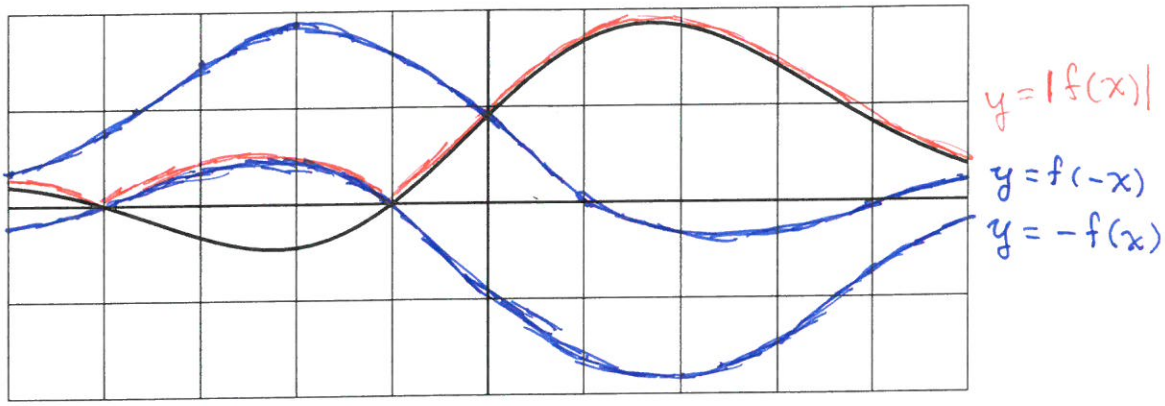
College of the Holy Cross
Math 135 (Calculus I)
Worksheet 4: Sums, Absolute Values, Power Functions

1. A graph $y = f(x)$ is shown. In the same grid, sketch $y = f(-x)$, $y = -f(x)$, $y = |f(x)|$.



2. Using a single set of axes for each part, sketch the graphs: See graph paper

(a) $y = |x|$,
$y = \frac{1}{2}x + |x|$,
$y = x + |x|$,
$y = 2x + |x|$.

(b) $y = |x|$,
$y = |x - 1|$, $y = |x| - 1$,
$y = |x + 2|$, $y = |x| + 2$.

(c) $y = |x - 1|$,
$y = |x + 2|$,
$y = |x - 1| + |x + 2|$.

(d) $y = |x - 1|$,
$y = -|x + 2|$,
$y = |x - 1| - |x + 2|$.

3. (a) Complete the table, using your calculator as little as possible:

x	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
$\frac{1}{x}$	10	5	$\frac{10}{3}$	$\frac{5}{2}$	2	$\frac{5}{3}$	$\frac{10}{7}$	$\frac{5}{4}$	$\frac{10}{9}$	1

x	1.25	1.5	1.75	2.0	2.25	2.5	2.75	3.0	3.5	4.0
$\frac{1}{x}$	$\frac{4}{5}=0.8$	$\frac{2}{3}$	$\frac{4}{7}$	$\frac{1}{2}$	$\frac{4}{9}$	$\frac{2}{5}$	$\frac{4}{11}$	$\frac{1}{3}$	$\frac{2}{7}$	$\frac{1}{4}$

What effect does doubling x have on $\frac{1}{x}$? Tripling x? Doubling x halves $\frac{1}{x}$; tripling divides $\frac{1}{x}$ by 3.

(b) On a piece of graph paper, carefully plot the data you found in part (a). (Omit portions lying outside the ranges $0 \le x \le 4$ and $0 \le y \le 4$.) Then fill in the graph $y = \frac{1}{x}$, a *hyperbola.*

(c) Use the graph from (b) to sketch the graph $y = \frac{1}{x^2}$. If you're not sure how part (b) helps, do the next question, then come back.

4. In this question, we'll graph the *power functions* $y = x$, $y = x^2$, $y = x^3$, and $y = x^4$ on the same set of axes by "judicious sampling" rather than systematically plotting points. The grid below extends from 0 to 1 both horizontally and vertically.

(a) Draw the line $y = x$. Place dots at the points where $x = 0$, $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, and 1.

(b) On the vertical line $x = \frac{1}{4}$, find and plot the point whose height is *one-quarter* the height of the line $y = x$.

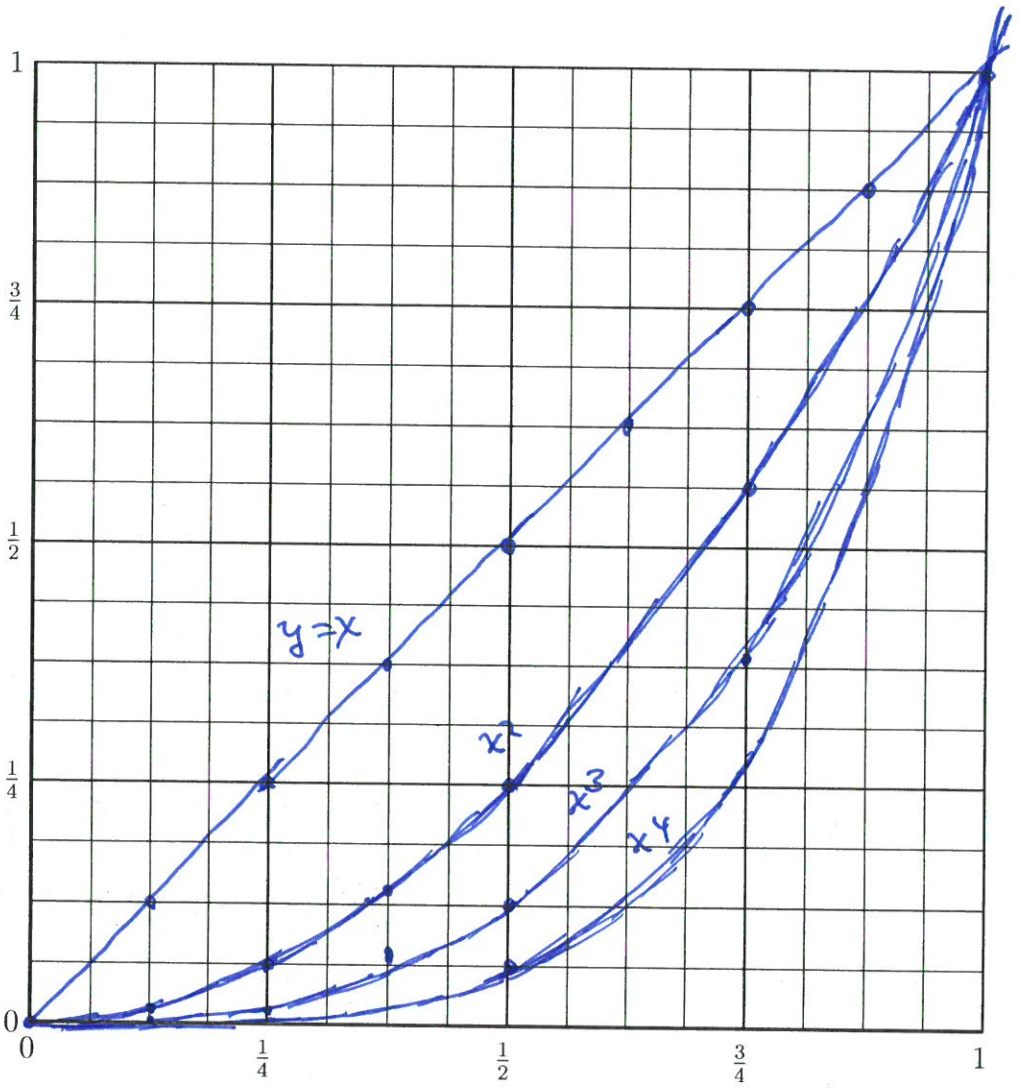
(c) On the vertical line $x = \frac{1}{2}$, find and plot the point whose height is *one-half* the height of the line $y = x$.

(d) On the vertical line $x = \frac{3}{4}$, find and plot the point whose height is *three-quarters* the height of the line $y = x$.

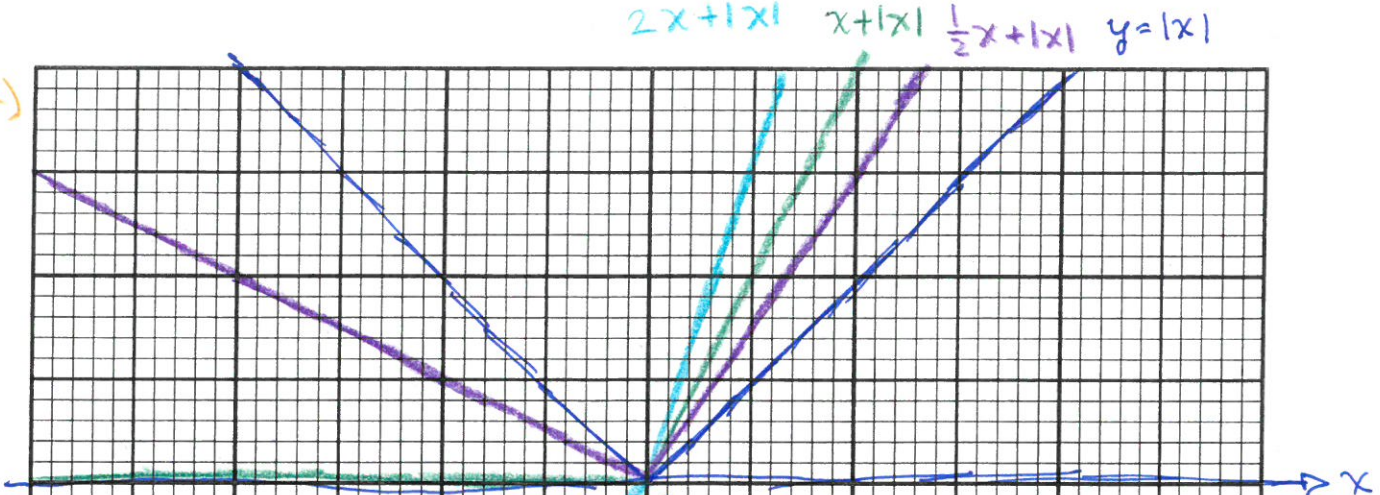
(e) Use these points to sketch the graph $y = x^2$. (Plot additional points if you like.)

(f) Repeat parts (b)–(e), but work relative to the parabola you just plotted. Use these points to sketch $y = x^3$.

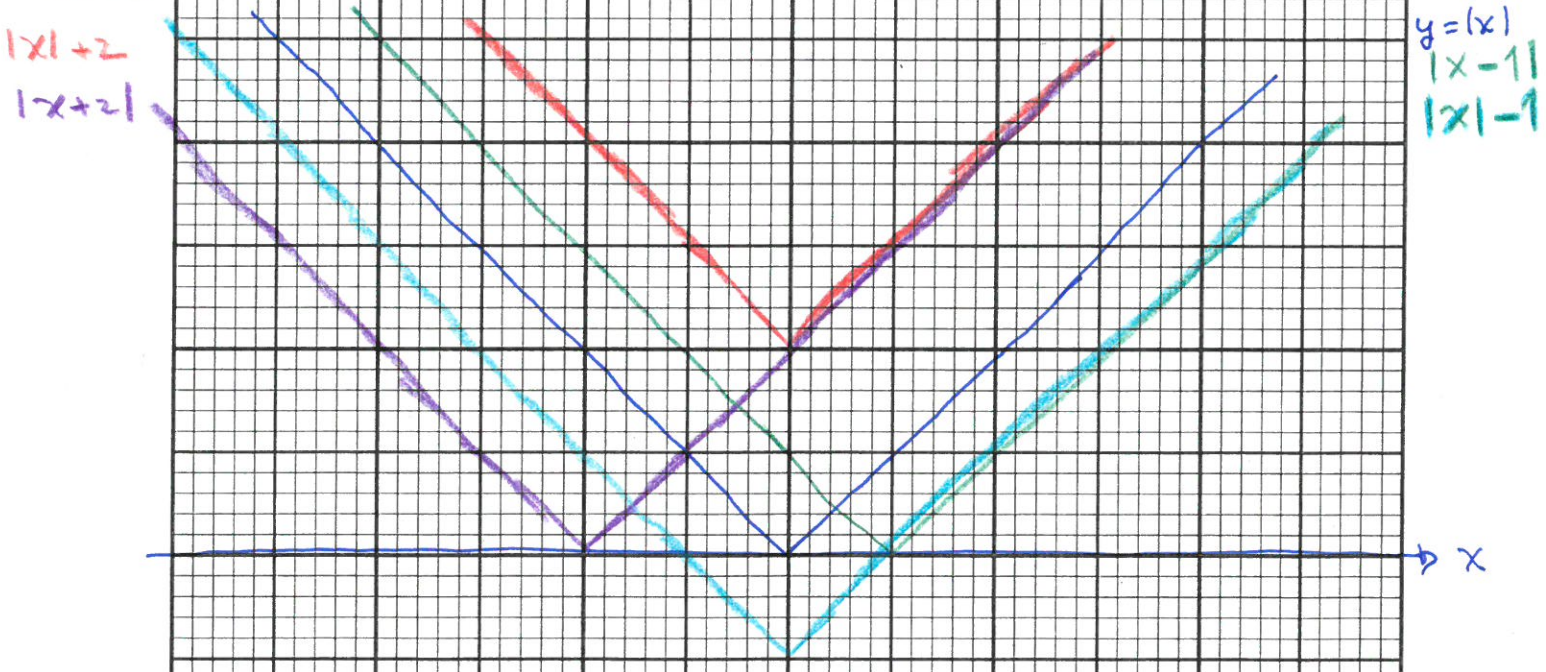
(g) Similarly, sketch $y = x^4$.

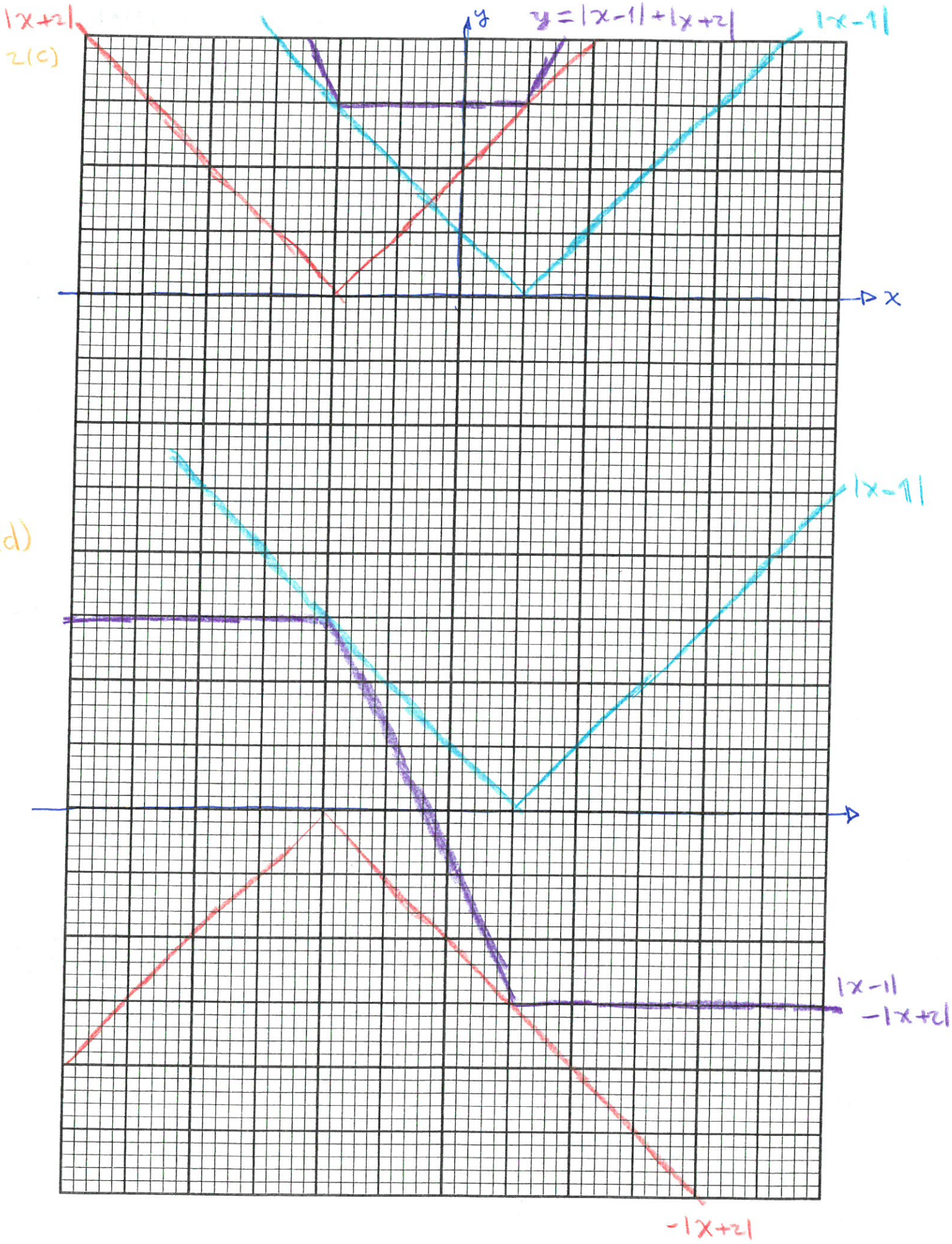


2(a)



2(b)




|x+2|
2(c)
y
y = |x-1| + |x+2|
|x-1|
x
2(d)
|x-1|
|x-1|
-|x+2|
-|x+2|