SOLUTIONS TO EXERCISES:
I LIVE TWO BLOCKS WEST OF YOU

IN-SECTION EXERCISES:

1. \( x \) must lie to the left of \( z \)
2. Nothing can be said: \( z \) could lie to the right of \( x \); \( z \) could equal \( x \); or \( z \) could lie to the left of \( x \).
3. \( -x \) must lie to the right of \( -y \)
4. \( y \) is bigger (farther from zero); \( x \) is smaller (closer to zero)
5a. ‘one is less than three’; true
5b. ‘two is less than or equal to two’; true
5c. ‘negative one is greater than negative three’; true
5d. ‘negative one is less than negative three’; false
5e. ‘ex is less than or equal to one’; ST/SF
5f. ‘ex is greater than or equal to negative one’; ST/SF
5g. ‘negative one is greater than or equal to one’; false
5h. ‘ex is greater than or equal to ex’; (always) true
6. Being ‘bigger than’ has to do with being farther from zero.
   Being ‘greater than’ has to do with being farther to the right on the number line.

7. Greatest member: 4
   Least member: 1
8. No greatest member: given any member, there is one that is farther to the right on the number line.
   Least member: 1
9. Greatest member: \(-1\)
   No least member: given any member, there is one that is farther to the left on the number line.
10. No greatest member; no least member. Zero is ‘trying’ to be the least member, but 0 isn’t included in this set!

11. Greatest member: 1
    No least member. Again, zero is ‘trying’ to be the least member, but 0 isn’t in this set!

12a. ‘For all ex greater than or equal to five . . . ’ (Drop the word ‘is’.)
12b. ‘Let ex be greater than or equal to five.’ (Drop the word ‘is’; add the word ‘be’.)

13a. \( t \leq 2 \)
13b. \( t \geq 2 \)
13c. \( y \leq -2 \)
13d. \( y \geq -2 \)
14a. \( t \) is at most 4
14b. \( t \) is at least 4
14c. \( y \) is at most \(-4\)
14d. \( y \) is at least \(-4\)
15. $x$ is at most 5
   $x$ is at most $\frac{1}{3}$
   $x$ is at most $-1$  (There are infinitely many correct answers possible!)
16. $x = 5$
   $x = \frac{1}{3}$
   $x = -1$  (There are infinitely many correct answers possible!)
17. $2x + 3y = 5$
   $\frac{1}{2}x + y = 4$
   $x + 7y = \frac{1}{2}$  (There are infinitely many correct answers possible!)
18a. equation; always false
   
   $x \quad x + 1$

18b. inequality; always true
   
   $x - 1 \quad x$

18c. inequality; always true
   
   $x \quad x + 1 \quad x + 2 \quad x + 3$

18d. inequality; always true
   
   $x - 1 \quad x \quad x + 1$

19a. equation in one variable ($x$)
19b. inequality in three variables ($x$, $y$, and $z$)
19c. inequality in one variable ($x$)
19d. equation in two variables ($a$ and $b$)
20. The universal set for $n$ is $\{1, 2, 3, \ldots\}$. You can’t have, say, 1.5 variables. It is conventional to use letters near the middle of the alphabet (like $i$, $j$, $k$, $m$ or $n$) to denote variables with a universal set that is a subset of $\mathbb{Z}$.
21. The universal set for $S$ is the set of all possible sentences in one variable. Here are some members of the universal set for $S$:  $x = 1$,  $x > 1$,  $2x - 1 \leq 3x$,  …
22. ‘$x$ is at least one’ means ‘$x \geq 1$’. So, one number, or more than one number, must equal zero.
23. At least one of $x$, $y$, or $z$ must equal 0. Here are some of the choices for $x$, $y$, and $z$ that make the sentence true:
   
   $x \quad y \quad z$  substitution into $xyz = 0$
   
   $0 \quad 1 \quad 2 \quad 0 \cdot 1 \cdot 2 = 0$
   $0 \quad 0 \quad 2 \quad 0 \cdot 0 \cdot 2 = 0$
   $1 \quad 0 \quad \frac{1}{2} \quad 1 \cdot 0 \cdot \frac{1}{2} = 0$
   $0 \quad 0 \quad 0 \quad 0 \cdot 0 \cdot 0 = 0$
24. Either $x + 1 = 0$ or $x + 2 = 0$ or $x - 1 = 0$ or $x = 0$. That is, either $x = -1$ or $x = -2$ or $x = 1$ or $x = 0$. These are the only four values of $x$ that make the sentence true.
25a. ‘$ex$ is less than two’; solution set $(-\infty, 2)$
   
   $2$

25b. ‘two is greater than $ex$’; solution set $(-\infty, 2)$
   
   $2$

25c. ‘$ex$ is greater than or equal to two’; solution set $[2, \infty)$
   
   $2$
25d. ‘two is less than or equal to ex’; solution set \([2, \infty)\)

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\begin{align*}
\text{\textbf{26.}} & \\
\text{\textbf{\(x\)}} & \text{\textbf{\substitution into ‘\(x \geq 2\)’}} & \text{\textbf{\substitution into ‘\(2 \leq x\)’}} \\
4 & 4 \geq 2 & 2 \leq 4 \quad \text{(true)} \\
2 & 2 \geq 2 & 2 \leq 2 \quad \text{(true)} \\
1 & 1 \geq 2 & 2 \leq 1 \quad \text{(false)} \\
2.3 & 2.3 \geq 2 & 2 \leq 2.3 \quad \text{(true)}
\end{align*}
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END-OF-SECTION EXERCISES:

27. \(x > 1\)
28. \(x \geq 1\)
29. \(x \leq 3\)
30. \(x < 3\)
31. \((x + 1)(x - 2) = 0\)
32. \(x = 0\)
33. \((x + 1)(x)(x - 2) = 0\)
34. \(x < 0\)
35. \(x \geq 0\)
36. \(x \leq 0\)
37. \(x \neq 0\)
38. 
39. 
40. 
41. 
42. 