Secondary Math III
Q 1 Review

Name KEY
Period _____

Unit 1

1. Name the parent function, then describe the following transformations in words.

a) $x-4$
Linear ($y=x$)
Down 4

b) x^2+5
Quadratic ($y=x^2$)
Up 5

c) $|-x|$
Abs. Value ($y=|x|$)
Flip over y-axis

d) $3\sqrt[3]{x}$
Cube Root ($y=\sqrt[3]{x}$)
Vertical Stretch of 3

e) $\frac{1}{4}\cdot 2^x$
Exponential ($y=2^x$)
Vertical Compression of 4

f) $\sqrt{2x}$
Square Root ($y=\sqrt{x}$)
Horizontal Compression of 2

g) $-x^3$
Cube ($y=x^3$)
Flip over x-axis

h) $(x+1)^2$
Quadratic ($y=x^2$)
Left 1

2. Fill in each blank with the parent function that corresponds to each of the graphs given below.

$y=\sqrt{x}$ A)

$y=x^2$ B)

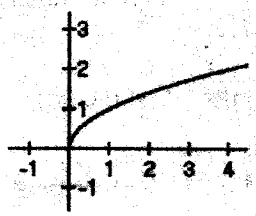
$y=\sqrt[3]{x}$ C)

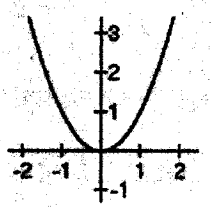
$y=|x|$ D)

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

$y=x^3$ F)

$y=2$ G)

A)


B)


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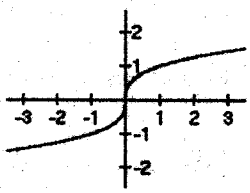

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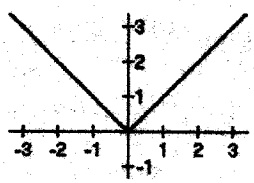

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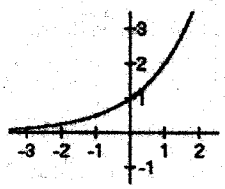
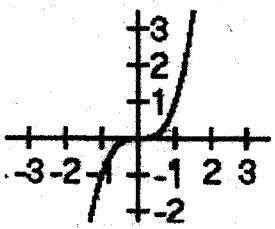
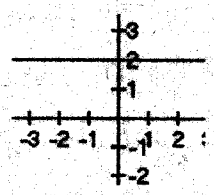


F)


G)


Given the parent function $f(x)$, write the equation that contains the given transformations.

5. $f(x) = \sqrt[3]{x}$

- Vertical Translation down two units
- Reflection across the y-axis

$f(x) =$ $\sqrt[3]{-x} - 2$

6. $f(x) = |x|$

- Horizontal Compression by a factor of 3
- Reflection across the x-axis

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

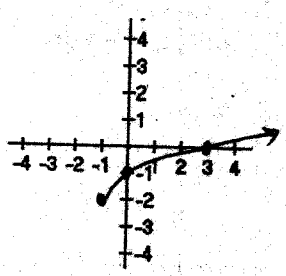
7. $f(x) = 2^x$

- Vertical Compression by a factor of 2
- Horizontal Translation left 3 units

$f(x) =$ $\frac{1}{2} \cdot 2^{(x+3)}$

Graph the following functions without using a calculator. Next, identify the parent function, list the transformations involved, and also include the new domain and range.

8. $g(x) = \sqrt{x+1} - 2$



Parent Function: $y = \sqrt{x}$

List the transformations in words:

a) Left 1

b) Down 2

Domain: $[-1, \infty)$

Range: $[-2, \infty)$

x-int: $(3, 0)$

y-int: $(0, -1)$

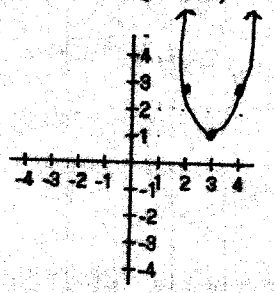
Left EB: None

Right EB: $\lim_{x \to \infty} g(x) = \infty$

Inc: $(-1, \infty)$

Dec: Never

9. $h(x) = 2(x-3)^2 + 1$



Parent Function: $y = x^2$

List the transformations in words:

a) Vertical Stretch of 2

b) Right 3

c) Up 1

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

Range: $[1, \infty)$

x-int: None

y-int: $(0, 19)$

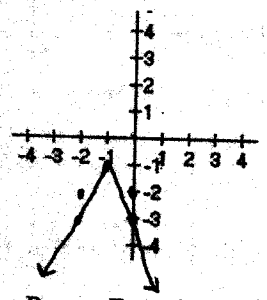
Left EB: $\lim_{x \to -\infty} h(x) = \infty$

Right EB: $\lim_{x \to \infty} h(x) = \infty$

Inc: $(3, \infty)$

Dec: $(-\infty, 3)$

10. $i(x) = -2|x+1| - 1$



Parent Function: $y = |x|$

List the transformations in words:

a) Flip over x-axis

b) Vertical Stretch of 2

c) Left 1

d) Down 1

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

Range: $(-\infty, -1]$

x-int: None

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

Left EB: $\lim_{x \to -\infty} i(x) = -\infty$

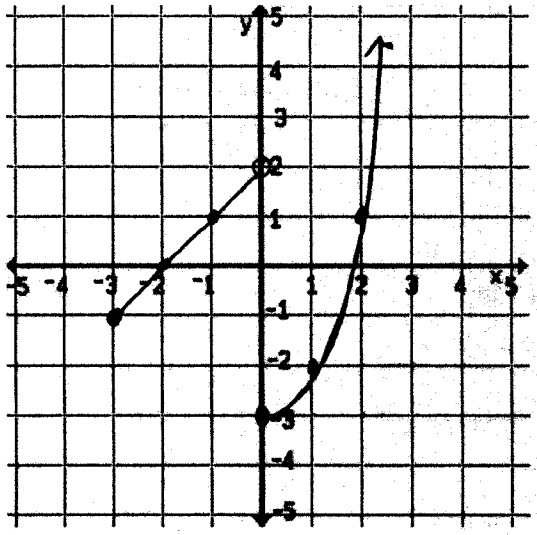
Right EB: $\lim_{x \to \infty} i(x) = -\infty$

Inc: $(-\infty, -1)$

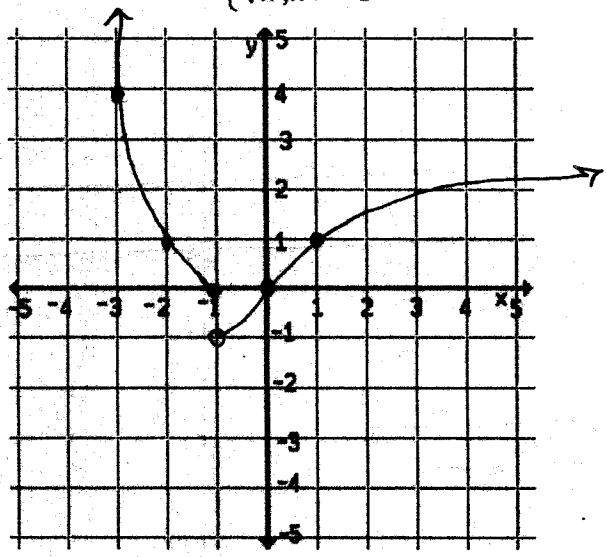
Dec: $(-1, \infty)$

Graph the piece-wise functions

11. $f(x)=\begin{cases} x+2, -3 \le x < 0 \\ x^2-3, x \ge 0 \end{cases}$



12. $f(x)=\begin{cases} (x+1)^2, x \le -1 \\ \sqrt[3]{x}, x > -1 \end{cases}$



Unit 2

1. Write the following polynomial in standard form $6x^3+5x^7-2x^9+4x^2+5$:

$-2x^9+5x^7+6x^3+4x^2+5$

2. What kind of polynomial is x^2+3x+2 ? (circle all that apply)

a) linear b) cubic (c) quadratic d) constant

e) monomial f) Binomial (g) trinomial (e) polynomial

Complete the polynomial operation. ***(Lesson 6.1, 6.2, 6.3, 6.5)***

1. $(8x^3-2x^2-4x+8)+(5x^2+6x-4)$

$8x^3+3x^2+2x+4$

2. $(-4x^2-2x+8)-(x^2+8x-5)$

$-5x^2-10x+13$

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

$12x^4+8x^3-4x^2+9x^3+6x^2-3x+6x^2+4x-2$

$12x^4+17x^3+8x^2+x-2$

4. $(3x^3+12x^2+11x-2)\div(x+2)$

-2 | 3 | 12 | 11 | -2

$\downarrow$ | -6 | -12 | 2

3 | 6 | -1 | 0

$3x^2+6x-1$

(5.) $(x+y)^6$

$x^6+6x^5y+15x^4y^2+20x^3y^3+15x^2y^4+6xy^5+y^6$

6. $(9x^4 + x^3 + 11x^2 - 4) \div (x^2 + 16)$

$9x^2 + x - 133$

$x^2+0x+16 \overline{)\,9x^4+x^3+11x^2+0x-4}$

$-9x^4 \mp 0x^3 \mp 144x^2$

$x^3 - 133x^2 + 0x$

$-x^3 \mp 0x^2 \mp 16x$

$-133x^2 - 16x - 4$

$+133x^2 + 0x + 2128$

$-6x + 2124$

$9x^4+x^3+11x^2-4 = (x^2+16)(9x^2-x-133)+\left(\frac{-6x+2124}{x^2+16}\right)$

7. $(5x + y)^4$

$(5x)^4 + 4(5x)^3y + 6(5x)^2y^2 + 4(5x)^1y^3 + y^4$

$\boxed{625x^4 + 500x^3y + 150x^2y^2 + 20xy^3 + y^4}$

Factor the polynomial. ***(Lesson 6.4)***

8. $3x^2 + 4x - 4$ -12, $-2, 6$

$(3x^2+6x)-2x-4$

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

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

9. $2x^3 + 4x^2 - 30x$

$2x(x^2+2x-15)$

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

10. $9x^2 - 25$

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

11. $4x^2 - 16x + 16$

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

$\boxed{4(x-2)(x-2)}$

12. $(x^3 + 8x^2)+(6x + 48)$

$x^2(x+8)+6(x+8)$

$\boxed{(x^2+6)(x+8)}$

13. $(8x^4 + 8x^3)+(27x + 27)$

$8x^3(x+1)+27(x+1)$

$(x+1)(8x^3+27)$

$\boxed{(x+1)(2x+3)(4x^2-6x+9)}$

Unit 3

1. Are (x+2) and (x-6) factors of $f(x) = 2x^3 + 8x^2 - 22x - 60$?

-2 | 2 8 −22 −60

↓ −4 −8 60

2 4 −30 | 0

$\boxed{(x+2) \text{ is a factor}}$

6 | 2 8 −22 −60

↓ 12 120 588

2 20 98 | 528

$\boxed{(x-6) \text{ is not a factor}}$

Find **all** the zeros of the following functions

3. $h(x) = (3x^3 - 2x^2) - (3x + 2)$

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

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

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

$\boxed{\begin{array}{l} x = -1 \\ x = 1 \\ x = \frac{2}{3} \end{array}}$

4. $f(x) = x^4 + x^3 - 14x^2 - 2x + 24$ $\pm \frac{1,2,3,4,6,8,12,24}{1}$

3 | 1 1 −14 −2 24

↓ 3 12 −6 −24

1 4 −2 −8 | 0

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

$\pm \frac{1,2,4,8}{1}$

-4 | 1 4 −2 −8

↓ −4 0 8

1 0 −2 | 0

$\boxed{\begin{array}{l} x = 3 \\ x = -4 \\ x = \pm\sqrt{2} \end{array}}$

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

6. 2 (multiplicity of 3), 5, –7(multiplicity of 2)

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

7. 4, 2(multiplicity of 5), -3

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

8. Given $g(x) = 3x^3 - 8x^2 + 3x + 2$, use the rational root theorem to determine which of the following are ***possible zeros*** of the function. $\frac{\pm 1,2}{1,3}$ $\pm 1, 2, \frac{1}{3}, \frac{2}{3}$

(a.) 2 ~~b. -3~~ ~~c. 4~~ (d.) $-\frac{2}{3}$ ~~e. $\frac{3}{4}$~~

For the following functions, find the zeros, state the end behavior using limit notation, and graph the function.

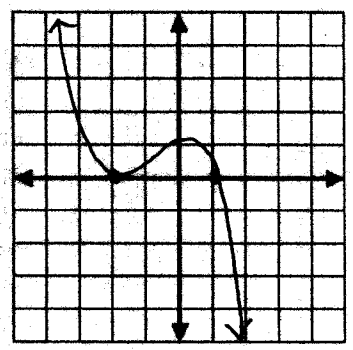
9. $f(x)=-(x+2)^2(x-1)$ x^3 ↖↘

zeros: $x=-2$ (mult. 2) $x=1$

End Behavior:

$\lim_{x\to-\infty} f(x) = \infty$

$\lim_{x\to\infty} f(x) = -\infty$



1,2,4,8,16 / 1

12. $g(x) = x^4 - 17x^2 + 16$ x^4 ↗↗

1 | 1 0 -17 0 16
↓ 1 1 -16 -16
1 1 -16 -16 | 0

4 | 1 1 -16 -16
↓ 4 20 16
1 5 4 | 0

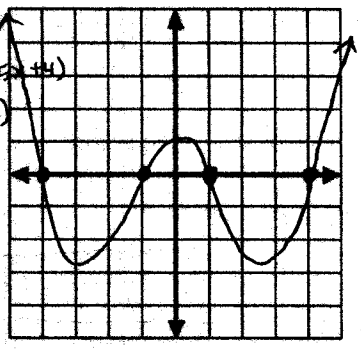
$(x-1)(x-4)(x^2+5x+4)$

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

zeros: $x=1, x=4, x=-1, x=-4$

End Behavior:

$\lim_{x\to-\infty} g(x)=\infty$ $\lim_{x\to\infty} g(x)=\infty$



13. $f(x) = 3x^3 - 8x^2 + 3x + 2$ x^3 ↙↗

3 | 3 -8 3 2
↓ 3 -5 -2
3 -5 -2 | 0

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

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

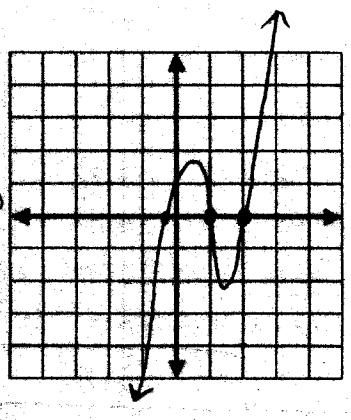
$3x(x-2)+1(x-2)$

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

zeros: $x=1, x=2, x=-\frac{1}{3}$

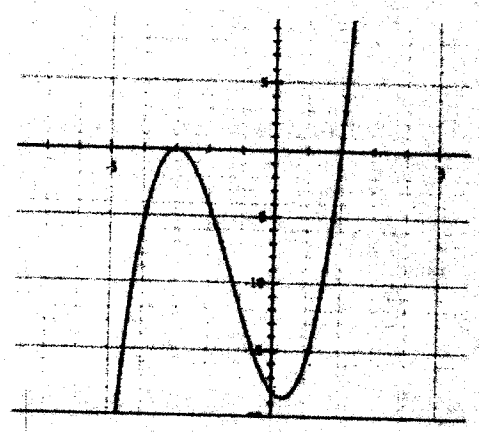
End Behavior:

$\lim_{x\to-\infty} f(x)=-\infty$ $\lim_{x\to\infty} f(x)=\infty$



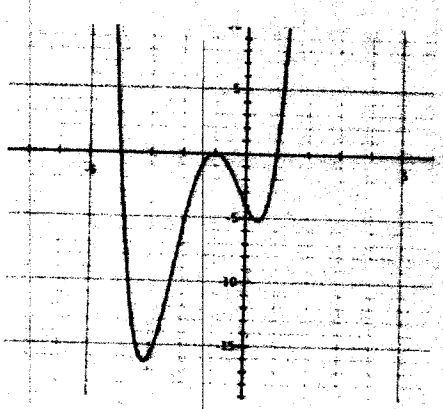
Given the following graphs analyze the functions

14.



Domain: $(-\infty, \infty)$
Range: $(-\infty, \infty)$
Increasing: $(-\infty, -3) \cup (0.5, \infty)$
Decreasing: $(-3, 0.5)$
max: 1 local Where: $(-3, 0)$
min: 1 local Where: $(0.5, -19)$
x-intercept(s): $(-3, 0)$
y-intercept: $(0, -18)$
End Behavior: $\lim_{x \to -\infty} f(x) = -\infty$ $\lim_{x \to \infty} f(x) = \infty$

15.



Domain: $(-\infty, \infty)$
Range: $(-16, \infty)$
Increasing: $(-3.5, -1) \cup (0.5, \infty)$
Decreasing: $(-\infty, -3.5) \cup (-1, 0.5)$
max: 1 local Where: $(-1, 0)$
min: 2 local Where: $(-3.5, -16)$; $(0.5, -5)$
x-intercept(s): $(-4, 0)$, $(-1, 0)$, $(1, 0)$
y-intercept: $(0, -4)$
End Behavior: $\lim_{x \to -\infty} g(x) = \infty$ $\lim_{x \to \infty} g(x) = \infty$

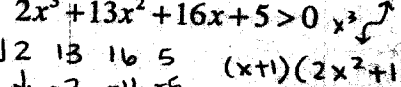
Solve the following polynomial inequalities

16. $x^3 - 3x^2 + x + 3 \geq 0$ $x^3 \nearrow$

$x^2(x-3) - 1(x-3) \geq 0$

$(x-3)(x^2-1) \geq 0$

$(x-3)(x+1)(x-1) \geq 0$ $x = 3, -1, 1$



$[-1, 1] \cup [3, \infty)$

17. $x^3 - 7x^2 + 10x + 6 < 0$ $x^3 \nearrow$

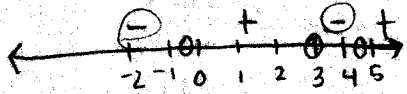
3 | 1 -7 10 6
↓ 3 -12 -6
1 -4 -2 | 0

$(x-3)(x^2-4x-2) \leq 0$

$x = \frac{4 \pm \sqrt{(-4)^2 - 4(1)(-2)}}{2(1)} = \frac{4 \pm \sqrt{16+8}}{2} = \frac{4 \pm \sqrt{24}}{2}$

$= \frac{4 \pm 2\sqrt{6}}{2} = 2 \pm \sqrt{6}$

$(x-3)(x-(2+\sqrt{6}))(x-(2-\sqrt{6}))$



$(-\infty, 2-\sqrt{6}) \cup (3, 2+\sqrt{6})$

18. $2x^3 + 13x^2 + 16x + 5 > 0$ $x^3 \nearrow$

-1 | 2 13 16 5
↓ -2 -11 -5
2 11 5 | 0

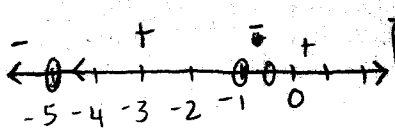
$(x+1)(2x^2+11x+5) > 0$

$(x+1)(2x^2+10x+x+5) > 0$

$x = -1, -5, -\frac{1}{2}$

$(x+1)(2x(x+5)+1(x+5)) > 0$

$(x+1)(x+5)(2x+1) > 0$



$(-5, -1) \cup (-\frac{1}{2}, \infty)$

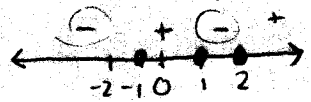
19. $(x^3 - 2x^2) - (x+2) \leq 0$ $x^3 \nearrow$

$x^2(x-2) - 1(x-2) \leq 0$

$(x-2)(x^2-1) \leq 0$

$(x-2)(x+1)(x-1) \leq 0$

$x = 2, -1, 1$



$(-\infty, -1] \cup [1, 2]$