Advanced Algebra II
Semester #1
Review Questions Handout

If you want to be as successful as possible on the exam, there is no substitute for hard work and preparation. The questions in this handout are designed to help you identify topics that you feel very confident about and topics that you may need to spend more time on and get help with if necessary to master. If you struggled with a section of questions, look the topics up in your notes/text, spend additional time reviewing the concepts, work additional problems, and get help if needed.

The best way to prepare for any exam is to form study groups and attack the concepts/material together. Work cooperatively on the problems and help each other out when someone doesn't understand a problem/concept. Explaining the material to someone else is a great way to master concepts.

Finally, all of the lectures are still posted on Google Classroom if you need to listen to and watch explanations of certain topics one more time.

Part I: Knowledge of Numbers

1) Check all of the different number sets that the number "23" a part of?

- X Complex Numbers
- X Real Numbers
- ____ Imaginary Numbers
- X Rational Numbers
- ____ Irrational Numbers
- X Integers
- X Whole Numbers
- X Natural/Counting Numbers

2) Check all of the different number sets that the number "-7" a part of?

- X Complex Numbers
- X Real Numbers
- ____ Imaginary Numbers
- X Rational Numbers
- ____ Irrational Numbers
- X Integers
- ____ Whole Numbers
- ____ Natural/Counting Numbers

3) Check all of the different number sets that the number "$\frac{3}{5}$" a part of?

- X Complex Numbers
- X Real Numbers
- ____ Imaginary Numbers
- X Rational Numbers
- ____ Irrational Numbers
- ____ Integers
- ____ Whole Numbers
- ____ Natural/Counting Numbers

4) Check all of the different number sets that the number "$\sqrt{23}$" a part of?

- X Complex Numbers
- X Real Numbers
- ____ Imaginary Numbers
- ____ Rational Numbers
- X Irrational Numbers
- ____ Integers
- ____ Whole Numbers
- ____ Natural/Counting Numbers

5) Check all of the different number sets that the number "$-53i$" a part of?

__X__ Complex Numbers
_____ Real Numbers
__X__ Imaginary Numbers
_____ Rational Numbers
_____ Irrational Numbers
_____ Integers
_____ Whole Numbers
_____ Natural/Counting Numbers

6) Check all of the different number sets that the number "0" a part of?

__X__ Complex Numbers
__X__ Real Numbers
_____ Imaginary Numbers
__X__ Rational Numbers
_____ Irrational Numbers
__X__ Integers
__X__ Whole Numbers
_____ Natural/Counting Numbers

7) Check all of the different number sets that the number "$\sqrt{144}$" a part of?

__X__ Complex Numbers
__X__ Real Numbers
_____ Imaginary Numbers
__X__ Rational Numbers
_____ Irrational Numbers
__X__ Integers
__X__ Whole Numbers
__X__ Natural/Counting Numbers

8) Check all of the different number sets that the number "$34+5i$" a part of?

__X__ Complex Numbers
_____ Real Numbers
_____ Imaginary Numbers
_____ Rational Numbers
_____ Irrational Numbers
_____ Integers
_____ Whole Numbers
_____ Natural/Counting Numbers

9) Check all of the different number sets that the number ".2396654..." a part of?

__X__ Complex Numbers
__X__ Real Numbers
_____ Imaginary Numbers
_____ Rational Numbers
__X__ Irrational Numbers
_____ Integers
_____ Whole Numbers
_____ Natural/Counting Numbers

Part II: Working With Expressions

10) What is the sum of 56 and 93?

$56+93=\boxed{149}$

11) What is the quotient of 244 and 4?

$\frac{244}{4}=\boxed{61}$

12) What is the quotient of $\frac{3}{5}$ and $\frac{6}{7}$?

$\frac{3}{5} \div \frac{6}{7}$

$\frac{3}{5} \times \frac{7}{6_2} \rightarrow \boxed{\frac{7}{10}}$

13) What is the sum of $\frac{3}{5}$ and $\frac{6}{7}$?

$\frac{7}{7} \cdot \frac{3}{5} + \frac{6}{7} \cdot \frac{5}{5}$

$\frac{21+30}{35} \rightarrow \boxed{\frac{51}{35}}$

14) What is the difference of $\frac{3}{5}$ and $\frac{6}{7}$?

$\frac{7}{7} \cdot \frac{3}{5} - \frac{6}{7} \cdot \frac{5}{5}$

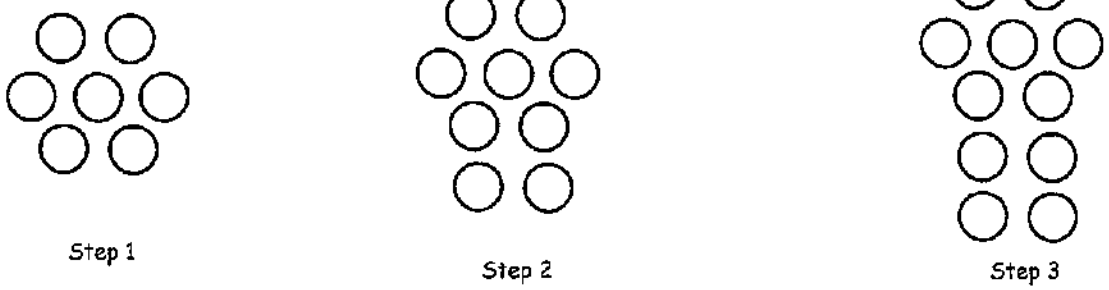
$\frac{21-30}{35} \rightarrow \boxed{-\frac{9}{35}}$

15) What is the product of $\frac{3}{5}$ and $\frac{6}{7}$?

$\frac{3}{5} \times \frac{6}{7} \rightarrow \boxed{\frac{18}{35}}$

16) Find an algebraic expression that would tell you how many circles would be in step "n".

$4n+3$



Step 1 Step 2 Step 3

17) Which step number would have 51 cicrles?

$4n+3=51$

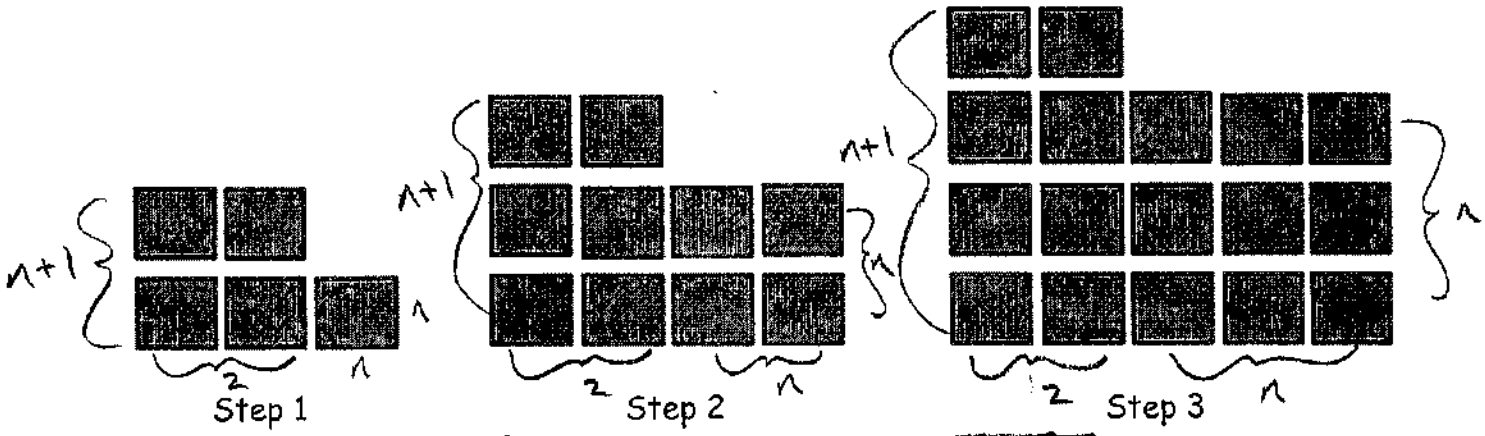
$-3 \quad -3$

$\frac{4n}{4} = \frac{48}{4}$

$n = 12$

Step #12

18) Write an expression that would tell you how many tiles would be in step "n".



$2(n+1)+n^2$

$2n+2+n^2$ → n^2+2n+2

19) How many tiles would be in the 10th step?

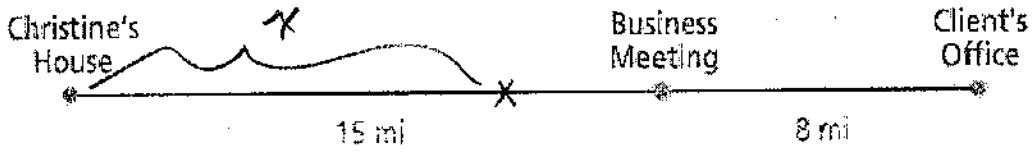
$10^2+2(10)+2$

$100+20+2$

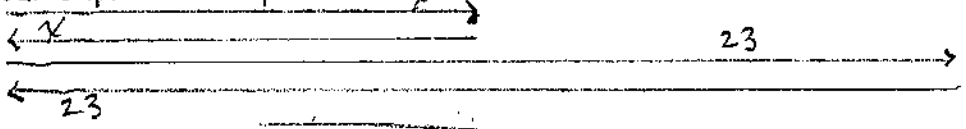
122

20) Christine drives her car for her sales job. Her company allows her to drive no more than 50 mi per day.

On Tuesday, Christine drives to a business meeting 15 mi from her house. On her way, she realizes she left her laptop computer at home and must drive back to get it. After attending the business meeting, Christine drives to a client's office 8 mi down the road from the location of the business meeting, as shown in the diagram below. After meeting with her client, Christine drives home, returning by the same road.



a) Write and simplify an algebraic expression that models the total distance that she returns home at the end of the day. State what the variable in your expression represents. x



$2x+46$ TOTAL MILES

b) In order for Christine not to exceed her daily mileage limit, what is the maximum distance that she could have driven before she went back to get her computer?

$2x+46 \leq 50$

$2x \leq 4$

$x \leq 2$

2 MILES

21) Identify and fix the mistake in the work for the simplification of each of the following expressions.

a) $3(2x-5y+3)-4(3x-5y+8)$

$6x-15y+9-12x-20y-32$

$-6x-35y-23$ $+20y$

$-6x+5y-23$

b) $(2x-4)(3x+5)$

$6x^2+10x-12x-20$

$6x^2+2x-20$

$6x^2-2x-20$

c) $(3-2i)^2$

$(3-2i)(3-2i)$

$9-6i-6i+4i^2$ $+4i^2$

$9-12i+4(-1)$ $4(-1)$

$9-12i+4$

$13-12i$ $9-12i-4$

$5-12i$

d) $2(5+3i)-4(-6+7i)$

$10+15i+24+7i$ $-28i$

$34+22i$

$34-22i$

22) Simplify each of the following expressions.

a) $(x+3)+5(3x-4)+2(2x+6)$

$x+3+15x-20+4x+12$

$20x-5$

b) $(5-6i)(4+7i)$

$20+35i-24i-42i^2$ $+42$

$62+11i$

c) $(5+2i)^2$

$(5+2i)(5+2i)$

$25+10i+10i+4i^2$ -4

$21+20i$

d) $-2(3x-4y+5)-3(2x+3y-1)$

$-6x+8y-10-6x-9y+3$

$-12x-y-7$

23) Factor each of the following polynomials:

a) $2x^3-20x^2+50x$

$2x(x^2-10x+25)$

$2x(x-5)(x-5)$

$2x(x-5)^2$

b) $x^2-9x-22$

$(x-11)(x+2)$

c) $15x^2+7x-2$

$(5x-1)(3x+2)$

d) $8x^2-30x+25$

$(4x-5)(2x-5)$

e) $x^3 - 16x$

$x(x^2-16)$

$x(x+4)(x-4)$

f) $4x^4 - 32x^2$

$4x^2(x^2-8)$

Part III: Working With Equations/Inequalities

24) Find the mistake(s) in the work for solving each of the following and fix it/them.

a) $3x+5=5(x+4)-9$

$3x+5=5x+4-9$ $\quad 3x+5=5x+20-9$

$3x+5=5x-5$ $\quad 3x+5=5x+11-11$

$10=2x$ $\quad -6=2x$

$5=x$ $\quad x=-3$

b) $x^2+5x=6$

$x^2+5x-6=0$ $\quad x^2+5x-6=0$

$(x-6)(x+1)=0$ $\quad (x+6)(x-1)=0$

$x-6=0$ $\quad x+1=0$ $\quad x+6=0$ $\quad x-1=0$

$x=6$ $\quad x=-1$ $\quad x=-6$ $\quad x=1$

c) $3(x+5)>4x-6$

$3x+15>4x-6$

$3x-3x+15>4x-3x-6$

$15>x-6$

$15+6>x-6+6$

$21>x$

$x<21$

d) $x^2-6x+36=0$

$x^2-6x+9=-36+9$

$(x-3)^2=-27$ $\quad (x-3)^2=-27$

$\sqrt{(x+3)^2}=\sqrt{-27}$ $\quad \sqrt{9\cdot 3}$

$x+3=\pm i\sqrt{27}$ $\quad x-3=\pm i\sqrt{27}$

$x+3=\pm\sqrt{9\cdot 3}$ $\quad x-3=\pm 3i\sqrt{3}$

$x+3=\pm 9\sqrt{3}$

$x=-3\pm 9\sqrt{3}$ $\quad x=3\pm 3i\sqrt{3}$

e) $3|2x-3|\geq 27$

$+3 \quad +3$ $\quad +3$

$2x-3\geq 9$ $\quad 2x-3\leq -9$ $\quad |2x-3|\geq 9$

$2x\geq 12$ $\quad 2x\leq -6$ $\quad 2x-3\geq 9$ or $2x-3\leq -9$

$x\geq 6$ $\quad x\leq -3$ $\quad x\geq 3$ or $x\leq -6$

$x\geq 3$ or $x\leq -6$

$x\leq -3$ OR $x\geq 6$

f) $2|x-5|+4\leq 12$

$2|x-5|\leq 8$

$|x-5|\leq 4$

$x-5\leq 4$ and $x-5\leq -4$ $\quad x-5\geq -4$

$x\leq 9$ and $x\leq 1$ $\quad x\geq 1$

$x\leq 1$

$1\leq x\leq 9$

g) $3x^2-6x+1=0$

$$x=\frac{-(-6)\pm\sqrt{(-6)^2-4(3)(1)}}{2(3)}$$

$$x=\frac{6\pm\sqrt{36-12}}{6}$$

$$x=\frac{6\pm\sqrt{-48}}{6}$$

$$x=\frac{6\pm i\sqrt{16\cdot 3}}{6}$$

$$x=\frac{6\pm 4i\sqrt{3}}{6}$$

$$x=1\pm 4i\sqrt{3}$$

$\frac{6\pm\sqrt{36-12}}{6}$ $\sqrt{4\cdot 6}$

$\frac{6\pm\sqrt{24}}{6}$

$\frac{6\pm 2\sqrt{6}}{6}$ $\frac{\overset{3}{\cancel{6}}\pm 2\sqrt{6}}{\underset{1}{\cancel{6}}\,3}$

$\frac{6}{6}\pm\frac{2\sqrt{6}}{6}$

$\boxed{1\pm\frac{\sqrt{6}}{3}}$ OR $\boxed{\frac{3\pm\sqrt{6}}{3}}$

25) Solve each of the following. Set up 2 cases for the absolute value problems and graph the solutions to the inequalities. Use factoring, completing the square, or the formula to solver quadratic equations.

a) $3x^2-5x+2=0$ b^2-4ac $(-5)^2-4(3)(2)$ $25-24$ 1

$(3x-2)(x-1)=0$

$3x-2=0$ $x-1=0$

$3x=2$ $\boxed{x=1}$

$\boxed{x=\frac{2}{3}}$

b) $2x+7(x+4)=7x+4$

$2x+7x+28=7x+4$

$9x+28=7x+4$

$2x=-24$

$\boxed{x=-12}$

c) $2|x-3|+6=18$ -6 -6

$2|x-3|=12$

$|x-3|=6$

$x-3=6$ $+3$ $+3$ $x-3=-6$ $+3$

$\boxed{x=9}$ $\boxed{x=-3}$

d) $3x+2\le 11$ or $2x+5\ge 21$

$3x\le 9$ $2x\ge 16$

$x\le 3$ $x\ge 8$

$\boxed{x\le 3 \text{ OR } x\ge 8}$

e) $3x^2-4x+2=0$ b^2-4ac $(-4)^2-4(3)(2)$ $16-24$ -8

$x=\frac{-(-4)\pm\sqrt{-8}}{2(3)}$

$x=\frac{4\pm 2i\sqrt{2}}{6}$ → $\boxed{x=\frac{2\pm i\sqrt{2}}{3}}$

f) $x^2-6x+21=0$

$x^2-6x+9=-21+9$

$(x-3)^2=-12$

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

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

$\sqrt{-12}$

$i\sqrt{4\cdot 3}$

$2i\sqrt{3}$

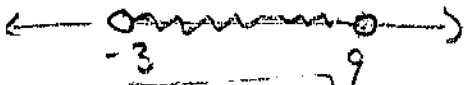
g) $2|x-3|+4<16$

$2|x-3|<12$

$|x-3|<6$

$x-3<6$ and $x-3>-6$

$x<9$ $\quad x>-3$



$\boxed{-3<x<9}$

h) $-3|x+2|-5\le -23$

$\frac{-3|x+2|}{-3}\le\frac{-18}{-3}$

$|x+2|\ge 6$

$x+2\ge 6$ OR $x+2\le -6$

$x\ge 4$ $\quad x\le -8$

$\boxed{x\le -8 \text{ OR } x\ge 4}$

i) $|2x-5|+5=14$

$|2x-5|=9$

$2x-5=9$ OR $2x-5=-9$

$2x=14$ $\quad 2x=-4$

$\boxed{x=7 \text{ OR } x=-2}$

j) $3x^2-5x+1=4$

$3x^2-5x-3=0$

$x=\frac{-(-5)\pm\sqrt{61}}{2(3)}$

b^2-4ac

$(-5)^2-4(3)(-3)$

$25+36$

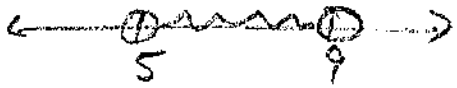
61

$\boxed{x=\frac{5\pm\sqrt{61}}{6}}$

k) $2x+5>15$ and $3x-4<23$

$2x>10$ $\quad 3x<27$

$x>5$ $\quad x<9$



$\boxed{5<x<9}$

l) $3x+2(x-7)=6x+9$

$3x+2x-14=6x+9$

$-5x \quad -5x$

$5x-14=6x+9$ $\quad -9 \quad -9$

$-23=x$

$\boxed{x=-23}$

m) $\frac{4(x-5)^2}{4}=\frac{32}{4}$

$\sqrt{(x-5)^2}=\sqrt{8}$

$\sqrt{8}$

$\sqrt{4}\cdot\sqrt{2}$

$2\sqrt{2}$

$x-5=\pm 2\sqrt{2}$

$\boxed{x=5\pm 2\sqrt{2}}$

n) $x^2-6x-18=0$ $\quad +18 \quad +18$

$x^2-6x+9=18+9$

$\sqrt{(x-3)^2}=\sqrt{27}$

$\sqrt{27}$

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

$3\sqrt{3}$

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

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

o) $x^2+13x+36=0$

$(x+4)(x+9)=0$

$x+4=0 \quad x+9=0$

$\boxed{x=-4 \quad x=-9}$

p) $\frac{6x^2}{6}+\frac{48}{6}=\frac{0}{6}$

$x^2+8=0$

$\sqrt{x^2}=\sqrt{-8}$

$\sqrt{-8}$
$i\sqrt{4}\cdot\sqrt{2}$
$2i\sqrt{2}$

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

q) $6x^2=31x-35$

$6x^2-31x+35=0$

$(3x-5)(2x-7)=0$

$3x-5=0 \quad 2x-7=0$

$3x=5 \quad 2x=7$

$\boxed{x=\frac{5}{3} \quad x=\frac{7}{2}}$

r) $x^2-4x=-12$

$x^2-4x+4=-12+4$

$\sqrt{(x-2)^2}=\sqrt{-8}$

$x-2=\pm 2i\sqrt{2}$

$\sqrt{-8}$
$i\sqrt{4}\cdot\sqrt{2}$
$2i\sqrt{2}$

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

26) Two cars leave Brookings at 2 in the afternoon. The first car is traveling north on I-29 at 55 mph and the second car is traveling south on I-29 at 65 mph. At what time will the 2 cars be 660 miles apart?

t = time driving

RATE · TIME = DISTANCE

NORTH CAR DIST = $55t$

SOUTH CAR DIST = $65t$

$55t+65t=660$

$120t=660$

$t=5.5$

THEY WILL BE 660 MILES APART AT 7:30 PM

27) The weather channel is predicting that the weather for the next 4 weeks will be between 58 degrees F and 72 degrees F. Write an absolute value inequality describing the temperature over the next 4 weeks. Let "t" equal the actual temperature.

$\frac{58+72}{2}=65$

$\boxed{|t-65| \leq 6.5}$

THE TEMP CAN VARY 6.5° ABOVE OR BELOW 65° TO A LOW OF 58° & A HIGH OF 72°

28) For each of the following formulas, isolate the bold faced variable identified behind the formula.

a) $A=\left(\frac{1}{2}bh\right)^2$ "h"

$\frac{2A}{b}=\frac{bh}{b}$

$h=\frac{2A}{b}$ $b\neq 0$

b) $A=2\pi r^2+2\pi rh$ "h"

$-2\pi r^2 \quad -2\pi r^2$

$\frac{2\pi rh}{2\pi r}=\frac{A-2\pi r^2}{2\pi r}$

$h=\frac{A-2\pi r^2}{2\pi r}$ $r\neq 0$

c) $A=\frac{1}{2}(b_1+b_2)h$ "b_2"

$\frac{2}{h}\cdot A=\frac{1}{2}h(b_1+b_2)\cdot\frac{2}{h}$

$\frac{2A}{h}-b_1=b_1+b_2-b_1$

$b_2=\frac{2A}{h}-b_1$ $h\neq 0$

d) $\frac{P}{2}=\frac{2(l+w)}{2}$ "w"

$\frac{P}{2}-l=l+w-l$

$w=\frac{P}{2}-l$

Part IV: Linear Concepts & Functions

29) Determine the equation of the line that passes through the point (4,3) and has slope $\frac{3}{2}$. Write the equation in slope-intercept form.

$y-y_1=m(x-x_1)$

$y-3=\frac{3}{2}(x-\frac{4}{1})$

$y-3=\frac{3}{2}x-\frac{12}{2}$ $+3$ $+3$

$y=\frac{3}{2}x-3$

30) Find the equation of the line that passes through the point (6,5) and runs parallel to the line $5x-2y=4$. Write the equation in slope-intercept form.

$5x-2y=4$

$\frac{-2y}{-2}=\frac{-5x}{-2}+\frac{4}{-2}$

$y=\frac{5}{2}x-2$

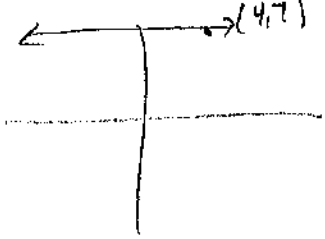
$m=5/2$

$y-5=\frac{5}{2}(x-\frac{6}{1})$

$y-5=\frac{5}{2}x-\frac{30}{2}$ $+5$ $+5$

$y=\frac{5}{2}x-10$

31) Write the equation of the line that passes through the point (4,7) and runs parallel to the x-axis.



$y=7$

32) Write the equation of the line that runs through the point (-5,6) and runs perpendicular to the line $5x+3y=12$. Write the equation in slope-intercept form.

$5x+3y=12$

$3y=-5x+12$

$y=-\frac{5}{3}x+4$

$m=-\frac{5}{3}$

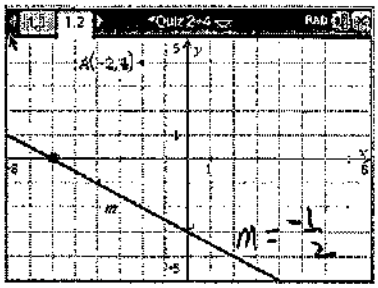
$m_\perp=\frac{3}{5}$

$y-6=\frac{3}{5}(x-(-5))$

$y-6=\frac{3}{5}x+\frac{15}{5}$ $+6$ $+6$

$\boxed{y=\frac{3}{5}x+9}$

33) Write the equation of the line that passes through point A and is perpendicular to line *m*. Express final answer in slope-intercept form.



$m_\perp=2$

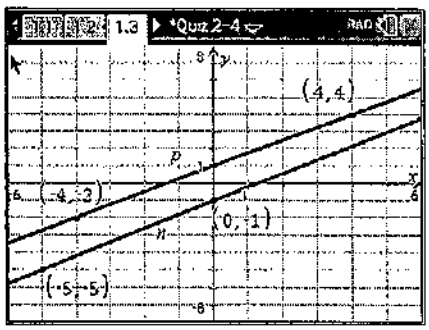
$y-4=2(x-(-2))$

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

$y-4=2x+4$

$\boxed{y=2x+8}$

34) Use the slopes to determine if lines *n* and *p* are parallel. Explain your reasoning.



$p \rightarrow \frac{(4)-(-2)}{(4)-(-4)} \rightarrow \frac{6}{8} \rightarrow \frac{3}{4}$

$n \rightarrow \frac{(-1)-(-5)}{(0)-(-5)} \rightarrow \frac{3}{5}$

SLOPES ARE NOT EQUAL
THE LINES ARE NOT PARALLEL

35) What is the basic definition of a function?

EVERY INPUT MAPS TO "EXACTLY" ONE OUTPUT

36) Explain the vertical line test.

IN ORDER TO BE A FUNCTION, A VERTICAL LINE CAN NEVER INTERSECT THE GRAPH IN MORE THAN ONE POINT AT A TIME

37) Given the function $f(x)=\frac{2}{3}x-4$, find $f(6)$.

$f(6)=\frac{2}{3}(6)-4$

$f(6)=4-4$

$f(6)=0$

(6, 0) OR $f(6)=0$

38) Given the function $f(x)=\begin{cases}3x-4 & \text{if } x\le -3\\ 2x+5 & \text{if } -3<x\le 4\\ -3x+1 & \text{if } x>4\end{cases}$ find each of the following:

a) $f(-1)$

$f(-1)=2(-1)+5$

$f(-1)=-2+5$

$f(-1)=3$

OR

$(-1, 3)$

b) $f(-6)$

$f(-6)=3(-6)-4$

$f(-6)=-18-4$

$f(-6)=-22$

OR

$(-6, -22)$

c) $f(8)$

$f(8)=-3(8)+1$

$f(8)=-24+1$

$f(8)=-23$

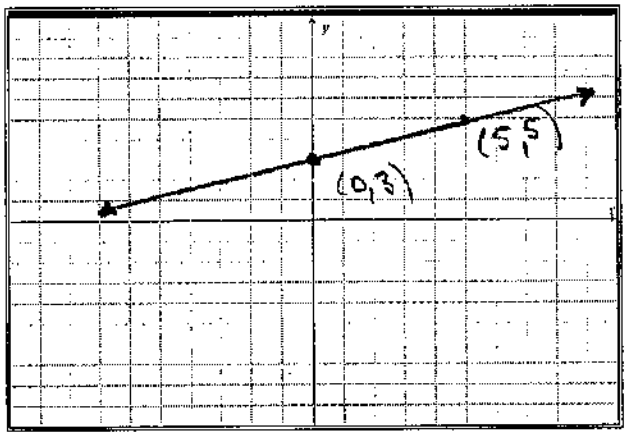
OR

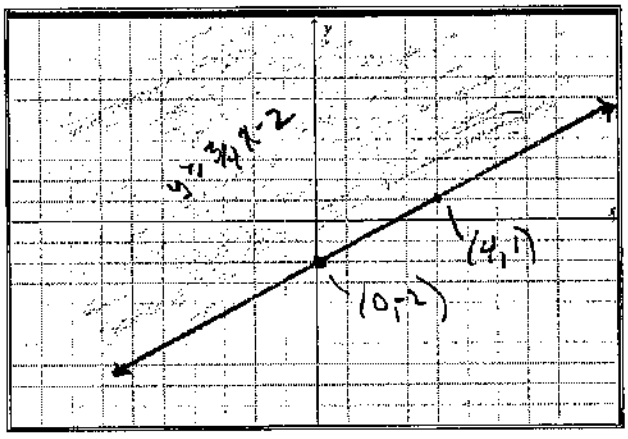
$(8, -23)$

39) Graph each of the following equations/inequalities.

a) $-2x+5y=15$

b) $3x-4y\le 8$





$-2x+5y=15$

$5y=2x+15$

$y=\frac{2}{5}x+3$

$3x-4y\le 8$

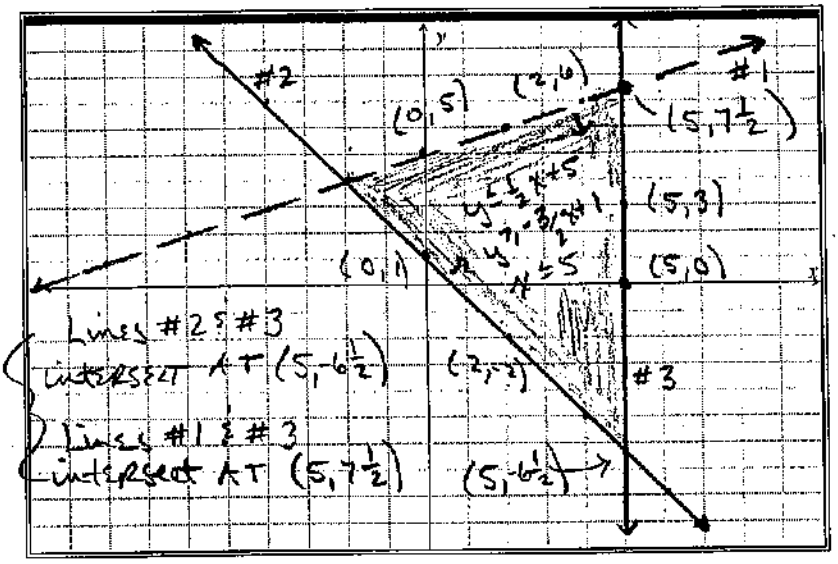
$-4y\le -3x+8$

$\frac{-4y}{-4}\ge\frac{-3x}{-4}+\frac{8}{-4}$

$y\ge\frac{3}{4}x-2$

40) Graph the following system and state the domain and the range.

$$x-2y>-10$$
$$3x+2y\geq 2$$
$$x\leq 5$$



USE SUBSTITUTION TO Find the intersection points

$x-2y>-10$
$-2y>-x-10$
$\frac{-2y}{-2}>\frac{-x}{-2}\frac{-10}{-2}$
(#1) $y<\frac{1}{2}x+5$

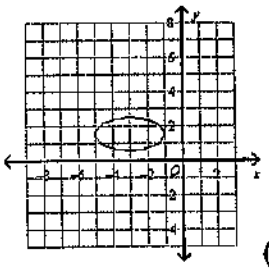
$3x+2y\geq 2$
$2y\geq -3x+2$
(#2) $y\geq -\frac{3}{2}x+1$

(#3) $x\leq 5$

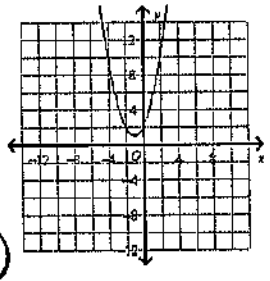
Domain: $-2<x\leq 5$
Range: $-6\frac{1}{2}\leq y<7\frac{1}{2}$

41) Which of the following relations are functions?

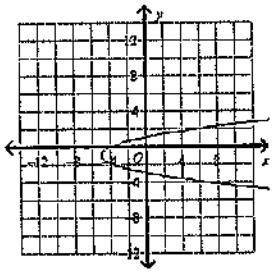
a)



b)



c)



"b" passes the Vertical Line Test.

42) A plumbing company's labor rates (excluding the cost of parts) are based on a set trip fee plus an hourly charge for their work. If a 3 hour job costs $185 and a 7 hour job costs $365, answer each of the following questions.

A) Let "h" equal the number of hours and "C" equal the total cost. Find cost function "C(h)".

$C(h) = 45h+50$

(3,185) (7,365)

$m=\frac{365-185}{7-3}$

$m=\frac{180}{4}$

$m=45$

$C-185=45(h-3)$

$C-185=45h-135$

$C=45h+50$

B) What is the value of the slope and what does the slope represent (in the context of the problem)? Be sure to label units.

Slope is 45. The plumber charges $45 per-hour

C) What is the value of the "C" intercept and what does the "C" intercept represent (in the context of the problem)? Be sure to label units.

Intercept is 50. The plumber charges a flat fee of $50 (trip charge) plus the hourly rate.

D) How much would the labor and trip fee total be for a 5.5 hour job?

$C(5.5) = 45(5.5) + 50$

$C(5.5) = 247.50 + 50$

$C(5.5) = \$297.50$

* The cost would be $247.50 in labor + the $50 trip fee. Total cost would be $297.50

43) Suppose the function $A(w)=300w+600$ models the amount of money "A" in your Savings account as a function of the number of weeks "w" that you have been Saving.

A) If you graphed the equation, what would the slope represent?

The amount you add each week ($300)

B) What would the 600 represent?

your starting amount

44) Graph the following piecewise function and state the domain and range.

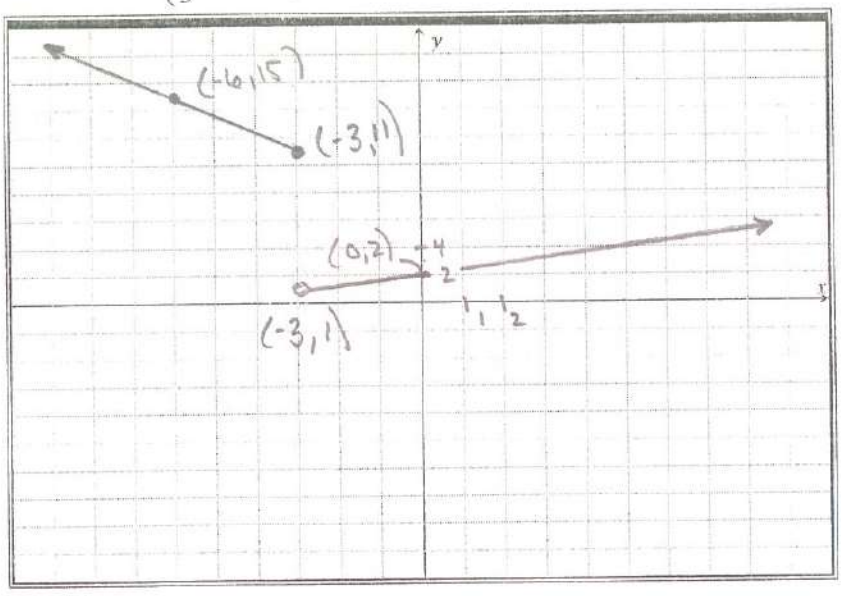
$$f(x)=\begin{cases}\frac{-4}{3}x+7 & \text{if } x\le -3\\ \frac{1}{3}x+2 & \text{if } x>-3\end{cases}$$

$y=\frac{-4}{3}x+7$

x	y
-3	11
-6	15

$y=\frac{1}{3}x+2$

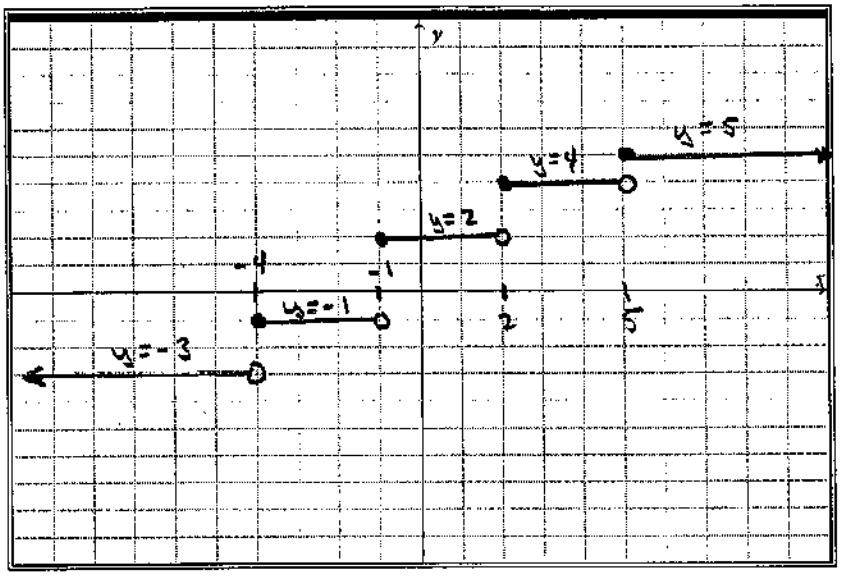
x	y
-3	1



Domain: $x=R$

Range: $y>1$

45) Graph the following step function and state the domain and range.



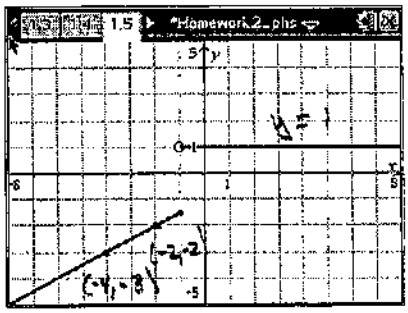
$$g(x)=\begin{cases}-3 & \text{if } x<-4\\ -1 & \text{if } -4\le x<-1\\ 2 & \text{if } -1\le x<2\\ 4 & \text{if } 2\le x<5\\ 5 & \text{if } x\ge 5\end{cases}$$

Domain: $x = R$

Range: $y = -3, -1, 2, 4, 5$

46) For each of the following graphs, write the piecewise function that describes it. Then state the domain and range for each function.

a)



$m = \frac{(-2)-(-3)}{(-2)-(-4)}$

$m = \frac{1}{2}$

$y-(-2)=\frac{1}{2}(x-(-2))$

$y+2=\frac{1}{2}(x+2)$

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

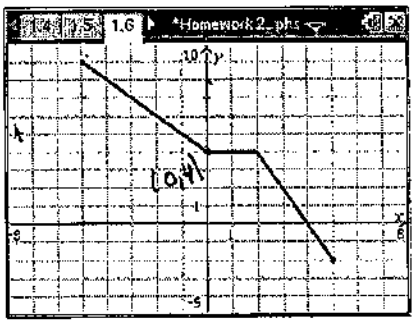
$y=\frac{1}{2}x-1$

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

Domain: $x = R$

Range: $y \le -1.5, y = 1$

b)

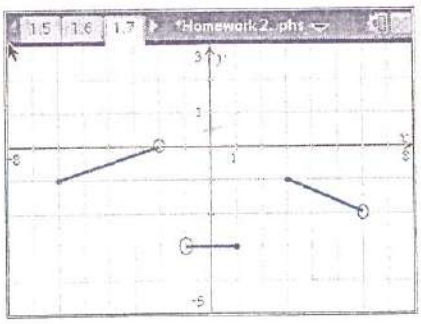


$$g(x)=\begin{cases}-x+4 & \text{if } -5\le x<0\\ 4 & \text{if } 0\le x<2\\ -2x+8 & \text{if } 2\le x\le 5\end{cases}$$

Domain: $-5 \le x \le 5$

Range: $-2 \le y \le 9$

c)

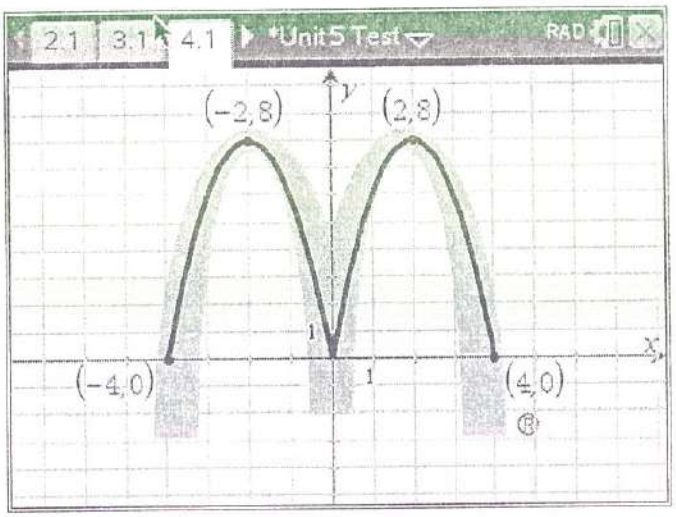


$$h(x) = \begin{cases} \frac{1}{4}x + \frac{1}{2} & \text{if } -6 \le x < -2 \\ -3 & \text{if } -1 < x \le 1 \\ -\frac{1}{3}x & \text{if } 3 \le x < 6 \end{cases}$$

Domain: $-6 \le x < -2$, $-1 < x \le 1$, $3 \le x < 6$

Range: $y = -3$, $-2 < y < 0$

d)



$$f(x) = \begin{cases} -2(x+2)^2 + 8 & \text{if } -4 \le x < 0 \\ -2(x-2)^2 + 8 & \text{if } 0 \le x \le 4 \end{cases}$$

Domain: $-4 \le x \le 4$

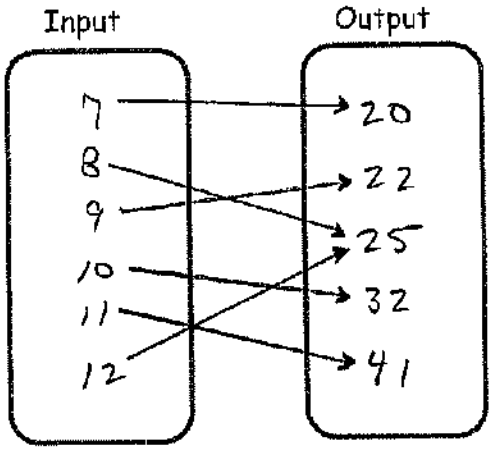
Range: $0 \le y \le 8$

47) The numbers of tickets sold for a talent show were grade 7:20; grade 8: 25; grade 9:22; grade 10:32; grade 11:41; grade 12:25.

a) Represent this relation as an input/output chart.

Grade	Tickets Sold
7	20
8	25
9	22
10	32
11	41
12	25

b) Represent the relation as a mapping diagram.



c) What are the domain and range in problem #41?

Domain = { 7, 8, 9, 10, 11, 12 }
Range = { 20, 22, 25, 32, 41 }

d) Is the relation a function? **Explain.**

yes. Every input maps to exactly one output.

48) Find the common solution for the following system of equations using combination or substitution.

$3\left(-5x+2y=-10\right)$
$3x-6y=-18$

$-15x+6y=-30$
$3x-6y=-18$

$-12x=-48$

$\frac{-12x}{-12}=\frac{-48}{-12}$

$x=4$

$3x-6y=-18$
$3(4)-6y=-18$
$12-6y=-18$
$-12\quad\quad -12$
$-6y=-30$
$y=5$

$\boxed{(4,5)}$

49) Find the common solution for the following system of linear equations by using substitution or combination. $3(3x-y=4)$

$5x+3y=9$

$9x-3y=12$
$5x+3y=9$
$14x=21$
$\frac{14}{14}\quad\frac{14}{14}$
$x=\frac{3}{2}$

$3x-y=4$
$3(\frac{3}{2})-y=4$
$\frac{9}{2}-y=\frac{8}{2}-\frac{9}{2}$
$-y=-\frac{1}{2}$
$y=\frac{1}{2}$

$(\frac{3}{2},\frac{1}{2})$

Part V: Transformations on Functions

50) Determine the requested transformation in each of the following equations.:

a) $y=2(x-3)^2+4$

1) What does the "2" represent? VERTICAL STRETCH by FACTOR OF 2
2) What does the "3" represent? HORIZONTAL SHIFT 3 UNITS RIGHT
3) What does the "4" represent? VERTICAL SHIFT 4 UNITS UP
4) Domain? $x=R$ 5) Range? $y\geq 4$

b) $y=\frac{-2}{3}|x-5|^2-4$

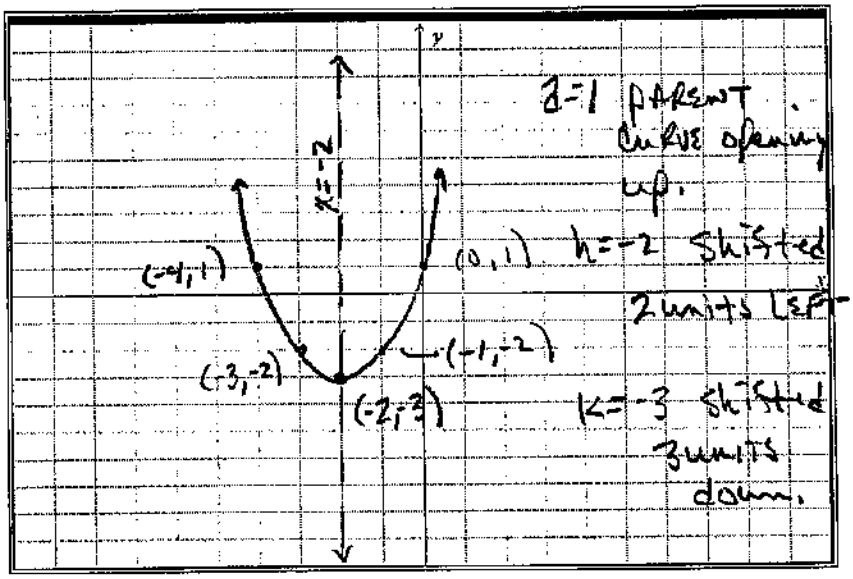
1) What does the "$\frac{-2}{3}$" represent? VERTICAL COMPRESSION by FACTOR $\frac{2}{3}$, REFLECT OVER X-AXIS
2) What does the "5" represent? SHIFT 5 UNITS RIGHT
3) What does the "4" represent? SHIFT 4 UNITS DOWN
4) Domain? $x=R$ 5) Range? $y\leq -4$

c) $y=3x^2-24x+53$

1) What is the vertical stretch/compression factor? 3
2) What is the horizontal shift & which direction? 4 UNITS RIGHT
3) What is the vertical shift and which direction? 5 UNITS UP
4) What is the domain ? $x=R$
5) What is the range? $y\geq 5$

$y=3(x^2-8x+16)+53-48$
$y=3(x-4)^2+5$

51) Graph the following parabola by completing the square on the equation and putting it into vertex form. Identify "a", "h", and "k" and describe what each value means. $y = x^2 + 4x + 1$. Also, state the domain and range.



$a=1$ parent curve opening up.

$h=-2$ shifted 2 units left

$k=-3$ shifted 3 units down.

$y = (x^2+4x)+1$

$y = (x^2+4x+4) + 1 - 4$

$y = (x+2)^2 - 3$

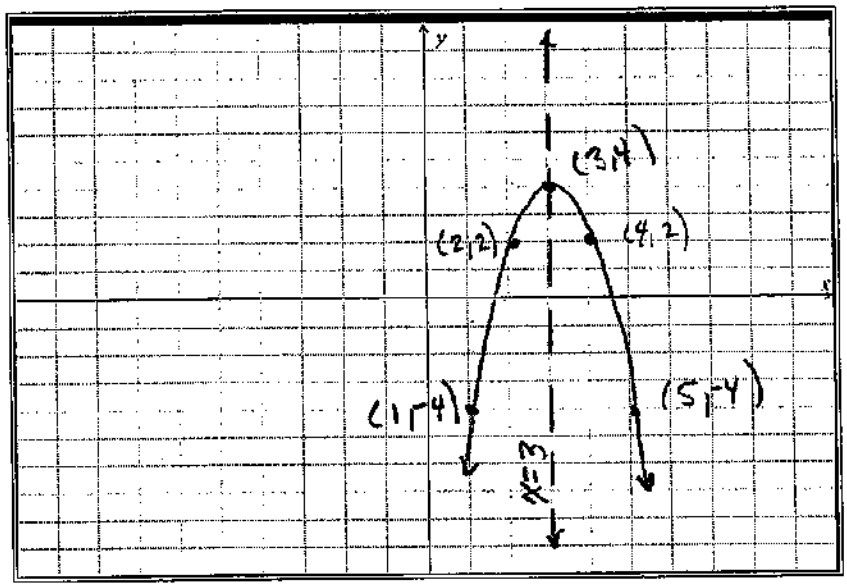
VERTEX $(-2,-3)$

Domain: $x = R$

RANGE: $y \geq -3$

$a=1$ $h=-2$ $k=-3$

52) Graph the following parabola by completing the square on the equation and putting it into vertex form. Identify "a", "h", and "k" and describe what each value means. $y = -2x^2 + 12x - 14$ Also, state the domain and range.



$y = (-2x^2 + 12x) - 14$

$y = -2(x^2 - 6x + 9) - 14 + 18$

$y = -2(x-3)^2 + 4$

VERTEX $(3,4)$

Domain: $x = R$

RANGE: $y \leq 4$

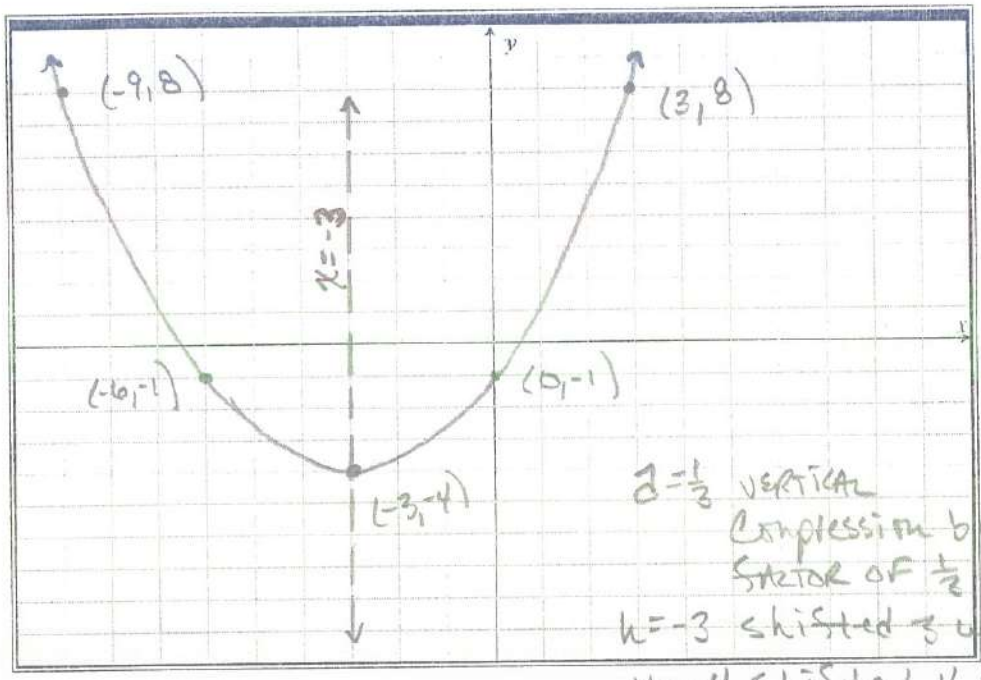
$a=-2$ $h=3$ $k=4$

$a=-2$ VERTICAL STRETCH by FACTOR OF 2 and REFLECTED OVER x-axis.

$h=3$ shifted 3 units RIGHT

$k=4$ shifted 4 units up

53) Graph the following parabola by completing the square on the equation and putting it into vertex form. Identify "a", "h", and "k" and describe what each value means. $y=\frac{1}{3}x^2+2x-1$



$y=\left(\frac{1}{3}x^2+2x\right)-1$

$y=\frac{1}{3}(x^2+6x+9)-1-3$

$y=\frac{1}{3}(x+3)^2-4$

VERTEX $(-3,-4)$

DOMAIN: $x=R$

RANGE: $y\geq -4$

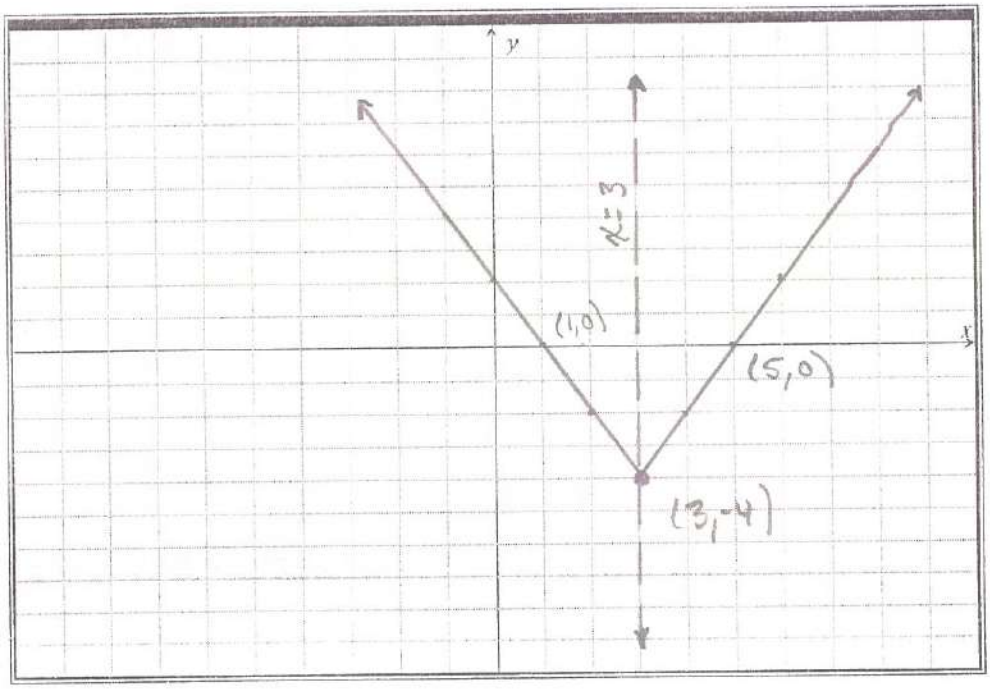
$a=\frac{1}{3}$ $h=-3$ $k=-4$

$a=\frac{1}{3}$ VERTICAL COMPRESSION BY FACTOR OF $\frac{1}{2}$, OPENING UP

$h=-3$ SHIFTED 3 UNITS LEFT

$K=-4$ SHIFTED 4 UNITS DOWN

54) Graph the following absolute value equation. Identify "a", "h", and "k" and describe what each value means. $y=2|x-3|-4$



$a=2$ VERTICAL STRETCH BY FACTOR OF 2, OPENS UP.

$h=3$ SHIFTED 3 UNITS RIGHT

$K=-4$ SHIFTED 4 UNITS DOWN

DOMAIN: $x=R$

RANGE: $y\geq -4$

(Use Desmos on Questions #55 & #56)

55) A Bobcat football player punted a ball as hard as he could straight into the air. The height h (in feet) of the ball given as a function of time t (in seconds) is given by $h(t) = -16t^2 + 50t + 3$.

a) What is the greatest height reached by the ball?

About 42.1 Feet

b) After how long did the ball reach the highest point?

About 1.6 seconds

c) After how long does the ball hit the ground?

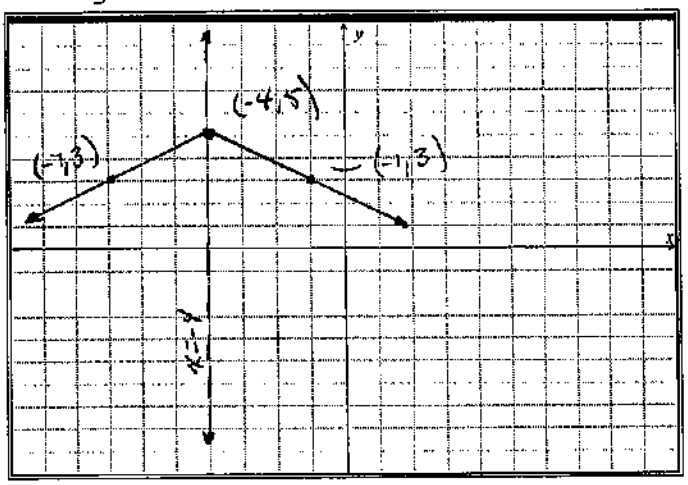
About 3.2 Seconds

56) Solve the quadratic equation by replacing "0" with "y" and using Desmos to graph the function and evaluate the solution. Answer to the nearest hundredth. $2x^2 - 2x - 1 = 0$

$x = -.37 \quad x = 1.37$

57) Graph the following absolute value equation and state the domain & range.

$y = \frac{-2}{3}|x+4|+5$



Domain: $x = R$
Range: $y \leq 5$

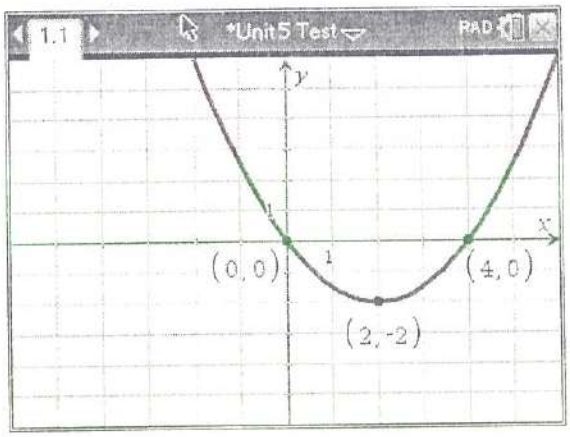
58) Describe the transformations of $f(x)$ that will produce $g(x)$.

$f(x)=3|x-2|+5 \quad \rightarrow \quad g(x)=6|x-4|-2$

- VERTICALLY STRETCHED by A FACTOR OF 2.
- shifted 2 units to the right
- shifted 7 units down

59) Write the function that models each graph. State the domain & range of each.

a)



$y=a(x-2)^2-2$

Substitute (0,0) for (x,y) to find "a".

$0=a(0-2)^2-2$

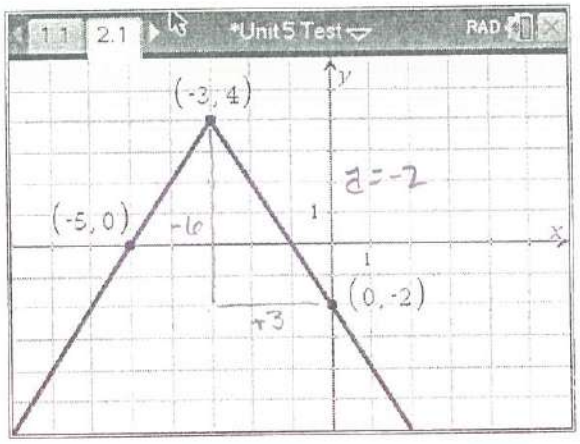
$0=a\cdot 4-2$

$4a=2$

$a=\frac{1}{2}$

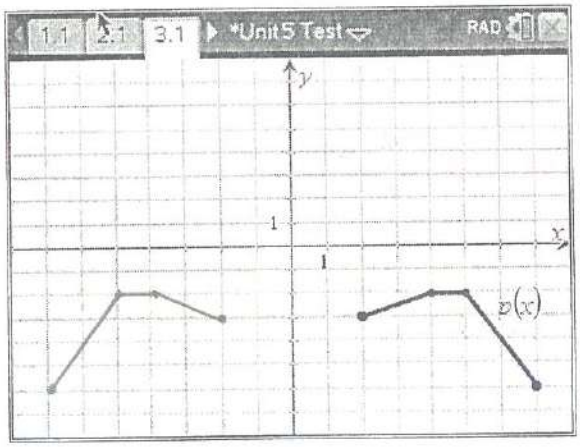
$y=\frac{1}{2}(x-2)^2-2$

b)



$y=-2|x+3|+4$

60) On the grid is the graph of $p(x)$. On the same grid, create the graph of $f(x)=p(-x)$.



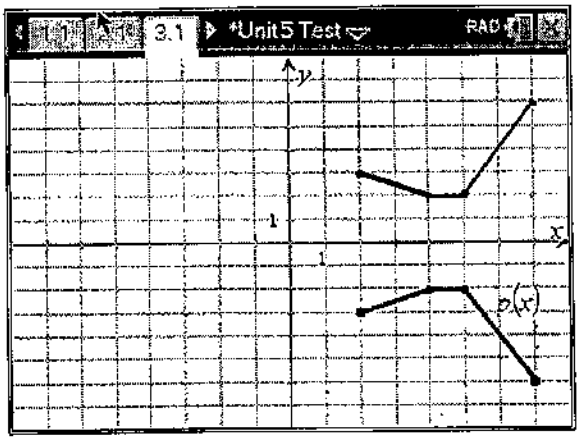
Domain of p(x): $2 \le x \le 7$

Range of p(x): $-6 \le y \le -2$

Domain of f(x): $-7 \le x \le -2$

Range of f(x): $-6 \le y \le -2$

61) On the grid is the graph of $p(x)$. On the same grid, create the graph of $f(x) = -p(x)$.



Domain of p(x): $2 \le x \le 7$

Range of p(x): $-6 \le y \le -2$

Domain of f(x): $2 \le x \le 7$

Range of f(x): $2 \le y \le 6$

62) Given the parabolic equation $y = \frac{3}{5}(x-4)^2 + 3$, what are the coordinates of the vertex?

(4, 3)

63) What would the equation for the parabola, in vertex form, be if the vertex is (–4,5) and the parabola passes through the point (-3,2)?

$y = -3(x+4)^2 + 5$

$y = a(x+4)^2 + 5$

sub (-3,2) $2 = a(-3+4)^2 + 5$

$2 = a(1)^2 + 5$

$-3 = a$

Part VI: Simplifying Radicals Involving the Imaginary Unit "i"

64) Simplify each of the following radicals involving "i".

a) $\sqrt{-27}$

$i\sqrt{9}\cdot\sqrt{3}$

$3i\sqrt{3}$

b) $\left(2\sqrt{-5}\right)^2$

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

$4i^2(5)$

-20

c) $2\sqrt{-8} + 4\sqrt{-72}$

$2i\sqrt{4}\cdot\sqrt{2} + 4i\sqrt{36}\cdot\sqrt{2}$

$4i\sqrt{2} + 24i\sqrt{2}$

$28i\sqrt{2}$

d) $2\sqrt{-3}\cdot 5\sqrt{-6}$

$2i\sqrt{3}\cdot 5i\sqrt{6}$

$10i^2\sqrt{18}$

$10(-1)\sqrt{9}\cdot\sqrt{2}$

$-30\sqrt{2}$

e) $4i\sqrt{-4}\cdot 2i\sqrt{9}$

$4i\cdot 2i\cdot 2i\cdot 3$

$8i^2\cdot 6i$

$-8\cdot 6i$

$-48i$

f) $2\sqrt{-18} + 4\sqrt{-27}$

$2i\sqrt{9}\cdot\sqrt{2} + 4i\sqrt{9}\cdot\sqrt{3}$

$2i\cdot 3\sqrt{2} + 4i\cdot 3\sqrt{3}$

$6i\sqrt{2} + 12i\sqrt{3}$

Part VI: Regressions

65) Car tire need to be inflated properly. Over inflation or under inflation can cause premature treadwear. The table shows tire life for different inflation values for a certain type of tire.

a) Use Desmos and a quadratic regression to find a function in standard form to model the data. Write the equation here.

$T_L = -.27543p^2 + 19.749p - 273.55$

$T_L(p)$ = tire life (in 1000's of miles)
p = pressure in (psi)

Pressure (psi)	Tire Life (in thousands of miles)
26	50
28	66
31	78
35	81
38	74
42	70
45	59

b) What pressure should these particular tires be inflated to in order to achieve maximum life?

About 35 psi

66) The table at the right shows the price of a first-class stamp from 1981 through 2008.

P = price
t = time t = 0 in 1981

a) Find a quadratic model for the data. Let time = 0 in 1981.

$P(t) = -.0035727t^2 + .930061t + 18.586$

b) Describe a reasonable domain and range for your model.

Domain $0 \le t \le 30$
Range $18 \le p \le 45$

c) Use your model to estimate when the first-class postage was 37 cents.

$t = 21.59$ in About 2002-2003

d) Use your model to estimate when first class postage would be 50 cents per-stamp. Explain why your prediction may not be valid.

$t = 39.89$ in about 2021

	Year	Price (cents)
0	1981	18
10	1991	29
14	1995	32
18	1999	33
20	2001	34
25	2006	39
26	2007	41
27	2008	42