Key

Thurs 8/17

2.1 Simplifying Rational Exponents

Examples:

1) $9^{\frac{3}{2}}$

$9^{3/2}$

$\sqrt[2]{9^3}$

$\sqrt{9\cdot 9\cdot 9}$

$\sqrt{3\cdot 3\ 3\cdot 3\ 3\cdot 3}$

$3\cdot 3\cdot 3$

$\boxed{27}$

$9^{3/2}$

$\sqrt{9^3}$

$\sqrt{(3^2)^3}$

$\sqrt{3^6}$

There are 6 and you are taking out pairs so...

$3^3 = \boxed{27}$

$9^{3/2}$

$(3^2)^{3/2}$

$3^{3/2\cdot 2}$

3^3

$\boxed{27}$

Three different ways to do this

2) $180^{\frac{1}{2}}$

$180^{1/2}$

$\sqrt{180}$

180
2 90
2 45
3 15
3 5

$\sqrt{2\cdot 2\ 3\cdot 3\cdot 5}$

$2\cdot 3\sqrt{5}$

$\boxed{6\sqrt{5}}$

$180^{1/2}$

$\sqrt{180}$

$\sqrt{9}\sqrt{20}$

$\sqrt{9}\sqrt{4}\sqrt{5}$

$3\cdot 2\sqrt{5}$

$\boxed{6\sqrt{5}}$

Look for perfect squares to simplify

2 ways to do this

3) $8^{\frac{3}{2}}\cdot 12^{\frac{1}{2}}$

12
2 6
2 3

$\sqrt{8^3}\sqrt{12}$

$\sqrt{(2^3)^3\cdot 2\cdot 2\cdot 3}$

$\sqrt{2^9\cdot 2^2\cdot 3}$

$\sqrt{2^{11}\cdot 3}$

$2^5\sqrt{2\cdot 3}$

$\boxed{32\sqrt{6}}$

There are eleven 2's, so you can take out 5 pairs w/1 leftover

4) $\sqrt[3]{(xy)^6}$

In a cube root, take out sets of 3, not 2!

$\sqrt[3]{x^6y^6}$

$\sqrt[3]{xxx\ xxx\ yyy\ yyy}$

$x\cdot x\cdot y\cdot y$

$\boxed{x^2y^2}$

or

$\sqrt[3]{(xy)^6} = (xy)^{6/3}$

$= (xy)^2 = x^2y^2$

5) $\sqrt{x} - \sqrt[3]{x}$

$x^{1/2} - x^{1/3}$

this is another way to write it, but these are not like terms and can't be simplified further

6) $\frac{\sqrt{x}}{\sqrt[4]{x}} = \frac{x^{1/2}}{x^{1/4}}$

$= x^{1/2 - 1/4} = x^{2/4 - 1/4}$

$= \boxed{x^{1/4}} = \boxed{\sqrt[4]{x}}$

can write answer either way.

7) $(27x^9)^{\frac{2}{3}}$

$\sqrt[3]{(27x^9)^2}$

$\sqrt[3]{(3^3)^2(x^9)^2}$

$\sqrt[3]{3^6x^{18}}$

take out 2 sets of 3 from 3's. Take out 6 sets of 3 from x's.

$3^2x^6 = \boxed{9x^6}$

or you can use fractions

$(27x^9)^{2/3}$

$(3^3x^9)^{2/3}$

$3^{3 \cdot 2/3} \cdot x^{9 \cdot 2/3}$

$3^2x^6 = \boxed{9x^6}$

If there is addition or subtraction in the denominator with a square root then we need to multiply the numerator and denominator by the conjugate.

Find the conjugate of the following:

8) $3-\sqrt{7}$

$(3-\sqrt{7})\,(?) = 3^2-(\sqrt{7})^2$

$(3-\sqrt{7})(3+\sqrt{7})$ foil

$9 + \cancel{3\sqrt{7} - 3\sqrt{7}} - (\sqrt{7})^2$

$9-7=2$

This is something we can multiply by so that it removes the radical.

$\boxed{3+\sqrt{7}}$ is the conjugate

9) $-6+\sqrt{2}$

$(-6+\sqrt{2})(-6-\sqrt{2})$ foil

$36 \cancel{+6\sqrt{2} - 6\sqrt{2}} - (\sqrt{2})^2$

$36-2=34$

So $\boxed{-6-\sqrt{2}}$ is the conjugate

Simplify the following radicals:

10) $\dfrac{4}{5+\sqrt{3}} \cdot \dfrac{(5-\sqrt{3})}{(5-\sqrt{3})} = \dfrac{20-4\sqrt{3}}{25-3} = \dfrac{\cancel{20}^{10}-\cancel{4}^{2}\sqrt{3}}{\cancel{22}_{11}}$

$\underbrace{(5+\sqrt{3})(5-\sqrt{3})}_{25-\cancel{5\sqrt{3}}+\cancel{5\sqrt{3}}-(\sqrt{3})^2}$

$= \boxed{\dfrac{10-2\sqrt{3}}{11}}$

11) $\dfrac{3}{7-\sqrt{2}} \cdot \dfrac{(7+\sqrt{2})}{(7+\sqrt{2})} = \dfrac{21+3\sqrt{2}}{49-2} = \boxed{\dfrac{21+3\sqrt{2}}{47}}$

$\underbrace{(7-\sqrt{2})(7+\sqrt{2})}_{49+\cancel{7\sqrt{2}}-\cancel{7\sqrt{2}}-(\sqrt{2})^2}$

12) $\dfrac{\sqrt{2}}{4+\sqrt{5}} \cdot \dfrac{(4-\sqrt{5})}{(4-\sqrt{5})} = \dfrac{4\sqrt{2}-\sqrt{10}}{16-5} = \boxed{\dfrac{4\sqrt{2}-\sqrt{10}}{11}}$

$\underbrace{(4+\sqrt{5})(4-\sqrt{5})}_{16-\cancel{4\sqrt{5}}+\cancel{4\sqrt{5}}-(\sqrt{5})^2}$

 foil top!

13) $\dfrac{3+\sqrt{7}}{2-\sqrt{10}}\dfrac{(2+\sqrt{10})}{(2+\sqrt{10})} = \dfrac{6+3\sqrt{10}+2\sqrt{7}+\sqrt{70}}{4-10} = \dfrac{6+3\sqrt{10}+2\sqrt{7}+\sqrt{70}}{-6}$

$4 \cancel{+2\sqrt{10}} \cancel{-2\sqrt{10}} - (\sqrt{10})^2$

move negative from denominator to numerator.

$\boxed{\dfrac{-6-3\sqrt{10}-2\sqrt{7}-\sqrt{70}}{6}}$

i – imaginary number

$i = \sqrt{-1}$

$i^2 = \sqrt{-1}\cdot\sqrt{-1} = (\sqrt{-1})^2 = \boxed{-1}$

$i^3 = \underbrace{\sqrt{-1}\cdot\sqrt{-1}}_{-1}\cdot\sqrt{-1} = -1\cdot\sqrt{-1} = \boxed{-i}$

$i^4 = \underbrace{\sqrt{-1}\cdot\sqrt{-1}}_{-1}\cdot\underbrace{\sqrt{-1}\cdot\sqrt{-1}}_{-1} = \boxed{1}$

$i^5 = \underbrace{\sqrt{-1}\sqrt{-1}\sqrt{-1}\sqrt{-1}}_{1}\sqrt{-1} = 1\cdot\sqrt{-1} = \boxed{i}$

$i^6 = \underbrace{\sqrt{-1}\sqrt{-1}\sqrt{-1}\sqrt{-1}}_{1}\underbrace{\sqrt{-1}\sqrt{-1}}_{-1} = \boxed{-1}$

$i^7 = \underbrace{\sqrt{-1}\sqrt{-1}\sqrt{-1}\sqrt{-1}}_{1}\cdot\underbrace{\sqrt{-1}\sqrt{-1}\sqrt{-1}}_{-i} = \boxed{-i}$

$i^8 = \underbrace{\sqrt{-1}\sqrt{-1}\sqrt{-1}\sqrt{-1}}_{1}\cdot\underbrace{\sqrt{-1}\sqrt{-1}\sqrt{-1}\sqrt{-1}}_{1} = \boxed{1}$

$i^9 = i^4\cdot i^4\cdot i^1 = \boxed{i}$

$i^{10} = \cancel{i^4\cdot i^4}\cdot i^2$
$1\cdot 1\cdot i^2 = \boxed{-1}$

$i^{11} = i^4\cdot i^4\cdot i^3 = i^3 = \boxed{-i}$

$i^{12} = i^4\cdot i^4\cdot i^4$
$1\cdot 1\cdot 1 = \boxed{1}$

$i^{13} = i^4\cdot i^4\cdot i^4\cdot i^1$
$1\cdot 1\cdot 1\cdot i = \boxed{i}$

$i^{14} = i^4\cdot i^4\cdot i^4\cdot i^2 = i^2 = \boxed{-1}$

$i^{15} = i^4 i^4 i^4\cdot i^3 = i^3 = \boxed{-i}$

$i^{16} = (i^4)^4 = \boxed{1}$

$i^{17} = i^{16}\cdot i = \boxed{i}$

$i^{18} = i^{16}\cdot i^2 = i^2 = \boxed{-1}$

$i^{19} = i^{16}\cdot i^3 = i^3 = \boxed{-i}$

$i^{20} = (i^4)^5 = (1)^5 = \boxed{1}$

$i^{21} = i^{20}\cdot i = \boxed{i}$

Is there a pattern?

Find the following:

there are 8 sets of 4, and $i^4 = 1$

$i^{32} = (i^4)^8 = (1)^8 = \boxed{1}$

there are 25 sets of 4 with 1 leftover

$i^{101} = i^{100} i = (i^4)^{25} \cdot i = 1 \cdot i = \boxed{i}$

$i^{47} = i^{44} \cdot i^2 = i^2 = \boxed{-1}$

$i^{222} = i^2 = \boxed{-1}$ $\quad 4\overline{)222}$ 55 R2

Simplify:

14) $\sqrt{-3} = i\sqrt{3}$

15) $\sqrt{-16} = 4i$

$\sqrt{-4 \cdot 4}$

16) $-i^{30}\sqrt{-21}\sqrt{3} =$

$i^{30} = i^2 = -1$

$-(-1)\sqrt{-7 \cdot 3 \cdot 3}$

$-(-1)\, i\, 3\sqrt{7}$

$\boxed{3i\sqrt{7}}$

17) $2i^{12}\sqrt{-25}\sqrt{12} =$

$i^{12} = 1$

$2 \cdot 5 \cdot i\sqrt{2 \cdot 2 \cdot 3}$

$10 \cdot i \cdot 2\sqrt{3}$

$\boxed{20i\sqrt{3}}$

Mon 8/21

2.2 Imaginary and Complex Numbers

Solve:

1) $x^2 = -12$

$\sqrt{x^2} = \pm\sqrt{-12}$

$x = \pm\sqrt{-2 \cdot 2 \cdot 3}$

$\boxed{x = \pm 2i\sqrt{3}}$

2) $2x^2 + 11 = -37$

$-11 \quad -11$

$\frac{2x^2}{2} = \frac{-48}{2}$

$x^2 = -24$

$\sqrt{x^2} = \pm\sqrt{-24} = \pm\sqrt{-1}\sqrt{4}\sqrt{6}$

$i \cdot 2 \cdot \sqrt{6}$

$\boxed{x = \pm 2i\sqrt{6}}$

3) $5x^2 + 33 = 3$

$-33 \quad -33$

$5x^2 = -30$

$x^2 = -6$

$\sqrt{x^2} = \sqrt{-6}$

$\boxed{x = i\sqrt{6}}$

Complex Numbers: $a + bi$

- a is the real part and
- bi is the imaginary part

Simplify:

4) $(8 - i) + (5 + 4i)$

$8 - i + 5 + 4i$

$\boxed{13 + 3i}$

5) $(7 - 6i) - (3 - 6i)$

$7 \cancel{-6i} - 3 \cancel{+6i}$

$\boxed{4}$

6) $10-(6+7i)+4i$

$10-6\underbrace{-7i+4i}$

$\boxed{4-3i}$

7) $4i(-6+i)$

$-24i+4i^2$ $\quad -1$

$-24i+4(-1)$

$\boxed{-4-24i}$

8) $(9-2i)(-4+7i)$

$-36+\underbrace{63i+8i}-14i^2$ $\quad -1$

$-36+71i+14$

$\boxed{-22+71i}$

9) $(2+i)(2-i)$

$4\cancel{-2i}\cancel{+2i}-i^2$

$4+1=\boxed{5}$

10) $6i(5-7i)-3(11+2i)$

$30i\underbrace{-42i^2}_{+42}-33-6i$

$24i+42-33$

$\boxed{29+24i}$

11) $\frac{\overset{2}{\cancel{8i}}(3-4i)}{\cancel{6i}}=\boxed{6-8i}$

12) $(i\sqrt{6}+3)^2$

$(i\sqrt{6}+3)(i\sqrt{6}+3)$

$i^2(\sqrt{6})^2 + 3i\sqrt{6} + 3i\sqrt{6} + 9$

$(-1)(6)$

$-6 + 6i\sqrt{6} + 9$

$\boxed{3+6i\sqrt{6}}$

13) $(i\sqrt{5}+4)(i\sqrt{5}-4)$

$\underbrace{i^2 \cdot 5}_{-5} \cancel{-4i\sqrt{5}} \cancel{+4i\sqrt{5}} -16$

$-5 \qquad -16$

$\boxed{-21}$

Conjugate a + b i and a - b i

The expression is not completely simplified if there is an imaginary # in the denominator so you have to multiply the numerator and denominator by the conjugate of the denominator.

14. $\frac{3 \cdot i}{\underbrace{5i \cdot i}_{-1}} = \frac{3i}{-5} = \frac{-3i}{5}$

15. $\frac{(2+4i)i}{(6i)i} = \frac{2i+4i^2}{6i^2} = \frac{-4+2i}{-6} = \frac{4-2i}{6}$

-4

-6

16. $\frac{(7+5i)(1+4i)}{(1-4i)(1+4i)} = \frac{7+28i+5i \cancel{+20i^2}}{1 \cancel{-16i^2}} = \boxed{\frac{-13+33i}{17}}$

-20

$+16$

$1 \cancel{+4i} \cancel{-4i} - 16i^2$

17. $\dfrac{(5+2i)(3+2i)}{(3-2i)(3+2i)} = \dfrac{15+10i+6i+\cancel{4i^2}^{\,-4}}{9\cancel{-4i^2}_{\,+4}} = \boxed{\dfrac{11+16i}{13}}$

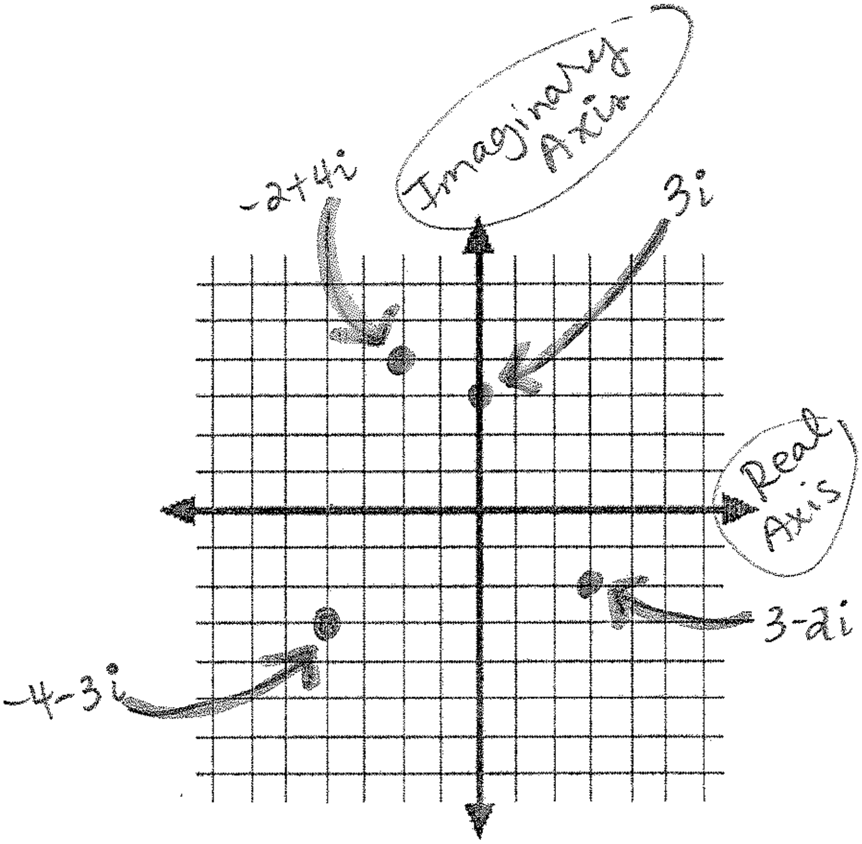
Plotting Complex numbers

18. $3-2i$

19. $-2+4i$

20. $3i$

21. $-4-3i$



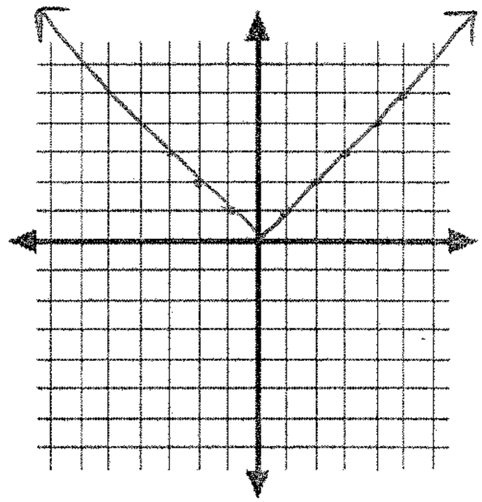
Wed 8/23

2.3 Absolute Value Functions

Parent Function $y = |x|$

"V" shape

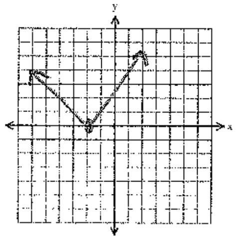
*Identify key features of parent function



*In different groups graph the following on the same coordinate plane and state the domain and range for each graph:

Group 1	Group 2	Group 3
$f(x) = \|x + 2\|$	$f(x) = \|x\|+2$	$f(x) = -\|x\|$
$f(x) = \|x - 3\|$	$f(x) = \|x\|-3$	$f(x) = \frac{1}{4}\|x\|$
$f(x) = \|x + 4\|$	$f(x) = \|x\|+4$	$f(x) = 2\|x\|$
$f(x) = \|x - 1\|$	$f(x) = \|x\|-1$	$f(x) = -3\|x\|$

Group 1

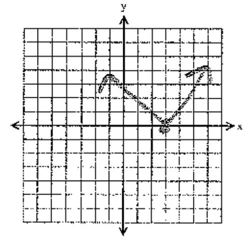


$f(x) = |x+2|$

$(-2,0)$

R: $\cancel{y \geq 0}$ $[0,\infty)$

D: $\mathbb{R}$ $(-\infty,\infty)$

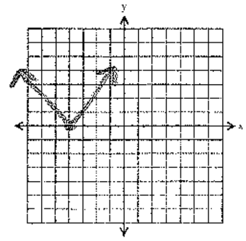


$f(x) = |x-3|$

$(3,0)$

R: $\cancel{y \geq 0}$ $[0,\infty)$

D: $\cancel{\mathbb{R}}$ $(-\infty,\infty)$

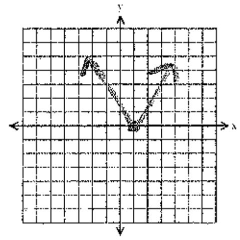


$f(x) = |x+4|$

$(-4,0)$

R: $\cancel{y \geq 0}$ $[0,\infty)$

D: $\cancel{\mathbb{R}}$ $(-\infty,\infty)$



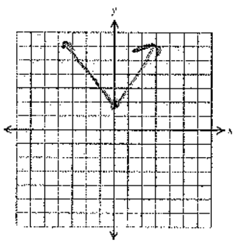
$f(x) = |x-1|$

$(1,0)$

R: $\cancel{y \geq 0}$ $[0,\infty)$

D: $\cancel{\mathbb{R}}$ $(-\infty,\infty)$

GROUP 2

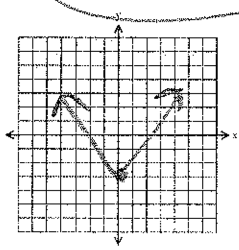


$f(x) = |x|+2$

$(0,2)$

D: $\cancel{\mathbb{R}}$ $(-\infty,\infty)$

R: $\cancel{y \geq 2}$ $[2,\infty)$

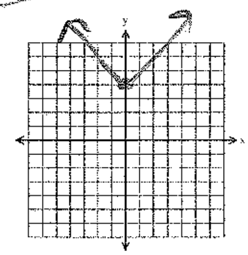


$f(x) = |x|-3$

$(0,-3)$

D: $\cancel{\mathbb{R}}$ $(-\infty,\infty)$

R: $\cancel{y \geq -3}$ $[-3,\infty)$

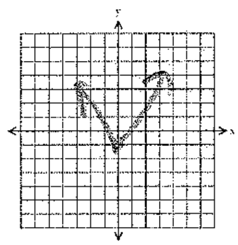


$f(x) = |x|+4$

$(0,4)$

D: $\cancel{\mathbb{R}}$ $(-\infty,\infty)$

R: $\cancel{y \geq 4}$ $[4,\infty)$



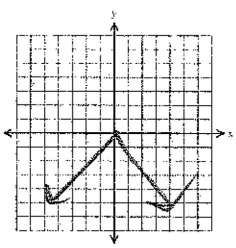
$f(x) = |x|-1$

$(0,-1)$

D: $\cancel{\mathbb{R}}$ $(-\infty,\infty)$

R: $\cancel{y \geq -1}$ $[-1,\infty)$

GROUP 3

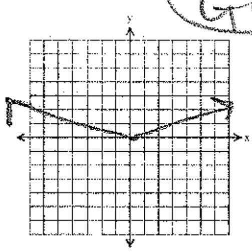


$f(x) = -|x|$

D: $\cancel{\mathbb{R}}$ $(-\infty,\infty)$

R: $\cancel{y \leq 0}$

$(-\infty,0]$

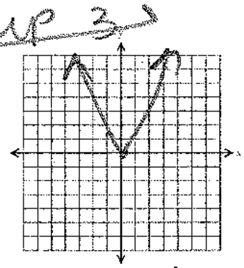


$f(x) = \frac{1}{4}|x|$

D: $\cancel{\mathbb{R}}$ $(-\infty,\infty)$

R: $\cancel{y \geq 0}$

$[0,\infty)$

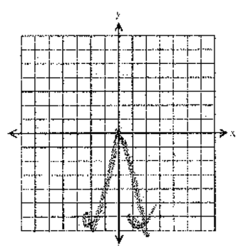


$f(x) = 2|x|$

D: $\cancel{\mathbb{R}}$ $(-\infty,\infty)$

R: $\cancel{y \geq 0}$

$[0,\infty)$



$f(x) = -3|x|$

D: $\cancel{\mathbb{R}}$ $(-\infty,\infty)$

R: $\cancel{y \leq 0}$

$(-\infty,0]$

stretch/compress

reflect

$$y = a|x - h| + k$$

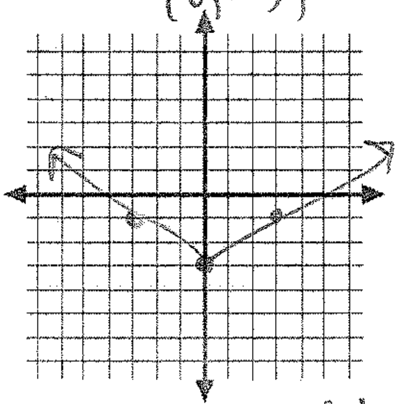
vertex @ (h, k)

Graph the following using transformations. Then state the D & R.

1. $f(x) = \frac{2}{3}|x| - 3$

↓3

(0, -3)



Trans: compressed by 2/3

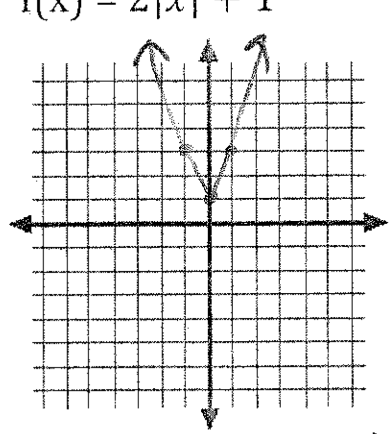
↓3

D: ~~ℝ~~ $(-\infty, \infty)$

R: ~~y ≥ -3~~ $[-3, \infty)$

2. $f(x) = 2|x| + 1$

(0, 1)



Transformations: stretched by 2

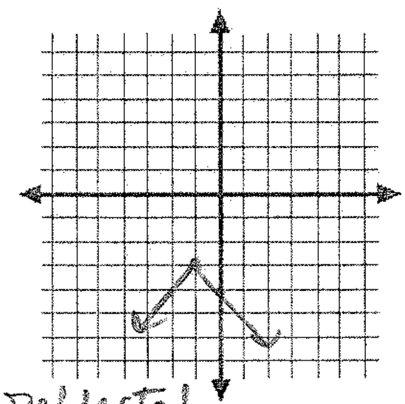
↑1

D: ~~ℝ~~ $(-\infty, \infty)$

R: ~~y ≥ 1~~ $[1, \infty)$

3. $f(x) = -|x + 1| - 3$

(-1, -3)



Transf: reflected

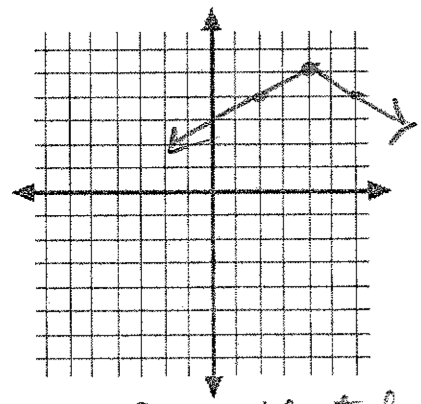
←1, ↓3

D: ~~ℝ~~ $(-\infty, \infty)$

R: ~~y ≤ -3~~ $(-\infty, -3]$

4. $f(x) = -\frac{1}{2}|x - 4| + 5$

(4, 5)



Transf: reflected

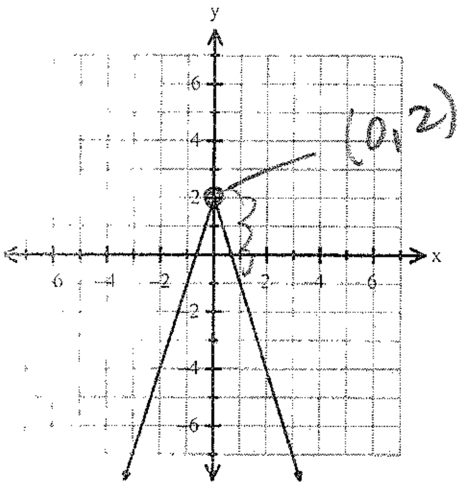
compressed by 1/2

→4 ↑5

D: ~~ℝ~~ $(-\infty, \infty)$, R: ~~y ≤ 5~~ $(-\infty, 5]$

Write the equation of the following graphs and state the D & R:

5.

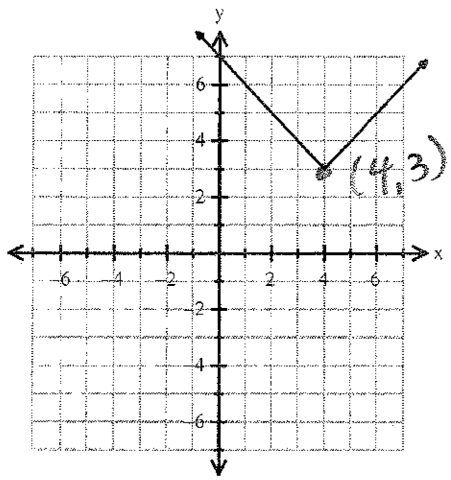


$y = -3|x| + 2$

D: ~~ℝ~~ $(-\infty, \infty)$

R: ~~$y \le 2$~~ $(-\infty, 2]$

6.

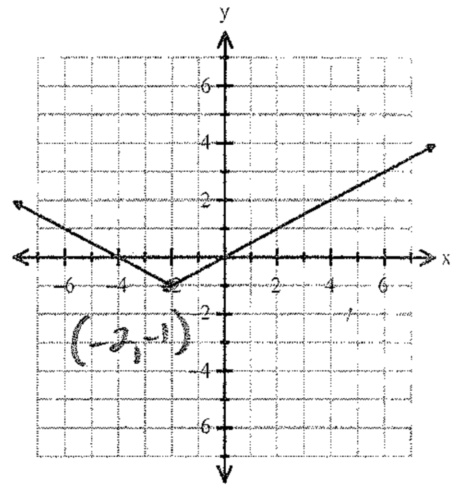


$y = |x - 4| + 3$

D: ~~ℝ~~ $(-\infty, \infty)$

R: ~~$y \ge 3$~~ $[3, \infty)$

7.



$y = \frac{1}{2}|x + 2| - 1$

D: ~~ℝ~~ $(-\infty, \infty)$

R: ~~$y \ge -1$~~ $[-1, \infty)$

x y h k

8. The vertex of an absolute value equation is at (-2, -3) and goes through the point (-1, -7). Write the equation of the function.

$y = a|x - h| + k$

$y = a|x + 2| - 3 \longrightarrow \boxed{y = -4|x + 2| - 3}$

$-7 = a|-1 + 2| - 3$

$-7 = a|1| - 3$

$+3 \quad\quad +3$

$-4 = a$

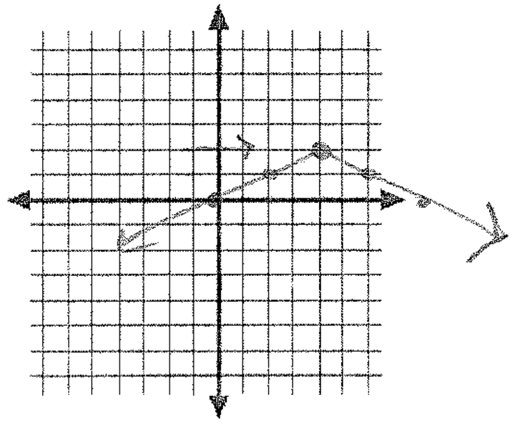
plug in x, y to find a. once you know a you have your equation

9. A snowstorm begins with light snow that increases to very heavy snow before decreasing again. The snowfall r (in inches per hour) is given by $r(t) = -0.5|t-4|+2$ where t is the time (in hours).

$-\frac{1}{2}$ $(4,2)$

- Graph the function

vertex @ $(4,2)$



- When is the snowfall heaviest?

at 4 hours

(when $x = 4$)

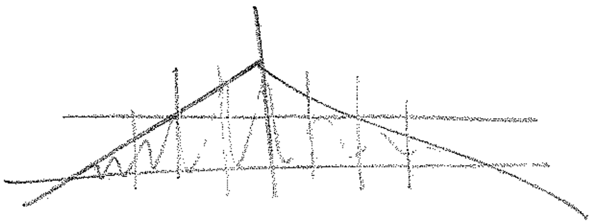
- What is the max snowfall rate?

2 inches/hr

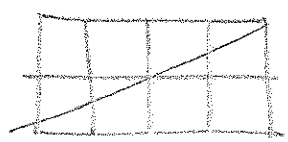
- How are your answers related to the graph?

The vertex tells us the max output (y)

- The total snowfall is given by the area of the triangle formed by the graph r(t) and the t-axis. What is the total snowfall?



=



$= 8 \frac{\text{inch}}{\text{hr}} \cdot \text{hr}$

$\boxed{= 8 \text{ inches}}$

Solving Absolute Value Equations

Always check for extraneous solutions

10. $|x-5|=7$

$x-5=7$ $\quad$ $x-5=-7$

$+5 \quad +5$ $\quad$ $+5 \quad +5$

$\boxed{x=12 \qquad x=-2}$

note: this works because $|\text{blah}|$ could be (blah) or $-$(blah) so you could also see equation like this: $|x-5|=7$

$(x-5)=7$ or $-(x-5)=7$

$\frac{-(x-5)}{-1}=\frac{7}{-1}$

$(x-5)=-7$

11. $|5x-10|=45$

$5x-10=45$ $\quad$ $5x-10=-45$

$+10 \quad +10$ $\quad$ $+10 \quad +10$

$5x=55$ $\quad$ $5x=-35$

$\boxed{x=11 \qquad x=-7}$

check work!

$|5(11)-10|=45$?

$|55-10|=45$?

$|45|=45$? ✓

$|5(-7)-10|=45$

$|-35-10|=45$?

$|-45|=45$? ✓

12. $|2x+12|=4x$

$2x+12=4x$

$-2x \qquad -2x$

$12=2x$

$x=6$

$-(2x+12)=4x$

$-2x-12=4x$

$+2x \qquad +2x$

$-12=6x$

$x=-2$

$\boxed{x=6, \cancel{-2}}$

Check:

$|2(6)+12|=4(6)$?

$|12+12|=24$?

$|24|=24$? ✓

$|2(-2)+12|=4(-2)$?

$|-4+12|=-8$?

$|8|=-8$?

no!

13. $|9-2x|=10+3x$

$9-2x=10+3x$

$-10+2x \quad -10+2x$

$-1=5x$

$x=\frac{-1}{5}$

$-(9-2x)=10+3x$

$-9+2x=10+3x$

$-10-2x \quad -10-2x$

$-19=x$

$\boxed{x=\frac{-1}{5}, \cancel{-19}}$

Check:

$|9-2(\frac{-1}{5})|=10+3(\frac{-1}{5})$

$|9+\frac{2}{5}|=10-\frac{3}{5}$

$|\frac{45}{5}+\frac{2}{5}|=\frac{50}{5}-\frac{3}{5}$

$|\frac{47}{5}|=\frac{47}{5}$ ✓

$|9-2(-19)|=10+3(-19)$

$|9+38|=10-57$

$|47|=-47$

no!

14. $\frac{|7p+4|}{8} = 3 \cdot 8$

$|7p+4| = 24$

$7p+4 = 24$, $-4 \quad -4$

$\frac{7p}{7} = \frac{20}{7}$

$7p+4 = -24$, $-4 \quad -4$

$7p = -28$

$p = -4$

$\boxed{p = \frac{20}{7}, -4}$

Check:

$\frac{|7(\frac{20}{7})+4|}{8} = 3?$

$\frac{|24|}{8} = 3$ ✓

$\frac{|7(-4)+4|}{8} = 3$

$\frac{|-24|}{8} = 3$

$\frac{24}{8} = 3$ ✓

15. $2 - 5|5m - 5| = -73$

$-2 \quad -2$

$\frac{-5|5m-5|}{-5} = \frac{-75}{-5}$

$|5m-5| = 15$

$5m-5 = 15$, $+5 \quad +5$

$5m = 20$

$\boxed{m = 4}$

$5m-5 = -15$, $+5 \quad +5$

$5m = -10$

$\boxed{m = -2}$

$2-5|5(4)-5| = -73$

$2-5|15| = -73$

$2-5(15) = -73$

$2-75 = -73$ ✓

$2-5|5(-2)-5| = -73$

$2-5|-15| = -73$

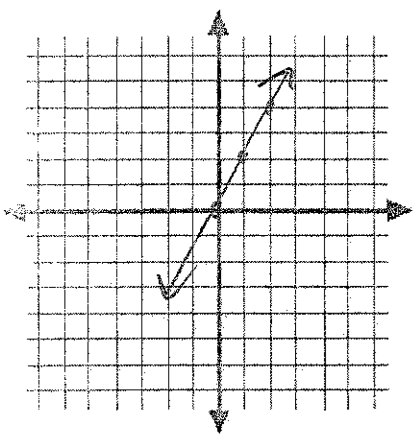
$2-5(15) = -73$ ✓

Fri 8/25

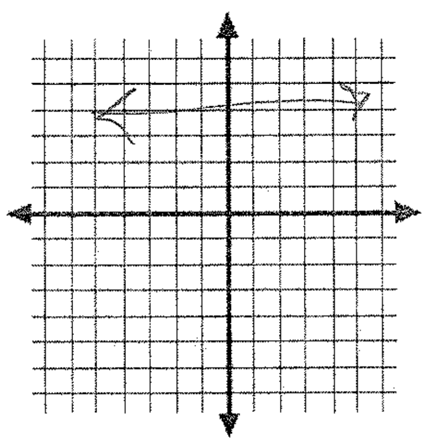
2.4 Step Functions and Piecewise Functions

Graph the following:

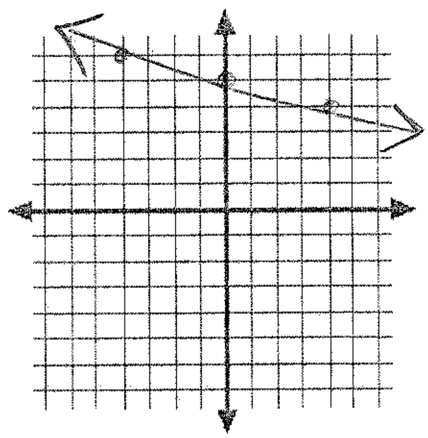
1) $y = 2x$



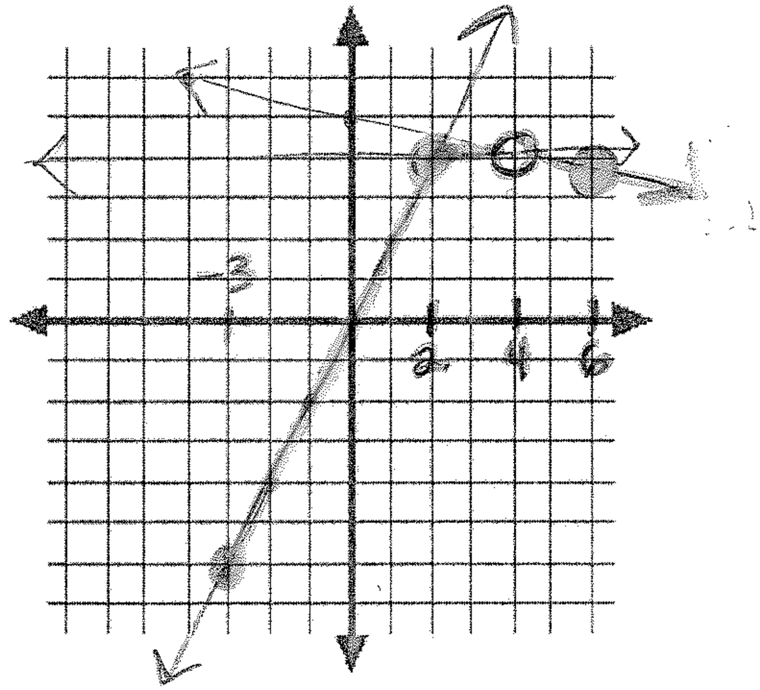
2) $f(x) = 4$



3) $g(x) = -\frac{1}{4}x + 5$

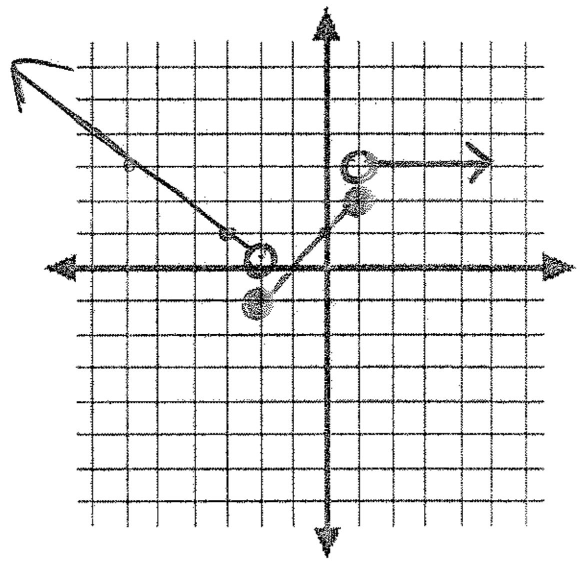


4) Graph on one coordinate plane: $f(x)=\begin{cases} 2x & if -3 \le x < 2 \\ 4 & if\ 2 \le x < 4 \\ -\frac{1}{4}x+5 & if\ 4 < x \le 6 \end{cases}$



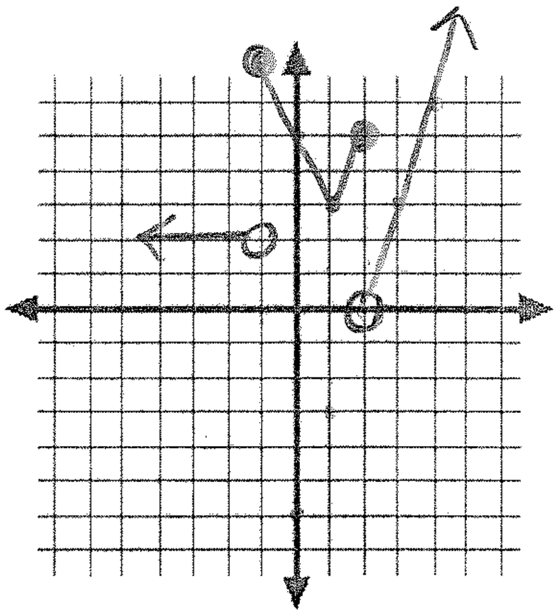
Graph the following using a table:

5) $f(x)=\begin{cases} -\frac{2}{3}x-1 & if\ x < -2 \\ x+1 & if -2 \le x \le 1 \\ 3 & if\ x > 1 \end{cases}$

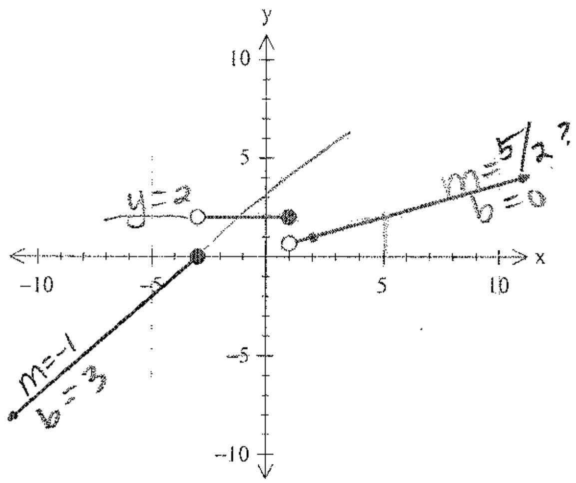


6) f(x)= $\begin{cases} 2 & if\ x < -1 \\ 2|x-1|-3 & if -1 \le x \le 2 \\ 3x-6 & if\ x > 2 \end{cases}$

(1, 3)



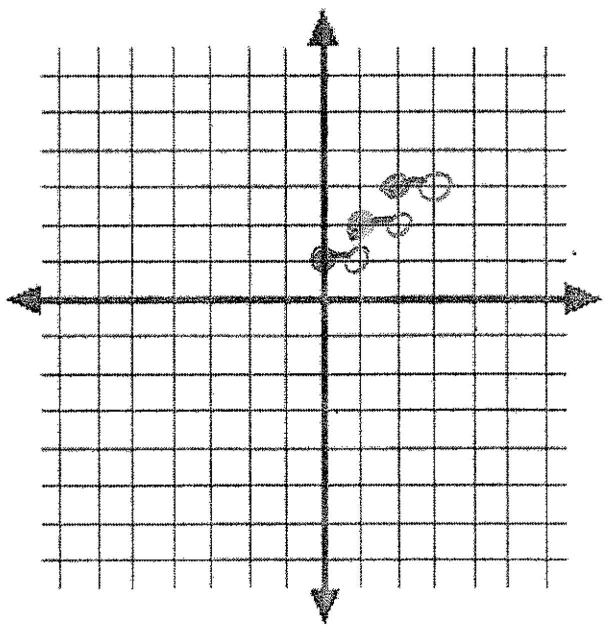
7) Write the piecewise function and state the domain and range



$\begin{cases} y = -x+3, & x \le -3 \\ y = 2, & -3 < x \le 1 \\ y = \frac{5x}{2} & x > 1 \end{cases}$

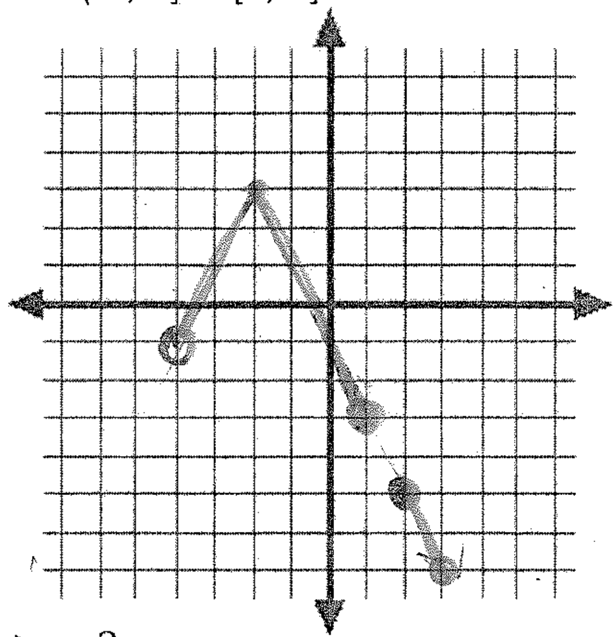
Step Function

8) Graph f(x)= $\begin{cases} 1 & if\ 0 \le x < 1 \\ 2 & if\ 1 \le x < 2 \\ 3 & if\ 2 \le x < 3 \end{cases}$



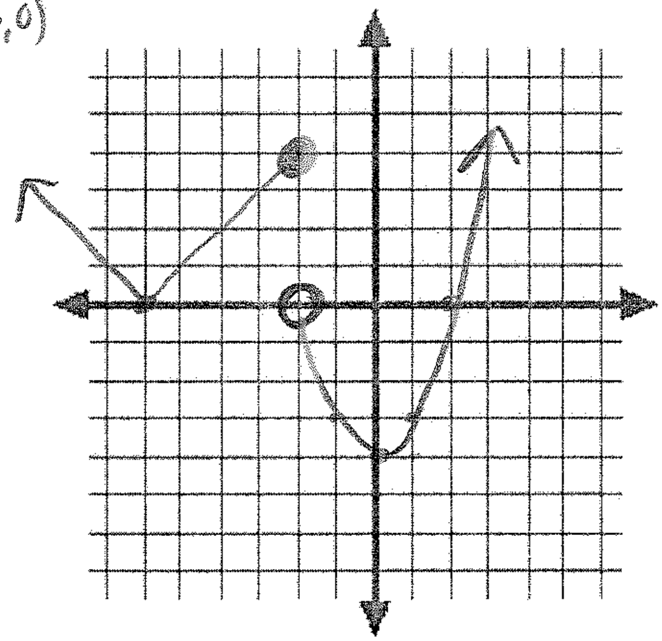
(-2, 3)

9) Graph y = -2$|x + 2| + 3$ over the domains (-4, 1] ∪ [2, 3]



10) Graph the function f(x)= $\begin{cases} x^2 - 4 \; if \;\; x > -2 \\ |x + 6| \; if \; x \le -2 \end{cases}$

(-6, 0)



11) The Mad Hatter is ordering cups from Teacups Limited for his tea party. The Teacups Limited catalog prices cups according to the number of cups ordered. For orders of 20 or fewer cups, the price is $1.40 per cups plus $12 for shipping and handling for the order. For orders more than 20 cups, the price is $1.10 per cup plus $15 shipping and handling.

$y = 1.4x + 12$

$y = 1.1x + 15$

- Write a function to describe the price of cups

$$\begin{cases} y = 1.4x + 12 & \text{if } x \le 20 \\ y = 1.1x + 15 & \text{if } x > 20 \end{cases}$$

- How much will it cost the Mad Hatter to order 16 cups?

$1.4(16) + 12 = 34.4$

$\$34.40$

- If the Mad Hatter wants to spend at most $45, what is the maximum number of cups he can order?

max on 1st eq.

$45 = 1.4x + 12$

$-12 \qquad -12$

$\frac{33}{1.4} = \frac{1.4x}{1.4}$

$x = 23.57$

which wouldn't use this function anyway!

$45 = 1.1x + 15$

$-15 \qquad -15$

$\frac{30}{1.1} = \frac{1.1x}{1.1}$

$\boxed{x = 27}$

12) A wholesale t-shirt manufacturer charges the following prices for t-shirt orders:

$20 per shirt for up to 20 shirts
$15 per shirt for 21-40 shirts
$10 per shirt for 41-80 shirts
$5 per shirt for over 80 shirts

$$y = \begin{cases} 20x & \text{if } x \le 20 \\ 15x & \text{if } 20 < x \le 40 \\ 10x & \text{if } 40 < x \le 80 \\ 5x & \text{if } x > 80 \end{cases}$$

- Write the function

- You have ordered 40 shirts and must pay $10 for shipping and handling. How much is your order?

$y = 15x$

$y = 15(40) = 600$

$\boxed{\$610}$