Sec 2 Math: Simple Linear Inequality

A) Basic Inequality

Solve each of the following inequalities

a) $4x + 8 \leq 2x - 6$ **b)** $9x > -18$

c) $\frac{4x+2}{3} > x + 3$ **d)** $-3x < -10$

a) $4x + 8 \leq 2x - 6$
$4x - 2x \leq -6 - 8$
$2x \leq -14$
$x \leq -7$

b) $9x > -18$
$x > -2$

c) $\frac{4x+2}{3} > x + 3$
$4x + 2 > 3x + 9$ (Multiply both side by 3)
$4x - 3x > 9 - 2$
$x > 7$

Note: **DO NOT cross multiply for inequalities! Instead, either try to make denominator the same or multiply both sides by the denominator.*

d) $-3x < -10$
$x > \frac{-10}{-3}$ (Dividing both sides by -3)
$x > -3\frac{1}{3}$

***Important Note: We have to "flip" the inequality sign whenever dividing or multiplying both sides of an inequality by a negative number.*

B) When × or ÷ by a negative number

Solve each of the following inequalities

a) $-2x > 6$ **b)** $2x > -6$ **c)** $-2x \leq -10$

a) $-2x > 6$
$x < \frac{6}{-2}$ (Flip sign as we $\div -2$)
$x < -3$

b) $2x > -6$
$x > -3$ (Do not flip sign as we $\div 2$)

c) $-2x \leq -10$
$x \geq \frac{-10}{-2}$ (Flip sign as we $\div -2$)
$x \geq 5$

C) Basic Inequality Question

Find the smallest integer value that satisfies the inequality $\frac{x}{2} + 1 < x + 3$

$\frac{x}{2} < x + 2$
$x < 2x + 4$ (Multiply both sides by 2)
$-x < 4$
$x > -4$ (Multiply by -1, flip inequality sign)

The smallest integer value that satisfy the inequality is -3.

**Note: Careful to read the question! Many students assumes that the question is about solving the inequality and did not read the question carefully. As such many did not give the smallest integer after solving the inequality.*

**Note: Make sure you revise the definitions for "Prime Number", "Rational Numbers", "Integers", "Perfect Squares"*

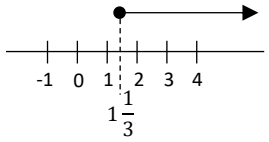
D) Number Lines

Solve the inequalities, illustrating your solutions on a number line.

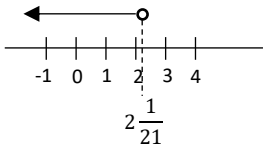
a) $7 - 2x \leq x + 3$

b) $\frac{2x-1}{5} > \frac{5x-9}{2}$

a) $7 - 2x \leq x + 3$
$-2x - x \leq 3 - 7$
$-3x \leq -4$
$x \geq 1\frac{1}{3}$



b) $\frac{2x-1}{5} > \frac{5x-9}{2}$
$\frac{4x-2}{10} > \frac{25x-45}{10}$
$4x - 2 > 25x - 45$
$4x - 25x > -45 + 2$
$-21x > -43$
$x < \frac{-43}{-21}$
$x < 2\frac{1}{21}$



**Note: For number lines, we use a "shaded circle" to mark points if the inequality is "greater/less than or equals to". An unshaded circle is used for situations for "greater/less than" without "equals to".*

E) Inequality Word Problem 1

The cost of printing invitation cards consists of a fixed charge of \$45 and an additional charge of 80 cents per card.

a) Write down an expression, in terms of x, for the total cost of printing x invitation cards.

b) Melissa has \$360 and wants to print some invitation cards. Using your answer in (a), form an inequality and find the maximum number of invitation cards she can print

a) Cost of printing $= 45 + 0.8x$

b) $45 + 0.8x \leq 360$
$0.8x \leq 315$
$x \leq \frac{315}{0.8}$
$x \leq 393.75$
The maximum number of invitation cards she can print is 393.

F) Inequality Word Problem 2

Jack sat for a Mathematics quiz consisting of 25 MCQ questions. Each correct answer carries 2 marks while 1 mark is deducted for each wrong answer. No points are deducted for unanswered questions. Jack answered a total of 22 questions, of which x questions were correct.

a) Write down an expression, in terms of x, for Jack's total score.

b) If Jack's total score was more than 31, form an inequality and determine the minimum number of questions he answered correctly.

a) Jack's score
$= (2)(x) + (-1)(22 - x) + (0)(3)$
$= 2x - 22 + x + 0$
$= 3x - 22$

b) $3x - 22 > 31$
$3x > 53$
$x > 17\frac{2}{3}$
Jack answered a minimum of 18 questions correctly.

G) Greatest or Smallest possible value

Given that x and y are integers such that $-3 \leq x \leq 7$ and $4 \leq y \leq 10$, find

i) the smallest possible value of $x - y$

ii) the largest possible value of $\frac{x}{y}$

iii) the smallest possible value of $x^2 - y^2$

Since we are only interested in either smallest or largest possible values, we will only need to consider the most extreme values for each variable.

For x, we only need to consider $x = -3, 0$ or 7

For y, we only need to consider $y = 4$ or 10

i) Smallest possible value of $x - y$ means we want x to be as small as possible and y to be as large as possible since we are subtracting it.
∴Smallest $x - y = (-3) - (10)$
$= -13$

ii) largest possible value of $\frac{x}{y}$ means we want both the numerator and denominator to be positive if possible and we want x to be largest while y to be smallest possible value.
∴ Largest possible $\frac{x}{y} = \frac{7}{4}$

iii) The smallest possible value of $x^2 - y^2$ means we want x^2 to be smallest while y^2 to be largest.
∴ smallest possible $x^2 - y^2 = (0)^2 - (10)^2$
$= -100$

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