U2D8 MCR3UI WORKSHEET **Inequalities**

Part A Linear Inequalities

1. **Solve the following linear inequalities.**

Question		Answer
a)	$3x+6>-3$	$x>-3$
b)	$7x \geq 2x+10$	$x \geq 2$
c)	$3(x-5) \leq 5x-9$	$x \geq -3$
d)	$3(y-5) \leq 9(y+1)-2y$	$y \geq -6$
e)	$\frac{x-2}{3} \leq 2x-3$	$x \geq \frac{7}{5}$

Part B Quadratic Inequalities

Solve the following quadratic inequalities.

a)	$x^2-1>0$	$x>1$ *or* $x<-1$
b)	$x^2-x-12<0$	$-3<x<4$
c)	$(2x-3)(x+4) \geq 0$	$x \geq \frac{3}{2}$ *or* $x \leq -4$
d)	$-3x(x-5) \leq 0$	$x \leq 0$ *or* $x \geq 5$
e)	$k^2-9k \geq 0$	$k \leq 0$ *or* $k \geq 9$

Extra Practice Questions:

1. Solve the following inequalities and graph the solution on the real number line:

a) $6-2x>4$ b) $4(1-x) \geq 3(x-1)$

c) $2(3x-1)-5x>-6(1-x)+7$ d) $\frac{2x}{3}+1 \geq 2$

e) $\frac{x+1}{2}<\frac{x+2}{3}$ f) $\frac{2-3x}{2}+\frac{2}{3} \leq \frac{3x-2}{6}$

2. Solve the following inequalities and graph the solution on the real number line:

a) $4x^2+8x+3>0$ b) $10x^2-17x+3 \leq 0$

c) $2x^2+11x+15<0$ d) $8x^2-10x-12 \geq 0$

e) $-6x^2-15x-9>0$ f) $12x^2-11x+2<0$

g) $-4x^2+18x+10 \leq 0$

ANSWERS

1a) $x<1$ b) $x \leq 1$ c) $x<\frac{-3}{5}$

d) $x \geq \frac{3}{2}$ e) $x<1$ f) $x \geq 1$

2a) $\left\{x<-\frac{3}{2}\right\} \cup \left\{x>-\frac{1}{2}\right\}$ b) $\left\{\frac{1}{5} \leq x \leq \frac{3}{2}\right\}$ c) $\left\{-3<x<-\frac{5}{2}\right\}$

d) $\left\{x \leq -\frac{3}{4}\right\} \cup \{x \geq 2\}$ e) $\left\{-\frac{3}{2}<x<-1\right\}$ f) $\left\{\frac{1}{4}<x<\frac{2}{3}\right\}$

g) $\left\{x \leq -\frac{1}{2}\right\} \cup \{x \geq 5\}$

A.

1a) $3x+6 > -3$

$3x > -9$

$x > -3$

$\therefore \{x > -3\}$

b) $7x \geq 2x+10$

$7x-2x \geq 2x+10-2x$

$5x \geq 10$

$\therefore \{x \geq 2\}$

c) $3(x-5) \leq 5x-9$

$3x-15 \leq 5x-9$

$3x-5x \leq -9+15$

$-2x \leq 6$

$\therefore \{x \geq -3\}$ ↙ sign flips when you divide by a negative.

notice: $-2x \leq 6$

$-2x+2x \leq 6+2x$

$0 \leq 6+2x$

$0-6 \leq 6+2x-6$

$-6 \leq 2x$

$\frac{-6}{2} \leq \frac{2x}{2}$

$\therefore \{-3 \leq x\}$ OR $\{x \geq -3\}$

d) $3(y-5) \leq 9(y+1)-2y$

$3y-15 \leq 9y+9-2y$

$3y-15 \leq 7y+9$

$3y-7y \leq 9+15$

$-4y \leq 24$ ↙ flip sign (dividing by -4).

$\therefore \{y \geq -6\}$

e) $\frac{x-2}{3} \leq 2x-3$

$x-2 \leq 6x-9$

$x-6x \leq -9+2$

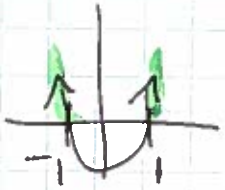
$-5x \leq -7$

$x \geq \frac{7}{5}$ $\quad \therefore \{x \geq \frac{7}{5}\}$

B.

a) $x^2-1>0$

$(x-1)(x+1)>0$

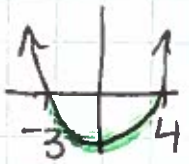


$x<-1$ OR $x>1$

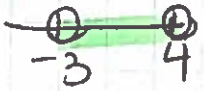
$\therefore \{x<-1 \text{ or } x>1\}$

b) $x^2-x-12<0$

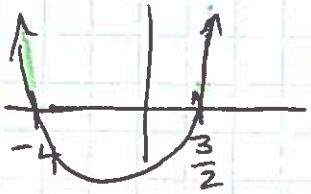
$(x-4)(x+3)<0$



$\{-3<x<4\}$

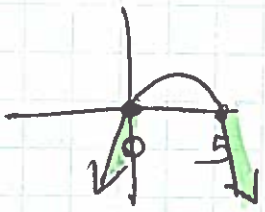


c) $(2x-3)(x+4) \geq 0$



$\{x \leq -4 \text{ OR } x \geq \frac{3}{2}\}$

d) $-3x(x-5) \leq 0$



$\{x \leq 0 \text{ OR } x \geq 5\}$

B. e) $k^2 - 9k \geq 0$

$k(k-9) \geq 0$

$\{k \leq 0$ OR $k \geq 9\}$

Extra Practice

1a) $6 - 2x > 4$

$-2x > -2$

$\therefore \{x < 1\}$

b) $4(1-x) \geq 3(x-1)$

$4 - 4x \geq 3x - 3$

$-7x \geq -7$

$\therefore \{x \leq 1\}$

c) $2(3x-1) - 5x > -6(1-x) + 7$

$6x - 2 - 5x > -6 + 6x + 7$

$x - 2 > 6x + 1$

$x - 6x > 1 + 2$

$-5x > 3$

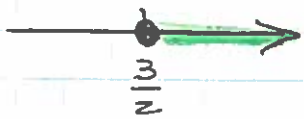
$\therefore \{x < -\frac{3}{5}\}$

d) $\frac{2x}{3} + 1 \geq 2$

$2x + 3 \geq 6$

$2x \geq 3$

$\therefore \{x \geq \frac{3}{2}\}$



e) $\frac{x+1}{2} < \frac{x+2}{3}$

$\frac{6}{2}(x+1) < \frac{6}{3}(x+2)$

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

$3x + 3 < 2x + 4$

$\therefore \{x < 1\}$

f) $\frac{2-3x}{2} + \frac{2}{3} \leq \frac{3x-2}{6}$

$\frac{6}{2}(2-3x) + \frac{6}{3}(2) \leq \frac{6}{6}(3x-2)$

$3(2-3x) + 2(2) \leq 3x - 2$

$6 - 9x + 4 \leq 3x - 2$

$-9x + 10 \leq 3x - 2$

$-9x - 3x \leq -2 - 10$

$-12x \leq -12$

$\therefore \{x \geq 1\}$

Extra Practice

2 a) $4x^2+8x+3>0$

$(2x+1)(2x+3)>0$

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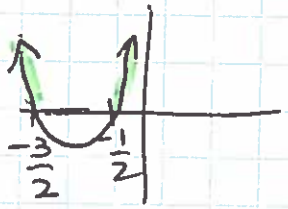
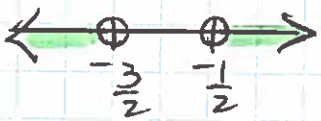


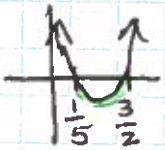
$\therefore \{x < -\frac{3}{2} \text{ OR } x > -\frac{1}{2}\}$

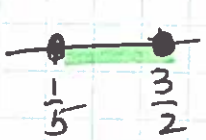


$x < -\frac{3}{2}$ or $-\frac{1}{2} < x$ ← can write it like this if it is easier for you (1)

b) $10x^2-17x+3\leq 0$

$(5x-1)(2x-3)\leq 0$



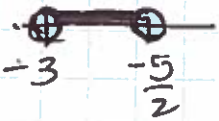


$\{\frac{1}{5} \leq x \leq \frac{3}{2}\}$

c) $2x^2+11x+15<0$

$(x+3)(2x+5)<0$

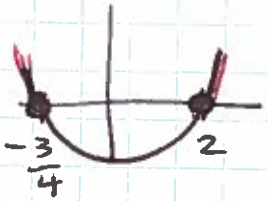
$\{-3 < x < -\frac{5}{2}\}$



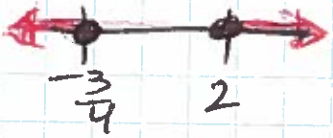
d) $8x^2-10x-12\geq 0$

$4x^2-5x-6\geq 0$

$(4x+3)(x-2)\geq 0$



$\{x \leq -\frac{3}{4} \text{ OR } x \geq 2\}$



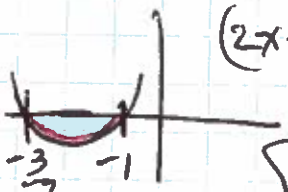
$x \leq -\frac{3}{4}$ OR $2 \leq x$

e) $-6x^2-15x-9>0$

$-3(2x^2+5x+3)>0$

$2x^2+5x+3<0$

$(2x+3)(x+1)<0$

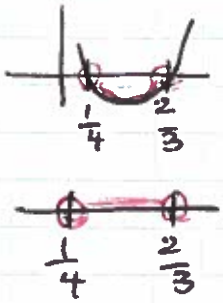


$\{-\frac{3}{2} < x < -1\}$

Extra Practice

#2 f) $12x^2 - 11x + 2 < 0$

$(4x-1)(3x-2) < 0$



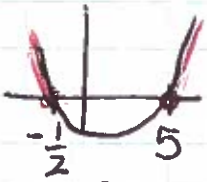
$\left\{\frac{1}{4} < x < \frac{2}{3}\right\}$

g) $-4x^2 + 18x + 10 \leq 0$

$-2(2x^2 - 9x - 5) \leq 0$

$2x^2 - 9x - 5 \geq 0$

$(2x+1)(x-5) \geq 0$



$\left\{x \leq -\frac{1}{2} \text{ OR } x \geq 5\right\}$

$x \leq -\frac{1}{2}$ (OR) $5 \leq x$