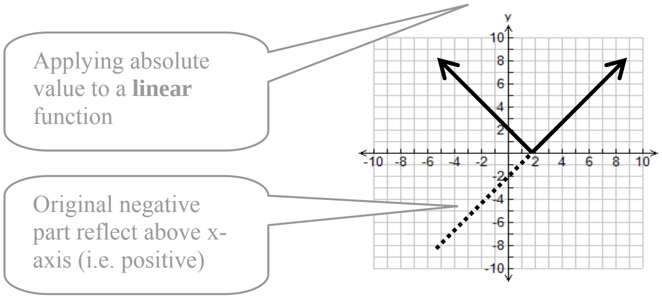
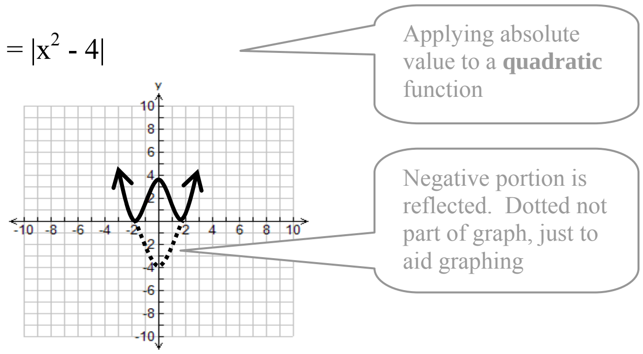
3.4B – Absolute Value Inequalities

Graphically the ***absolute value function*** reflects any part below the x-axis to the positive side.

Ex. a) $f(x) = |x - 2|$ b) $g(x) = |x^2 - 4|$





Before examining inequalities involving absolute value(s) let us re-examine absolute value equations comparing the algebraic and graphically methods.

Ex. $|2x – 1| = 5$

case 1: Negative

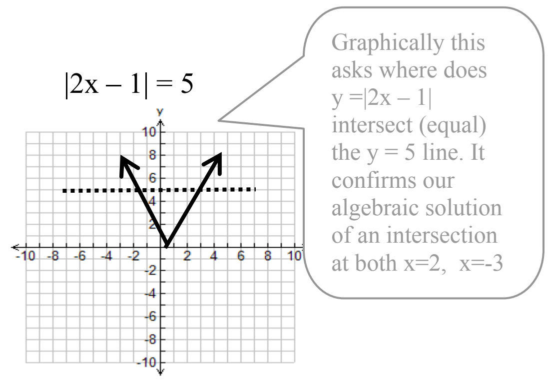
$-(2x – 1) = 5$
$-2x + 1 = 5$
$x = -2$

or

case 2: Positive

$+(2x – 1) = 5$
$2x – 1 = 5$
$x = 3$

$|2x – 1| = 5$



Ex. $|x – 5|=2x – 7$

The algebra seems to work fine, but one needs to be careful. x = 2 is ***inadmissible***.

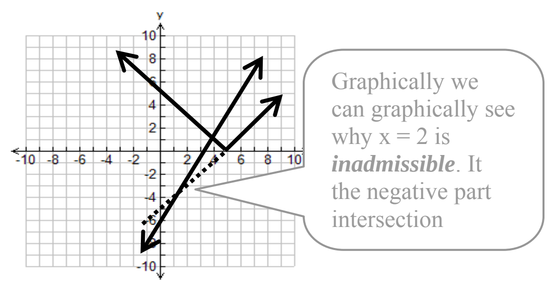
$(x – 5) = 2x – 7$
$x – 5 = 2x – 7$
$2 = x$

or

$-(x - 5) = 2x – 7$
$-x + 5 = 2x – 7$
$12 = 3x$
$4 = x$

Inadmissible

$\therefore$ x = 4 is only solution



With the caveat shown above one should always confirm solutions to absolute value by formally checking using substitution (LS=RS) or by graphing. With absolute value inequalities one will have to graph (sketch) since inequalities are best solved graphically by highlighting the area(s) that match criteria.

Ex. $|x – 3| > 5$

Recall sign changes when multiplying by a negative

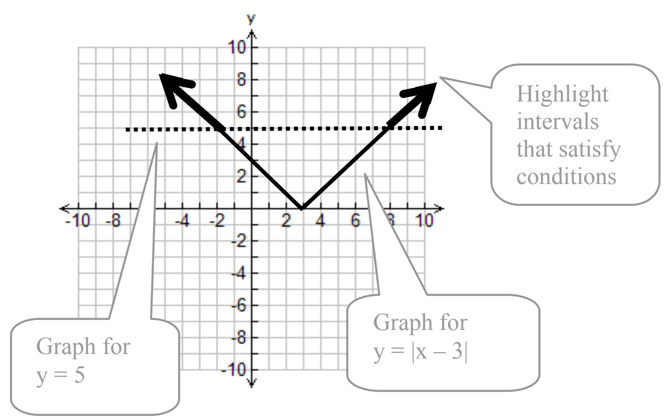
$-(x – 3) > 5$
$- x + 3 > 5$
$-x > 2$
$x < -2$

or

$+(x – 3) > 5$
$x – 3 > 5$
$x > 8$

both solutions confirmed graphically

$\therefore$ $x < -2$ or $x > 8$



3.4B – Absolute Value Inequalities Practice Questions

Transformation is best method for d,e,f. All others should use feflection technique

1. Graph the following.

a) $f(x) = |x + 2|$　　b) $f(x) = |x - 2|$　　c) $f(x) = |3x - 1|$
d) $h(x) = |x| + 2$　　e) $h(x) = 2|x| - 1$　　f) $h(x) = \frac{1}{2}|x + 1| - 3$
g) $g(x) = |x^2 - 3|$　　h) $g(x) = |(x - 3)^2|$　　i) $g(x) = |(x + 2)(x - 1)|$
j) $y = |(x + 3)^2(x - 2)|$　　k) $y = |-2x^2 + 4x|$　　l) $y = -|(x + 1)^2 - 2| + 3$

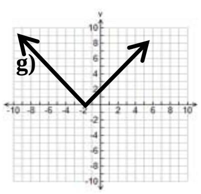
2. Solve the following equations algebraically and check graphically

a) $|x + 4| = -2$　　b) $|x - 4| = 3x - 7$
c) $3x - |x + 3| = 0$　　d) $4x + 1 = |x - 5|$

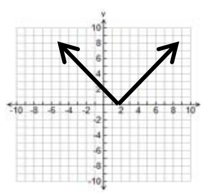
3. Solve the following inequalities.

a) $|x| < 3$　　b) $|x - 2| \leq 3$　　c) $|x + 3| \geq -1$
d) $5 \leq |x - 4|$　　e) $|x - 4| > 3x - 7$　　f) $2x - |x + 3| < 0$

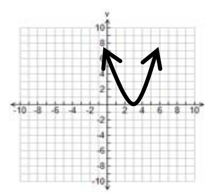
Answers 1. a&d) **g)**

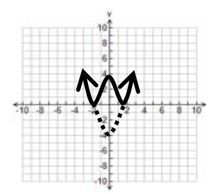


b)



h)

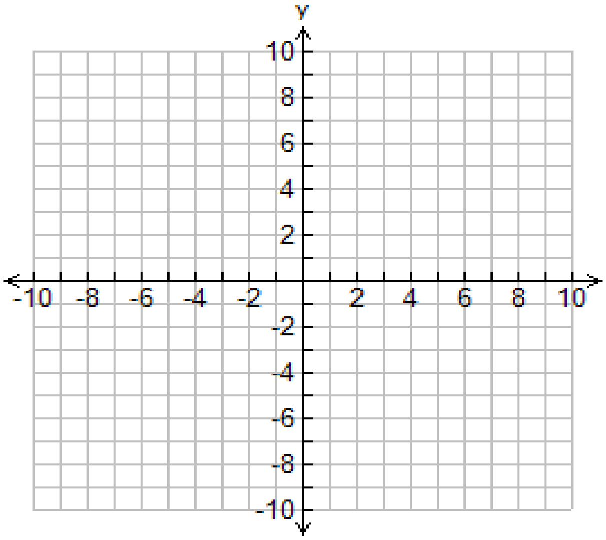


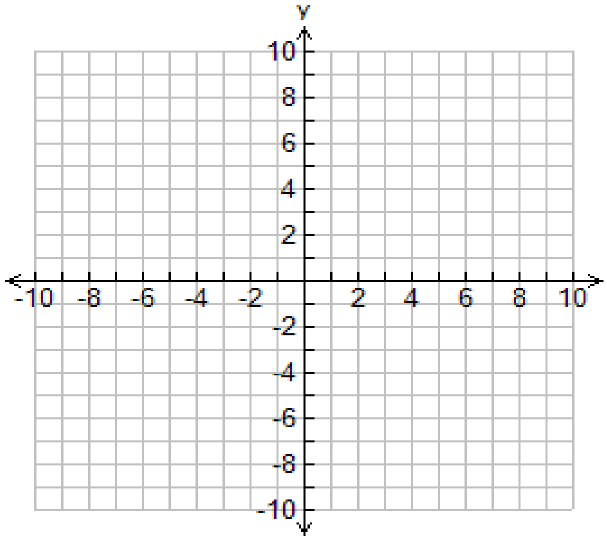


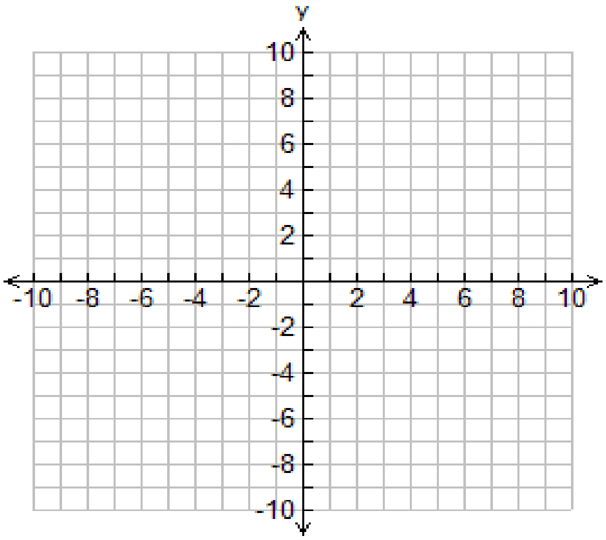
Check other graphs on calculator

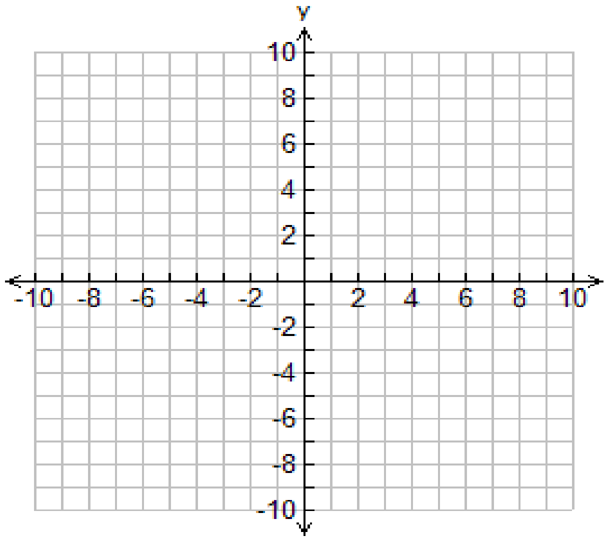
2. a) no solution **b)** $x=11/4$ **c)** $x=1.5$ **d)** $x=4/5$ **3. a)** $-3<x<3$ **b)** $1\leq x\leq 5$ **c)** $x\in R$ **d)** $x\leq 1$ or $x\geq 9$ **e)** $x<11/4$
f) $x<3$

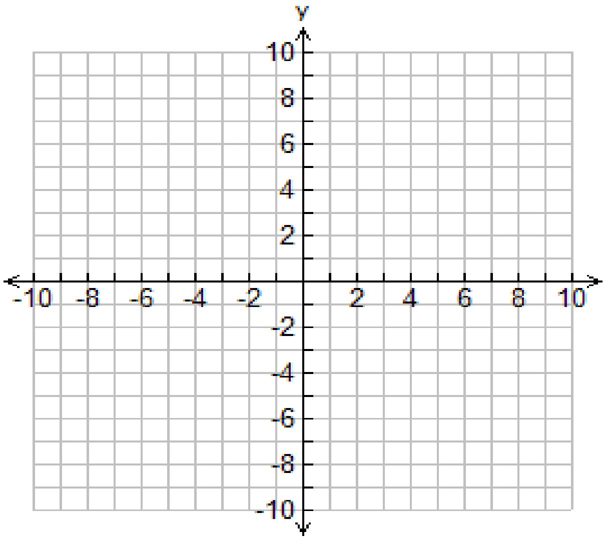
3.4 - Sketching Practice Sheets

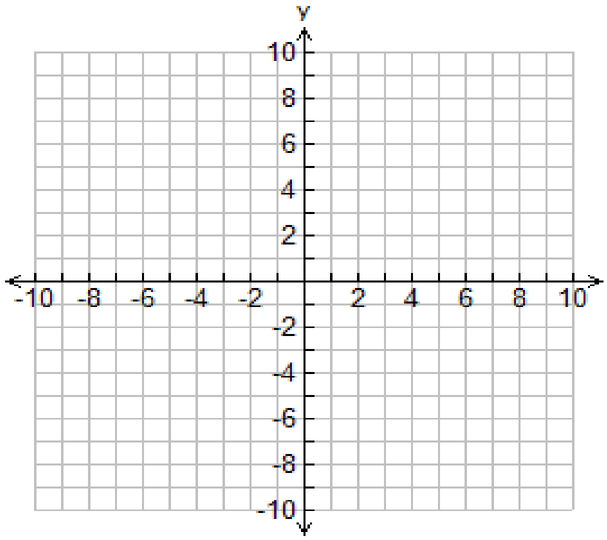












3.4B – absolute value inequalities