Summative Review
Secondary 3

Name:_____
Date:_____ Class:_____

Unit 1

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

$\sqrt{x}$ A)

x^2 B)

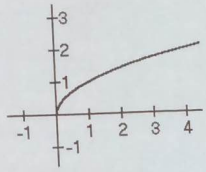
$\sqrt[3]{x}$ C)

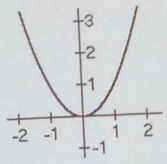
$|x|$ D)

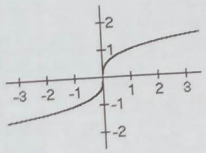
2^x E)

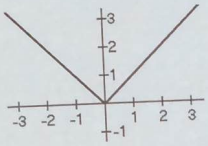
x^3 F)

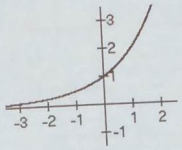
x G)

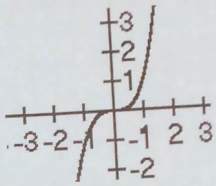
A)


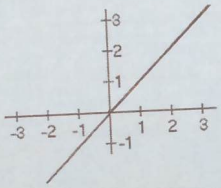
B)


C)


D)


E)


F)


G)


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

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

- Vertical Translation down two units
- Reflection across the y-axis (H. Flip)

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

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

- Horizontal Translation right 3 units
- Reflection across the x-axis (V. Flip)

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

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

- Vertical Compression by a factor of 2
- Horizontal Shift 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.

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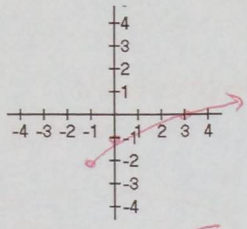
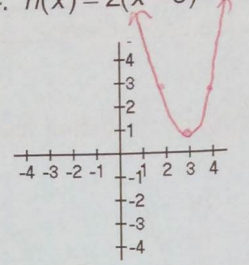
3. $g(x)=\sqrt{x+1}-2$



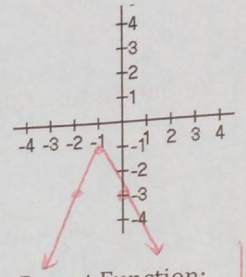
Parent Function: $\sqrt{x}$

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



Parent Function: x^2

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



Parent Function: $|x|$

List the transformations in words:

a) Shift Left 1

b) Shift Down 2

a) V. Stretch by 2

b) Shift Right 3

c) Shift Up 1

a) V. Flip

b) V. Stretch by 2

c) Shift Left 1

d) Shift Down 1

Domain: $[-1,\infty)$	Domain: $(-\infty,\infty)$	Domain: $(-\infty,\infty)$
Range: $[-2,\infty)$	Range: $[1,\infty)$	Range: $(-\infty,-1]$
x-int: $(3,0)$	x-int: None	x-int: None
y-int: $(0,-1)$	y-int: $(0,19)$	y-int: $(0,-3)$
Left EB: None	Left EB: $\lim_{x\to-\infty} f(x)=+\infty$	Left EB: $\lim_{x\to-\infty} f(x)=-\infty$
Right EB: $\lim_{x\to+\infty} f(x)=\infty$	Right EB: $\lim_{x\to+\infty} f(x)=+\infty$	Right EB: $\lim_{x\to\infty} f(x)=-\infty$
Inc: $(-1,\infty)$	Inc: $(3,\infty)$	Inc: $(-\infty,-1)$
Dec: Never	Dec: $(-\infty,3)$	Dec: $(-1,\infty)$

y-int : $x=0$

$2(0-3)^2+1$

~~2(18~~

$2(9)+1$

$18+1$

19

Graph the piece-wise functions

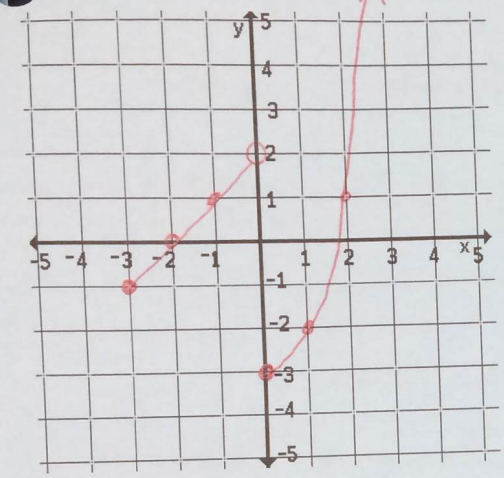
$x+2$

x	y
-3	-1
-2	0
-1	1
0	2

x^2-3

x	y
0	-3
2	-2
3	1
	6

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



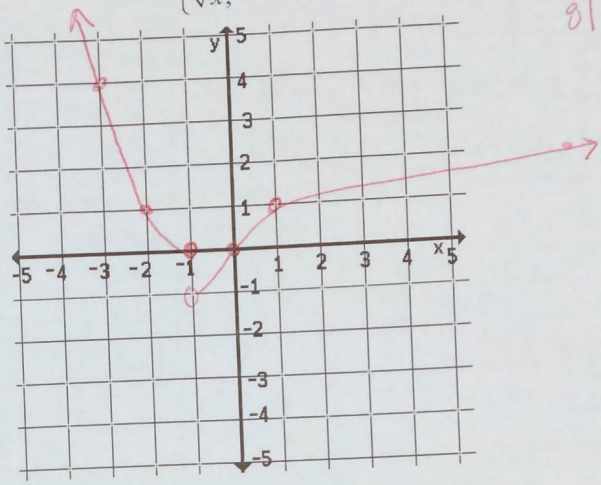
$(x+1)^2$

x	y
-3	4
-2	1
-1	0

$\sqrt[3]{x}$

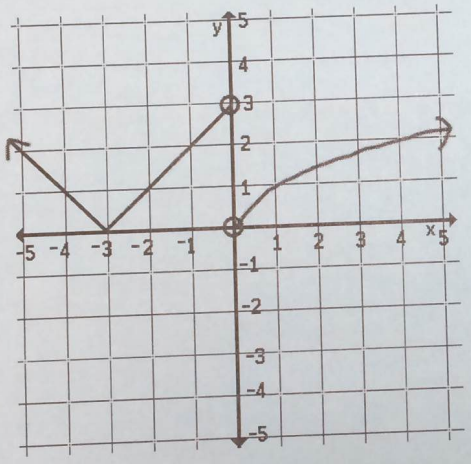
x	y
-1	-1
0	0
1	1
8	2

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

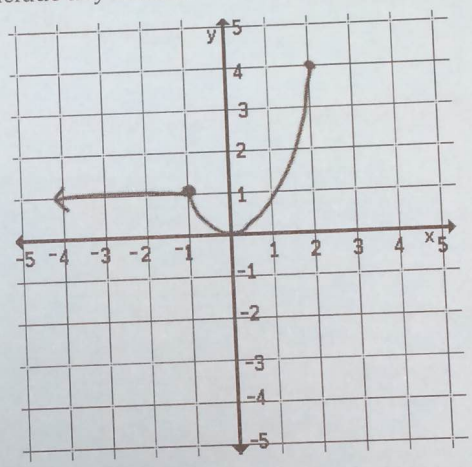


Write a function given the piecewise graphs. Be sure to include any domain restrictions!

8.



9.



Function:

$f(x)=\begin{cases} |x+3|, & x<0 \\ \sqrt{x}, & x>0 \end{cases}$

Function:

$f(x)=\begin{cases} 1, & x\le -1 \\ x^2, & -1<x\le 2 \end{cases}$

Unit 2

Complete the polynomial operation.

combine like terms

10. $(8x^3 - 2x^2 - 4x + 8) + (5x^2 + 6x - 4)$

$\boxed{8x^3 + 3x^2 + 2x + 4}$

11. $5x(x + 2)(3x - 7)$

$(5x^2 + 10x)(3x - 7) = 15x^3 - 35x^2 + 30x^2 - 70x$

$\boxed{15x^3 - 5x^2 - 70x}$

12. $(-4x^2 - 2x + 8) - (x^2 + 8x + 5)$

$\boxed{-5x^2 - 10x + 13}$

13. $(3x^3 + 12x^2 + 11x - 2) \div (x + 2)$

-2	3	12	11	-2
+	↓	-6	-12	2
	3	6	-1	0

$\boxed{3x^2 + 6x - 1}$ R=0

14. ~~$(5x + 1)^4$~~

15. $(4x^2 + 3x + 2)(3x^2 + 2x - 1)$

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

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

$+ \quad + 9x^3 + 6x^2 - 3x$

$+ 6x^2 + 4x - 2$

$\boxed{12x^4 + 17x^3 + 8x^2 + x - 2}$

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

$\boxed{9x^2 + x - 133 \quad R: -16x + 2124}$

$x^2 + 0x + 16 \overline{)\, 9x^4 + 1x^3 + 11x^2 + 0x - 4}$

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

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

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

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

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

$-16x + 2124$

Factor the polynomial.

17. $3x^2 + 4x - 4$

$6 \cdot -2 = -12$

$6 + -2 = 4$

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

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

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

18. $2x^3 + 4x^2 - 30x$

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

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

19. $9x^2 - 25$

$a^2 - b^2 = (a - b)(a + b)$

$a = 3x$

$b = 5$

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

20. $(8x^4 + 8x^3) + (27x + 27)$

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

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

$a = 2x \quad b = 3$

$a^3 + b^3 = (a + b)(a^2 - ab + b^2)$

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

Use a calculator!

Unit 3

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

21. $f(x) = x^4 + x^3 - 14x^2 - 2x + 24$

$\boxed{x = -4, 3, -1.41, 1.41}$

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

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

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

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

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

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

$\boxed{(x-2)^3(x-5)(x+7)^2}$

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

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

24. 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.

L.C. const.

$\frac{\pm \text{factors of const}}{\text{factors of L.C.}}$

$\pm 1, \pm 2, \pm 1/3, \pm 2/3$

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.

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

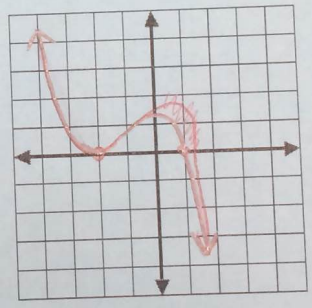
zeros: $-2, 1$

End Behavior: ↑ ↓

L.C: −

Deg: 3

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



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

zeros: $0, -3, 2$

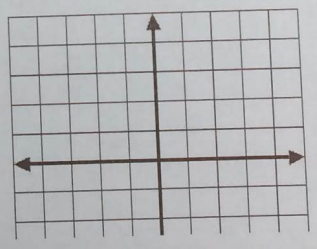
End Behavior:

L.C: +

Deg: 6

EB: ↑↑

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



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

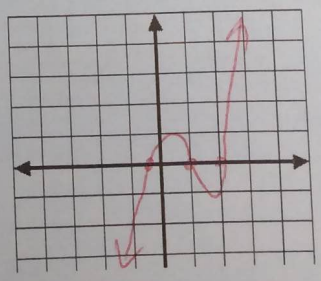
Possible RR

$\pm 1, \pm 2, \pm 1/3, \pm 2/3$

zeros: $-1/3, 1, 2$

EB: ↓↑

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



~~End Behavior:~~

$(x^2-16)(x^2-1) = (x-4)(x+4)(x+1)(x-1)$

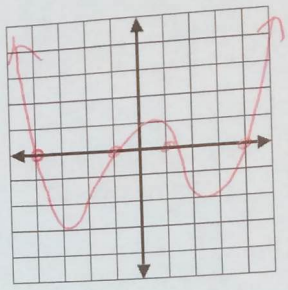
28. $g(x) = x^4 - 17x^2 + 16$

LC: 7
Deg: 4

zeros: $4, -4, -1, 1$
End Behavior: ↑↑

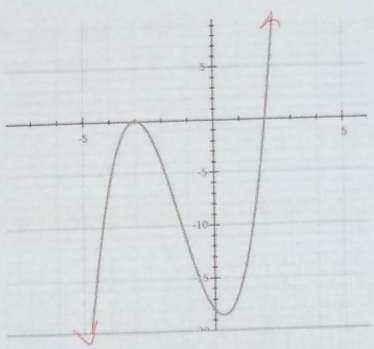
$\lim_{x \to -\infty} f(x) = \infty$

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



Given the following graphs analyze the functions

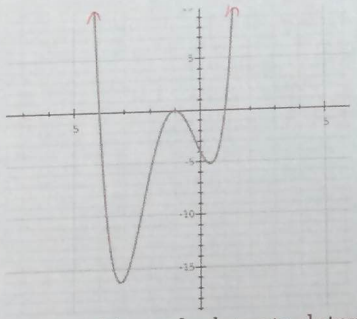
29.



Domain: $(-\infty, \infty)$
Range: $(-\infty, \infty)$
Increasing: $(-\infty, -3) \cup (0.5, \infty)$
Decreasing: $(-3, +0.5)$
#/type max: $(3, 0) \rightarrow$ local max / ~~global absolute max~~
#/type min: $(+0.5, -18) \rightarrow$ local min / relative min
x-intercept(s): $(-3, 0)$ $(2, 0)$
y-intercept: $(0, 18)$
End Behavior:

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

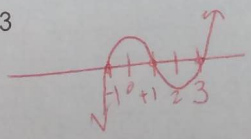
30.



Domain: $(-\infty, \infty)$
Range: $[-16, \infty)$
Increasing: $(-3, -1) \cup (0.5, \infty)$
Decreasing: $(-\infty, -3) \cup (-1, 0.5)$
#/type max: $(-3, -16) \rightarrow$ absolute/global min $(0.5, -5) \rightarrow$ relative/local max
#/type min: $(-1, 0) \rightarrow$ local / relative ~~max~~ max
x-intercept(s): $(-4, 0), (-1, 0), (1, 0)$
y-intercept: $(0, -4)$
End Behavior: $\lim_{x \to -\infty} f(x) = \infty$ $\lim_{x \to \infty} f(x) = \infty$

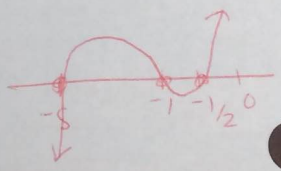
Use your graphing calculator to determine the intervals where the function values are: a) zero, b) positive and c) negative.

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



a) $x = -1, 1, 3$
b) $(-1, 1) \cup (3, \infty)$
c) $(-\infty, -1) \cup (1, 3)$

32. $h(x) = 2x^3 + 13x^2 + 16x + 5$



a) $x = -5, -1, -1/2$
b) $(-5, -1) \cup (-1/2, \infty)$
c) $(-\infty, -5) \cup (-1, -1/2)$