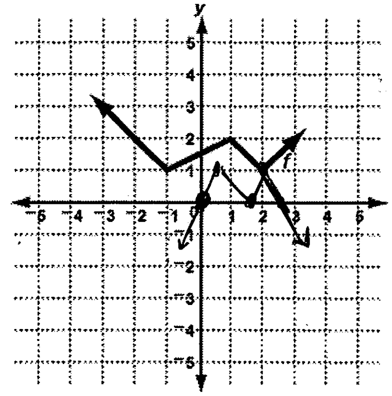
Honors Algebra 2 Name *KEY*

1st Semester Review

Non Calculator

1-1 1. Using the parent function at the right, perform the following transformation and graph the new function: horizontal compression by a factor of $\frac{1}{2}$ followed by a reflection over the x-axis then vertical translation up 2 and a horizontal translation right 1.



original

x	y	$\left(\frac{1}{2}x+1,\ -y+2\right)$
-2	2	(0 , 0)
-1	1	(½ , 1)
1	2	(1½ , 0)
2	1	(2 , 1)
3	2	(2½ , 0)

2-1 2. Write the equation for $g(x)$, ~~in vertex form~~, that fits the description below.

a) "The parent function $f(x)=x^2$ is horizontally stretched by a factor of 9, reflected over the x-axis and translated up 8 units."

$$\boxed{g(x) = -\left(\tfrac{1}{9}x\right)^2 + 8}$$

b) "The parent function $f(x)=x^2$ is vertically compressed by a factor of $\frac{3}{8}$, translated right 4 and down 7 units."

$$\boxed{g(x) = \tfrac{3}{8}(x-4)^2 - 7}$$

2-1 For question 3 and 4 below...

2-2 a) Describe the transformation from the parent quadratic function.

b) Determine the vertex.

c) Find an equation for the axis of symmetry.

d) Tell how the parabola opens.

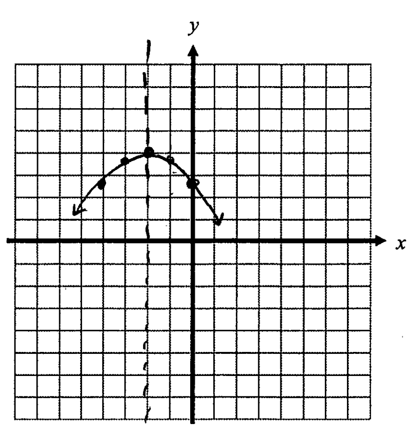
e) Tell whether the graph has a max or a min and what that value is.

f) List the domain and range.

g) Then graph the parabola with at least 3 points labeled.

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

g)



$(-1, 3\frac{2}{3})$
$(0, 2\frac{2}{3})$

a) $(x-2, -\frac{1}{3}y+4)$
Reflect over x-axis
Vertical Compression by a factor of 1/3
Left 2
Up 4

b) $V(-2,4)$

c) $x=-2$

d) DOWN

e) MAX = 4

f) D: ℝ
R: $y \le 4$

4. $g(x)=x^2-4x+6$

REWRITE USING CTS

$g(x)-6 = x^2-4x$

$g(x)-6 +4 = x^2-4x+4$

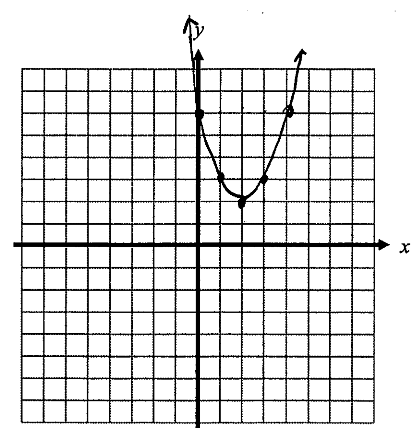
$g(x)-2 = (x-2)^2$

$\boxed{g(x) = (x-2)^2+2}$

vertex using $x=-b/2a$

$x = \frac{+4}{2(1)} = 2$

$g(2) = (2)^2-4(2)+6$
$= 4-8+6$
$= 2$



a) $(x+2, y+2)$
Right 2, Up 2

b) $V(2,2)$

c) $x=2$

d) UP

e) MIN = 2

f) D: ℝ
R: $y \ge 2$

2-3 5. Given: $y = 10x^2 - 17x - 20$. Write the quadratic function as a product of factors.

$\boxed{y = (2x - 5)(5x + 4)}$

2-3 6. Solve using factoring:

a) $x^2 - x - 30 = 0$

$(x-6)(x+5) = 0$

$\boxed{x = 6 \text{ or } x = -5}$

b) $10x^2 + 11x - 6 = 0$

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

$\boxed{x = -3/2 \text{ or } x = 2/5}$

2-3 7. Write a quadratic equation, in standard form, for the function whose zeros are $x = -\frac{1}{3}$ and $x = 5$

$y = (x + 1/3)(x - 5)$

$y = x^2 - 5x + \frac{1}{3}x - 5/3$

$\boxed{y = x^2 - \frac{14}{3}x - 5/3}$

OR

$y = (3x+1)(x-5)$

$y = 3x^2 - 15x + 1x - 5$

$y = 3x^2 - 14x - 5$

2-4 8. Solve and simplify your answer:

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

$(x+2)^2 = 12$

$x + 2 = \pm 2\sqrt{3}$

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

b) $2(5x+9)^2 = 8$

$(5x+9)^2 = 4$

$5x + 9 = \pm 2$

$5x + 9 = 2$ $\quad$ $5x + 9 = -2$

$5x = -7$ $\quad$ $5x = -11$

$\boxed{x = -7/5}$ or $\boxed{x = -11/5}$

2-4 9. Rewrite in vertex form. Then, identify the vertex.

USE CTS

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

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

$y - 1 = x^2 + 4x + \underline{4}$

$\underline{+4}$

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

$\boxed{y = (x+2)^2 - 3}$ $\boxed{V(-2, -3)}$

b) $y = 3x^2 - 6x + 1$.

$y - 1 = 3x^2 - 6x$

$y - 1 = 3(x^2 - 2x + \underline{\quad})$

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

$\underline{+3}$

$y + 2 = 3(x-1)^2$

$\boxed{y = 3(x-1)^2 - 2}$

2-5
2-6 10. Solve: $x^2 - 10x + 31 = -10$

$x^2 - 10x = -41$

$x^2 - 10x + \underline{25} = -41 + \underline{25}$

$(x-5)^2 = -16$

$x - 5 = \pm 4i$

$\boxed{x = 5 \pm 4i}$

OR

$x^2 - 10x + 41 = 0$

$x = \frac{10 \pm \sqrt{100 - 4(1)(41)}}{2(1)} = \frac{10 \pm \sqrt{100 - 164}}{2}$

$= \frac{10 \pm \sqrt{-64}}{2} = \frac{10 \pm 8i}{2} = 5 \pm 4i$

10 32
25 16·2

2-6 11. Solve using the quadratic formula: $5x^2+10x-11=0$
Simplify your answer!

$$x=\frac{-10\pm\sqrt{100-4(5)(-11)}}{2(5)}=\frac{-10\pm\sqrt{100+220}}{10}=\frac{-10\pm\sqrt{320}}{10}=\frac{-10\pm 8\sqrt{5}}{10}=\boxed{-1\pm\frac{4\sqrt{5}}{5}}$$

2-6 12. Given: $y=9x^2-12x+4$

a) Find the value of the $\boxed{\text{discriminant}}$ → b^2-4ac

$$(-12)^2-4(9)(4) = 144-144=0$$

b) Determine the number and type of solutions.

Since $b^2-4ac=0$ There is 1 Real Solution

2-6 13. Find the roots (real and imaginary) of each function.

a) $f(x)=-x^2+8x-3$

$-x^2+8x-3=0$

$-3=x^2-8x+16$

$+16$

$13=(x-4)^2$

$\pm\sqrt{13}=x-4$

$\boxed{4\pm\sqrt{13}=x}$

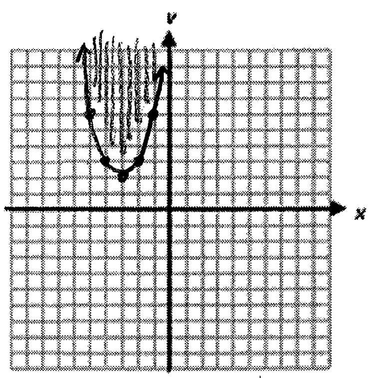
b) $f(x)=2x^2-9x+25$

$$x=\frac{9\pm\sqrt{81-4(2)(25)}}{2(2)}=\frac{9\pm\sqrt{81-200}}{4}=\frac{9\pm\sqrt{-119}}{4}$$

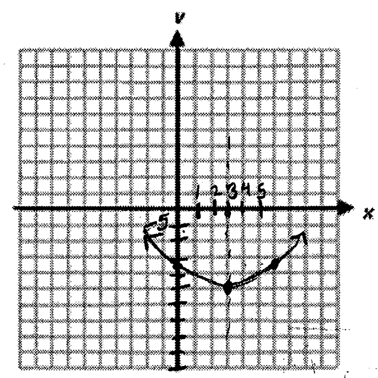
$$\boxed{x=\frac{9\pm i\sqrt{119}}{4}}$$

2-7 14. Graph each inequality.

a) $y\geq(x+3)^2+2$ $\quad V(-3,2)$



b) $y<x^2-6x-16$



$x=\frac{-b}{2a}=\frac{+6}{2(1)}=3$

$y(3)=(3)^2-6(3)-16$

$=9-18-16$

$=-25$

$V(3,-25)$

y-int: $(0,-16)$

2-5 15. Find the complex conjugate: $4+3i$ $\quad\boxed{4-3i}$

2-9 16. Use complex conjugates to write the quotient in $a+bi$ form: $\frac{(8+5i)(5-3i)}{(5+3i)(5-3i)}$

$$\frac{40-24i+25i-15i^2}{25-15i+15i-9i^2}=\frac{40+i+15}{25+9}=\frac{55+i}{34}$$

$$\boxed{=\frac{55}{34}+\frac{1}{34}i}$$

2-9 17. Simplify: $(-4-4i)+(-9+8i)$ $= \boxed{-13+4i}$

3-1 18. Add: $(3x^2+3x+5)+(-2x^2+4x+2)$ $= \boxed{x^2+7x+7}$

3-1 19. Subtract: $(7x^3-4x)-(-6x-5+5x^3)$ $= 7x^3-4x+6x+5-5x^3$

$\boxed{= 2x^3+2x+5}$

3-2 20. Multiply: $(x-1)(x^2-3x-5)$

$x^3-3x^2-5x-x^2+3x+5 = \boxed{x^3-4x^2-2x+5}$

3-3 21. Use synthetic substitution to evaluate the given polynomial for x = - 2

Be sure to report your answer correctly!

a) $6x^4-3x^3-12x^2-5x+6$

-2	6	-3	-12	-5	6
		-12	30	-36	82
	6	-15	18	-41	$\boxed{88}$

if you plug in -2 you get $\boxed{88}$

b) $x^4-3x^3-11x^2-9$

Don't forget this!

-2	1	-3	-11	0	-9
		-2	10	2	-4
	1	-5	-1	2	$\boxed{-13}$

if you plug in -2 you get $\boxed{-13}$

3-3 Divide.

22. $\dfrac{-3x^4-7x^3+12x^2+7x+3}{x^2+3x-1}$

$$
\begin{array}{r}
-3x^2+2x+3 \\
x^2+3x-1 \enclose{longdiv}{-3x^4-7x^3+12x^2+7x+3} \\
-(-3x^4-9x^3+3x^2) \\
\hline
2x^3+9x^2+7x \\
-(2x^3+6x^2-2x) \\
\hline
3x^2+9x+3 \\
-(3x^2+9x-3) \\
\hline
6
\end{array}
$$

$\boxed{-3x^2+2x+3+\dfrac{6}{x^2+3x-1}}$

23. $\dfrac{2y^2-2y+2}{y+2}$

-2	2	-2	2
		-4	12
	2	-6	14

$\boxed{2y-6+\dfrac{14}{y+2}}$

3-4 24. Factor each expression completely.

a) $8x^6+27$

$\boxed{(2x^2+3)(4x^4-6x^2+9)}$

b) $y^3+7y^2-2y-14$

	y	7
y^2	y^3	$7y^2$
-2	$-2y$	-14

$\boxed{(y+7)(y^2-2)}$

c) $2x^3-128$ $= 2(x^3-64)$

$\boxed{2(x-4)(x^2+4x+16)}$

d) $4x^3-8x^2-x+2$

	x	-2
$4x^2$	$4x^3$	$-8x^2$
-1	$-x$	2

$(x-2)(4x^2-1)$

$\boxed{(x-2)(2x+1)(2x-1)}$

e) $6x^4-23x^2+20$

	$3x^2$	-4
$2x^2$	$6x^4$	$-8x^2$
-5	$-15x^2$	20

$\boxed{(3x^2-4)(2x^2-5)}$

f) $27x^2+39x-10$

	$3x$	5
$9x$	$27x^2$	$45x$
-2	$-6x$	-10

$\boxed{(3x+5)(9x-2)}$

3-4 25. Find all real and/or imaginary roots of each function.

3-5

3-6 a) $f(x)=(2x-3)(4-x)(x+7) = 0$

$\boxed{x = 3/2, \quad x = 4, \quad x = -7}$

b) $f(x)=8x^3-4x^2-50x+25 = (2x-1)(4x^2-25)$

$= (2x-1)(2x+5)(2x-5) = 0$

	$2x$	-1
$4x^2$	$8x^3$	$-4x^2$
-25	$-50x$	25

$\boxed{x = 1/2, \quad x = -5/2, \quad x = 5/2}$

c) $f(x)=2x^3+x^2-13x+6$; given -3 is a zero

-3	2	1	-13	6
		-6	15	-6
	2	-5	2	$\boxed{0}$

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

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

$x = 1/2 \qquad x = 2$

$\boxed{x = -3, \quad x = 1/2, \quad x = 2}$

d) $f(x)=5x^4+3x^3+3x^2+3x-2$; given -1 and $\frac{2}{5}$ are zeros.

-1	5	3	3	3	-2
		-5	2	-5	2
2/5	5	-2	5	-2	$\boxed{0}$
		2	0	2	
	5	0	5	$\boxed{0}$	

$5x^2+5=0$

$5x^2=-5$

$x^2=-1$

$x = \pm i$

$\boxed{x = -1, \quad x = 2/5, \quad x = i, \quad x = -i}$

3-6 26. Write the simplest polynomial function in factored form with the given zeros.

a) zeros of $-\frac{5}{4}$ and 2 (multiplicity of 2)

$\boxed{y = (x + 5/4)(x-2)^2}$

b) zeros of 6 and $\sqrt{3}$ & $-\sqrt{3}$

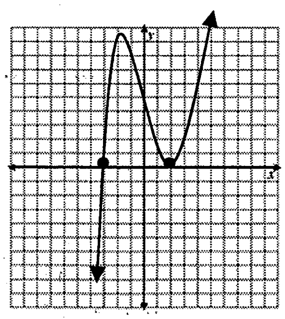
$\boxed{y = (x-6)(x-\sqrt{3})(x+\sqrt{3})}$

d) zeros of 3 and $5+i$ & $5-i$

$\boxed{y = (x-3)[x-(5+i)][x-(5-i)]}$

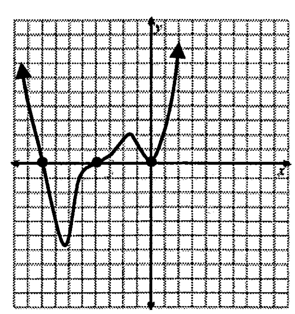
3-7 27. For the graphs below, identify whether the function has an even or odd degree and positive or negative leading coefficient. (L.C.)

3-5 Also, identify the zeros and their multiplicity.

a) 

ODD Degree
Positive L.C.

ZEROS	MULT
$x = -3$	1
$x = 2$	2

b) 

EVEN DEGREE
POSITIVE L.C.

ZEROS	MULT
$x = -8$	1
$x = 4$	3
$x = 6$	2

3-7 28. For each function,

i) List the degree.
ii) Describe the end behavior using infinity notation.
iii) Find the zeros (including their multiplicity).
iv) Based on the information from parts (a) through (c), sketch a graph of the function. Your sketch should have a scale on the x-axis only.

	$3x$	2
x^2	$3x^3$	$2x^2$
-9	$-27x$	-18

a) $f(x) = -2x^3(x-4)^2(2x+3) = -4x^6 + \sim$

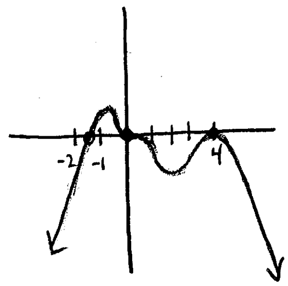
$\swarrow \ \downarrow$

i) deg = 6

ii) as $x \to \infty$, $f(x) \to -\infty$
as $x \to -\infty$, $f(x) \to -\infty$

iii)

zeros	mult
$x=0$	3
$x=4$	2
$x=-3/2$	1



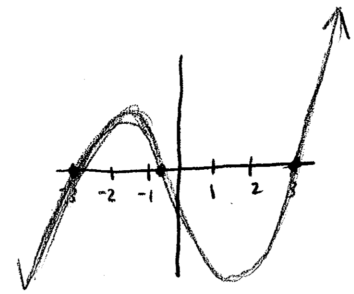
b) $g(x) = 3x^3 + 2x^2 - 27x - 18 = (3x+2)(x^2-9)$
$= (3x+2)(x+3)(x-3)$

i) deg = 3

ii) as $x \to \infty$, $g(x) \to \infty$
as $x \to -\infty$, $g(x) \to -\infty$

iii)

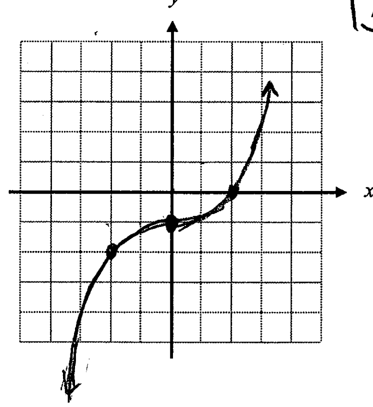
zeros	mult
$x=-2/3$	1
$x=-3$	1
$x=3$	1



3-8 29. Consider the given parent function below. Rewrite the function given the following transformations and then sketch the transformed graph:

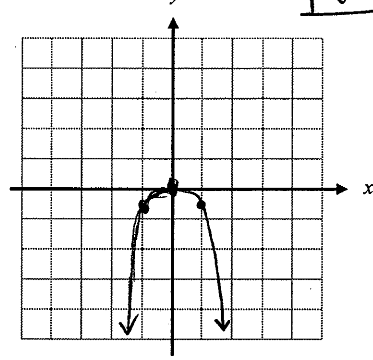
a) $f(x) = x^3$
Horizontal stretch by a factor of 2 and a vertical translation 1 units down

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



b) $f(x) = x^4$
Vertical compression $\frac{1}{2}$ and reflect over the x axis.

$\boxed{y = -\tfrac{1}{2}x^4}$



Pre4 30. Simplify completely using the properties of exponents.

4-4 a) $\left(100^{5/3}\right)^{3/2}$

$100^{5/2} = (\sqrt{100})^5$
$= 10^5$
$\boxed{= 100{,}000}$

b) $7^{-9/4} \cdot 7^{1/3}$ $\quad {}^{-27+4}_{\ \ 12}$

$\boxed{7^{-23/12}}$

c) $\dfrac{8^{5/6}}{8^{2/6}} = 8^{3/6} = 8^{1/3}$
$= \sqrt[3]{8} = \boxed{2}$

d) $6^{1/2} \cdot 36^{5/4} = 6^{1/2} \cdot (6^2)^{5/4}$
$= 6^{1/2} \cdot 6^{5/2} = 6^3$
$\boxed{= 216}$

e) $\log_6\left(6^{7x-y}\right)$

$\boxed{7x - y}$

f) $\dfrac{125^{7/6}}{5^{5/2}} = \dfrac{(5^3)^{7/6}}{5^{5/2}}$

$= \dfrac{5^{7/2}}{5^{5/2}} = 5^1$

$\boxed{= 5}$

g) $81^{-3/4} = (\sqrt[4]{81})^{-3}$
$= 3^{-3}$
$\boxed{= \frac{1}{27}}$

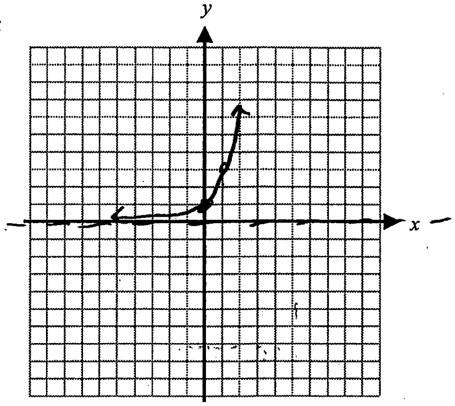
h) $\left(\dfrac{4}{9}\right)^{-3/2} = \left(\sqrt{\tfrac{4}{9}}\right)^{-3} = \left(\tfrac{2}{3}\right)^{-3}$
$= \left(\tfrac{3}{2}\right)^3$
$\boxed{= \frac{27}{8}}$

4-1 31. Graph. Identify at least 2 points and the asymptote. Tell whether the graph shows exponential growth or exponential decay. Then identify the domain and range.

a) $y = 3^x$

0	1
1	3

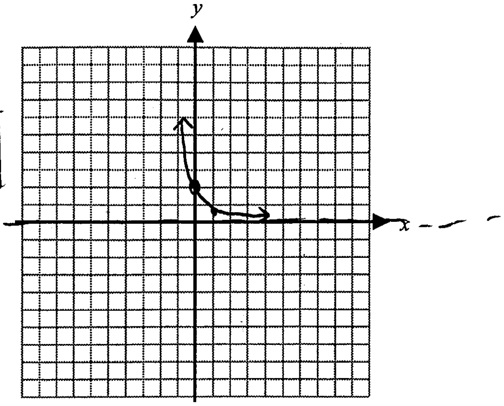
HA $y = 0$



b) $y = 2\left(\frac{1}{4}\right)^x$

$(0,1)$ $(1, \frac{1}{4})$ $\rightarrow$ $x, 2y$: $(0,2)$ $(1, \frac{1}{2})$

HA: $y=0$ $y=0$



4-2 4-3 32. Graph the function and its inverse in the same coordinate plane. Then, find an equation for $f^{-1}(x)$.

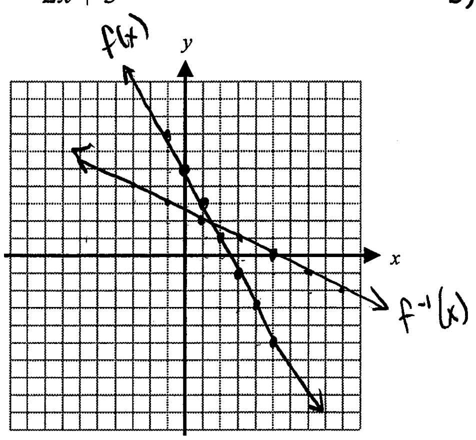
a) $f(x) = -2x+5$

$x = -2y + 5$

$x - 5 = -2y$

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

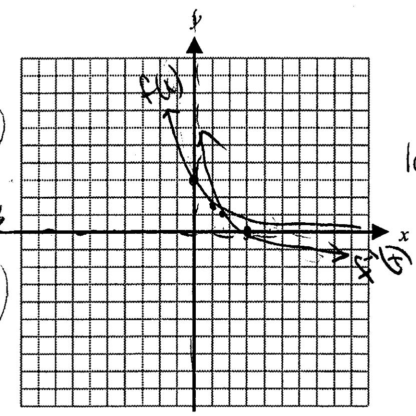
$\therefore \boxed{f^{-1}(x) = \frac{x-5}{-2}}$



b) $f(x) = 3\left(\frac{1}{2}\right)^x$

HAS POINTS
$(0,3)$ $(1, 1\frac{1}{2})$ (HA $y=0$)

$f^{-1}(x)$ HAS POINTS
$(3,0)$ $(1\frac{1}{2}, 1)$ (VA $x=0$)



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

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

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

$\log_{\frac{1}{2}}\left(\frac{x}{3}\right) = y$

$\therefore \boxed{f^{-1}(x) = \log_{\frac{1}{2}}\left(\frac{x}{3}\right)}$

4-3 33. Write the equation $3^4 = 81$ in logarithmic form.

$\log_3(81) = 4$

4-3 34. Write the equation $\log_{125} 25 = \frac{2}{3}$ in exponential form.

$125^{2/3} = 25$

4-3 35. Evaluate each logarithm.

a) $\log_{\frac{1}{25}} 125 = x$

$\left(\frac{1}{25}\right)^x = 125$

$5^{-2x} = 5^3$

$-2x = 3$

$\boxed{x = -3/2}$

b) $\ln e^{-5+x} = \boxed{-5+x}$

4-7 36. Identify the parent function and describe how it was transformed into the given function. Determine the asymptote. Graph the function by hand including 2 key points and a dashed line for the asymptote.

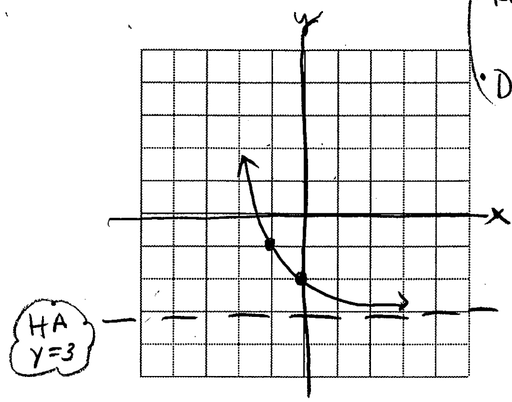
a) $g(x) = (2)^{-x} - 3$

Parent: $y = 2^x$

• Reflect over y-axis

• Down 3

$(-x, y-3)$



b) $h(x) = \frac{1}{2}\log_3(x+1)$

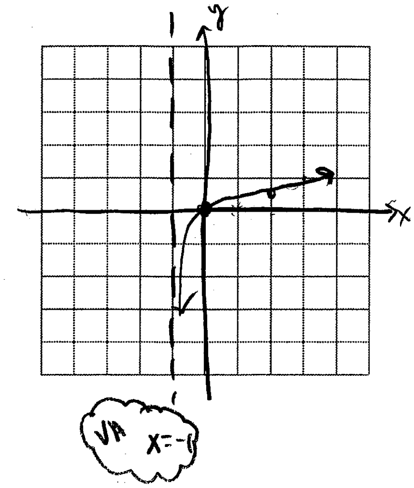
Parent:

$y = \log_3 x$

• Vertical Compression by a factor of 1/2

• Left 1

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



4-7 37. Rewrite the function given the transformation(s) below.

a) $g(x) = e^{(x)}$; horizontal stretch by a factor of 2 followed by a vertical translation 7 units down.

$$\boxed{y = e^{\frac{1}{2}x} - 7}$$

b) $h(x) = \ln x$; vertical stretch by a factor of 2 followed by a reflection over the y axis and a vertical translation 8 units up.

$$\boxed{y = 2\ln(-x) + 8}$$

Calculator Allowed

Round any decimal answers to the nearest thousandths.

1-4 38. A photographer hiked through the Grand Canyon. Each day she filled a photo memory card with images. When she returned from the trip, she deleted some photos, saving only the best. The table shows the number of photos she kept from all those taken on each memory card.

Grand Canyon Photos	
Photos Taken	Photos Kept
117	25
128	31
140	39
157	52
110	21
188	45
170	42

a) Write the equation of the line of best fit. $y = .33097043x - 11.32573346$] STORE AS Y_1

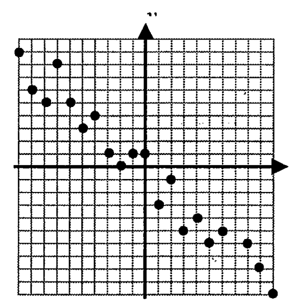
b) Find the correlation coefficient. (TURN DIAGNOSTICS ON if you aren't seeing **r**)

$r \approx .8482291734$ GO TO CATALOG THEN DOWN TO DIAGNOSTICS ON

c) Predict the number of photos the photographer will keep if she takes 200 photos on the memory card. $y = ?$ $x = 200$

$Y_1(200) \approx 54.86835253$ $\boxed{\approx 55 \text{ photos will be kept}}$

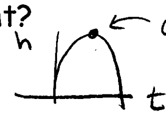
1-4 39. What type of $\boxed{\text{relationship}}$--positive, negative, or none---is shown by the scatter plot?



Negative correlation

2-2
2-3 40. The equation $h = -16t^2 + 40t + 5$ gives the height *h*, in feet, of a baseball as a function of time, *t*, in seconds, after it is hit.

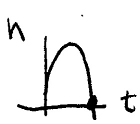
a) What is the maximum height the baseball reaches? How many seconds does it take the ball to reach this height?



← Calculate maximum
(1.25, 30)

MAX HEIGHT = 30 feet
Takes 1.25 seconds to reach that height

b) After how many seconds does the ball hit the ground if Mrs. Cofield and Mrs. Wilson are trying to catch it?



Takes ≈ 2.619 seconds for the ball to hit the ground.

calculate zero
(2.6193064, 0)

2-2 41. Give 3 ways to find the maximum value or minimum value for the function: $f(x) = -x^2 + 6x + 4$

① Use $x = -b/2a$ then plug that value in to find the y-value = MAX

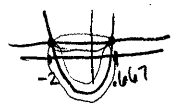
② Use completing the square to rewrite f(x) in vertex form y-value of vertex = MAX

③ graph f(x) on calculator, Calculate the maximum y-value = MAX

2-7 42. Solve the inequality:

a) $3x^2 + 4x - 3 \le 1$

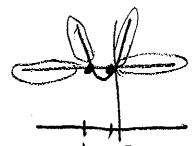
we want y_1 below y_2



$\boxed{-2 \le x \le .667}$

b) $2x^2 + 3x + 6 > 5$

we want $y_1 > y_2$



$\boxed{x < -1 \text{ or } x > -.5}$

2-8 43. A variety of spruce trees called No. 1 Common Spruce are often used as support columns in buildings. The maximum load allowance for each column depends on the height of the spruce column. The following table gives some of this data.

Height of the Column (ft)	4	5	6	7
Maximum Load (lb)	7280	7100	6650	5960

a) Find a quadratic regression model for this data. $y = -127.5x^2 + 961.5 + 5475.5$ (STORE AS Y_1)

b) Use the model to predict the load allowed for a 6.5 ft spuce column. $x = 6.5$

SHOW THIS! $\boxed{Y_1(6.5) = 6338.375 \text{ lb}}$

c) What is the maximum load a Common Spruce can hold?

(3.771, 7288.210)

$\boxed{\approx 7288.210}$

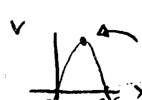
d) What is the height of the spruce column at that maximum load?

$\boxed{\approx 3.771 \text{ feet}}$

3.2 44. You are making an open box to hold paper clips out of a piece of cardboard that is 5 inches by 10 inches. The box will be formed by making an x inch by x inch square cut out of the corners as shown in the diagram and folding up the sides. You want the box to have the greatest volume possible.

a) Use a graphing calculator to find how long you should make the cuts. Explain your reasoning.

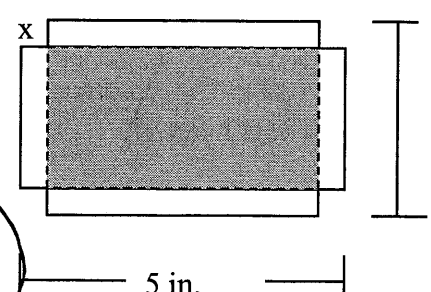
$V = x(5-2x)(10-2x)$



calculate maximum ... set $X_{min} = 0$ & $X_{max} = 2.5$ Why?

(1.057, 24.056)

To have max Volume, make the cuts $\boxed{\approx 1.057 \text{ inches}}$



b) What is the maximum volume of the box?

$\boxed{\text{Max Volume} = 24.056 \text{ in}^3}$

c) What will the dimensions of the finished box be?

Length $= 10 - 2x \approx 10 - 2(1.057) = 7.886$

width $= 5 - 2x \approx 5 - 2(1.057) \approx 2.886$

Dimensions will be $1.057 \times 2.886 \times 7.886$

3-5
3-6

45. Find all real and/or imaginary zeros of each function. Show work!

a) $f(x)=2x^3-13x^2+26x-10$

graph f(x)... $x=\frac{1}{2}$ looks like a zero

$$\begin{array}{c|cccc} \frac{1}{2} & 2 & -13 & 26 & -10 \\ & & 1 & -6 & 10 \\ \hline & 2 & -12 & 20 & \boxed{0} \end{array}$$

$2x^2-12x+20=0$

$2(x^2-6x+10)=0$

$x^2-6x+10=0$

$x^2-6x=-10$

$x^2-6x+9=-10+9$

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

$x-3=\pm i$

$x=3\pm i$

ZEROS
$x=\frac{1}{2}$
$x=3+i$
$x=3-i$

b) $f(x)=2x^4-7x^3-6x^2+44x-40$

graph f(x)... $x=2$ looks like a zero w/mult = 3

$$\begin{array}{c|ccccc} 2 & 2 & -7 & -6 & 44 & -40 \\ & & 4 & -6 & -24 & 40 \\ \hline 2 & 2 & -3 & -12 & 20 & \boxed{0} \\ & & 4 & 2 & -20 & \\ \hline 2 & 2 & 1 & -10 & \boxed{0} & \\ & & 4 & 10 & & \\ \hline & 2 & 5 & \boxed{0} & & \end{array}$$

$2x+5=0$

$x=-5/2$

ZEROS
$x=2$ w/mult = 3
$x=-5/2$

3-9

46. Use the table below to determine the best polynomial equation for the number of birds to visit a particular birdfeeder as a function of the number of months since 1-1-2011. Give the best polynomial equation and explain why you chose that model.

Number of Months	1	2	3	4	5	6
Number of Birds	3	8	18	36	65	108

-5 -10 -18 -29 -43

5 8 11 14

-3 -3 -3

Since the 3rd differences of the y-values are the same, I chose a CUBIC equation

$\boxed{y=.5x^3-.5x^2+3x}$

For questions 47-49: solve algebraically OR graphically. Be sure to practice BOTH methods.

Graph both sides, find intersection.

4-1

47. A medication is eliminated from a person's bloodstream at a rate of 7 % per hour. Suppose a tablet contains 30 mg of medication. Write an equation for the amount of the medication in the bloodstream after x hours. How many hours will it take for half the tablet to be eliminated?

$y=30(.93)^x$

x = hrs since medication was taken

y = mg of medication left in bloodstream

$15=30(.93)^x$

$\frac{1}{2}=.93^x$

$\log_{.93}(\frac{1}{2})=x$

$\boxed{x \approx 9.551 \text{ hours till half is eliminated}}$

4-1

48. A computer programmer earned a yearly salary of $40,000 in 1990 and averaged a 4% raise each year after that time.

$y=40000(1.04)^x$ x = yrs since 1990

y = salary after x yrs

a) Find the doubling time for the programmer's salary.

$80000=40000(1.04)^x$

$2=1.04^x$

$\log_{1.04}(2)=x$

$\boxed{x \approx 17.673 \text{ years till salary doubles}}$

b) Calculate the programmer's salary in 1998.

$x=8$

$y=40000(1.04)^8 \approx \boxed{\$54742.76}$

SHOW THIS!

4-4 49. The Richter magnitude of an earthquake, M, is related to the energy released in ergs, E, by the formula $M = \frac{2}{3}\log\left(\frac{E}{10^{11.8}}\right)$.

a) In August 2011, an earthquake struck Colorado releasing approximately 5.623×10^{19} ergs of energy. What was the magnitude of this earthquake?

$$M = \frac{2}{3}\log\left(\frac{5.623 \times 10^{19}}{10^{11.8}}\right) \approx 5.280822247 \qquad \boxed{\approx 5.3 \text{ magnitude earthquake}}$$

b) Find the inverse of the original equation.

$$\frac{3}{2}M = \log\left(\frac{E}{10^{11.8}}\right)$$

$$10^{3/2 M} = \frac{E}{10^{11.8}}$$

$$\boxed{10^{11.8} \cdot 10^{3/2 M} = E} = 10^{11.8 + 3/2 M} = E$$

c) How much energy was released by the 9.0 earthquake that struck off the coast of Japan in March of 2011?

$$E = 10^{11.8 + 3/2(9)} = \boxed{10^{25.3}} \approx \boxed{1.995 \times 10^{25}}$$

4-4 50. Evaluate $\log_5 130$

$$\boxed{\approx 3.024}$$

4-5
4-6 51. Solve each equation algebraically.

a) $2(1.04)^{x+3} = 12$

$$(1.04)^{x+3} = 6$$

$$\log_{1.04}(6) = x + 3$$

$$\boxed{\log_{1.04}(6) - 3 = x} \quad \boxed{\approx 42.684}$$

b) $-16 = 4 - 5\left(\frac{1}{6}\right)^{3x}$

$$-20 = -5\left(\frac{1}{6}\right)^{3x}$$

$$4 = \left(\frac{1}{6}\right)^{3x}$$

$$\log_{\frac{1}{6}}(4) = 3x$$

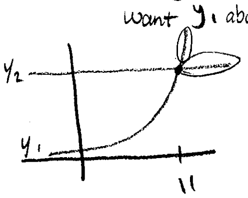
$$\boxed{\frac{1}{3}\log_{\frac{1}{6}}(4) = x}$$

$$\boxed{-.258 \approx x}$$

4-5 52. Use your graphing calculator to solve the inequality.

a) $\underbrace{2^{x-5}}_{} > \underbrace{64}_{}$

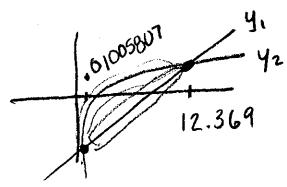
want y_1 above y_2



$$\boxed{x > 11}$$

b) $\underbrace{x - 8}_{} < \underbrace{4\log x}_{}$

want y_1 below y_2



$$\boxed{.010 < x < 12.369}$$

4-6 53. If \$3900 is deposited in an account at the bank and earns 6% annual interest, compounded continuously, what is the amount in the account after 4 years?

use $A = Pe^{rt}$

$A = 3900\, e^{(.06)(4)} \approx 4957.871686$

$\boxed{\approx \$4957.87}$

4-6 54. A paleontologist uncovers a fossil of a saber-toothed cat in California. He analyzes the fossil and concludes that the specimen contains 15% of its original carbon-14. Carbon-14 has a half-life of about 5730 years.

a = original amount

a) Using the equation $y = ae^{-kt}$, find the decay constant.

$.5\cancel{a} = \cancel{a}e^{-k(5730)}$

$.5 = e^{-5730k}$

$\ln(.5) = -5730k$

$\boxed{\frac{\ln(.5)}{-5730} = k}$

$k \approx .0001209680943$

b) Using the equation, determine the age of the fossil. Show/Explain your work.

$.15\cancel{a} = \cancel{a}e^{-\frac{\ln(.5)}{-5730}\cdot t}$

$.15 = e^{\frac{\ln(.5)}{5730}\cdot t}$

$\ln(.15) = \frac{\ln(.5)}{5730}\cdot t$

$\boxed{\frac{5730\ln(.15)}{\ln(.5)} = t} \approx \boxed{15{,}682.813 \text{ years}}$

4-8 55. In one state, the Real Estate Board found that the median cost of housing changed according to the data in this table.

Years since 1990	Median cost (in dollars)
0	77,000
1	79,000
2	83,000
3	90,000
4	99,000

a) Find an exponential model for the data.

x = yrs since 1990

$y = 75098.94762\,(1.065345402)^x$ STORE AS Y_1

b) Determine the median cost of housing in the year 2005. DO NOT ROUND.

$x = 15$

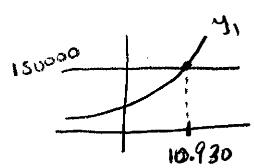
$Y_1(15) \approx \boxed{\$194084.29}$

c) Predict the year when the median cost of housing will exceed \$150,000

when will $y_1 > \underbrace{150000}_{y_2}$

$x > 10.930$

11th year after 1990 (2001)



4.8 56. Determine whether f is an exponential function of x. If so, find the constant ratio.

a)

x	-1	0	1	2	3
y	9	27	41	113	329

$\frac{27}{9} \to 3$ $\quad \frac{41}{27} \to 1.519$ ✗

NOT EXPONENTIAL

NOT THE SAME RATIO

b)

x	-2	-1	0	1	2
y	4	2	1	0.5	0.25

$\frac{2}{4} \to .5 \quad \frac{1}{2} \to .5 \quad \frac{.5}{1} \to .5 \quad \frac{.25}{.5} \to .5$

IS EXPONENTIAL ... CONSTANT RATIO = .5