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## Graded quiz on Sets, Number Line, Inequalities, Simplification, and Sigma Notation

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1. Let  $B = \{3, 5, 10, 11, 14\}$ . Is the following statement true or false:  $3 \notin B$

1 / 1 point

☐ True

☒ False

✓ **Correct**

The symbol  $\notin$  stands for "is not an element of." Since 3 is an element of the set  $B$ , the given statement is not true.

2. Let  $A = \{1, 3, 5\}$  and  $B = \{3, 5, 10, 11, 14\}$ . Which of the following sets is equal to the union  $A \cup B$ ?

0 / 1 point

☐  $\{1, 10, 18\}$

☐  $\{3, 5, 10, 11, 14\}$

☐  $\{1, 3, 5, 10, 11, 14\}$

☒  $\{1, 3, 5, 3, 5, 10, 11, 14\}$

! **Incorrect**

An element is never listed more than once in a set. You may find the discussion of "The Inclusion-Exclusion Principle" in the Venn Diagrams video illuminating here!

3. How many real numbers are there between the integers 1 and 4?

1 / 1 point

☐ 4

☐ None

☒ Infinitely many

☐ 2

✓ **Correct**

There are in fact infinitely many real numbers between any pair of distinct integers, or indeed any pair of distinct real numbers!

4. Suppose I tell you that  $x$  and  $y$  are two real numbers which make the statement  $x \geq y$  true. Which pair of numbers cannot be values for  $x$  and  $y$ ?

1 / 1 point

☐  $x = 2$  and  $y = 1$

☐  $x = 10$  and  $y = 10$

☒  $x = -1$  and  $y = 0$

☐  $x = 5$  and  $y = 3.3$

✓ **Correct**

Recall that the statement  $x \geq y$  means that  $x$  is either equal to  $y$  or  $x$  is to the right of  $y$  on the real number line. Since  $-1$  is actually to the left of  $0$ , these cannot be values for  $x$  and  $y$ .

5. Suppose that  $z$  and  $w$  are two positive numbers with  $z < w$ . Which of the following inequalities is false?

1 / 1 point

☒  $-5z < -5w$

☐  $-z > -w$

☐  $z < w$

☐  $z + 3 < w + 3$

☐  $w - 7 > z - 7$

✓ Correct

If we start with  $z < w$  and multiply both sides by  $-5$ , we need to flip the less-than sign, which would give  $-5z > -5w$ . For an example, try  $z = 1$  and  $y = 2$  and see what happens!

6. Find the set of all  $x$  which solve the inequality  $-2x + 5 \leq 7$

0 / 1 point

☒  $x \leq -1$

☐  $x \geq -1$

☐  $x = -1$

☐  $x \geq -6$

! Incorrect

If you got here, you probably correctly subtracted 5 from both sides of the inequality to obtain  $-2x \leq 2$ .

But then you probably divided both sides by  $-2$  and forgot to flip the inequality sign.

To see that this answer cannot be right, note that  $x = -2$  satisfies this answer, but if we plug in  $-2$  to the given inequality, we get  $-2 \times (-2) + 5 = 4 + 5 = 9 \leq 7$ , which is not true!

7. Which of the following real numbers is not in the closed interval  $[2, 3]$

1 / 1 point

☒ 1

☐ 2.1

☐ 2

☐ 3

✓ Correct

Recall that the closed interval  $[2, 3]$  consists of all real numbers  $x$  which satisfy  $2 \leq x \leq 3$ . Since  $2 \leq 1$  is false,  $1 \notin [2, 3]$

8. Which of the following intervals represents the set of all solutions to:

1 / 1 point

$-5 \leq x + 2 < 10$ ?

☐  $[-7, 8]$

☐  $[-5, 10)$

☒  $[-7, 8)$

☐  $(7, 8)$

✓ Correct

Subtracting 2 from all sides of the inequalities gives  $-7 \leq x < 8$ , and the set of all real numbers  $x$  which make that true is exactly the half-open interval  $[-7, 8)$ .

9. Which of the numbers below is equal to the following summation:  $\sum_{k=2}^5 2k$ ?

1 / 1 point

☐ 14

☒ 28

☐ 4

☐ 10

✓ Correct

We compute  $\sum_{k=2}^5 2k = 4 + 6 + 8 + 10 = 28$ .

10. Suppose we already know that  $\sum_{k=1}^{20} k = 210$ . Which of the numbers below is equal to  $\sum_{k=1}^{20} 2k$ ?

1 / 1 point

- ☐ 210
- ☐ 2
- ☒ 420
- ☐ 40

✓ Correct

By applying one of our Sigma notation simplification rules, we can rewrite the summation in question as  $2 \left( \sum_{k=1}^{20} k \right) = 2 \times 210 = 420$ .

11. Which of the numbers below is equal to the summation  $\sum_{i=2}^{10} 7$ ?

1 / 1 point

- ☐ 7
- ☒ 63
- ☐ 48
- ☐ 70

✓ Correct

According to one of our Sigma notation simplification rules, this summation is just equal to 9 copies of the number 7 all added together, and so we get  $9 \cdot 7 = 63$ .

12. Which of the following numbers is the variance of the set  $Z = \{-2, 4, 7\}$ ?

1 / 1 point

- ☐  $\sqrt{14}$
- ☐ 69
- ☐ 42
- ☒ 14

✓ Correct

To get the variance of a set of numbers, you need to perform four steps:

First compute the mean (which is 3)

Then calculate all the squared differences between the numbers in the set and this mean (here you get 25, 1, 16)

Then add all these up (here you get 42)

Then divide by the number of elements in the set (which is 3).

Therefore, the variance of  $Z$

$$= \frac{1}{3} [(-2 - 3)^2 + (4 - 3)^2 + (7 - 3)^2]$$

$$= \frac{1}{3} [25 + 1 + 16] = \frac{42}{3} = 14$$

13. Which of the following sets does *not* have zero variance? (hint: don't do any calculation here, just think!)

1 / 1 point

- ☐  $\{5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5\}$
- ☐  $\{0, 0, 0, 0, 0, 0, 0\}$
- ☒  $\{2, 5, 9, 13\}$
- ☐  $\{1, 1, 1, 1\}$

✓ Correct

Intuitively, the numbers in this set are spread out.