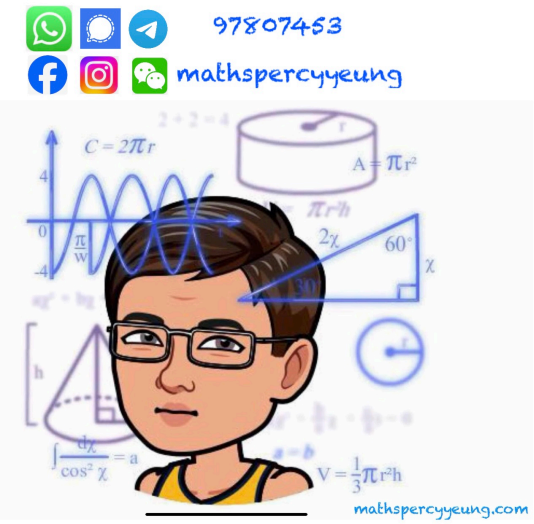
School TT

S.3 Mathematics

School-Based Exercise (S.B.E)

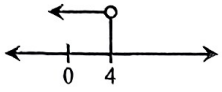
Chapter 3 Linear Inequalities in One Unknown



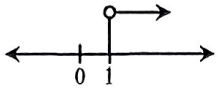
Simple Inequalities

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

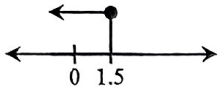
(i) $x < 4$



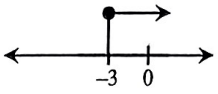
(ii) $x > 1$



(iii) $x \leq 1.5$



(iv) $x \geq -3$



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

(a) $-4.3 \square -4.2$

(b) $-5.4 \square \frac{27}{5}$

(c) $\frac{1}{13} \square \frac{1}{12}$

(d) $\frac{8}{3} \square 1.5$

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

(a) $7.13 \square -9.42$

(b) $6.7 \square \frac{27}{4}$

(c) $\frac{1}{2} \square \frac{2}{3}$

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

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

(a) x is not less than 3.6.

(b) y plus 3 is less than or equal to 5.

(c) 2 times z is not greater than 8.

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

(a) The room temperature (t °C) on a day is 24°C or above.

(b) The length (ℓ m) of a metal wire is at least 5.3 m.

(c) The speed (v km/h) of a car on a road cannot exceed 75 km/h.

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

(a) The number of marbles (n) in a bag is more than 25.

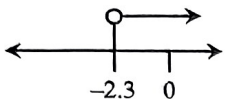
(b) The weight (w kg) of a notebook computer is at most 1.37 kg.

(c) The size (x°) of an acute angle is less than 90°.

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

(6 – 11)

6.



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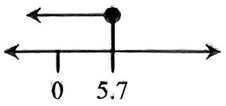

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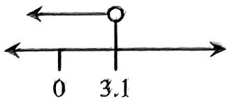

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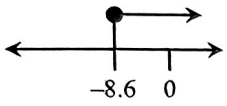

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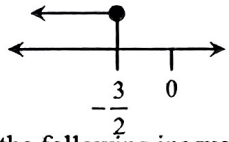

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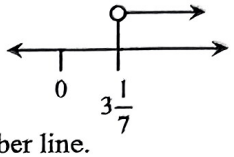


12. Represent the solutions of each of the following inequalities on a number line.

(a) $x \leq -6.4$ **(b)** $x > 8.6$

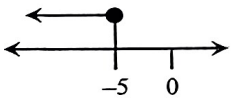
(c) $x \geq 7.8$ **(d)** $x < -3.9$

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

(a) $x > -\frac{4}{9}$ **(b)** $x \geq -2\frac{3}{4}$

(c) $x < 8\frac{1}{2}$ **(d)** $x \leq \frac{1}{12}$

14. The solutions of an inequality in x are represented on the number line as shown.



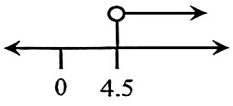
Is each of the following values a solution of the inequality?

(a) –5

(b) 0

(c) 5

15. The solutions of an inequality in x are represented on the number line as shown.



(a) Is $x = 4.5$ a solution of the inequality?

(b) Is $x = 5$ a solution of the inequality?

(c) Give three values of x which satisfy the inequality.

16. **(a)** Is $x = -2$ a solution of the inequality $x < 2$?

(b) Is $x = -2$ a solution of the inequality $x \geq -2$?

(c) According to the results of **(a)** and **(b)**, is $x = -2$ a common solution of both $x < 2$ and $x \geq -2$?

17. In each of the following, find the maximum integral solution of x.

(a) $x \leq 9$ **(b)** $x < 12$

(c) $x \leq 4.2$ **(d)** $x < 5.8$

18. In each of the following, find the minimum integral solution of y.

(a) $y \geq 9$ **(b)** $y > 12$

(c) $y \geq 4.2$ **(d)** $y > 5.8$

19. The figure shows a road sign of a road. Patty is driving on the road.

Determine whether she is speeding for each of the following driving speeds. Explain your answer.

(a) 52 km/h **(b)** 48 km/h **(c)** 50 km/h

20. Give three values of x which satisfy the inequality $x < 5$.

21. Give an inequality in x such that $x = -3$ is one of its solutions.

22. **(a)** Represent the solutions of each of the following inequalities on the same number line.

(i) $x \geq -\frac{23}{4}$ **(ii)** $x \leqslant -2$

(b) Write down all the integers that satisfy both the inequalities in **(a)**.

23. Some passengers are waiting for a lift. Denote the average weight of a passenger by x kg. Use an inequality to represent each of the following situations.

(a) The total weight of two passengers is less than 100 kg.

(b) The total weight of three passengers is at most 185 kg.

Solving 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. Given two numbers m and n such that $m > n$, determine whether each of the following is necessarily true.

(a) $m - 2 > n - 2$

(b) $6m > 6n$

(c) $2m < m + n$

2. Given two numbers a and b such that $a \geq b > 1$, determine whether each of the following is necessarily true.

(a) $\frac{a}{4} \geq \frac{b}{4}$

(b) $\frac{1}{a-1} \geq \frac{1}{b-1}$

(c) $-\frac{1}{a} \geq -\frac{1}{b}$

Solve each of the following inequalities and represent the solutions on a number line. **(3 – 17)**

3. $x + 5 > -3$

4. $7 - x \leq 4$

5. $-2x < 14$

6. $15 \leq -9 - 4x$

7. $x + 5 \leq 3x + 23$

8. $17 - 2x \geq 5x + 3$

9. $6x - 1 \leq 4x - 7$

10. $4(x+3) > x$

11. $2(3 - x) \geq 3x + 11$

12. $3(2x+1) < 4(x+2)$

13. $\frac{1-5x}{8} < 2$

14. $\frac{2(x-4)}{5} > 4$

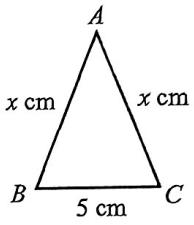
15. $2x+1 \geq \frac{x-4}{2}$ **16.** $\frac{x-3}{3} > \frac{1+3x}{4}$ **17.** $\frac{x}{2} - \frac{1}{4} > \frac{x+2}{3}$

18. If the sum of x and 3 is less than or equal to 8, find the range of the values of x.

19. Three times y is not greater than 12. If y is an integer, find the largest possible value of y.

20. Five times z minus 3 is greater than 17. If z is an even number, find the smallest possible value of z.

21. In the figure, the perimeter of an isosceles triangle ABC is at least 27 cm. $AB = AC = x$ cm and $BC = 5$ cm.



(a) Find the range of the values of x.

(b) Find the minimum length of AB.

22. (a) Solve the inequality $\frac{7-2x}{5} > \frac{x+1}{2}$.

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

23. (a) Solve the inequality $4(1-x) - 3(2x-3) \geq 24$.

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

24. Each interior angle of an n-sided regular polygon is less than 150°. Find the greatest possible value of n.

25. The sum of two consecutive numbers is not greater than 85. Find the greatest possible value of the smaller number.

26. The Lee's family has 6 members. The ages of 5 of them are 6, 10, 32, 38 and 70. If the average age of the Lee's family is greater than 27, find the minimum age of the remaining member.

27. Rosa has 5 more stickers than twice the numbers of stickers that Mandy has. If they have at most 70 stickers altogether, find the maximum number of stickers that Mandy has.

28. Ada has \$50 for buying apples and oranges. The prices of an apple and an orange are \$8 and \$5 respectively. If she wants to buy 8 fruits in total, at most how many apples can she buy?

29. There were 20 questions in a mathematics quiz. 5 marks were awarded for each correct answer and 2 marks were deducted for each wrong answer. Given that the passing score was 40 marks. Tom answered all the questions and got a pass in the quiz. At least how many questions did he answer correctly?

30. There are 20 students in a class. Mr Wong wants to distribute 12 packs of sweets evenly to the class. If 5 of them are absent, the remaining students can get at least 4 more sweets each. At least how many sweets are there in each pack?

31. It is given that $\frac{1}{7} < \frac{m}{n} < \frac{1}{6}$ where m and n are positive integers. Give two sets of possible values of m and n.

32. Given two numbers x and y such that $x > 8$ and $y < 4$, determine whether each of the following is necessarily true.

(a) $x - y > 4$ **(b)** $x^2 > y^2$ **(c)** $\frac{y}{x} < \frac{1}{2}$

33. Consider the following sequence.

76, 67, 58, 49, 40, ...

It is given that the nth term of the sequence is $76 - 9(n - 1)$. If the kth term is the smallest positive term in the sequence, find the value of k.

MC

1. Which of the following must be true?

A. $-3 \geq 3$

B. $-5 \leq -7$

C. $-2 \leq -2$

D. $0 \geq 0.04$

2. The right diagram represents the solutions of the inequality

A. $x > 19$.

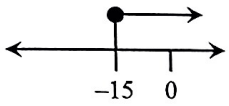
B. $x \geq 19$.

C. $x < 19$.

D. $x \leq 19$.

3. Which of the following represents the solutions of $x < -15$?

A.



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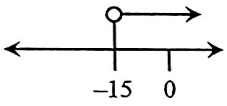
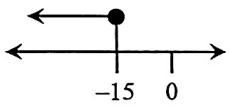
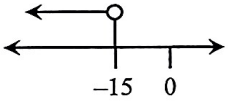


C.



D.



4. Which of the following is / are a solution of the inequality $x \geq -1$?

I. -1

II. 0

III. 2

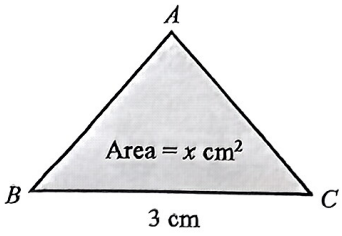
A. I only

B. III only

C. II and III only

D. I, II and III

5. In the figure, if the height of the triangle ABC is not greater than 8 cm with the base BC, which of the following inequalities can be used to find the range of the values of x?



A. $\frac{2x}{3} < 8$

B. $\frac{2x}{3} \leq 8$

C. $\frac{2x}{3} > 8$

D. $\frac{2x}{3} \geq 8$

6. If $x > z$ and $y > z$, then which of the following must be true?

A. $x > y$

B. $x - y > 0$

C. $x + y > z$

D. $x + y > 2z$

7. If $x < y < 0$, then which of the following must be true?

I. $x - y < 0$

II. $\frac{1}{x} < \frac{1}{y}$

III. $x^2 > y^2$

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

8. If $-4x + 3 \geq 9 - x$, then

A. $x \geq -2$.

B. $x \geq \frac{6}{5}$.

C. $x \leq -2$.

D. $x \leq \frac{6}{5}$.

9. The solutions of $\frac{2x-3}{3} < 7-2x$ is

A. $x > 6$.

B. $x > 3$.

C. $x < 6$.

D. $x < 3$.

10. How many positive integers x satisfy the inequality $2(x + 2) < 10$?

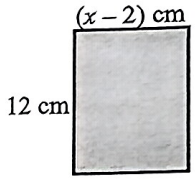
A. 2

B. 3

C. 4

D. 5

11. The figure shows a rectangle with area at most 36 cm^2.
Which of the following must be true?



A. $x < 3$

B. $x < 5$

C. $x \leq 3$

D. $x \leq 5$

12. A box contains only \$2 coins and \$10 coins and there are 43 coins in total. If the total value of all the coins in the box is greater than \$278, find the minimum number of \$10 coins.

A. 25

B. 24

C. 19

D. 18