TT S3 03 - Linear Inequalities in One Unknown - notes

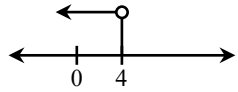
S.3 Mathematics
Chapter 03 - Linear Inequalities in One Unknown – Note 01

Name:_____ Class:_____( ) Date:_____

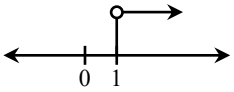
Inequalities on a Number Line

The solutions of an inequality can be represented graphically by a number line:

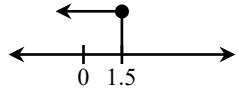
(i) $x < 4$



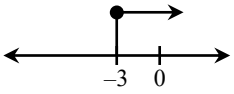
(ii) $x > 1$



(iii) $x \leq 1.5$



(iv) $x \geq -3$



1. Fill in each of the following boxes with an inequality sign '<' or '>'.

(*The first one has been done for you as an example.*)

(a) $-5 \square 3$ **(b)** $2.4 \square -1.8$ **(c)** $\frac{1}{2} \square \frac{1}{5}$

2. Fill in each of the following boxes with an inequality sign '≤' or '≥'.

(a) $-8 \square -9$ **(b)** $-3.1 \square 0.5$

(c) $-\frac{9}{2} \square \frac{7}{3}$ **(d)** $-\frac{5}{7} \square -\frac{3}{5}$

3. Fill in each of the following boxes with an inequality sign '<' or '>'.

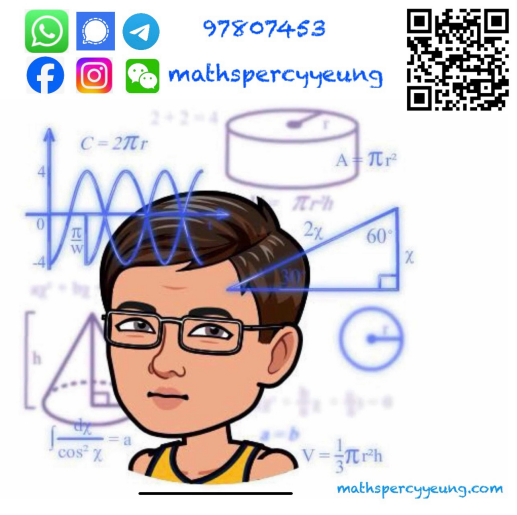
(a) $5 \square -5$ **(b)** $-1.3 \square 0.9$

(c) $\frac{2}{5} \square \frac{3}{8}$ **(d)** $4.1 \square \frac{9}{2}$

4. Fill in each of the following boxes with an inequality sign '≤' or '≥'.

(a) $-7 \square -4$ **(b)** $7.6 \square -7.7$

(c) $0 \square -1\frac{3}{4}$ **(d)** $-\frac{10}{3} \square -3\frac{1}{2}$



5. Use an inequality to represent each of the following statements.

(a) 6 times x is not greater than 1.

(b) The average humidity over the last 10 years (H%) of a city is higher than 70%.

(c) The speed (x km/h) of an electric vehicle is at most 130 km/h.

(d) Peter can vote in an election in Hong Kong. The legal voting age in Hong Kong is 18 years old. Peter is x years old.

6. Use an inequality to represent each of the following statements.

(a) Triple of x is not less than 22.

(b) The shortest member in a basketball team is 165 cm tall. Denote E cm as the height of a member in the team.

(c) The total price of 5 tape holders is not more than \$100. The price of each tape holder is \$$x$.

(d) The time required (t seconds) for an athlete to finish a 200 m race is at least 20 seconds.

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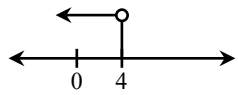
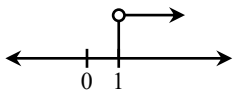
Inequalities on a Number Line

The solutions of an inequality can be represented graphically by a number line:

(i) $x < 4$



(ii) $x > 1$



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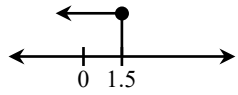
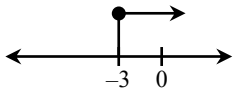
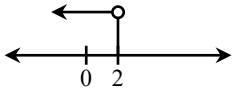


(iv) $x \geq -3$

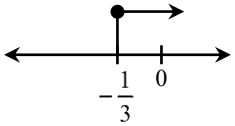


1. In each of the following, write down an inequality in x whose solutions are represented by the given figure.

(a)



(b)



2. Represent the solutions of each of the following inequalities on a number line.

(a) $x < 3$ **(b)** $x \geq -1$

(c) $x > 4.5$ **(d)** $x \leq 0$

(e) $x \geq \frac{3}{4}$ **(f)** $x \leq -\frac{1}{2}$

3. Represent the solutions of each of the following inequalities on a number line.

(a) $x > 2$

(b) $x < -4$

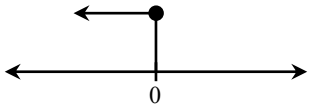
(c) $x \leq 3.5$

(d) $x \geq -5.5$

(e) $x < -\frac{7}{4}$

(f) $x \leq 2\frac{1}{3}$

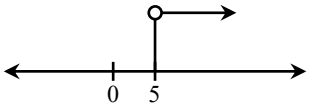
4. The solution of an inequality in x are represented on the number line as shown. Is each of the following values of x a solution of the inequality?



(a) 0

(b) 6.5

5. The solutions of an inequality in y are represented on the number line as shown. Is each of the following values of y a solution of the inequality?



(a) 8

(b) 3

6. Write down an inequality in y such that $y = -10$ is a solution of the inequality.

S.3 Mathematics
Chapter 03 - Linear Inequalities in One Unknown – Note 03

Name:_____ Class:_____( ) Date:_____

Solve Simple Linear Inequalities in One Unknown

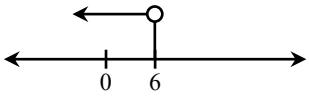
$$2x - 3 < 9$$

$$2x - 3 + 3 < 9 + 3 \quad \text{◅ Add 3 to both sides.}$$

$$2x < 12$$

$$\frac{2x}{2} < \frac{12}{2} \quad \text{◅ Divide both sides by 2.}$$

$$x < 6$$



***Note** When both sides of an inequality are **Multiplied or Divided by a Negative Number**, the inequality sign will be reversed.

1. Fill in the boxes with appropriate inequality signs.

(a) If $y \geq 3$, then $y + 3$ $\boxed{\geq}$ 6.

(b) If $a < b$, then $3a$ $\boxed{<}$ $3b$.

(c) If $a \geq b$, then $5a + 1$ $\boxed{\geq}$ $5b + 1$.

(d) If $x < y$, then $-4x$ $\boxed{>}$ $-4y$.

2. Solve the inequality $3x - 8 \geq 1$ and represent the solutions on a number line.

3. Solve the inequality $14 - 3x < 2$ and represent the solutions on a number line.

4. Solve the inequality $6x + 15 < 7$ and represent the solutions on a number line.

5. Solve the inequality $21 - 2x \geq 0$ and represent the solutions on a number line.

6. Solve the inequality $5 - 2x \leq 1$ and represent the solutions on a number line.

Name:_____ Class:_____( ) Date:_____

Solve Simple Linear Inequalities in One Unknown

$2x - 3 < 9$

$2x - 3 + 3 < 9 + 3$ ◅ Add 3 to both sides.

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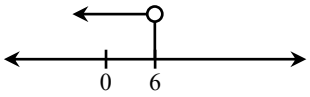
$\frac{2x}{2} < \frac{12}{2}$ ◅ Divide both sides by 2.

$x < 6$



***Note** When both sides of an inequality are **Multiplied or Divided by a Negative Number**, the inequality sign will be reversed.

1. Solve the inequality $7x + 4 < 3x - 4$ and represent the solutions on a number line.

2. Solve the inequality $8 - x \geq 5 + x$ and represent the solutions on a number line.

3. Solve the inequality $8x - 3 \leq 2x + 33$ and represent the solutions on a number line.

4. Solve the inequality $19 - 5x > 11 + 3x$ and represent the solutions on a number line.

5. Solve the inequality $-2(x + 1) + 5 \leq x - 6$ and represent the solutions on a number line.

6. Solve the inequality $\frac{x+4}{-6} \leq -1$ and represent the solutions on a number line.

Name:_____ Class:_____( ) Date:_____

Solve Simple Linear Inequalities in One Unknown

If the given inequality involves bracket(s), we have to remove the bracket(s) first,

e.g. $2(x + 1) > 9 \rightarrow 2x + 2 > 9$.

If the given inequality involves fraction(s), we have to multiply both sides by the L.C.M. of the denominators of the fraction(s). Take $\frac{x+2}{2} < \frac{x-1}{3}$ as an example.

$$\frac{x+2}{2} < \frac{x-1}{3}$$

$$6 \times \frac{x+2}{2} < \frac{x-1}{3} \times 6 \qquad \text{◅ 6 is the L.C.M. of 2 and 3.}$$

$$3(x + 2) < 2(x - 1) \qquad \text{◅ Remove the bracket(s).}$$

$$3x + 6 < 2x - 2$$

$$x < -8$$

1. Solve the inequality $5(x - 1) > 2x + 7$ and represent the solutions on a number line.

2. Solve the inequality $8(x + 3) - 9 < 5x$ and represent the solutions on a number line.

3. Solve the inequality $4(x - 10) < x + 5$ and represent the solutions on a number line.

4. Solve the inequality $1 - 5(x - 1) \geq x$ and represent the solutions on a number line.

5. Solve the inequality $3(x - 2) \leq x + 2$ and represent the solutions on a number line.

Name:_____ Class:_____( ) Date:_____

Solve Simple Linear Inequalities in One Unknown

If the given inequality involves bracket(s), we have to remove the bracket(s) first,

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$$\frac{x+2}{2} < \frac{x-1}{3}$$

$$6 \times \frac{x+2}{2} < \frac{x-1}{3} \times 6 \qquad \text{◅ 6 is the L.C.M. of 2 and 3.}$$

$$3(x + 2) < 2(x - 1) \qquad \text{◅ Remove the bracket(s).}$$

$$3x + 6 < 2x - 2$$

$$x < -8$$

1. Solve the inequality $\frac{x+4}{3} \geq \frac{x-6}{2}$ and represent the solutions on a number line.

2. Solve the inequality $\frac{2-x}{4} \leq \frac{x+8}{6}$ and represent the solutions on a number line.

3. Solve the inequality $\frac{x-8}{4} \leq \frac{x+5}{6}$ and represent the solutions on a number line.

4. Solve the inequality $\frac{x+3}{-2} > \frac{7-2x}{3}$ and represent the solutions on a number line.

5. **(a)** Solve the inequality $\frac{2x-3}{3} > 4x + 9$ and represent the solutions on a number line.

(b) If x is an integer, find the greatest possible value of x.

6. **(a)** Solve the inequality $\frac{5x+11}{4} - 6 \geq x - 5$ and represent the solutions on a number line.

(b) If x is an integer, find the least possible value of x.

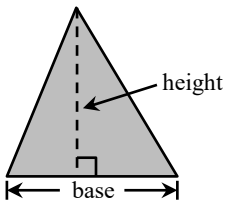
Name:_____ Class:_____( ) Date:_____

Figures or Real-Life Problems Related to Linear Inequalities in One Unknown

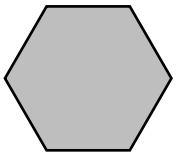
1. Define the unknown
2. Set up an inequality according to the situation
3. Solve the inequality to obtain the desired result.
4. Answer the question.

1. The perimeter of a square is at most 68 cm. Let x cm be the length of a side of the square. Find the maximum length of a side of the square.

2. The area of a triangle is at most 28.5 cm^2. It is known that the base of the triangle is 6 cm. Find the corresponding maximum height of the triangle.



3. The perimeter of a regular hexagon is at most 78 cm. Let x cm be the length of a side of the regular hexagon. Find the maximum length of a side of the regular hexagon.



4. The area of a rectangle is at least 36 cm^2. It is known that the width of the rectangle is 3 cm. Find the minimum length of the rectangle.

5. The perimeter of an equilateral triangle is at least 54 cm. Let x cm be the length of a side of the triangle. Find the minimum length of a side of the triangle.

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Figures or Real-Life Problems Related to Linear Inequalities in One Unknown

5. Define the unknown
6. Set up an inequality according to the situation
7. Solve the inequality to obtain the desired result.
8. Answer the question.

1. In a party, the entrance fees of each adult and each child are $35 and $15 respectively. There are 20 persons join the party. If the total entrance fees collected is not greater than $540, at most how many adults are there in the party?

2. A box contains only $20 notes and $50 notes and there are 25 notes in total. If the total value of all the notes in the box is more than $800, at least how many $50 notes are there in the box?

3. Kathy has $31 500 for buying desktop computers and notebook computers. A desktop computer costs $3000 and a notebook computer costs $4500. If Kathy wants to buy 8 computers in total, find the maximum number of notebook computers that she can buy.

4. Linda has a number of $20 vouchers and $50 vouchers and there are 44 vouchers in total. If the total value of the vouchers is not more than $2000, find the minimum number of $20 vouchers Linda has.

5. Each exterior angle of an n-sided regular polygon is greater than 40°.
Find the greatest possible value of n.

6. Each interior angle of a regular polygon is at least double of each exterior angle. Find the minimum number of sides of the regular polygon.