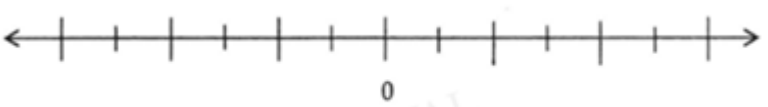


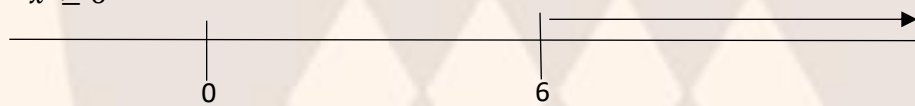
6 ESSENTIAL QUESTIONS TO MASTER

LINEAR INEQUALITIES

1	Solve the inequality $\frac{1}{4}x + 6 \leq 14 - x$	
2	Given that $3x + \frac{x}{4} \geq 34$: (a) Solve the inequality. (b) Hence state the smallest value of x if x is a prime number.	
3	(a) Solve the inequality $5 - 2x \leq -7$ and represent its solution on a number line. (b) State the (i) smallest positive integer. (ii) greatest negative integer.	
4	Given that $4 \leq a \leq 6$ and $-3 \leq b \leq 5$ and that a and b are integers, find: (i) the smallest possible value of ab , (ii) the smallest possible value of $a^2 + b^2$, (iii) the largest possible value of $a - \frac{b}{a}$.	
5	Ethan cycled from home for x km at 9 km/h to the MRT station. He waited for 3 minutes before catching the next MRT train. The MRT train travelled at an average speed of 60 km/h. He walked for $\frac{1}{2}$ km at an average speed of 6 km/h before reaching his school. The distance from his home to the school by the above route is 12 km and the total time he spent is 28 minutes. (i) Express, in terms of x , the time he spent cycling from home to the MRT station. (ii) Find the distance he travelled by Ethan on the MRT train. (iii) Form an equation in x and solve it.	
6	a) Solve the inequality $-5 \leq 2x + 1 < \frac{3x+10}{3}$ b) Represent the solution set in (a) on the number line below. 	

Answer Key:

1	$\frac{1}{4}x + x + 6 \leq 14$ $\frac{5}{4}x + 6 \leq 14$ $\frac{5}{4}x \leq 14 - 6$	
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	$\frac{5}{4}x \leq 8$ $x \leq 8 \times \frac{4}{5}$ $x \leq \frac{32}{5}$	
2	(a) $3x + \frac{x}{4} = \frac{12x}{4} + \frac{x}{4} = \frac{13x}{4}$ $\frac{13x}{4} \geq 34$ $13x \geq 34 \times 4$ $13x \geq 136$ $x \geq \frac{136}{13}$ As a decimal, $\frac{136}{13} \approx 10.46$ (b) Since $x \geq \frac{136}{13} \approx 10.46$, we need to find the smallest prime number greater than or equal to 10.46. The prime numbers are 2, 3, 5, 7, 11, 13, 17, 19, ... The smallest prime number greater than 10.46 is 11. Therefore, the smallest value of x if x is a prime number is 11.	
3	(a) $5 - 2x - 5 \leq -7 - 5$ $-2x \leq -12$ $\frac{-2x}{-2} \geq \frac{-12}{-2}$ $x \geq 6$  (b)(i) Smallest positive integer is 1 (ii) Greatest negative integer is -1.	
4	Given: $4 \leq a \leq 6$, where a is an integer. So, a can be 4, 5, or 6. $-3 \leq b \leq 5$, where b is an integer. So, b can be -3, -2, -1, 0, 1, 2, 3, 4, or 5. (i) Smallest possible value of ab To minimize the product ab, we need to consider the most negative value possible. If a is positive, we want b to be as negative as possible. The smallest value for b is -3.	

	Now we want to choose the value of a that minimizes the product. The smallest value for a is 4. So, the smallest value of ab is $4 \times (-3) = -12$. (ii) Smallest possible value of $a^2 + b^2$ To minimize $a^2 + b^2$, we want to minimize both a^2 and b^2. Since squaring a number always results in a non-negative value, we want a and b to be as close to 0 as possible. The smallest possible value for a is 4, so $a^2 = 4^2 = 16$. The smallest possible value for b^2 occurs when b is closest to 0. In this case, $b = 0$, so $b^2 = 0^2 = 0$. Therefore, the smallest value of $a^2 + b^2$ is $16 + 0 = 16$. (iii) Largest possible value of $a - \frac{b}{a}$ To maximize $a - \frac{b}{a}$, we want to maximize a and minimize $\frac{b}{a}$. To maximize a, we choose $a = 6$. To minimize $\frac{b}{a}$, we want b to be as negative as possible. So, $b = -3$. Then, $a - \frac{b}{a} = 6 - \frac{-3}{6} = 6 + \frac{1}{2} = 6.5$. So, the largest possible value of $a - \frac{b}{a}$ is 6.5.	
5	(i) Amount of time spent cycling = $\frac{x}{9}$ hrs (ii) Amount of time spent taking the train $= \frac{28}{60} - \frac{x}{9} - \frac{3}{60} - \frac{1}{2}$ $= \frac{15}{60} - \frac{x}{9} - \frac{3}{60} - \frac{1}{2}$ $= \left(\frac{1}{3} - \frac{x}{9}\right) \text{ hrs}$ Distance travelled by Ethan on the MRT train $= 60\left(\frac{1}{3} - \frac{x}{9}\right)$ $= (20 - 6\frac{2}{3}x) \text{ km}$ (iii) $x + 20 - 6\frac{2}{3}x + \frac{1}{2} = 12$ $6\frac{2}{3}x - x = 20 + \frac{1}{2} - 12$ $5\frac{2}{3}x = 8\frac{1}{2}$ $x = 1\frac{1}{2}$	
6	a) Solving the inequality: We have the compound inequality $-5 \leq 2x + 1 < \frac{3x+10}{3}$. We need to solve this inequality in two parts.	

Part 1 : $-5 \leq 2x + 1$

Subtract 1 from both sides:

$$-6 \leq 2x$$

Divide both sides by 2:

$$-3 \leq x$$

So, $x \geq -3$

Part 2: $2x + 1 < \frac{3x+10}{3}$

Multiply both sides by 3:

$$3(2x + 1) < 3x + 10$$

$$6x + 3 < 3x + 10$$

Subtract $3x$ from both sides:

$$3x + 3 < 10$$

Subtract 3 from both sides:

$$3x < 7$$

$$x < \frac{7}{3}$$

$$\text{So, } x < \frac{7}{3}$$

Combining both parts, we have $-3 \leq x < \frac{7}{3}$. In interval notation, this is $[-3, \frac{7}{3})$

b) Representing the solution set on the number line:

the solution set is $[-3, \frac{7}{3})$. This means we include -3 and all numbers up to, but not including $\frac{7}{3} \approx 2.33$.

Number line representation:

A closed circle (filled in) at -3, indicating that -3 is included in the solution set.

An open circle at $\frac{7}{3}$, indicating that $\frac{7}{3}$ is not included in the solution set.

A Line connecting the closed circle at -3 and the open circle at $\frac{7}{3}$, indicating that all numbers between -3 and $\frac{7}{3}$ are part of the solution set.