

Precalculus Honors

Parent Functions

Lesson 5: Parent Functions

Analyzing Functions

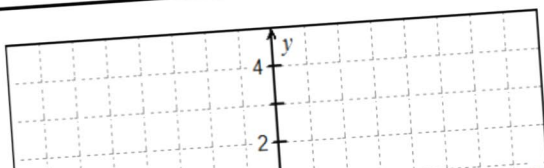
Give a complete analysis for each of the “parent functions”. The analysis should include as many of the following as possible:

- | | | |
|---|---|--|
| ☐ Domain | ☐ Increasing/decreasing behavior | ☐ Horizontal asymptotes |
| ☐ Range | ☐ Symmetry (even/odd) | ☐ Vertical asymptotes |
| ☐ Roots | ☐ Boundedness | ☐ End behavior |
| ☐ y-intercept(s) | ☐ Local extrema | ☐ Continuity |

For each function, sketch the graph and analyze for features in the list above.

Constant Function

$$f(x) = c$$



Domain:

Range:

x-intercept(s):

Maximum:

Completely Editable

1.5

Lesson 5: Parent Functions

Analyzing Functions

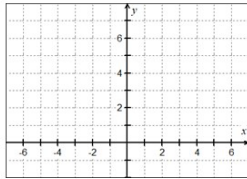
Give a complete analysis for each of the "parent functions". The analysis should include as many of the following as possible:

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| ☐ y-intercept(s) | ☐ Local extrema | ☐ Continuity |

For each function, sketch the graph and analyze for features in the list above.

Constant Function

$$f(x) = c$$



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

Domain: Range:

x-intercept(s): Maximum:

y-intercept: Minimum:

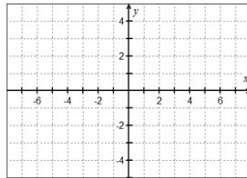
Increases:

Decreases:

Other:

Identity Function

$$f(x) = x$$



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

Domain: Range:

x-intercept(s): Maximum:

y-intercept: Minimum:

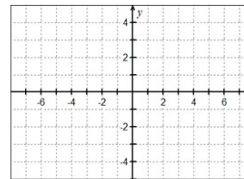
Increases:

Decreases:

Other:

Rational Function

$$f(x) = \frac{1}{x}$$



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

Domain: Range:

x-intercept(s): Maximum:

y-intercept: Minimum:

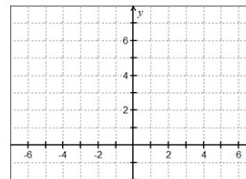
Increases:

Decreases:

Other:

Quadratic Function

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



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

Domain: Range:

x-intercept(s): Maximum:

y-intercept: Minimum:

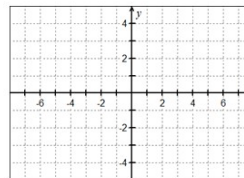
Increases:

Decreases:

Other:

Cubic Function

$$f(x) = x^3$$



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

Domain: Range:

x-intercept(s): Maximum:

y-intercept: Minimum:

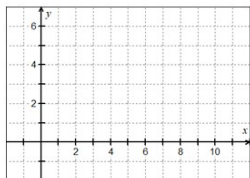
Increases:

Decreases:

Other:

Square Root Function

$$f(x) = \sqrt{x}$$



$$\lim_{x \rightarrow 0^+} f(x) = \quad \lim_{x \rightarrow \infty} f(x) =$$

Domain: Range:

x-intercept(s): Maximum:

y-intercept: Minimum:

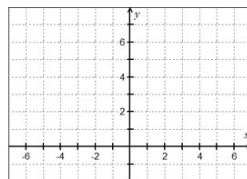
Increases:

Decreases:

Other:

Absolute Value Function

$$f(x) = |x|$$



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

Domain: Range:

x-intercept(s): Maximum:

y-intercept: Minimum:

Increases:

Decreases:

Other:

Cube Root Function

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



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

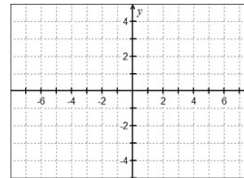
Increases:

Decreases:

Other:

Exponential Function (base b)

$$f(x) = b^x$$



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

Domain: Range:

x-intercept(s): Maximum:

y-intercept: Minimum:

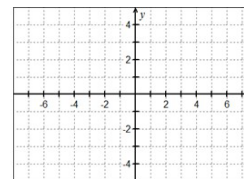
Increases:

Decreases:

Other:

Exponential Function (base e)

$$f(x) = e^x$$



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

Domain: Range:

x-intercept(s): Maximum:

y-intercept: Minimum:

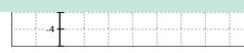
Increases:

Decreases:

Other:

Logarithmic Function

$$f(x) = \log_b x$$



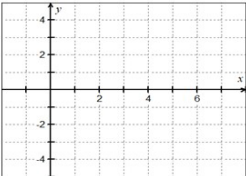
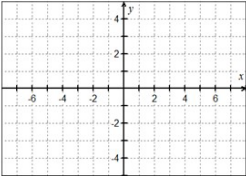
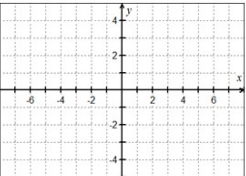
$$\lim_{x \rightarrow 0^+} f(x) = \quad \lim_{x \rightarrow \infty} f(x) =$$

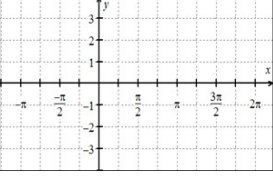
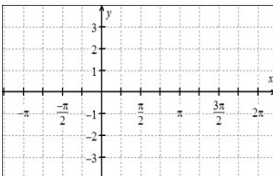
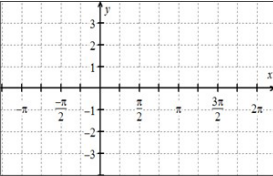
Increases:

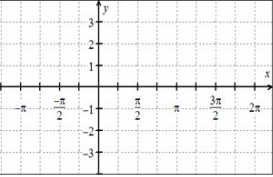
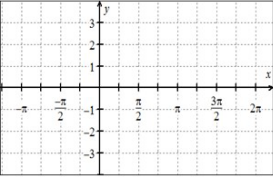
Decreases:

Other:

NOTES

Natural Logarithmic Function	$f(x) = \ln x$
	Domain: _____ Range: _____ x-intercept(s): _____ Maximum: _____ y-intercept: _____ Minimum: _____ Increases: _____ Decreases: _____ Other: _____
$\lim_{x \rightarrow 0^+} f(x) =$ $\lim_{x \rightarrow \infty} f(x) =$	
Greatest Integer Function	$f(x) = \lfloor x \rfloor$
	Domain: _____ Range: _____ x-intercept(s): _____ Maximum: _____ y-intercept: _____ Minimum: _____ Increases: _____ Decreases: _____ Other: _____
$\lim_{x \rightarrow -\infty} f(x) =$ $\lim_{x \rightarrow \infty} f(x) =$	
Signum Function	A Step Function
	$f(x) = \begin{cases} \frac{ x }{x} & ; x \neq 0 \\ 0 & ; x = 0 \end{cases}$ Domain: _____ Range: _____ x-intercept(s): _____ y-intercept: _____ Other: _____
$\lim_{x \rightarrow -\infty} f(x) =$ $\lim_{x \rightarrow \infty} f(x) =$	
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Sine Function	$f(x) = \sin x$
	Domain: _____ Range: _____ Period: _____ 5 Key Points: _____ Other: _____
Cosine Function	$f(x) = \cos x$
	Domain: _____ Range: _____ Period: _____ 5 Key Points: _____ Other: _____
Tangent Function	$f(x) = \tan x$
	Domain: _____ Range: _____ Period: _____ Asymptotes: _____ 5 Key Points: _____ Other: _____
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Cosecant Function	$f(x) = \csc x$
	Domain: _____ Range: _____ Period: _____ Asymptotes: _____ 5 Key Points: _____ Other: _____
Secant Function	$f(x) = \sec x$
	Domain: _____ Range: _____ Period: _____ Asymptotes: _____ 5 Key Points: _____ Other: _____
Cotangent Function	$f(x) = \cot x$
	5 Key Points: _____ Other: _____
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NOTES

1.5 Parent Functions

Name _____

Date _____ Period _____

Problems 1-12. Each graph is a small variation on the graph of one of the twelve basic parent functions. Match the graph to one of the twelve functions. Support your answer by checking the graph on your calculator.

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

2. $y = \sqrt{x-1}$

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

4. $y = \sin(x) + 2$

5. $y = (x-2)^3$

6. $y = \lfloor x+1 \rfloor$

7. $y = |x| + 2$

8. $y = -\cos(x)$

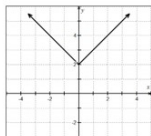
9. $y = -x + 3$

10. $y = \ln(x-1)$

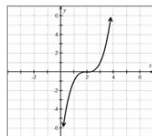
11. $y = e^x - 2$

12. $y = \sqrt[3]{x+1}$

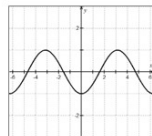
A.



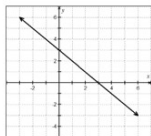
B.



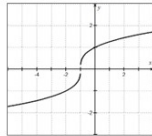
C.



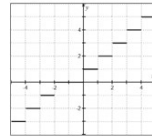
D.



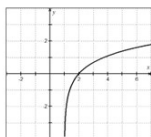
E.



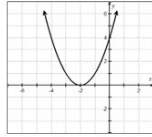
F.



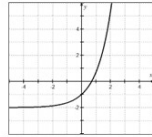
G.



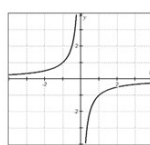
H.



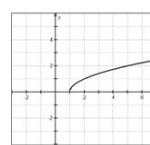
J.



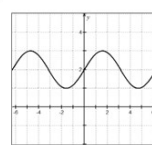
K.



L.



M.



Problems 13-18. Use the functions pictured in questions 1-12 to identify functions that fit the following descriptions given below.

13. The function whose domain consists of all non-negative real numbers.

14. The two functions that have at least one point of discontinuity.

15. The function that is not a *continuous function*.

16. The function whose domain excludes zero.

17. The two functions that are bounded above.

18. The six functions that are bounded below.

Problems 19 - 26. Identify which of the basic functions have the following characteristics.

19. The six functions that are increasing on their entire domains.

20. The odd functions.

21. The even functions.

22. The three functions that are decreasing over the interval $(-\infty, 0)$.

23. The three functions whose range is all real numbers.

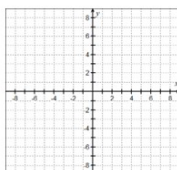
24. The two functions with no zeros.

25. The three functions with infinitely many local extrema.

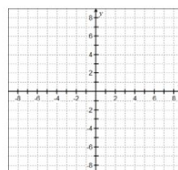
26. The functions that *do not* have end behavior $\lim_{x \rightarrow \infty} f(x) = \infty$

Problems 27 - 32. Sketch the graph of the piecewise-defined function. (Try to do this without a graphing utility.) For each problem, give any points of discontinuity.

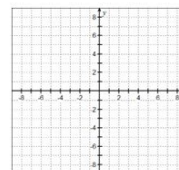
27. $f(x) = \begin{cases} -x, & x < 0 \\ x^2, & x \geq 0 \end{cases}$



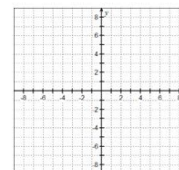
28. $g(x) = \begin{cases} x^2, & x \leq 0 \\ \sqrt{x}, & x > 0 \end{cases}$



31. $w(x) = \begin{cases} -2-x, & x \leq 0 \\ \cos x, & x > 0 \end{cases}$

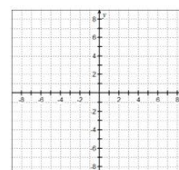


32. $f(x) = \begin{cases} 2x, & x < 0 \\ 3, & 0 \leq x < 2 \\ x^2, & x \geq 2 \end{cases}$

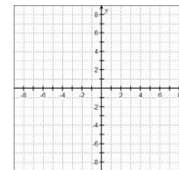


Problems 33 - 36. Use your graphing utility to graph the function. Then, determine the domain and range of the function, the x-intercept(s), if any, and the end behavior.

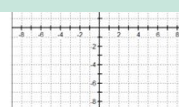
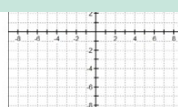
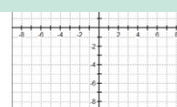
33. $f(x) = x^2 - 4$



34. $g(x) = |x+3| - 2$



Practice Sets



1.5 Parent Functions Practice

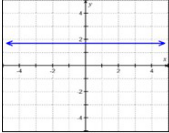
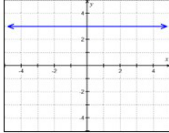
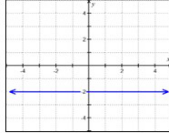
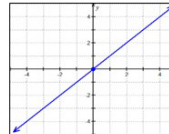
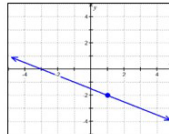
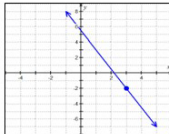
Name _____

Date _____ Period _____

On each grid in the first column is the graph of a **Parent Function**. The name, general equation and domain and range of the function is given. In the next two columns, there are graphs which are transformations of the parent function.

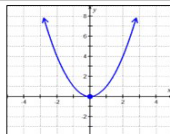
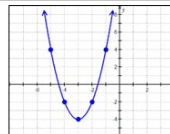
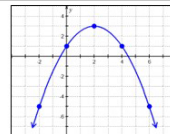
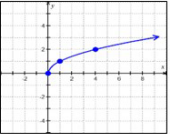
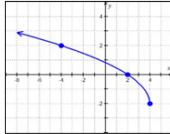
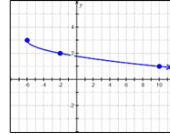
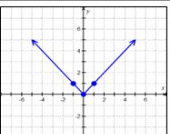
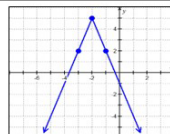
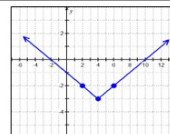
(A) State the domain and range of each transformed function.

(B) Write an equation for each of the transformed functions $g(x)$ and $h(x)$ using standard form: $y = Af[B(x - C)] + D$, where (C, D) is indicated on the graph; A, B are real numbers and C, D are integers.

$f(x)$	$g(x)$	$h(x)$
		
1A) Constant Function: $f(x) = c$ Domain: $x \in (-\infty, \infty)$ Range: $y = c$	1B) Function equation: $g(x) =$ Domain: Range:	1C) Function equation: $h(x) =$ Domain: Range:
		
2A) Identity Function: $f(x) = x$ Domain: $x \in (-\infty, \infty)$ Range: $y \in \mathbb{Z}$ (integers)	2B) Function equation: $g(x) =$ Domain: Range:	2C) Function equation: $h(x) =$ Domain: Range:

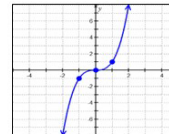
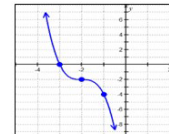
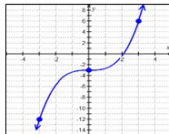
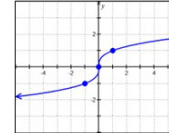
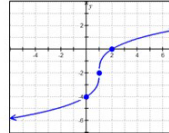
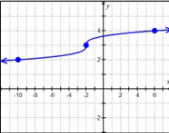
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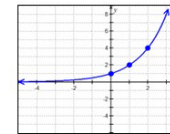
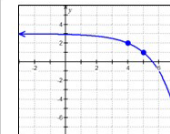
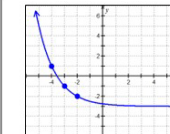
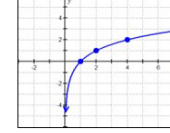
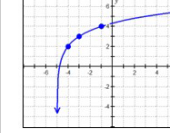
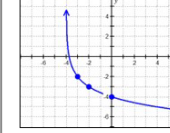
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$f(x)$	$g(x)$	$h(x)$
		
3A) Quadratic Function: $f(x) = x^2$ Domain: $x \in (-\infty, \infty)$ Range: $y \in [0, \infty)$	3B) Function equation: $g(x) =$ Domain: Range:	3C) Function equation: $h(x) =$ Domain: Range:
		
4A) Square Root Function: $f(x) = \sqrt{x}$ Domain: $x \in [0, \infty)$ Range: $y \in [0, \infty)$	4B) Function equation: $g(x) =$ Domain: Range:	4C) Function equation: $h(x) =$ Domain: Range:
		
5A) Absolute Value Function: $f(x) = x $ Domain: $x \in (-\infty, \infty)$ Range: $y \in [0, \infty)$	5B) Function equation: $g(x) =$ Domain: Range:	5C) Function equation: $h(x) =$ Domain: Range:

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$f(x)$	$g(x)$	$h(x)$
		
6A) Cubic Function: $f(x) = x^3$ Domain: $x \in (-\infty, \infty)$ Range: $y \in (-\infty, \infty)$	6B) Function equation: $g(x) =$ Domain: Range:	6C) Function equation: $h(x) =$ Domain: Range:
		
7A) Cube Root Function: $f(x) = \sqrt[3]{x}$ Domain: $x \in (-\infty, \infty)$ Range: $y \in (-\infty, \infty)$	7B) Function equation: $g(x) =$ Domain: Range:	7C) Function equation: $h(x) =$ Domain: Range:

$f(x)$	$g(x)$	$h(x)$
		
9A) Exponential Function: $f(x) = 2^x$ Domain: $x \in (-\infty, \infty)$ Range: $y \in (0, \infty)$	9B) Function equation: $g(x) =$ Domain: Range:	9C) Function equation: $h(x) =$ Domain: Range:
		
10A) Logarithmic Function: $f(x) = \log_2 x$ Domain: $x \in (0, \infty)$ Range: $y \in (-\infty, \infty)$	10B) Function equation: $g(x) =$ Domain: Range:	10C) Function equation: $h(x) =$ Domain: Range:

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Practice Sets

Domain: $x \in (-\infty, 0) \cup (0, \infty)$
Range: $y \in (-\infty, 0) \cup (0, \infty)$

Domain:
Range:

Domain:
Range:

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Domain: $x \in (-\infty, \infty)$
Range: $y \in \mathbb{Z}$, integers

Domain:
Range:

Domain:
Range:

Lesson Warm-Ups

1.5 Parent Functions	Form A
Name _____	
Date _____ Period _____	
1. Determine whether the equation represents y as a function of x. $16x - y^4 = 0$	
2. Given: $f(x) = x^2 + 1$ Evaluate the function for $f(x - 2)$	
3. State the domain of the function. $f(x) = \sqrt{25 - x^2}$	
Grade: _____	

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1.5 Parent Functions	Form B
Name _____	
Date _____ Period _____	
1. Determine whether the equation represents y as a function of x. $8x - y^3 = 0$	
2. Given: $f(x) = x^2 - 3$ Evaluate the function for $f(x - 2)$	
3. State the domain of the function. $f(x) = \frac{x}{x^2 - x - 12}$	
Grade: _____	

Lesson 1.5: Parent Functions		Warm-Up # 1
Name _____ Date _____ Period _____		
1. Determine whether the equation represents y as a function of x. $81x - y^4 = 0$	2. Given: $f(x) = x^2 - 4$, evaluate the function for $f(x - 3)$.	
3. State the domain of the function $f(x) = \sqrt[3]{x^2 - 8}$		

Lesson 1.5: Parent Functions		Warm-Up # 2
Name _____ Date _____ Period _____		
1. Determine whether the equation represents y as a function of x. $27x + y^3 = 0$	2. Given: $f(x) = x^2 - 4$, evaluate the function for $f(x - 1)$.	
3. State the domain of the function $f(x) = \sqrt{x^2 - 24}$		

Daily Lesson Quiz