Graphing Solutions to Inequalities on a Number Line

Apply the skill to decisions and designs

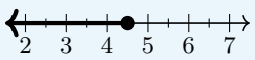
Name _____ **Date** _____ **Score** _____ / 6

QUICK REVIEW

Graph the stated rule, then apply any setting limits. For $x > 2$, an integer dial can start at 3, but the real ray still starts with an open circle at 2.

Worked example

A tide gauge is 2 m below its zero mark, then changes by d m. Graph the changes that leave it no higher than 2.5 m above zero.

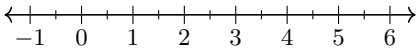


1. The signed gauge reading must satisfy $d - 2 \le 2.5$.
2. Add 2: $d \le \frac{9}{2}$.
3. At $d = \frac{9}{2}$, $(\frac{9}{2}) - 2 = \frac{5}{2}$. $\frac{5}{2} \le \frac{5}{2}$ is true: use a closed circle.
4. At $d = \frac{7}{2}$, $\frac{3}{2} \le \frac{5}{2}$ is true. Shade left.
Answer: $d \le \frac{9}{2}$ m; closed at $\frac{9}{2}$, shade left.

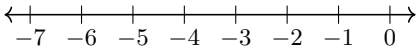
Practice Problems

Show your thinking.

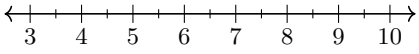
1. A dial at s gives $9 - 2s$ volts. Graph the real settings giving less than 4 V. Which dial mark works: $2, 2.5, 3$?



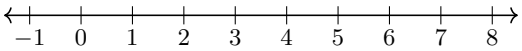
2. A survey flags a drop of at least 4 cm. Graph the signed changes d that are flagged. Is a 3 cm drop flagged?



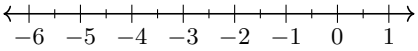
3. A volunteer needs 10 hours total and has logged 3.5. Graph the additional hours h needed. Choose the shortest qualifying shift from $6, 7, 8$ hours.



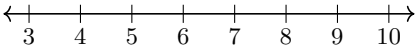
4. A slider position x is at least 0 m. Its remaining track length, $15 - x$ meters, must be more than 8 m. Graph the allowed positions.



5. Programs are numbered -4 through 1. A score $2p + 1$ below -4 is locked out. Graph the real rule for unlocked settings, then list the locked-out program numbers.



6. A mixer uses three doses of x mL and adds 2 mL. The minimum total rises from 14 to 20 mL. Graph the new rule. Which whole-mL doses no longer qualify?



Answer Key

1. $s > \frac{5}{2}$; open at $\frac{5}{2}$, shade right. Choose setting 3.
2. $d \le -4$ cm; closed at -4, shade left. A 3 cm drop is not flagged.
3. $h \ge \frac{13}{2}$ hours; closed at $\frac{13}{2}$, shade right. Choose 7 hours.
4. $0 \le x < 7$ m; closed at 0, open at 7; shade between.
5. $p \ge -\frac{5}{2}$; closed at $-\frac{5}{2}$, shade right. Lock out $-4, -3$.
6. $x \ge 6$ mL; closed at 6, shade right. 4 and 5 mL no longer qualify.

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. Subtract 9: $-2s < -5$.
2. Divide by -2 and reverse the comparison: $s > \frac{5}{2}$.
3. At $s = \frac{5}{2}$, $-2(\frac{5}{2}) + 9 = 4$. $4 < 4$ is false: use an open circle.
4. At $s = \frac{7}{2}$, $2 < 4$ is true. Shade right.
5. Of $2, 2.5, 3$ only 3 lies right of 2.5. It gives $9 - 2(3) = 3$ V.

Problem 2

1. A drop of 4 cm is $d = -4$. A larger drop is more negative: $d \le -4$.
2. At $d = -4$, $(-4) = -4$. $-4 \le -4$ is true: use a closed circle.
3. At $d = -5$, $-5 \le -4$ is true. Shade left.
4. A 3 cm drop gives $d = -3 > -4$, so it is not flagged.

Problem 3

1. The total must satisfy $h + 3.5 \ge 10$.
2. Subtract $\frac{7}{2}$: $h \ge \frac{13}{2}$.
3. At $h = \frac{13}{2}$, $(\frac{13}{2}) + \frac{7}{2} = 10$. $10 \ge 10$ is true: use a closed circle.
4. At $h = \frac{15}{2}$, $11 \ge 10$ is true. Shade right.
5. Six more hours give 9.5 hours; seven give 10.5. Choose 7 hours.

Problem 4

1. $15 - x > 8$ gives $-x > -7$, then $x < 7$. Also require $x \ge 0$.
2. $x = 0$ leaves $15 > 8$ m and meets the lower limit: closed circle.
3. $x = 7$ leaves $15 - 7 = 8$ m, not more than 8: open circle.
4. Only $0 \le x < 7$ meets both rules. Shade between the two circles.

Problem 5

1. Unlocked settings satisfy $2p + 1 \ge -4$.
2. Subtract 1: $2p \ge -5$.
3. Divide by 2: $p \ge -\frac{5}{2}$.
4. At $p = -\frac{5}{2}$, $2(-\frac{5}{2}) + 1 = -4$. $-4 \ge -4$ is true: use a closed circle.
5. At $p = -\frac{3}{2}$, $-2 \ge -4$ is true. Shade right.
6. Of the listed integers, only -4 and -3 are left of $-\frac{5}{2}$.

Problem 6

1. The new minimum requires $3x + 2 \ge 20$.
2. Subtract 2: $3x \ge 18$.
3. Divide by 3: $x \ge 6$ mL.
4. At $x = 6$, $3(6) + 2 = 20$. $20 \ge 20$ is true: use a closed circle.
5. At $x = 7$, $23 \ge 20$ is true. Shade right.
6. The old rule $3x + 2 \ge 14$ gave $x \ge 4$. Only 4 and 5 whole mL were lost.

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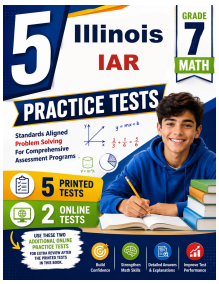

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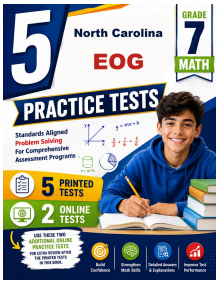

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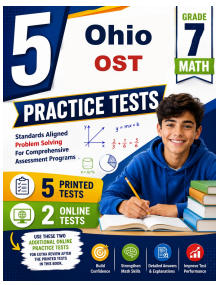

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