{8},$
 $\frac{3}{4}, \frac{7}{5}, \sqrt{2}, \frac{22}{15}, \frac{8}{5}$
 $-\sqrt{5}, -\frac{9}{5}, -\sqrt{3}, -\frac{8}{5},$

$-|9|, -|-6|, |-8|$

$|, -|7|, -|-2|$
 $|5 - 7| = |7| - |5|$
 $|(-3)^3| = 3^3$

12. true 13. false;
 $= |b| - |a|$ 14. true
 16. 12 17. $-\frac{4}{5}$

19. 8 20. 6 21. 6

23. 4 24. 14 25. -1

27. -5 28. 8

30. $5 - \pi$

32. $x - 4$

34. $3r - 15$

36. $x - y$

38. $x^2 + 4$

40. property 1

42. property 3

44. property 5

46. property 4

Write the numbers in each list in numerical order, from least to greatest. Use a calculator as necessary. See Examples 1 and 2.

1. $\sqrt{8}, -4, -\sqrt{3}, -2, -5, \sqrt{6}, 3$

2. $\sqrt{2}, -1, 4, 3, \sqrt{8}, -\sqrt{6}, \sqrt{7}$

3. $\frac{3}{4}, \sqrt{2}, \frac{7}{5}, \frac{8}{5}, \frac{22}{15}$

4. $-\frac{9}{8}, -3, -\sqrt{3}, -\sqrt{5}, -\frac{9}{5}, -\frac{8}{5}$

5. $|-8|, -|9|, -|-6|$

6. $-|7|, -|-2|, -|-9|$

7. What is wrong with writing the statement " $x < 2$ or $x > 5$ " as $5 < x < 2$?

8. Students often say "Absolute value is always positive." Is this true? Explain your answer.

Concept Check Decide whether each statement is true or false. If false, correct the statement so it is true.

9. $|5 - 7| = |5| - |7|$

10. $|(-3)^3| = -|3^3|$

11. $|-5| \cdot |4| = |-5 \cdot 4|$

12. $\frac{|-8|}{|2|} = \left| \frac{-8}{2} \right|$

13. $|a - b| = |a| - |b|$, if $b > a > 0$.

14. If a is negative, then $|a| = -a$.

Evaluate each expression. See Example 2.

15. $|-9|$

16. $|-12|$

17. $-\left| \frac{4}{5} \right|$

18. $-\left| \frac{27}{2} \right|$

Let $x = -4$ and $y = 2$. Evaluate each expression. See Examples 3, 5, and 6.

19. $|2x|$

20. $|-3y|$

21. $|x - y|$

22. $|2x + 5y|$

23. $|3x + 4y|$

24. $|-5y + x|$

25. $\frac{2|y| - 3|x|}{|xy|}$

26. $\frac{4|x| + 4|y|}{|x|}$

27. $\frac{|-8y + x|}{-|x|}$

28. $\frac{|x| + 2|y|}{5 + x}$

Write each expression without absolute value bars. See Example 3.

29. $|\pi - 3|$

30. $|\pi - 5|$

31. $|y - 3|$, if $y < 3$

32. $|x - 4|$, if $x > 4$

33. $|2k - 8|$, if $k < 4$

34. $|3r - 15|$, if $r > 5$

35. $|x - y|$, if $x < y$

36. $|x - y|$, if $x > y$

37. $|3 + x^2|$

38. $|x^2 + 4|$

Justify each statement by giving the correct property of absolute value. Assume all variables represent real numbers. See Example 5.

39. $|m| = |-m|$

40. $-|k| \geq 0$

41. $|-3| \cdot |-5| = |15|$

42. $|8| \cdot |-4| = |-32|$

43. $|k - m| \leq |k| + |-m|$

44. $|5 + x| \leq |5| + |x|$

45. $|12 + 11r| \geq 0$

46. $\left| \frac{-12}{5} \right| = \frac{|-12|}{|5|}$

,648 yd; No, it is not the
because the sum of the
te values is 17,660. 48. 7;
represents the number of
s between their scores.
50. 113 or 147
°F 52. 73°F 53. 22°F

Solve each problem.

47. **Total Football Yardage** During his 16 yr in the NFL, Marcus Allen gained 12,243 rd rushing, 5411 yd receiving, and -6 yd returning fumbles. Find his total yardage (called *all-purpose yards*). Is this the same as the sum of the absolute values of the three categories? Why or why not? (Source: *The Sports Illustrated 2003 Sports Almanac*, 2003.)
48. **Golf Scores** In the 2002 U.S. Women's Open golf tournament, Juli Inkster won with a score that was 4 under par, while Shani Waugh finished third with a score that was 3 over par. Using -4 to represent 4 under par and $+3$ to represent 3 over par, find the difference between these scores (in either order) and take the absolute value of this difference. What does this final number represent? (Source: *The Sports Illustrated 2003 Sports Almanac*, 2003.)
49. **Blood Pressure Difference** Calculate the P_d value for a woman whose actual systolic pressure is 116 and whose normal value should be 125. (See Example 4.)
50. **Systolic Blood Pressure** If a patient's P_d value is 17 and the normal pressure for his gender and age should be 130, what are the two possible values for his systolic blood pressure? (See Example 4.)

Windchill The windchill factor is a measure of the cooling effect that the wind has on a person's skin. It calculates the equivalent cooling temperature if there were no wind. The chart gives the windchill factor for various wind speeds and temperatures at which frostbite is a risk, and how quickly it may occur.

		Temperature (°F)								
		40	30	20	10	0	-10	-20	-30	-40
Wind speed (mph)	5	36	25	13	1	-11	-22	-34	-46	-57
	10	34	21	9	-4	-16	-28	-41	-53	-66
	15	32	19	6	-7	-19	-32	-45	-58	-71
	20	30	17	4	-9	-22	-35	-48	-61	-74
	25	29	16	3	-11	-24	-37	-51	-64	-78
	30	28	15	1	-12	-26	-39	-53	-67	-80
	35	28	14	0	-14	-27	-41	-55	-69	-82
40	27	13	-1	-15	-29	-43	-57	-71	-84	

Source: National Oceanic and Atmospheric Administration, National Weather Service

If we are interested only in the magnitude of the difference between two of these entries, then we subtract the two entries and find the absolute value. Find the magnitude of the difference of each pair of windchill factors.

51. wind at 15 mph with a 30°F temperature and wind at 10 mph with a -10 °F temperature
52. wind at 20 mph with a -20 °F temperature and wind at 5 mph with a 30°F temperature
53. wind at 30 mph with a -30 °F temperature and wind at 15 mph with a -20 °F temperature