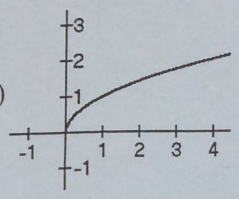
Secondary III
Review Unit 1

Name Key
Class A3 & B7

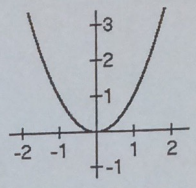
Unit 1:
Fill in each blank with the graph that corresponds to each of the parent functions given below.

1. $f(x) = x$ C
2. $f(x) = x^2$ B
3. $f(x) = |x|$ D
4. $f(x) = \sqrt{x}$ A
5. $f(x) = x^3$ H
6. $f(x) = \frac{1}{x}$ I
7. $f(x) = 2^x$ G
8. $f(x) = \sqrt[3]{x}$ F
9. $f(x) = \frac{1}{x^2}$ E

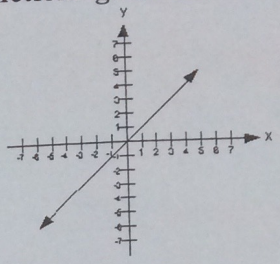
A)



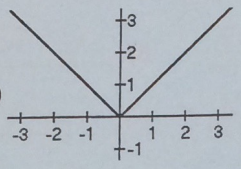
B)



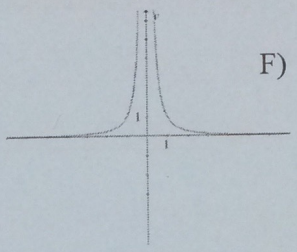
C)



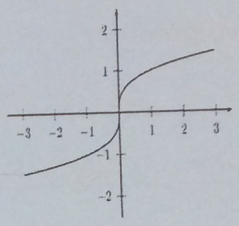
D)



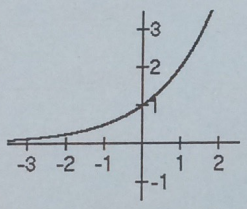
E)



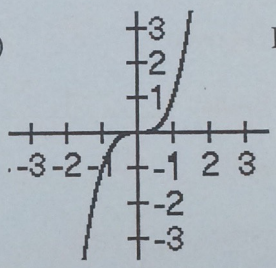
F)



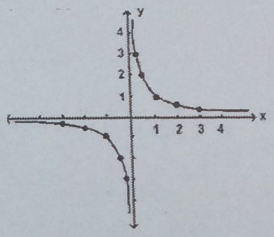
G)



H)

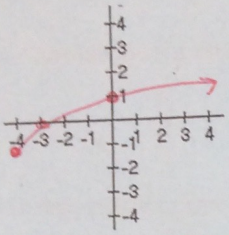


I)



Graph the following functions, identify the parent function, and list the transformations involved.

10. $g(x)=\sqrt{x+4}-1$



Parent Function: $\sqrt{x}$

List the transformations in words:

a) Shift Left 4

b) Shift Down 1

Domain: $[-4,\infty)$

Range: $[-1,\infty)$

x-int: $(-3,0)$

y-int: $(0,1)$

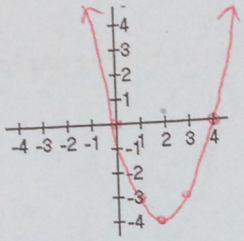
Left EB: ~~As $x\to-\infty$, $y\to+\infty$~~ None

Right EB: As $x\to+\infty$, $y\to+\infty$

Inc: $(-4,\infty)$

Dec: None

11. $h(x)=(x-2)^2-4$



Parent Function: x^2

List the transformations in words:

a) Shift Right 2

b) Shift Down 4

Domain: $(-\infty,\infty)$

Range: $[-4,\infty)$

x-int: $(6,0)$, $(4,0)$

y-int: $(0,0)$

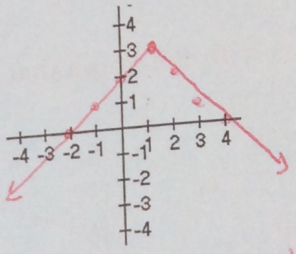
Left EB: As $x\to-\infty$, $y\to+\infty$

Right EB: As $x\to+\infty$, $y\to+\infty$

Inc: $(2,\infty)$

Dec: $(-\infty,-2)$

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



Parent Function: $|x|$

List the transformations in words:

a) V. Flip

b) Shift Right 1

c) Shift Up 3

Domain: $(-\infty,\infty)$

Range: $(-\infty,3]$

x-int: $(-2,0)$, $(4,0)$

y-int: $(0,2)$

Left EB: As $x\to-\infty$, $y\to-\infty$

Right EB: As $x\to+\infty$, $y\to-\infty$

Inc: $(-\infty,1)$

Dec: $(1,\infty)$

Unit 2:

1. Write the following polynomial in standard form: $8x^3+7x-14x^{10}+4-6x^9+2x^{11}$

$2x^{11}-14x^{10}-6x^9+8x^3+7x+4$

Complete the polynomial operations and write the answers in standard form.

2. $(82x^8+21x^2-6)+(18x+7x^8-42x^2+3)$

$89x^8-21x^2+18x-3$

3. $(3x^3-4x^2+10)-(x^3+2x^2+5x)$

$3x^3-x^3$
$-4x^2--2x^2$
$-5x$
$+10$

$= 2x^3-2x^2-5x+10$

4. $(x+2)(3x-7)$

$3x^2-7x+6x-14$

$3x^2-x-14$

5. $(15x-121x^{12}+x^9+x^7+3x^2)+(x^7-68x^2+x^9)$

$-121x^{12}+2x^7-65x^2+15x$

6. $(6x^5+9x^3-17x+5)-(5x^4+2x^3+7x+5)$

$6x^5-5x^4+11x^3-24x+10$

7. $(x^3+7x^2-14x+3)\div(x-2)$

x^2+9x+4 R: 11

$x-2 \;\overline{)\; x^3+7x^2-14x+3}$

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

$9x^2-14x$

$-(9x^2-18x)$

$4x+3$

$-(4x-8)$

11

2| 1 7 -14 3
↓ 2 18 8
1 9 4 11

x^2+9x+4 R: 11

8. $(2x-1)(x^2+3x-4)$

$2x^3+6x^2-8x$
$+\quad -1x^2-3x+4$

$2x^3+5x^2-11x+4$

9. $(2x^3+5x-8)\div(x+3)$

$+0x^2$

-3| 2 0 5 -8
↓ -6 18 -39
2 -6 13 |31

$2x^2-6x+13$ R: 31

Factor the polynomial.

10. $3x-9$

$3(x-3)$

11. $5x^2-25x$

$5x(x-5)$

12. x^2+5x+4

$(x+4)(x+1)$

13. $3x^2-18x+27$

$3(x^2-6x+9)$

$3(x-3)(x-3)$

14. $x^2-10x+21$

$(x-7)(x-3)$

15. $(7x^3+x^2)+(28x-4)$

$x^2(7x+1)-4(7x+1)$

$(7x+1)(x^2-4)$

$(7x+1)(x+2)(x-2)$

Unit 3:

1. Use division to determine if (x+2) or (x-6) are factors of $f(x) = 2x^3 + 8x^2 - 22x - 60$.

(x+2) is a factor

-2	2	8	-22	-60
	↓	-4	-8	60
	2	4	-30	0

(x-6) isn't a factor

6	2	8	-22	-60
	↓	12	120	588
	2	20	98	528

2. When you divide a polynomial by (x-a), then (x-a) is a factor if the remainder equals 0.

Find all the **zeros** and **factors** of the following functions: use a calculator or factor!

3. $g(x) = x^3 + 4x^2 + 4x$

$x(x^2+4x+4)$

$x(x+2)(x+2)$ ← factors

$x = 0, -2$ ← zeros

multiplicity 2

4. $h(x) = x^3 - 4x^2 - 5x$

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

$x(x-5)(x+1)$ ← factors

$x = 0, 5, -1$ ← zeros

5. $g(x) = x^2 + 3x - 10$

$(x+5)(x-2)$ ← factors

$x = -5, 2$ ← zeros

6. $f(x) = x^4 - 10x^2 + 9$ (use a calculator & graph)

zeros $x = -3, -1, 1, 3$

factors → $(x+3)(x+1)(x-1)(x-3)$

Given the following zeros and multiplicities, write a function in factored form:

7. 3 (multiplicity of 2), -5, -7

exponent

$(x-3)^2(x+5)(x+7)$

8. 2, -4 (multiplicity of 5), 3 (multiplicity of 2)

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

For the following functions, find the zeros, state the multiplicity of each zero and the type of intersection. State the end behavior and sketch a graph by hand.

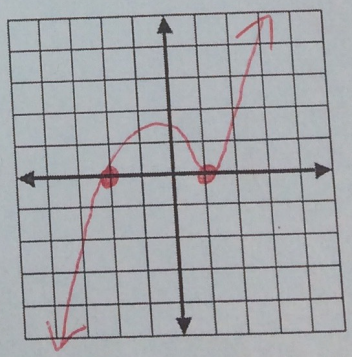
9. $f(x) = (x+2)(x-1)^2$

Zeros	Multiplicity	Intersection
-2	1	straight
1	2	tangent or bounce

End Behavior: Deg: 3 LC: + ↓↑

As $x \to -\infty$, $y \to -\infty$

As $x \to +\infty$, $y \to +\infty$



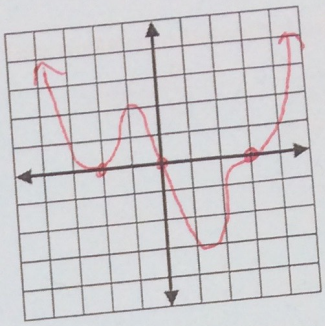
10. $f(x) = x(x+2)^2(x-3)^3$

Zeros	Multiplicity	Intersection
0	1	straight
-2	2	tangent or bounce
3	3	inflection

End Behavior: Deg: 6 LC: + ↑↑

As $x \to -\infty$, $y \to +\infty$

As $x \to +\infty$, $y \to +\infty$



For the following functions, graph on your calculator, state the zeros and multiplicity, write in factored form and analyze.

11. $f(x) = x^3 - x^2 - 6x$

Zeros	Multiplicity	Intersection
0	1	straight
-2	1	straight
3	1	straight

Factored form: $f(x) = x(x+2)(x-3)$

End Behavior:

As $x \to -\infty$, $y \to -\infty$

As $x \to +\infty$, $y \to +\infty$

12. $g(x) = x^4 - 17x^2 + 16$

Zeros	Multiplicity	Intersection
-4	1	straight
-1	1	straight
1	1	straight
4	1	straight

Factored form: $g(x) = (x+4)(x+1)(x-1)(x-4)$

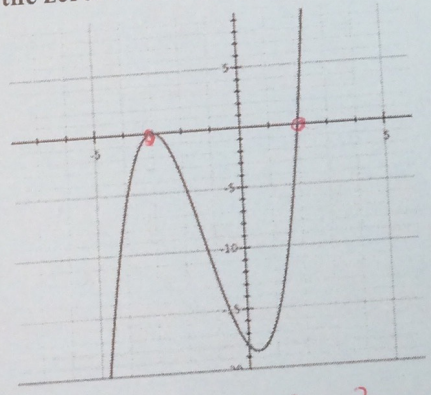
End Behavior:

As $x \to -\infty$, $y \to +\infty$

As $x \to +\infty$, $y \to +\infty$

Find the zeros on the graph, then write the function in factored form.

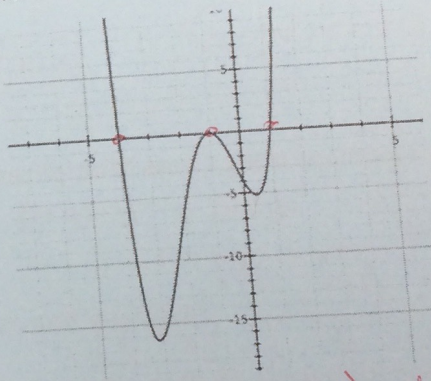
13.



Zeros: -3 (mult of 2), 2

Factored Form: f(x)= $(x+3)^2(x-2)$

14.



Zeros: -4, -1 (m. 2), 1

Factored Form: f(x)= $(x+4)(x+1)^2(x-1)$

Unit 4:

Perform the indicated operation and state the excluded values

1. $\frac{(x-5)(x+1)}{3x-15} \cdot \frac{4}{(x-3)(x+1)}$

$3(x-5)$

$x \neq 5, 3, -1$

$\frac{4}{3(x-3)}$

2. $\frac{x+2}{x-4} \div \frac{x}{3x-12}$

$3(x-4)$

$x \neq 4, 0$

$\frac{(x+2)}{(x-4)} \cdot \frac{3(x-4)}{x} = \frac{3(x+2)}{x}$

3. $\frac{x+3}{x+2} \div \frac{x^2+3x}{2x-4}$

$x(x+3)$ $\quad 2(x-2)$

$x \neq -2, 2, 0, -3$

$\frac{(x+3)}{(x+2)} \cdot \frac{2(x-2)}{x(x+3)} = \frac{2(x-2)}{x(x+2)}$

4. $\frac{3x+6}{x+2} \cdot \frac{x-3}{x-4}$

$3(x+2)$

$x \neq -2, 4$

$\frac{3(x+2)}{(x+2)} \cdot \frac{(x-3)}{(x-4)} = \frac{3(x-3)}{(x-4)}$

5. $\frac{6x+6}{(x+3)(x-3)} + \frac{(x+3)}{(x+3)} \cdot \frac{(x-3)}{(x-3)}$

LCD: $(x+3)(x-3)$ $\quad x \neq -3, 3$

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

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

$x \neq 1$

$\frac{-x+2}{x-1}$

7. $\frac{4}{x(x-1)} - \frac{x+2}{x-1} \cdot \frac{x}{x}$

LCD: $x(x-1)$ $\quad x \neq 0, 1$

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

Solve the equations using Cross Multiplication:

8. $\frac{3x}{7} = \frac{4x+1}{9}$

$9(3x) = 7(4x+1)$

$27x = 28x + 7$

$-28x \quad -28x$

$-x = 7$

$x = 7$

9. $\frac{x+5}{2} = \frac{-5}{x-6}$

$x \neq 6$

$(x+5)(x-6) = 2(-5)$

$x^2 - 6x + 5x - 30 = -10$

$+10 \quad +10$

$x^2 - x - 20 = 0$

$(x-5)(x+4) = 0$

$x = 5, -4$

Solve the equation using "Kill the Denominator:"

10. $\frac{x}{x-1} + \frac{1}{x-3} = \frac{2}{(x-1)(x-3)}$

LCD: $(x-1)(x-3)$ $\quad x \neq 1, 3$

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

$x^2 - 3x + x - 1 = 2$

$-2 \quad -2$

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

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

$x = 3, -1$

$x = -1$

11. $\frac{3}{x+2} + \frac{3}{2} = \frac{x}{2(x+2)}$

LCD: $2(x+2)$ $\quad x \neq -2$

$\frac{2(x+2) \cdot 3}{(x+2)} + \frac{2(x+2) \cdot 3}{2} = \frac{2(x+2) \cdot x}{2(x+2)}$

$6 + 3x + 6 = x$

$3x + 12 = x$

$-x \quad -x$

$2x + 12 = 0$

$-12 \quad -12$

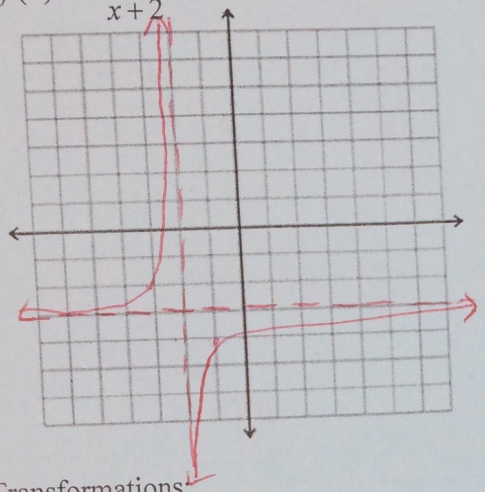
$\frac{2x}{2} = \frac{-12}{2}$

$x = -6$

Unit 5:

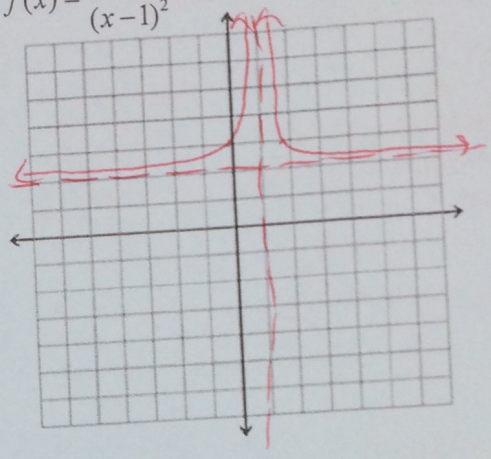
List the transformations and graph the following:

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



Transformations:
- V. Flip
- Shift Left 2
- Shift Down 3

2. $f(x) = \frac{1}{(x-1)^2} + 2$ Volcano



Transformations:
- Shift Right 1
- Shift Up 2

Use division to put into transformation form, then list the transformations from $f(x) = \frac{1}{x}$

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

$g(x) = \frac{-7}{(x+2)} + 3$

$-2 \mid 3 \quad -1 \quad \downarrow \quad -6 \quad \overline{3 \quad -7}$

- V. Stretch by -7 (V. Flip)
- Shift Left 2
- Shift Up 3

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

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

$2 \mid 2 \quad -3 \quad \downarrow \quad 4 \quad \overline{2 \quad 1}$

- Shift Right 2
- Shift Up 2

For the following functions, identify the holes, asymptotes, and intercepts.

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

Holes: $x = 5$
V.A.: $x = -1$
H.A.: $y = 1$
x-int: $(-4, 0)$
y-int: $(0, 4)$

6. $f(x) = \frac{x-3}{(x+1)(x+5)}$

Holes: None
V.A.: $x = -1, \; x = -5$
H.A.: $y = 0$
x-int: $(3, 0)$
y-int: $(0, -3/5)$

$\frac{3(x-2)}{2(x+2)}$

Find the information for the functions, then graph.

7. $f(x)=\frac{3x-6}{2x+4}$ $=0$ $=0$

$3x-6=0$, $+6\ +6$, $\frac{3x}{3}=\frac{6}{3}$, $x=2$

$2x+4=0$, $-4\ -4$, $\frac{2x}{2}=\frac{-4}{2}$, $x=-2$

$\frac{3(0)-6}{2(0)+4}=\frac{-6}{4}=-\frac{3}{2}$

Domain: $(-\infty,-2)\cup(-2,\infty)$

Range: $(-\infty,3/2)\cup(3/2,\infty)$

x- int: $(2,0)$

y-int: $(0,-3/2)$

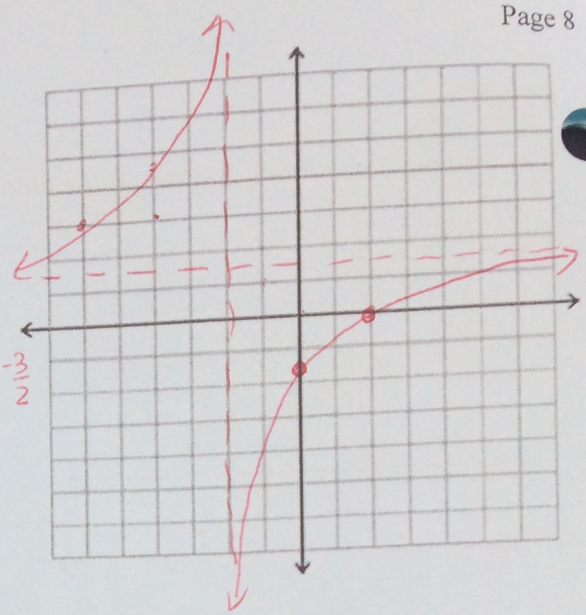
Vertical Asymptote: $x=-2$

Horizontal Asymptote: $y=3/2$

End Behavior:

As $x\to-\infty$, $y\to3/2$

As $x\to+\infty$, $y\to3/2$



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

Hole: $x=3$

Domain: $(-\infty,-1)\cup(-1,3)\cup(3,\infty)$

Range: $(-\infty,1)\cup(1,\infty)$

x- int: ~~4~~ $(-2,0)$

y-int: $(0,2)$

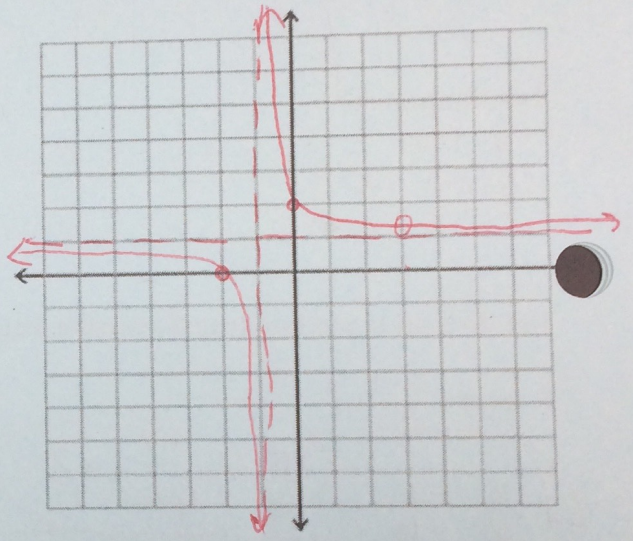
Vertical Asymptote: $x=-1$

Horizontal Asymptote: $y=1$

End Behavior:

As $x\to-\infty$, $y\to1$

As $x\to+\infty$, $y\to1$



9. $f(x)=\frac{10}{x-5}$

Domain: $(-\infty,5)\cup(5,\infty)$

Range: $(-\infty,0)\cup(0,\infty)$

x- int: None

y-int: $(0,-2)$

Vertical Asymptote: $x=5$

Horizontal Asymptote: $y=0$

End Behavior:

As $x\to-\infty$, $y\to0$

As $x\to+\infty$, $y\to0$