Chain Rule Review

Chain Rule

This rule is used to find the derivative of composite functions.

$F(x) = f\big(g(x)\big)$ $then\ F'(x) = f'\big(g(x)\big)g'(x)$

Note: The composite function could be larger than 2 functions, in which case we continue the pattern of working our way 'outside to inside'.

Note: Other techniques may also have to be applied (product & quotient rule). Analyze the equation to figure out the rule to apply at each step.

Examples

$(5-3x)^2$

e^{5x}

$\sin^2(5x)$

$\big(x^3\sin(x)\big)^2$

$x^3\sin(2x)$

Exponential Derivatives Review

Derivative of e^x is e^x

What if the base is not e?

Derivative of a^x is $a^x lna$

Examples

e^x

5^x

π^x

e^{x^2}

Summary To Date

Tables of Derivatives

f(x)	f'(x)
a	0
ax	a
ax^n	anx^{n-1}
e^x	e^x
a^x	$a^x \ln a$
sin(x)	cos(x)
cos(x)	-sin(x)
tan(x)	$\sec^2(x)$
csc(x)	-csc(x)cot(x)
sec(x)	sec(x)tan(x)
cot(x)	$-\csc^2(x)$

f(x)	f'(x)
$cf(x)$	$cf'(x)$
$f(x) \pm g(x)$	$f'(x) \pm g'(x)$
$f(x)g(x)$	$f'(x)g(x) + g'(x)f(x)$
$\frac{f(x)}{g(x)}$	$\frac{f'(x)g(x) - g'(x)f(x)}{[g(x)]^2}$
$f(g(x))$	$f'(g(x))g'(x)$

Tangent Line equation

$$y - y_0 = m(x - x_0)$$

(x_0, y_0) is the point on the line and m is the slope (derivative)

Product Rule

The derivative of a product of two functions is given by the following formula:

$$(uv)' = u'v + v'u$$

Quotient Rule

The derivative of a quotient of two functions is given by:

$$\left(\frac{u}{v}\right)' = \frac{u'v - v'u}{v^2}$$

3.4 Question 7

Find the derivative

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

3.4 Question 9

Find the derivative

$$f(x) = \sqrt{5x + 1}$$

3.4 Question 13

Find the derivative

$f(\theta) = \cos(\theta^2)$

3.4 Question 17

Find the derivative

$y = x^2 e^{-3x}$

3.4 Question 25

Find the derivative

$y = e^{tan\theta}$

3.4 Question 35

Find the derivative

$y = 4^{c/x}$

3.4 Question 39

Find the derivative

$F(t) = tan\sqrt{1 + t^2}$

3.4 Question 41

Find the derivative

$y = \sin^2(x^2 + 1)$

3.4 Question 59

Find an equation of the tangent line to the curve at the given point

$y = \sin(\sin x) \quad (\pi, 0)$

3.4 Question 65

Find all points on the graph of the function
$f(x) = 2 \sin x + \sin^2 x$ at which the tangent line is horizontal.

3.4 Question 87

A Cepheid variable star is a star whose brightness alternately increases and decreases. The most easily visible such star is Delta Cephei, for which the interval between times of maximum brightness is 5.4 days. The average brightness of this star is 4.0 and its brightness changes by ± 0.35. In view of these data, the brightness of Delta Cephei at time t, where t is measured in days, has been modeled by the function

$$B(t) = 4.0 + 0.35 \sin\left(\frac{2\pi t}{5.4}\right)$$

(a) Find the rate of change of the brightness after t days.
(b) Find, correct to two decimal places, the rate of increase after one day.