Solutions for Rumack's Preparation Workbook: 3.3

1. To find the smallest possible integer value, solve the inequality. $2 \times (N - 1) + 12 > 33$, $2\times N - 2 \times 1 + 12 = 33$, $2N - 2 + 12 > 33$, $2N + 10 > 33$, $2N + 10 - 10 > 33 - 10$, $2N > 23$, $\frac{2N}{2} > \frac{23}{2}$, $N > 11.5$. If N is greater than 11.5, the smallest possible integer value is 12. The answer is (D).

2. To find the largest possible whole number, solve the inequality. $2N \leq 3 \times (7 - 5)2$, $2N \leq 3 \times (2)2$, $2N \leq 12$, $\frac{2N}{2} \leq \frac{12}{2}$, $N \leq 6$. The answer is (D).

3. To find the largest possible value, solve the inequality. $4 \times (2N - 7) \leq 68$, $4 \times 2N - 4 \times 7 \leq 68$, $8N - 28 + 28 \leq 68 + 28$, $8N \leq 96$, $\frac{8N}{8} \leq \frac{96}{8}$, $N \leq 12$.

4. To find the largest possible value of M, simplify. $2 \times (5 - N) \geq M$, $2 \times 5 - 2 \times N \geq M$, $10 - 2N \geq M$. Since N is between 0 and 5, try the smallest and largest possibility. If $N = 1$, $10 - 2N \geq M$, $10 - 2(1) \geq M$, $8 \geq M$. M is 8 or less. If $N = 4$, $10 - 2N \geq M$, $10 - 2(4) \geq M$, $2 \geq M$. Then M is 2 or less. Among these two scenarios, the greatest possible value of M is 8. The answer is (B).

5. To find the value that makes the two sides equal, rewrite the inequality with an equal sign instead of the inequality symbol, and then solve. The equation is $6 \times (M + 3) = 4 \times (N + 6)$. Since M and N are the same integer, replace one variable with the other. $6 \times (M + 3) = 4 \times (M + 6)$, $6 \times M + 6 \times 3 = 4 \times M + 4 \times 6$, $6M + 18 = 4M + 24$, $6M + 18 - 18 = 4M + 24 - 18$, $6M = 4M + 6$, $6M - 4M = 4M - 4M + 6$, $2M = 6$, $\frac{2M}{2} = \frac{6}{2}$, $M = 3$. The answer is (D).

6. To find the largest possible value for N, substitute the known value for M and solve. $N \times (1 - 2) + 3 \times (2 + N) \leq M$, $N \times (1 - 2) + 3 \times (2 + N) \leq 10$, $N \times (-1) + 3 \times 2 + 3 \times N \leq 10$, $-N + 6 + 3N \leq 10$, $2N + 6 \leq 10$, $2N + 6 - 6 \leq 10 - 6$, $2N \leq 4$, $\frac{2N}{2} \leq \frac{4}{2}$, $N \leq 2$. The answer is (C).

7.To find the value that N cannot be, solve the inequality and then consider the answer choices. $2 \times (N - 9) < 0$, $2 \times N - 2 \times 9 < 0$, $2N - 18 < 0$, $2N - 18 + 18 < 0 + 18$, $2N < 18$, $\frac{2N}{2} < \frac{18}{2}$, $N < 9$. The answer is (A).

8. To find the smallest possible value for the expression, try substituting the smallest possible value for N. Since $N > 10$, the smallest possible integer value is 11. Substitute $N = 11$: $2 \times N - 3 + 4 \times (N - 5) = 2 \times (11) - 3 + 4 \times \big((11) - 5\big) = 22 - 3 + 4 \times (6) = 19 + 24 = 43$. To double check, choose any larger number. Substitute $N = 12$: $2 \times N - 3 + 4 \times (N - 5) = 2 \times (12) - 3 + 4 \times \big((12) - 5\big) = 24 - 3 + 4 \times 7 = 21 + 28 = 49$. Since $49 > 43$, we can conclude that as N increases, the expression also increases. Therefore 43 is the smallest possible value for the expression. The answer is (D).

9. To find the inequality, list numbers on the number line, describe which numbers are included, and choose the appropriate inequality. List numbers: 8, 9, 10, and so on. Describe: "numbers 8 or larger" or "numbers greater than 7". Using symbols: $N \geq 8$ or $N > 7$. The answer is (C).

10. To find the inequality, list numbers on the number line, describe which numbers are included, and choose the appropriate inequality. List numbers: 1, 2, 3, 4, 5. Describe: “numbers 5 or smaller” or “numbers less than 6”. Using symbols: $N \leq 5$ or $N < 6$. The answer is (D).

11. To solve the inequality, isolate the variable. $N - 1 < 7$, $N - 1 + 1 < 7 + 1$, $N < 8$. The answer is (C).

12. To solve the inequality, isolate the variable. $2N - 5 \geq 11$, $2N - 5 + 5 \geq 11 + 5$, $2N \geq 16$, $\frac{2N}{2} \geq \frac{16}{2}$, $N \geq 8$. The answer is (E).

13. To find the matching inequality, list numbers on the number line, describe which numbers are included, and choose the appropriate inequality. List numbers: 10 and greater numbers (not shown). Describe: “numbers 10 or greater” or “numbers greater than 9”. Using symbols: $N \geq 10$ or $N \geq 9$. The answer is (C) $N \geq 9$.

14. To find the set of numbers, describe the inequality and then list the possible numbers. $N < 10$. Describe: The possible numbers are less than 10. Remember that N is an integer greater than zero. List numbers: 1, 2, 3, 4, 5, 6, 7, 8, 9. The answer is (C) {1, 2, 3, 4, 5, 6, 7, 8, 9}.

15. To find the solution set, list numbers on the number line, describe which numbers are included, and choose the appropriate inequality. List numbers: 6, 7, 8, 9, 10, and so on. Describe: “numbers 6 or greater” or “numbers greater than 5”. Using symbols: $N \geq 6$ or $N > 5$. The answer is (B) $N \geq 6$.

16. To find the symbolic representation of the set, describe it and then write using symbols. Describe: “numbers 11 or greater” or “numbers greater than 10”. Using symbols: $N \geq 11$ or $N > 10$. The answer is (B) $N \geq 11$.

17.To find the solution set, list the numbers that appear in the graph. List numbers: 3, 4, 5, 6, 7, 8, 9, 10, and so on. The answer is (C) {3, 4, 5, …}.

18. To find the symbolic representation of the set, describe it and then write using symbols. Describe: “numbers 14 or smaller” or “numbers less than 15”. Using symbols: $N \leq 14$ or $N < 15$. The answer is (A) $N \leq 14$.

19. To find the matching graph, list numbers included in the symbolic representation, and then find the graph that includes only these numbers. Symbolic representation: $N < 6$. Description: Numbers less than 6, not including 6. List: 1, 2, 3, 4, 5. The answer is (B).

20. To solve the inequality, isolate the variable. $3N - 2 > 4$, $3N - 2 + 2 > 4 + 2$, $3N > 6$, $\frac{3N}{3} > \frac{6}{3}$, $N > 2$. The answer is (B).

21. To find the proper inequality, solve each possible answer. Because the given inequality has a $\leq$ symbol, the matching inequality will also have this symbol or the opposite $\geq$ symbol. The answer is (B), since $4N - 32 \leq 12$, $4N - 32 + 32 \leq 12 + 32$, $4N \leq 44$, $N \leq 11$.

22. To find the inequality, list numbers on the number line, describe which numbers are included, and choose the matching inequality. List numbers: 2, 3, 4, 5, 6, 7, 8, 9, 10, and so on. Describe: “numbers 2 or greater” or “numbers greater than 1”. Using symbols: $N \geq 2$ or $N > 1$. The answer is (B) $N \geq 2$.

23. To find out which number is not in the solution set, solve the inequality. $7N - 1 \geq 20$, $7N - 1 + 1 \geq 20 + 1$, $7N \geq 21$, $\frac{7N}{7} \geq \frac{21}{7}$, $N \geq 3$. The only number not in the solution set is (E) 2.

24. To find the solution set, list numbers on the number line, describe which numbers are included, and then choose the solution set that contains the appropriate inequalities. List numbers: 3, 4, 5, 6, 7. Describe: "numbers 3 or greater" or "numbers greater than 2" with symbols: $N \geq 3$ or $N > 2$. Also "numbers 7 or less" or "numbers less than 8" with symbols: $N \leq 7$ or $N < 8$. Consider each answer choice. The answer is (A), since $2 < N < 8$ means $N > 2$ and $N < 8$.

25. To solve the inequality, isolate the variable. $-2N + 3 < -41$, $-2N + 3 - 3 < -41 - 3$, $-2N < -44$, $\frac{-2N}{-2} > \frac{-44}{-2}$, $N > 22$. The answer is (B).