2.3 Homework: Product and Quotient Rules and Higher-Order Derivatives

Use the Product Rule to differentiate the function.

1. $f(x)=\left(x^2+1\right)\left(x^2-2x\right)$

3. $\sqrt[3]{t}\left(t^2+4\right)$

5. $f(x)=x^3\cos x$

Use the Quotient Rule to differentiate the function.

7. $f(x)=\dfrac{x}{x^2+1}$

10. $h(s)=\dfrac{s}{\sqrt{s}-1}$

11. $g(x)=\dfrac{\sin x}{x^2}$

8. $g(t)=\dfrac{t^2+2}{2t-7}$

Find $f'(x)$ and f′(c)

13. $f(x)=\left(x^3-3x\right)\left(2x^2+3x+5\right)$ $\quad c=0$

15. $f(x)=\dfrac{x^2-4}{x-3}$ $\quad c=1$

17. $f(x)=x\cos x$ $\quad c=\dfrac{\pi}{4}$

Complete the table without using the Quotient Rule.

Function	**Rewrite**	**Differentiate**	**Simplify**
19. $y=\dfrac{x^2+2x}{3}$			
21. $y=\dfrac{7}{3x^3}$			

Find the derivative of the algebraic function:

25. $f(x)=\dfrac{3-2x-x^2}{x^2-1}$ 33. $f(x)=\dfrac{2-\dfrac{1}{x}}{x-3}$ 34. $g(x)=x^2\left(\dfrac{2}{x}-\dfrac{1}{x+1}\right)$

Find the derivative of the trigonometric function.

39. $f(t)=t^2\sin t$ 43. $f(x)=-x+\tan x$ 45. $g(t)=\sqrt[4]{t}+8\sec t$

49. $y=-\csc x-\sin x$ 53. $f(x)=2x\sin x+x^2\cos x$

Find an equation of the tangent line to the graph of *f* at the given point, then use a graphing calculator to graph the function and its tangent line at the point, and then use the derivative feature of your calculator to confirm your results.

64. $f(x)=(x-1)(x^2-2);\quad (0,2)$ 67. $f(x)=\tan x\ ;\quad \left(\dfrac{\pi}{4},1\right)$

Prove the following differentiation rules.

88. a) $\dfrac{d}{dx}(\sec x)=\sec x\tan x$ b) $\dfrac{d}{dx}(\csc x)=-\csc x\cot x$

Find the second derivative of the function.

95. $f(x)=\dfrac{x}{x-1}$ 96. $f(x)=\dfrac{x^2+2x-1}{x}$ 97. $f(x)=3\sin x$

Acceleration

116. An automobile's velocity starting from rest is $v(t) = \dfrac{100t}{2t+15}$ where v is measured in feet per second. Find the acceleration at (a) 5 seconds, (b) 10 seconds, and (c) 20 seconds.