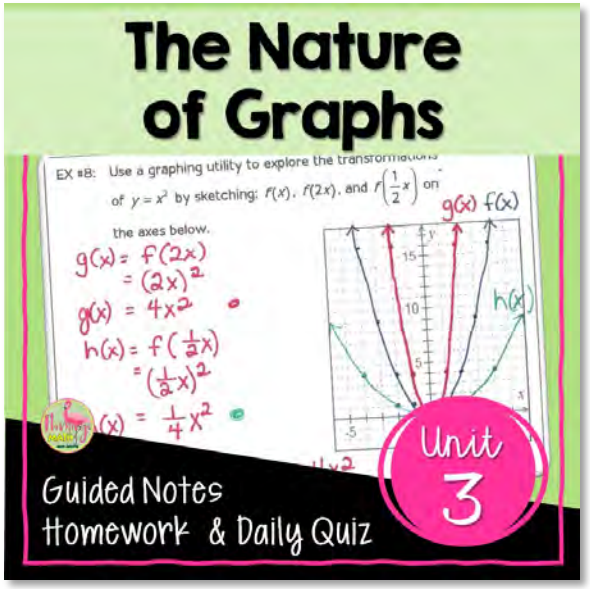


The Nature of Graphs Unit Essentials Bundle

You will find everything you need to differentiate instruction for the topics and concepts of The Nature of Graphs in an Algebra 2, Algebra 3, Integrated Math 3 or PreCalculus Course.

What is included in the Essentials Bundle?

Every lesson is presented with a set of **Guided Student Notes**, a rigorous **homework/practice** assignment, mid-unit quizzes, end-unit review and **assessments**, including editable versions. The content is presented in easily digestible sections for meeting a variety of needs for your learners. All items include **full solutions**.

GUIDED NOTES:
The unit is organized into six lessons, aligned to both **South Carolina Standards and CCSS**, that will take approximately 10 instructional days for a block schedule or 15 days in a regular schedule. There is ample space for writing and recording knowledge in this format. Guided Notes promote student engagement as an interactive tool.

HOMEWORK:
Each lesson topic includes an alternative to textbook homework assignments, with an emphasis on rigor to cover concepts and learning objectives in depth. Whatever your teaching needs, you will find practice for every lesson in the units of study.

DAILY CONTENT QUIZZES:
You can use the daily quiz for a homework check, a warm-up activity after the lesson has been taught, or as an exit ticket.

REVIEW and ASSESSMENTS:
Each unit will contain two forms of a mid-unit quiz, two forms of an end-unit test in free response format, and two forms of an end-unit multiple choice test. The answer keys are included for all materials.

*There are also **editable versions in MS Word® for each assessment to help you meet your personal needs.***

Lesson		Skills & Learning Objectives
South Carolina: A2.FBF.3; PC.FBF.4; A2.FIF.4; A2.FIF.7; A2.FIF.5; PC.FBF..4 **CCSS:** HSF.IF.B.4 ; HSF.IF.C.7.A; HSF.IF.C.7.B; HSF.IF.C.7.C; HSF.IF.C.7.D; HSF.IF.C.7.E; HSF.BF.A.1.C; HSF.IF.B.4; HSF.IF.B.5; HSF.BF.B.4.A; HSF.BF.B.4.B; HSF.BF.B.4.C; HSF.BF.B.4.D; MP4; MP5; MP6		
3.1	Properties of Functions	▪ Find intercepts, domain and range of a function. ▪ Determine intervals on which functions are increasing, decreasing, or constant. ▪ Identify even and odd functions.
3.2	Library of Functions	▪ Graph 14 basic parent functions ▪ Analyze properties and key-features of the parent functions
3.3	Transformations of Functions	▪ Graph transformations of linear, quadratic and absolute value function families ▪ Use rigid transformation properties for graphing functions ▪ Use non-rigid transformation properties for graphing functions ▪ Analyze transformations and write equations in standard form given transformations
3.4	More Operations on Functions	▪ Determine continuity of functions. ▪ Find domain and range of a function analytically ▪ Compare functions using multiple representations ▪ Perform operations on functions using tables, graphs and equations.
3.5	Functions and Their Inverses	▪ Find inverse functions informally and algebraically. ▪ Verify two functions are inverses of each other ▪ Use graphs of functions to determine whether functions have inverse functions ▪ Use the Horizontal Line Test to determine if functions are one-to-one
3.6	Modeling with Functions	▪ Write a function from known formulas ▪ Solve “real-world” problems from verbal descriptions ▪ Use data to write functions and solve problems ▪ Find regression equations from data



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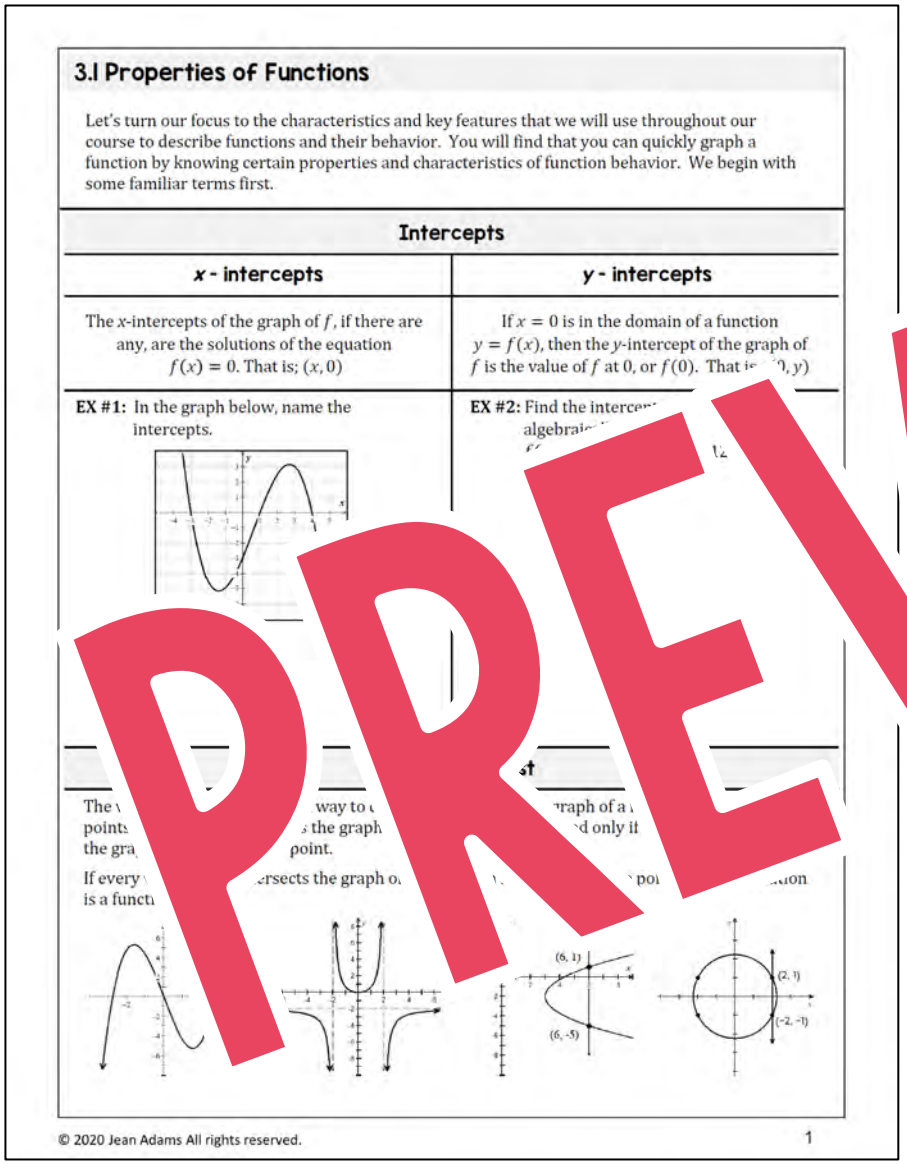


My goal is to help you bring balance into your teacher life by providing relevant content, engaging activities, and comprehensive assessments for your high-stakes math course.

Jean

Flamingo MATH Jean Adams

Lesson 1: Guided Notes



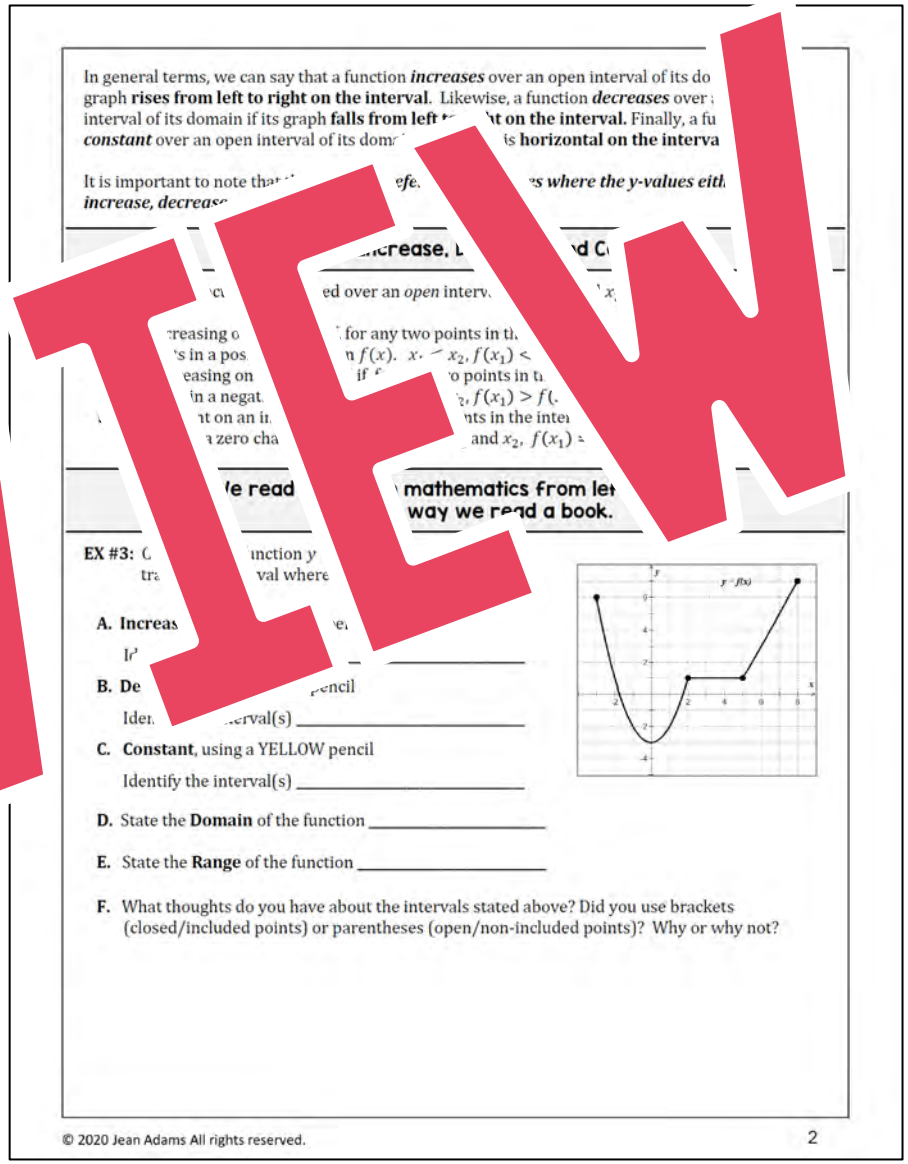
3.I Properties of Functions

Let's turn our focus to the characteristics and key features that we will use throughout our course to describe functions and their behavior. You will find that you can quickly graph a function by knowing certain properties and characteristics of function behavior. We begin with some familiar terms first.

Intercepts

***x*-intercepts**	***y*-intercepts**
The x-intercepts of the graph of f, if there are any, are the solutions of the equation $f(x) = 0$. That is; $(x, 0)$	If $x = 0$ is in the domain of a function $y = f(x)$, then the y-intercept of the graph of f is the value of f at 0, or $f(0)$. That is; $(0, y)$
EX #1: In the graph below, name the intercepts.	**EX #2:** Find the intercep… algebrai…

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In general terms, we can say that a function ***increases*** over an open interval of its do… graph **rises from left to right on the interval.** Likewise, a function ***decreases*** over … interval of its domain if its graph **falls from left to …t on the interval.** Finally, a fu… ***constant*** over an open interval of its dom… …is **horizontal on the interva…**

It is important to note that … …efe… …s where the y-values eith… ***increase, decrease…***

…ncrease, … …d C…

…ed over an *open* interv… …x…

…reasing o… …for any two points in th… …s in a pos… …n $f(x)$. $x_1 < x_2$, $f(x_1) <$ … …easing on… …if … …o points in th… …in a negat… …x_2, $f(x_1) > f($… …nt on an in… …nts in the inter… …a zero cha… …and x_2, $f(x_1) =$…

…e read **…mathematics from le… …way we read a book.**

EX #3: G… …nction y… …tra… …val where…

A. Increas… …e…

I…

B. De… …encil

Iden… …erval(s) _____

C. Constant, using a YELLOW pencil

Identify the interval(s) _____

D. State the **Domain** of the function _____

E. State the **Range** of the function _____

F. What thoughts do you have about the intervals stated above? Did you use brackets (closed/included points) or parentheses (open/non-included points)? Why or why not?

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Guided Notes

EX #4: Use a graphing utility to determine the open intervals on which the function is increasing, decreasing, or constant.

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

Increase _____

Decrease _____

Constant _____

B. $g(x) = |x+2| + |x-1| - 2$

Increase _____

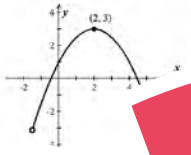
Decrease _____

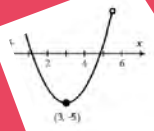
Constant _____

Local Maximum and Local Minimum Values

When the graph of a function is increasing to the left of $x = c$ and decreasing to the right of $x = c$, then at $x = c$ the value of f is largest. This y-value is called a *local maximum of f*.

When the graph of a function is decreasing to the left of $x = c$ and increasing to the right of $x = c$, then at $x = c$ the value of f is smallest. This y-value is called a *local minimum of f*.





unctio xis] (ntains c in the

has a um . And $f(c)$ i tive (local)

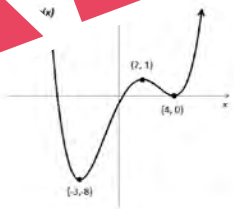
2 mum at . $f(c)$ is c

EX #5: finition above, id

A. Rel um is _____ where

B. Relat is _____ where x

C. Relativ s _____ where $x =$ _____



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Approximating Extrema

We will explore techniques for finding extrema (maximum and minimum value mial functions in a later chapter. For now, graphing calculator to appro ma.

EX #6: Use a graphing uti f(1.
Then, det ma
rou

x

minimun

at: _____

metry

ns even the symmetry that exists

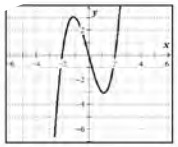
Eve

even if a A function f is o and only if, when
the poi the graph point (x, y) is on the graph of f, then the
also point $(-x, -y)$ is also on the graph.

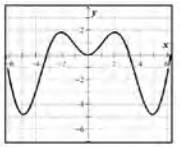
$f(-x) = -f(x)$

EX # graph is even, odd or neither.

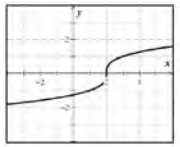
A.



B.



C.



EX #8: Algebraically determine whether each of the following functions is even, odd or neither.

A. $y = |x| - 2$ **B.** $y = x^3 - 3$ **C.** $y = 2x^3 - x$

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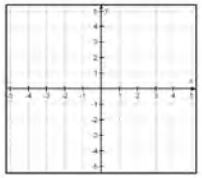
Daily Quizzes

Name _____ Date _____ Period _____

Lesson 3.3: Transformations of Functions **Form A**

1. Describe the transformation from the common function that occurs in the function:
$f(x) = (x-1)^2 - 2$

2. Graph the function from Question #1



3. State the Domain and Range for the graph above.

Domain:

Range:

4. Write an equation for the shape of $f(x) = x^3$ but moved two units to the le… up, and reflected in th…

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Name _____ Date _____ Period _____

Lesson 3.4: More Operations on F…ons **…m A**

Use the graphs of $f(x)$ and $g(x)$ below to answer e… question.



2. $f(g(0))$

$\frac{(0)+f(4)}{g(1)}$

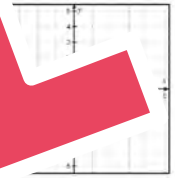
…?

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Name _____ D…

L… …3: T… …a… …Fun… …orm B

1. D… fun… …ansfo… …curs… …n th… on: 3 …the …tion from …stion #1



3. State the D… …nge for the graph abo… …rite an… …or the shape of $f(x) = x^2$ …moved three units to the left, four units …wn, and reflected in the x-axis.

Domain:

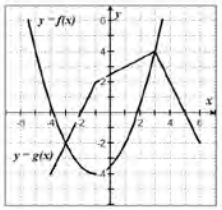
Range:

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Name _____ Date _____ Period _____

Lesson … …erations on Functions **Form B**

Use the grap… of $f(x)$ and $g(x)$ below to answer each question.



1. The values of x such that $f(x) = g(x)$

2. $g(f(3))$

3. $\frac{4g(1)+f(-3)}{f(g(1))}$

4. If $h(x) = |x+5| - 2$ for what value(s) of x is $h(x) = g(f(-5))$?

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PREVIEW

You can use the daily quiz for a homework check, a warm-up activity after the lesson has been taught, or an exit ticket.

Lesson 4: Homework

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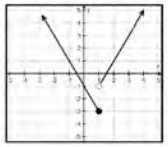
3.4
More Operations on Functions

Name _____

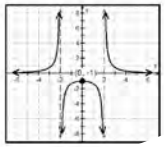
Date _____ Period _____

Problems 1 – 4, Describe the types of discontinuity for each graph below. Write the domain in interval notation.

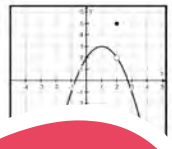
1.



2.



3.



4.



Pr **3,** Find of

5. g $\frac{2}{\cdot^2-2x-15}$

7. $f(x) = \frac{3}{x}$ $) = \frac{\sqrt{x}-4}{x-4}$

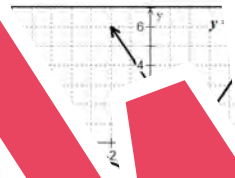
11

Problems 9 – 12, Use the graphs of f and g, shown at right, to evaluate the following.

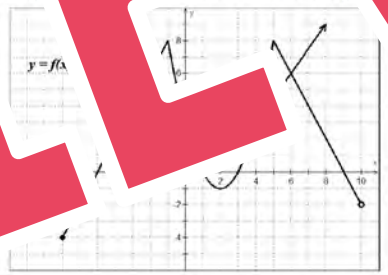
9. $(f \circ g)(-2)$

10. $(g \circ f)(3)$

12.)



Problem e the grap own below to com



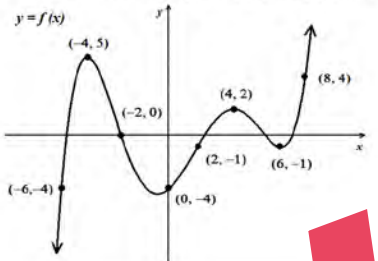
13. The value(s) of x such that $f(x) = g(x)$	14. The value(s) of x such that $f(x) = 0$
15. The value(s) of x such that $g(x) = 0$	16. The value(s) of x such that $f(x) > g(x)$
17. The value(s) of x such that $f(x) < g(x)$	18. The value(s) of x such that $g(x) < 0$

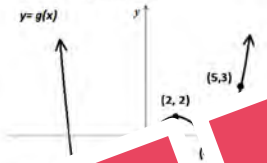
12

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Homework

Problems 19 - 24: Use the graphs of $f(x)$ and $g(x)$ to evaluate each expression.





19. $5f(0) + 2$[illegible] $f(-4))$

$f(-6)$ $g(4))$

3. [illegible] $1)) \cdot g\left(f(g($[illegible]

[illegible] value(s) of x

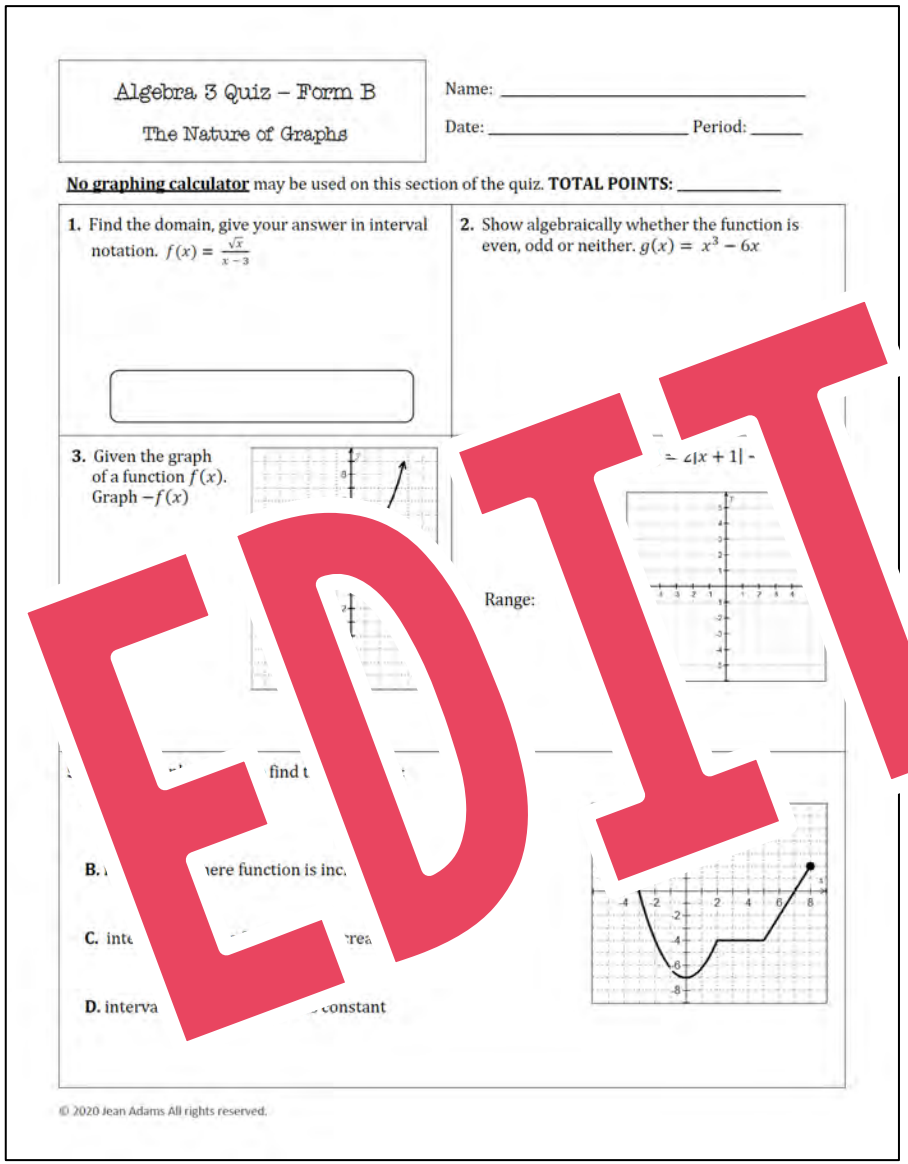
26. If $k(x) = 2|x - 3|$, for what value(s) of x is $k(x) = f(g(-5))$?

13

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Mid-Unit Assessments



Algebra 3 Quiz – Form B

The Nature of Graphs

Name: _____

Date: _____ Period: _____

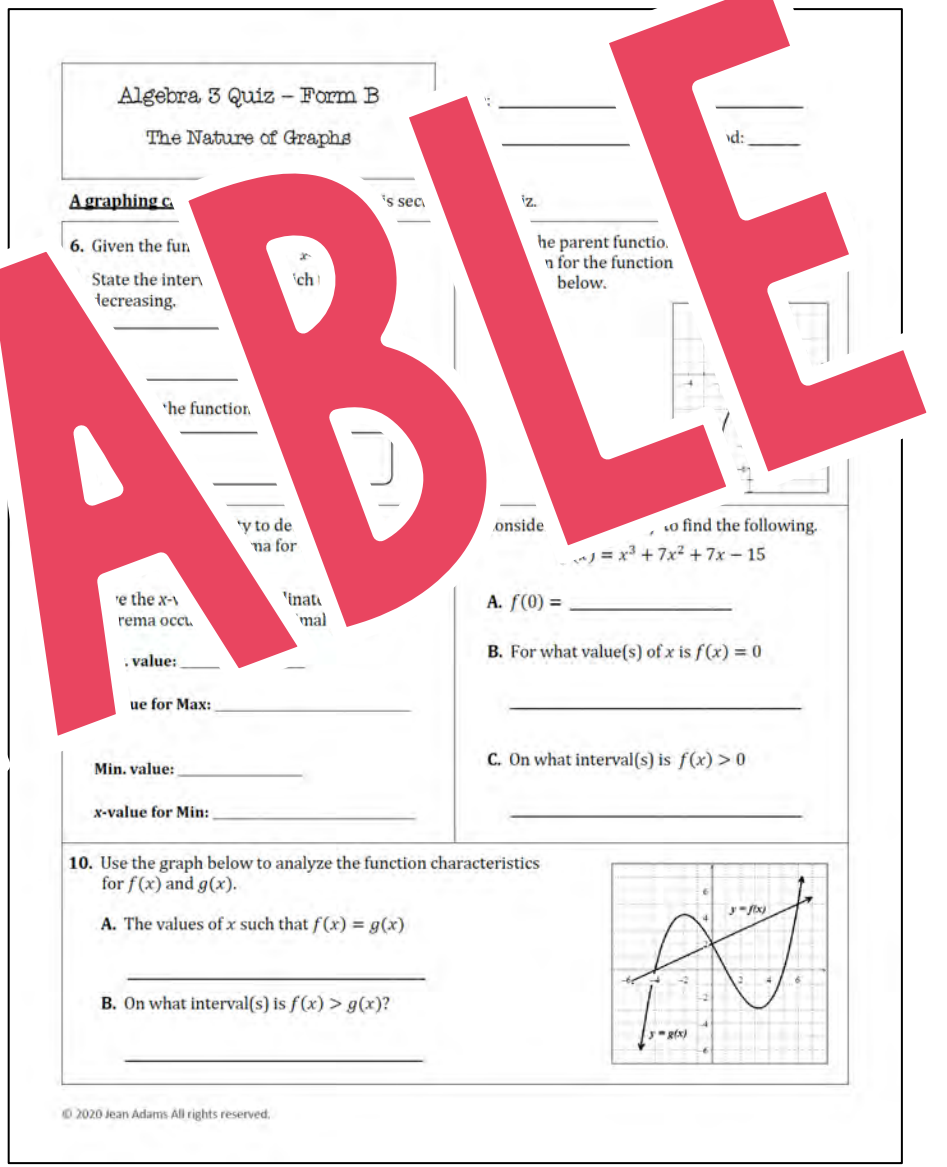
No graphing calculator may be used on this section of the quiz. **TOTAL POINTS:** _____

1. Find the domain, give your answer in interval notation. $f(x) = \frac{\sqrt{x}}{x-3}$

2. Show algebraically whether the function is even, odd or neither. $g(x) = x^3 - 6x$

3. Given the graph of a function $f(x)$. Graph $-f(x)$

Range:



Algebra 3 Quiz – Form B

The Nature of Graphs

6. Given the fun

State the inter

decreasing.

he function

y to de

na for

e the *x*-

rema occu

. value: _____

ue for Max: _____

Min. value: _____

x-value for Min: _____

he parent functio

n for the function

below.

onside

o find the following.

$= x^3 + 7x^2 + 7x - 15$

A. $f(0) =$ _____

B. For what value(s) of x is $f(x) = 0$

_____

C. On what interval(s) is $f(x) > 0$

_____

10. Use the graph below to analyze the function characteristics for $f(x)$ and $g(x)$.

A. The values of x such that $f(x) = g(x)$

_____

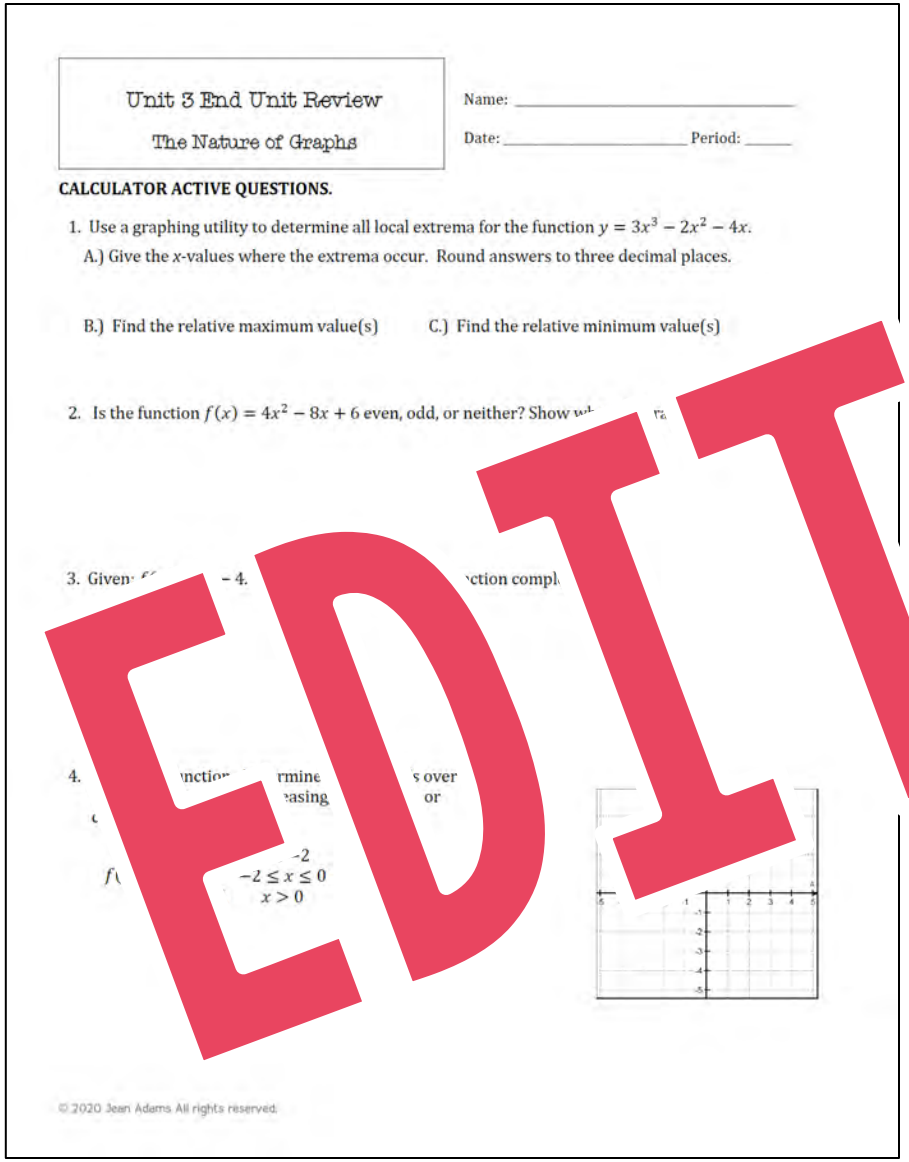
B. On what interval(s) is $f(x) > g(x)$?

_____

EDITABLE

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Unit Review



Unit 3 End Unit Review

The Nature of Graphs

Name: _____

Date: _____ Period: _____

CALCULATOR ACTIVE QUESTIONS.

1. Use a graphing utility to determine all local extrema for the function $y = 3x^3 - 2x^2 - 4x$.

   A.) Give the x-values where the extrema occur. Round answers to three decimal places.

   B.) Find the relative maximum value(s) C.) Find the relative minimum value(s)

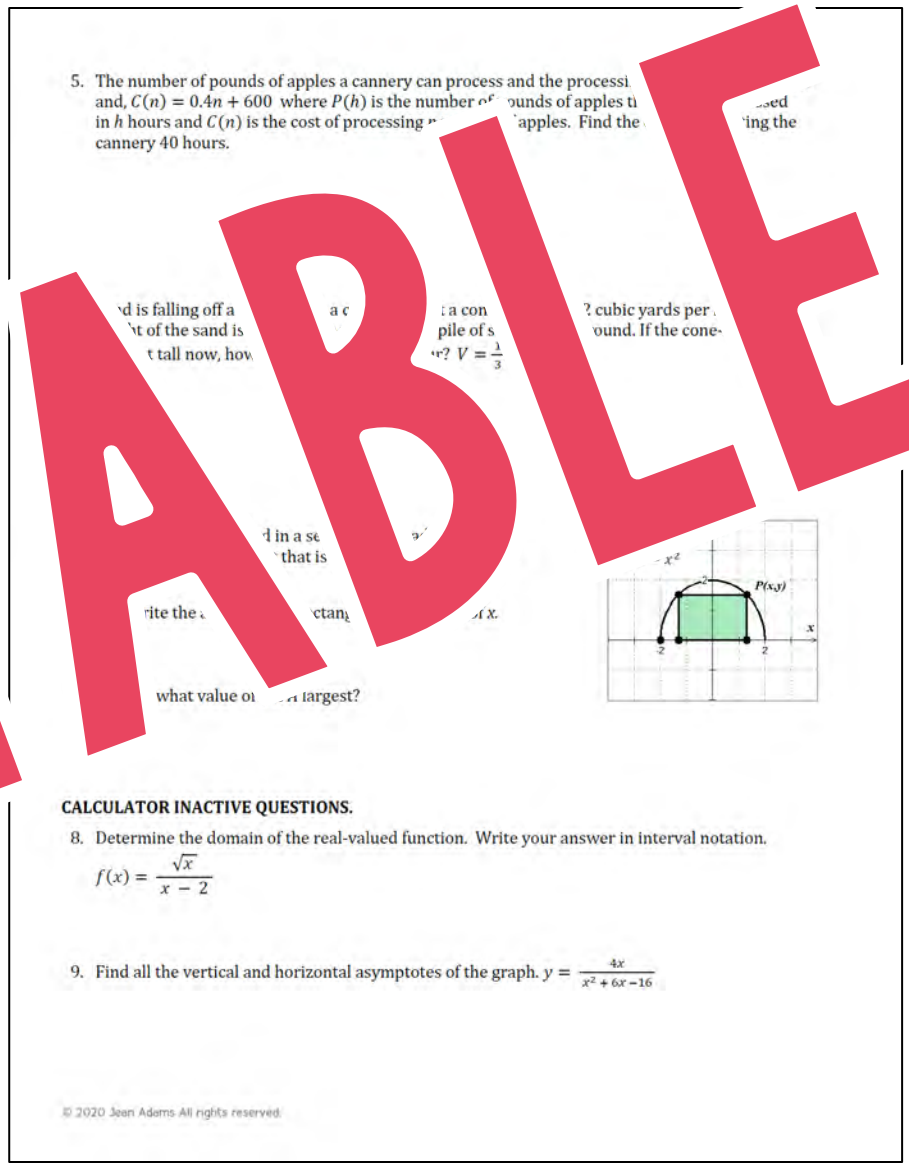
2. Is the function $f(x) = 4x^2 - 8x + 6$ even, odd, or neither? Show w

3. Given f -4. ction compl

4. nctio rmine s over easing or

   $f($ -2
   $-2 \le x \le 0$
   $x > 0$

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5. The number of pounds of apples a cannery can process and the processi and, $C(n) = 0.4n + 600$ where $P(h)$ is the number o pounds of apples t in h hours and $C(n)$ is the cost of processing apples. Find the ing the cannery 40 hours.

d is falling off a a c a con ? cubic yards per t of the sand is pile of s ound. If the cone- t tall now, how r? $V = \frac{1}{3}$

d in a se that is

rite the ctan $f(x)$.

what value o largest?

CALCULATOR INACTIVE QUESTIONS.

8. Determine the domain of the real-valued function. Write your answer in interval notation.

   $f(x) = \frac{\sqrt{x}}{x - 2}$

9. Find all the vertical and horizontal asymptotes of the graph. $y = \frac{4x}{x^2 + 6x - 16}$

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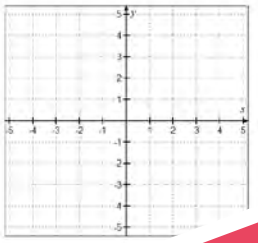
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Unit Review

10. Graph the piecewise function. $f(x) = f(x) = \begin{cases} x^2 - 3, & x > 0 \\ 2x + 1, & x \le 0 \end{cases}$

A.) Is the function continuous?

B.) Explain why or why not.



11. Describe how the graph of $y = (x + 3)^2 - 2$ can be obtained from the g
Use the words: horizontal, vertical, up, down, left, right, reflec t,
units, as needed.

ain. **B.** Ex e) has an inverse tha
find ou might v $f(x)$ and its inverse.

func odd

14. tank with diameter oline to a feet. The gasoline
g at a constant rate ond. Write e volume of the gasoline
re e tank s a draining, as a function of time, t. **Do not**
sin

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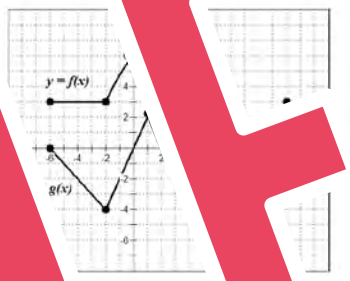
15. Use the graphs of $f(x)$ and $g(x)$ shown at r
to complete the following.

A. $f(x) = g(x)$

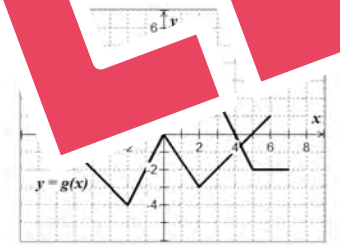
B. $g(x)$

C. $g(x) > 0$

D. $g(x) = 0$



graphs of f
the followi
$-2)$

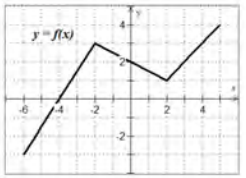


e the graphs $y = f(x)$ and $y = g(x)$ to evaluate the following.

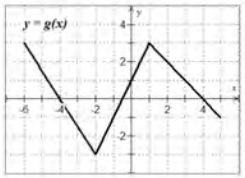
$f^{-1}(0)$

B. $g^{-1}(-3)$

C. $f^{-1}(g(-2))$



D. If $h(x) = |x + 3| - 4$, for what value(s) of x is $h(x) = f(g(1))$?

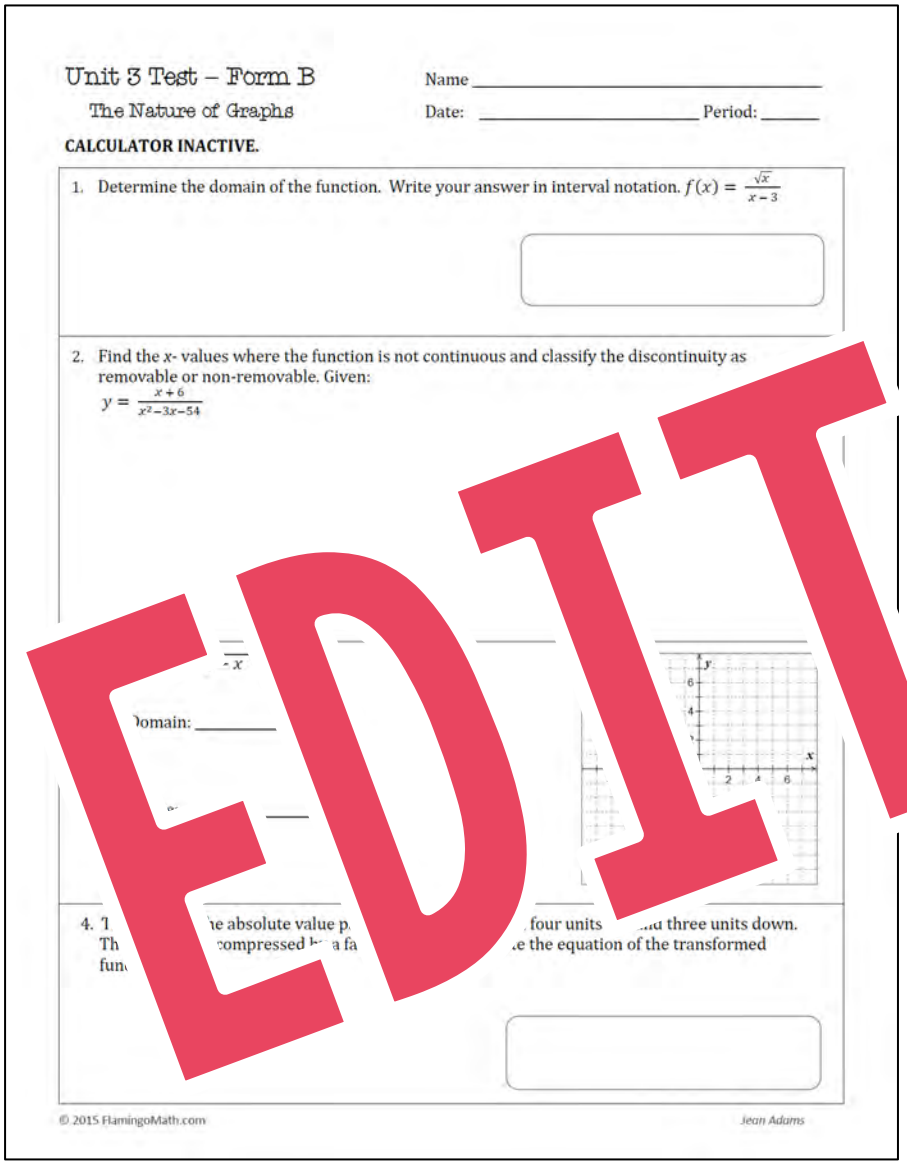


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Free-Response Assessments



Unit 3 Test – Form B

The Nature of Graphs

Name _____

Date: _____ Period: _____

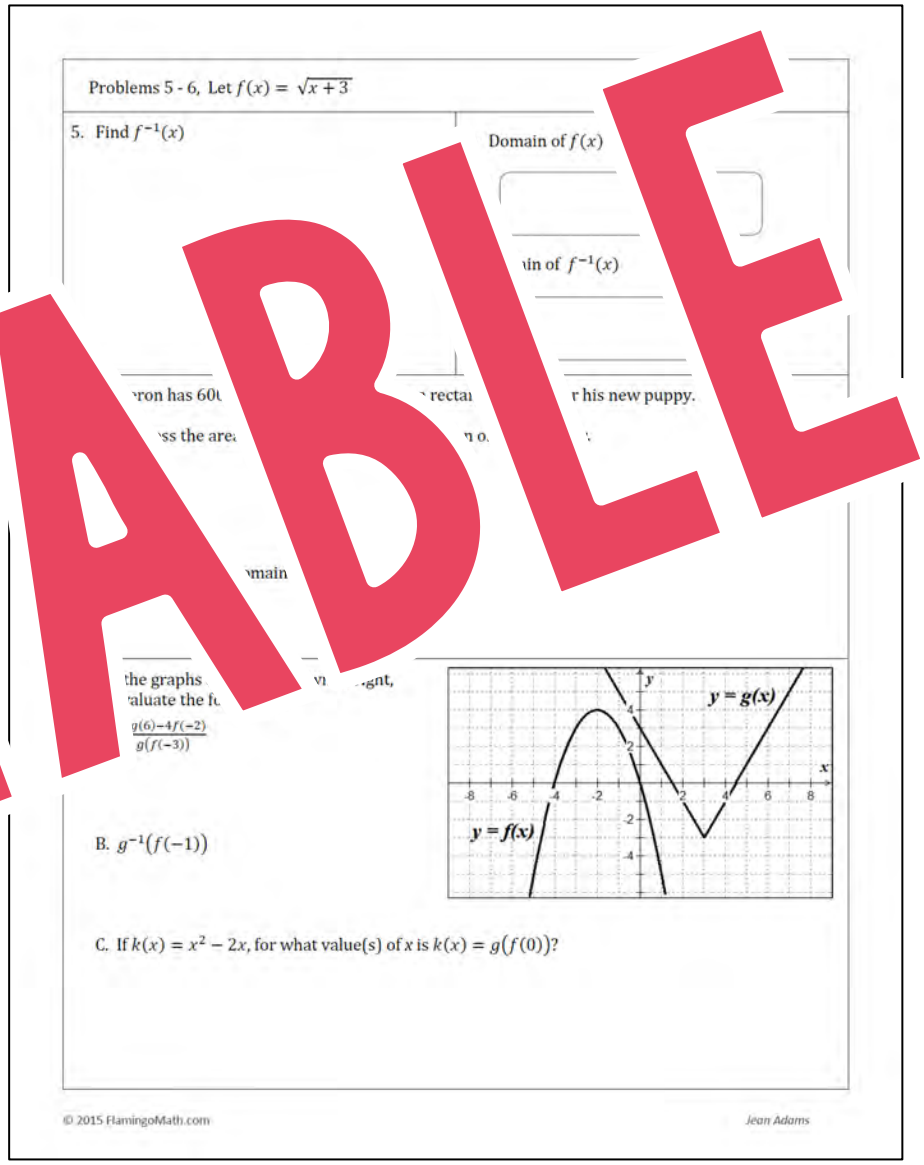
CALCULATOR INACTIVE.

1. Determine the domain of the function. Write your answer in interval notation. $f(x) = \frac{\sqrt{x}}{x-3}$

2. Find the x- values where the function is not continuous and classify the discontinuity as removable or non-removable. Given:
$y = \frac{x+6}{x^2-3x-54}$

4. T… …e absolute value p… …four units … …d three units down. Th… …compressed … …a fa… …e the equation of the transformed fun…

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Problems 5 - 6, Let $f(x) = \sqrt{x+3}$

5. Find $f^{-1}(x)$

Domain of $f(x)$

…in of $f^{-1}(x)$

…ron has 60… …rectan… …r his new puppy. …ss the area… …n o…

…main

…the graphs … …ght, …aluate the fu…

$\frac{g(6)-4f(-2)}{g(f(-3))}$

B. $g^{-1}(f(-1))$

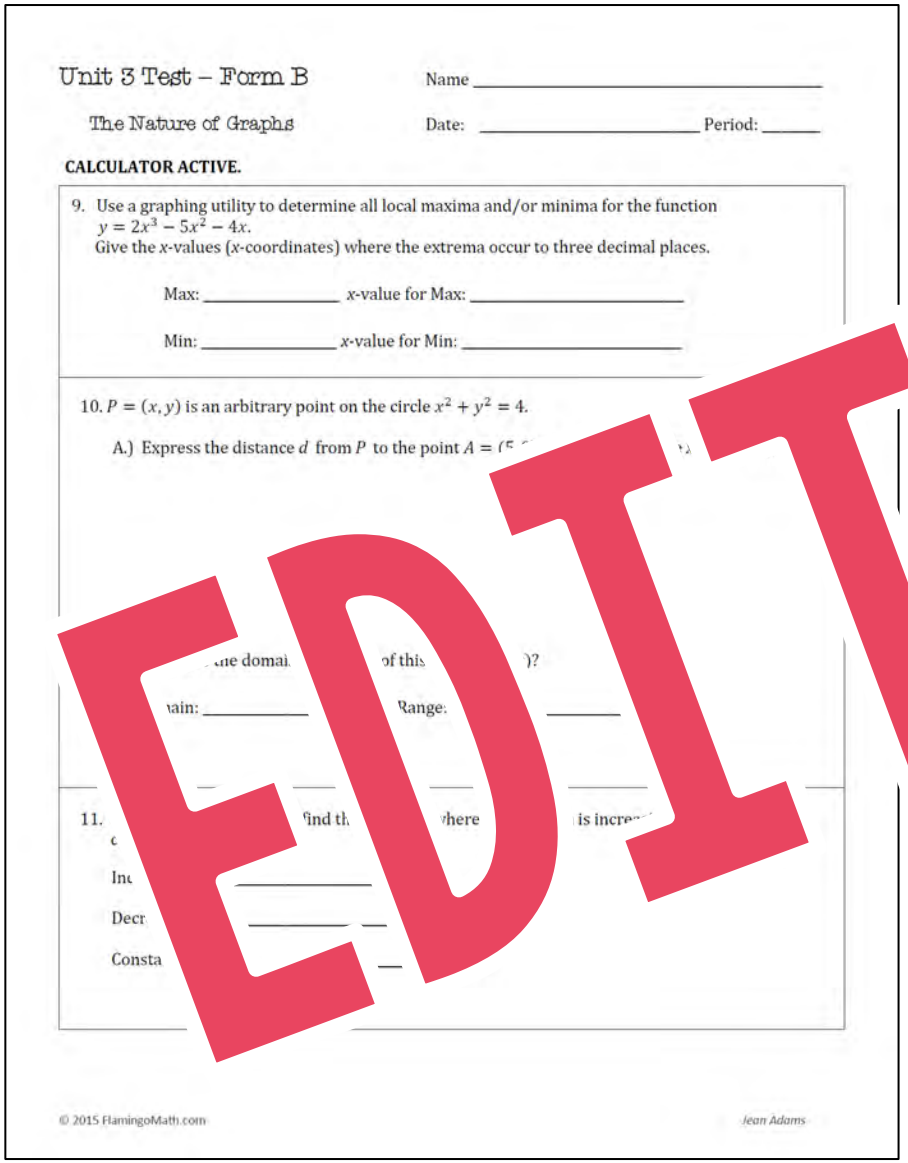
C. If $k(x) = x^2 - 2x$, for what value(s) of x is $k(x) = g(f(0))$?

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Free-Response Assessments



Unit 3 Test – Form B

The Nature of Graphs

Name _____

Date: _____ Period: _____

CALCULATOR ACTIVE.

9. Use a graphing utility to determine all local maxima and/or minima for the function $y = 2x^3 - 5x^2 - 4x$.
Give the x-values (x-coordinates) where the extrema occur to three decimal places.

Max: _____ x-value for Max: _____

Min: _____ x-value for Min: _____

10. $P = (x, y)$ is an arbitrary point on the circle $x^2 + y^2 = 4$.

A.) Express the distance d from P to the point $A =$

ıain: _____ Range: _____

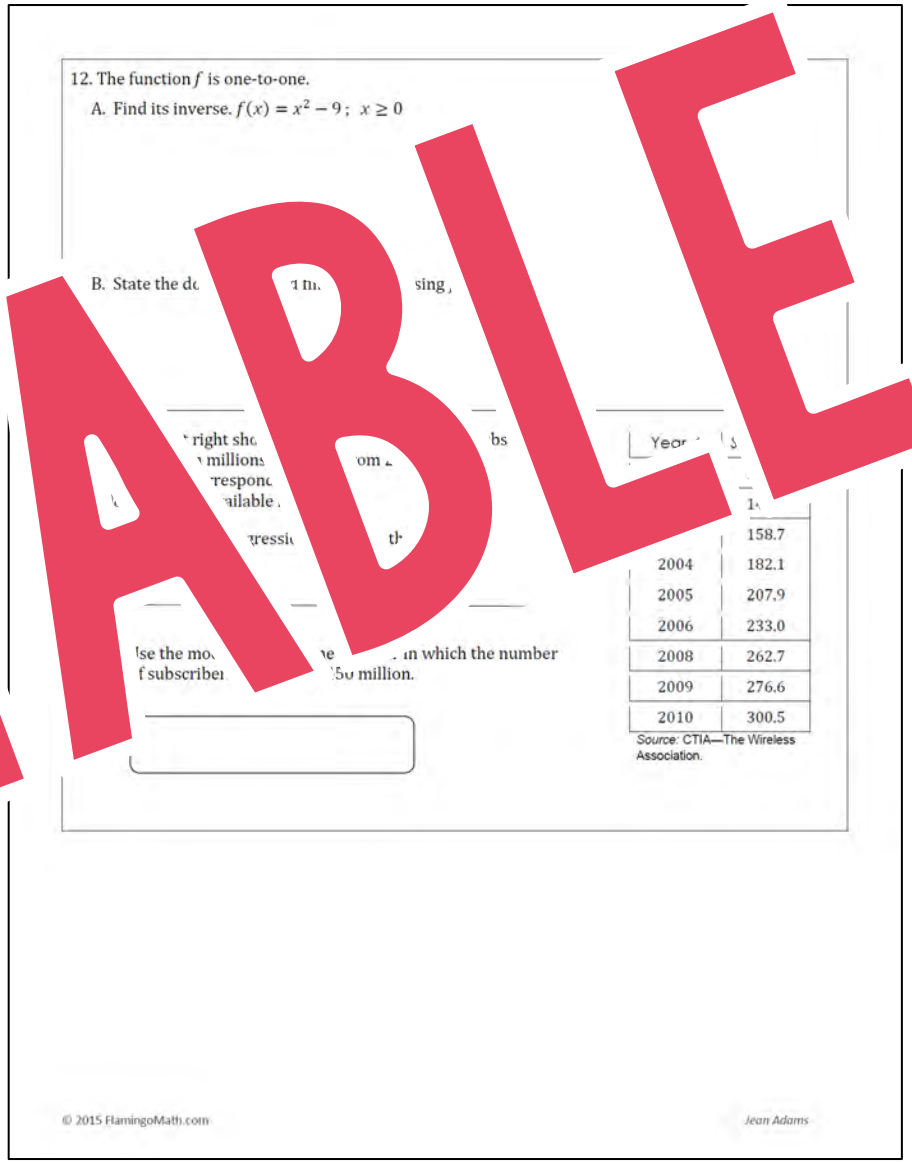
11.

Inc

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12. The function f is one-to-one.

A. Find its inverse. $f(x) = x^2 - 9\,;\ x \geq 0$

B. State the do

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Year

	158.7
2004	182.1
2005	207.9
2006	233.0
2008	262.7
2009	276.6
2010	300.5

Source: CTIA—The Wireless Association.

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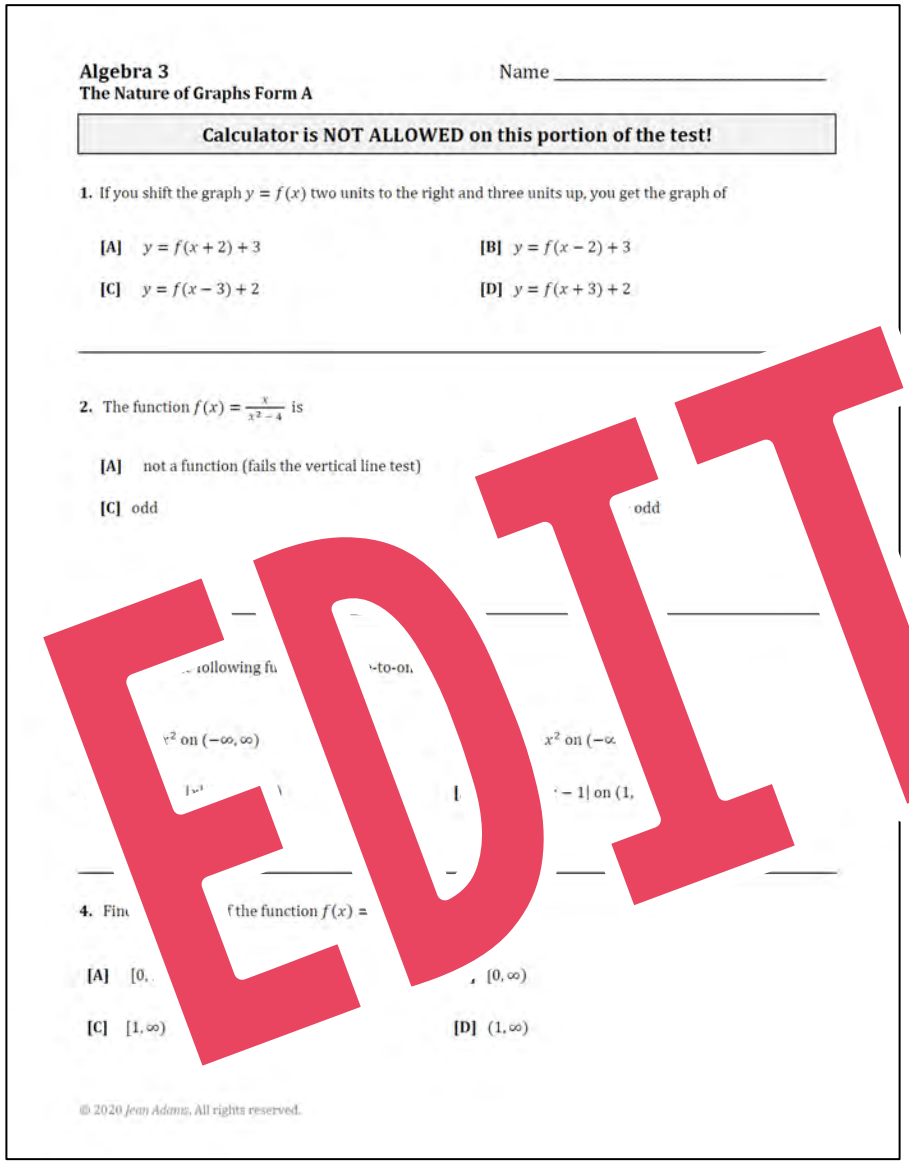
50 million.

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Multiple Choice Assessments



Algebra 3 Name _____
The Nature of Graphs Form A

Calculator is NOT ALLOWED on this portion of the test!

1. If you shift the graph $y = f(x)$ two units to the right and three units up, you get the graph of

[A] $y = f(x+2)+3$ **[B]** $y = f(x-2)+3$

[C] $y = f(x-3)+2$ **[D]** $y = f(x+3)+2$

2. The function $f(x) = \frac{x}{x^2-4}$ is

[A] not a function (fails the vertical line test)

[C] odd

odd

following fu -to-on

^{2} on $(-\infty, \infty)$

x^2 on $(-\infty$

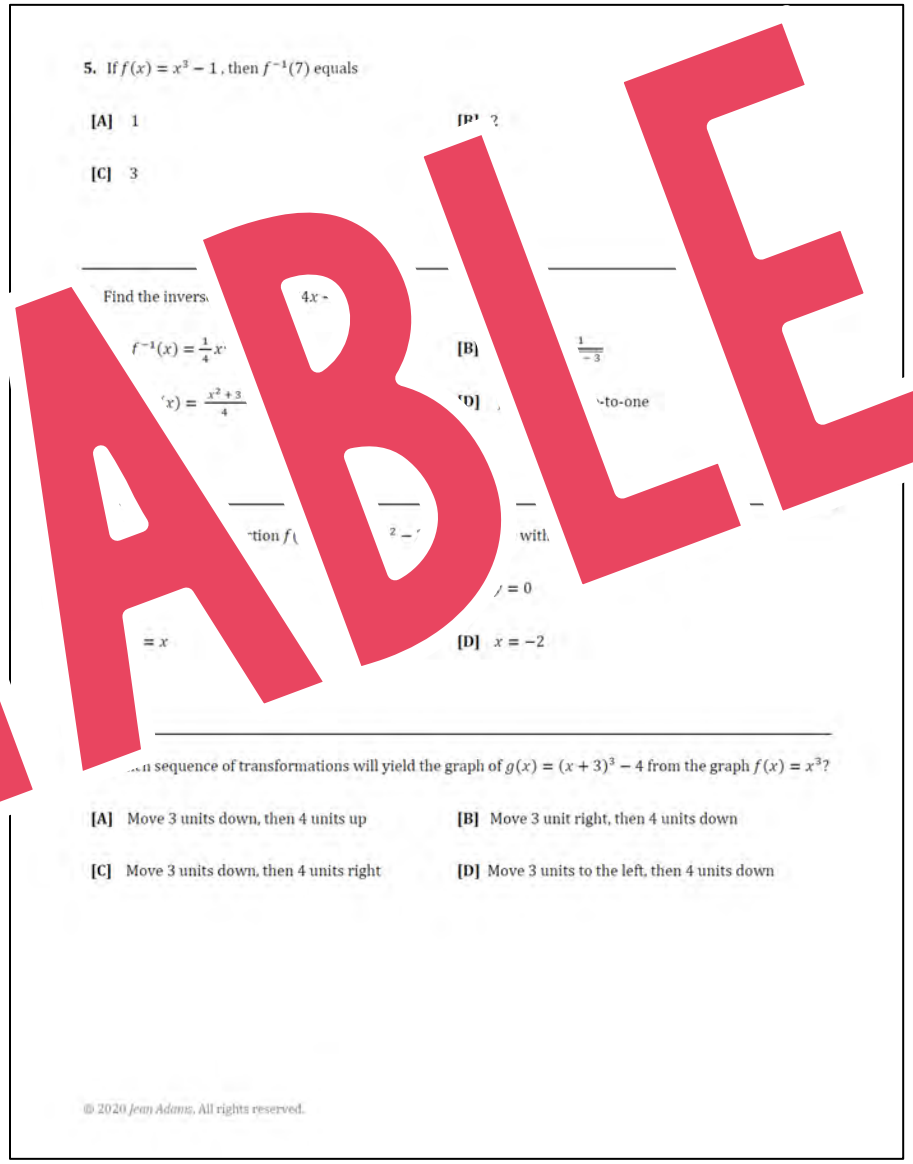
$-1|$ on $(1,$

4. Fin f the function $f(x) =$

[A] $[0,$ $[0, \infty)$

[C] $[1, \infty)$ **[D]** $(1, \infty)$

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5. If $f(x) = x^3 - 1$, then $f^{-1}(7)$ equals

[A] 1 **[B]** ?

[C] 3

Find the invers $4x -$

$f^{-1}(x) = \frac{1}{4}x$ **[B]** $\frac{1}{-3}$

$(x) = \frac{x^2+3}{4}$ **[D]** -to-one

tion $f($ $^2 -$ with

$= 0$

$= x$ **[D]** $x = -2$

n sequence of transformations will yield the graph of $g(x) = (x+3)^3 - 4$ from the graph $f(x) = x^3$?

[A] Move 3 units down, then 4 units up **[B]** Move 3 unit right, then 4 units down

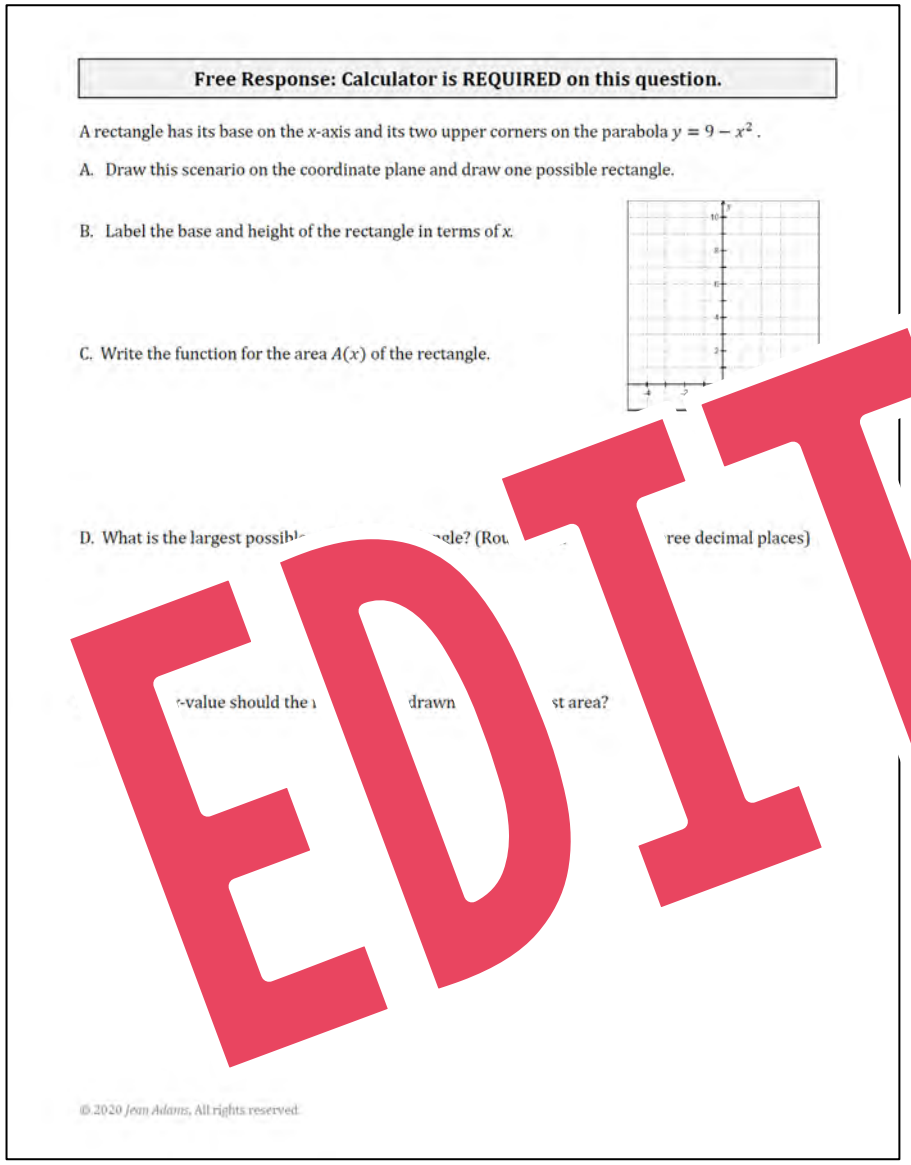
[C] Move 3 units down, then 4 units right **[D]** Move 3 units to the left, then 4 units down

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Multiple Choice Assessments



Free Response: Calculator is REQUIRED on this question.

A rectangle has its base on the x-axis and its two upper corners on the parabola $y = 9 - x^2$.

A. Draw this scenario on the coordinate plane and draw one possible rectangle.

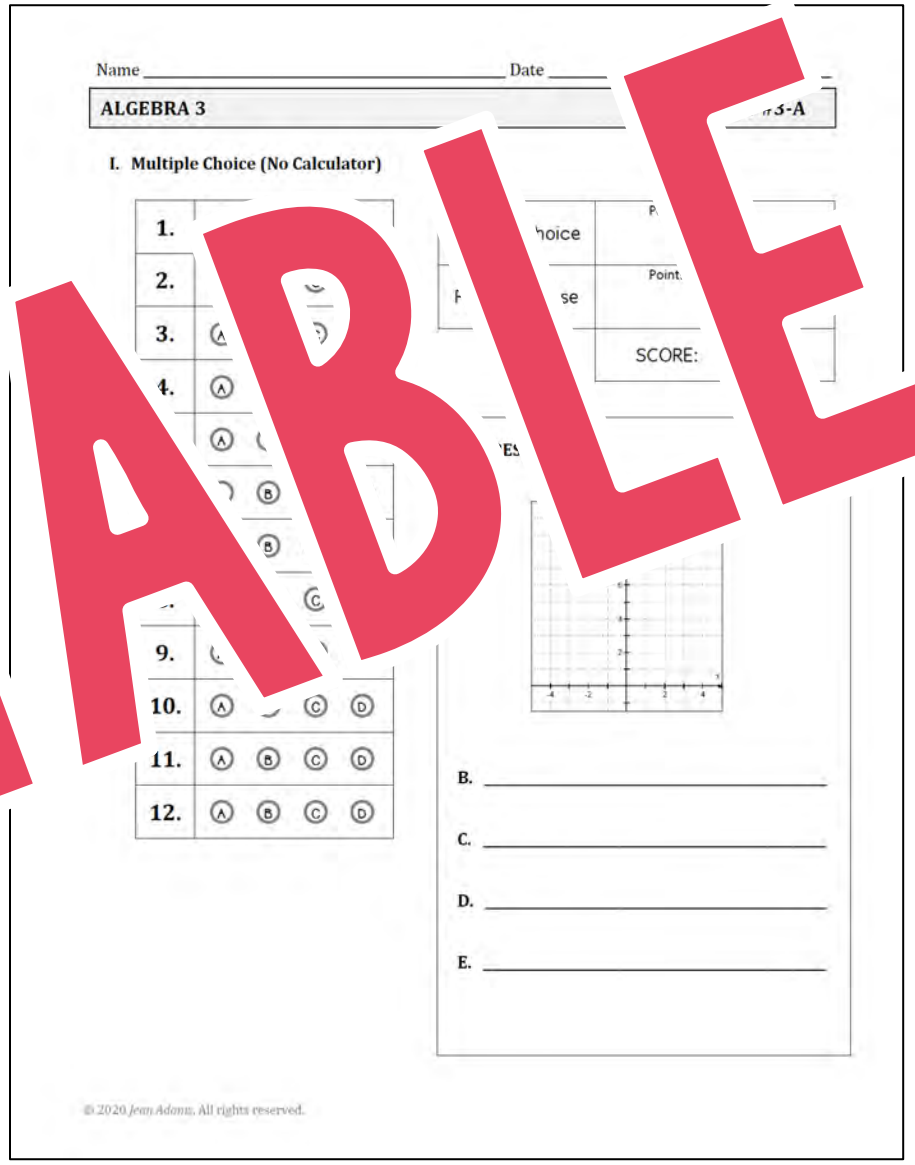
B. Label the base and height of the rectangle in terms of x.

C. Write the function for the area $A(x)$ of the rectangle.

D. What is the largest possib- -ele? (Rou- - ree decimal places)

-value should the - drawn - st area?

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Name _____ Date _____

ALGEBRA 3

I. Multiple Choice (No Calculator)

1.				
2.				
3.				
4.				
9.				
10.	A		C	D
11.	A	B	C	D
12.	A	B	C	D

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se

SCORE:

B. _____

C. _____

D. _____

E. _____

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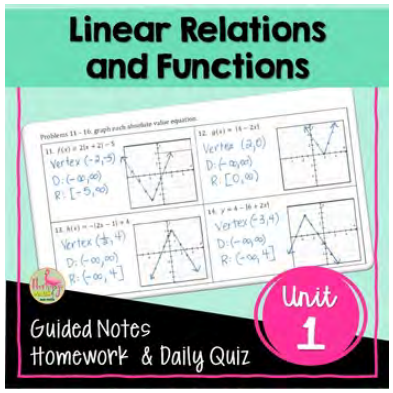
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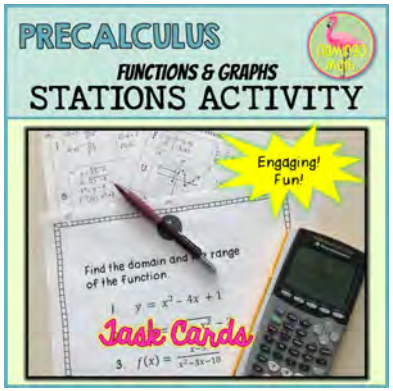
My goal is to help you bring balance into your teacher life by providing relevant content, engaging activities, and comprehensive assessments for your high-stakes math course.

Jean

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