3.1 THE CHAIN RULE

1. Chain rule gives us a way to differentiate ________________ functions, and a ________________ function is a ________________ of another ________________.

2. Circle the functions where we'll need to apply chain rule.

$y = \sin x$	$y = \ln(2x^4 + 3)$	$y = e^x$
$y = 8x$	$y = \tan^2(3x)$	$y = (9x - 6)^3$

3. Complete the table with the "inside" of each function.

Function	**"Inside"**
$\ln(-x^2 + 3x + 2)$	
$\sec(\pi x)$	
$(2x + 5)^2$	
e^{7x^4+2}	

4. What steps do we take to apply chain rule?

1. ____

____

2. ____

5. Build an "outline" for the derivative of the function, and separately find each value that you need for the outline.

Function **"Outline"**

$$f(x) = \frac{e^{x^2}\sin(8x) + (9x-2)\ln(2x^3)}{(7x^2+3x+1)^2}$$

N =

N' =

D =

D' =

3.2 IMPLICIT DIFFERENTIATION

1. Whenever we differentiate y, we have to multiply by ________________ or by ________________.

2. Circle every expression equivalent to the following second derivative:

$$y'' = \frac{-(2xy+1) - (e^x - y^2)}{(2xy+1)^2}$$

$y'' = -\dfrac{(2xy+1) + (e^x - y^2)}{(2xy+1)^2}$	$y'' = -\dfrac{e^x - y^2 + 2xy + 1}{(2xy+1)^2}$
$y'' = \dfrac{(e^x - y^2) + (2xy+1)}{-(2xy+1)^2}$	$y'' = \dfrac{(e^x - y^2) - (2xy+1)}{-(2xy+1)^2}$

3.3 DIFFERENTIATING INVERSE FUNCTIONS

1. Functions which are ________________ of one another are reflections of each other over the line ________________.

2. Complete the table by finding $f^{-1}(x)$ for each function.

Function	Inverse function
$y = x^2 + 1, x \geq 0$	
$y = \ln x$	
$y = e^{x-6}$	

3.4 DIFFERENTIATING INVERSE TRIGONOMETRIC FUNCTIONS

1. Two things to watch out for:

   1. ____

   2. ____

2. Match each inverse trig function to its derivative.

$y = \sin^{-1} x$	$y' = -\dfrac{1}{\lvert x \rvert \sqrt{x^2 - 1}}$
$y = \cos^{-1} x$	$y' = -\dfrac{1}{1 + x^2}$
$y = \tan^{-1} x$	$y' = -\dfrac{1}{\sqrt{1 - x^2}}$
$y = \csc^{-1} x$	$y' = \dfrac{1}{\sqrt{1 - x^2}}$
$y = \sec^{-1} x$	$y' = \dfrac{1}{\lvert x \rvert \sqrt{x^2 - 1}}$
$y = \cot^{-1} x$	$y' = \dfrac{1}{1 + x^2}$

3.5 SELECTING PROCEDURES FOR CALCULATING DERIVATIVES

1. Circle the derivative rules that will be used to find the first derivative of each function.

$y = \sin^2(3x)$	Power	Product	Quotient	Chain
$y = 3e^{x^2} \ln(4x)$	Power	Product	Quotient	Chain
$y = \dfrac{7 \sec x}{(9x^2 + 2)e^{4x}}$	Power	Product	Quotient	Chain

3.6 CALCULATING HIGHER-ORDER DERIVATIVES

1. The second derivative is just the ________________ of the ________________.

2. In the second derivative of an implicit function, don't forget to substitute for ________________.

3. Complete the table so that every value in each row expresses the same function.

		$\frac{d^2y}{dx^2}$
g''		
	$x''(t)$	

4. Find the first and second derivatives of each function.

$f(x)$	$f'(x)$	$f''(x)$
$\sin(3x^2)$		
e^{x^2+1}		
$\ln(8x-3)$		