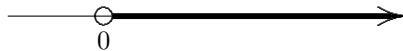


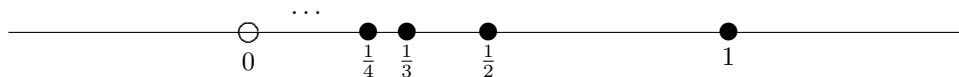
## SOLUTIONS TO EXERCISES: I LIVE TWO BLOCKS WEST OF YOU

### 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!)

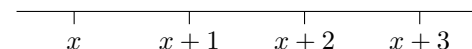
18a. equation; always false



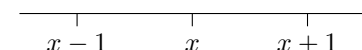
18b. inequality; always true



18c. inequality; always true



18d. inequality; always true



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  $\{1, 2, 3, \dots\}$ . 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  $S$ :  $x = 1$ ,  $x > 1$ ,  $2x - 1 \leq 3x$ , ...

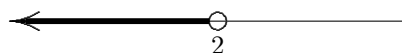
22. ' $x$  is at least one' means ' $x \geq 1$ '. So, one number, or more than one number, must equal zero.

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:

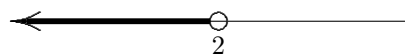
| $x$ | $y$ | $z$           | substitution into $xyz = 0$       |
|-----|-----|---------------|-----------------------------------|
| 0   | 1   | 2             | $0 \cdot 1 \cdot 2 = 0$           |
| 0   | 0   | 2             | $0 \cdot 0 \cdot 2 = 0$           |
| 1   | 0   | $\frac{1}{2}$ | $1 \cdot 0 \cdot \frac{1}{2} = 0$ |
| 0   | 0   | 0             | $0 \cdot 0 \cdot 0 = 0$           |

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.

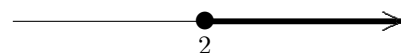
25a. ' $x$  is less than two'; solution set  $(-\infty, 2)$



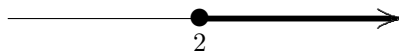
25b. 'two is greater than  $x$ '; solution set  $(-\infty, 2)$



25c. ' $x$  is greater than or equal to two'; solution set  $[2, \infty)$



25d. 'two is less than or equal to ex'; solution set  $[2, \infty)$



26.

| $x$ | substitution into ' $x \geq 2$ ' | substitution into ' $2 \leq x$ ' |
|-----|----------------------------------|----------------------------------|
| 4   | $4 \geq 2$ (true)                | $2 \leq 4$ (true)                |
| 2   | $2 \geq 2$ (true)                | $2 \leq 2$ (true)                |
| 1   | $1 \geq 2$ (false)               | $2 \leq 1$ (false)               |
| 2.3 | $2.3 \geq 2$ (true)              | $2 \leq 2.3$ (true)              |

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.  $x \neq 0$

