

$$\begin{aligned} 1) y &= \frac{9x^2 - 5x - 4}{\sqrt{x}} \rightarrow \frac{9x^2}{x^{1/2}} - \frac{5x}{x^{1/2}} - \frac{4}{x^{1/2}} \\ &= 9x^{3/2} - 5x^{1/2} - 4x^{-1/2} \\ y' &= 9\left(\frac{3}{2}\right)x^{1/2} - 5\left(\frac{1}{2}\right)x^{-1/2} - 4\left(-\frac{1}{2}\right)x^{-3/2} \\ &= \boxed{\frac{27}{2}\sqrt{x} - \frac{5}{2\sqrt{x}} + \frac{2}{x^{3/2}}} \end{aligned}$$

$$1) y = \frac{9x^2 - 5x - 4}{\sqrt{x}}$$

$$\frac{N'D - D'N}{D^2}$$

$$N' \rightarrow 18x - 5 \quad D' = \frac{1}{2\sqrt{x}}$$

$$y' = \frac{(18x - 5)(\sqrt{x}) - \left(\frac{1}{2\sqrt{x}}\right)(9x^2 - 5x - 4)}{(\sqrt{x})^2}$$

$$= \frac{27}{2}\sqrt{x} - \frac{5}{2\sqrt{x}} + \frac{2}{x^{3/2}}$$

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

$$m' n + n' m$$

$$m' = 10x - 3$$

$$n' = \cos x$$

$$f'(x) = (10x - 3)(\sin(x)) + (5x^2 - 3x + 2)(\cos(x))$$

$$3) g(x) = \frac{3x^4 + 5}{\cos(x)}$$

$$N' \rightarrow 12x^3$$

$$D' \rightarrow -\sin(x)$$

$$g'(x) = \frac{(12x^3)(\cos x) - (-\sin x)(3x^4 + 5)}{\cos^2 x}$$

$$g'(x) = \frac{12x^3 \cos x + (\sin x)(3x^4 + 5)}{\cos^2 x}$$

$$g'(x) = \frac{12x^3}{\cos x} + \frac{(\sin x)(3x^4 + 5)}{\cos^2 x}$$

$$4) y = 3^{(4x+1)}$$

Chain Rule

$$4x+1 \rightarrow 4$$

$$3^y \rightarrow 3^{\textcircled{y}} (\ln 3)$$

$$y' = (4) (\ln 3) (3^{4x+1})$$

$$y' = 4 \ln 3 (3^{4x+1})$$

$$5) h(x) = \sqrt{7 - 3 \ln(x)} = (7 - 3 \ln(x))^{1/2}$$

$$m = 7 - 3 \ln(x) \rightarrow m' = -\frac{3}{x} \quad m^{1/2} = \frac{1}{2} m^{-1/2}$$

$$m^{1/2} \rightarrow \frac{1}{2m^{1/2}} = \frac{1}{2\sqrt{m}}$$

$$h'(x) = \left(-\frac{3}{x}\right) \left(\frac{1}{2\sqrt{7-3\ln x}}\right) = \boxed{\frac{-3}{2x\sqrt{7-3\ln x}}}$$

$$6) x^2 + 6xy + 12y^2 = 28$$

$$2x + (6y + 6xy') + 24yy' = 0$$

$$6xy' + 24yy' = -2x - 6y$$

$$y'(6x + 24y) = -2x - 6y$$

$$y' = \frac{-2x - 6y}{6x + 24y}$$

$$y' = -\frac{x + 3y}{3x + 12y}$$

$$\left. \begin{array}{l} x^2 \rightarrow 2x \\ 6xy \rightarrow 6y + 6xy' \\ 6x \rightarrow 6 \\ y \rightarrow y' \\ 12y^2 \rightarrow 24y y' \\ 28 \rightarrow 0 \end{array} \right\}$$

$$7) m(x) = \tan^{-1}(5x^2 - 4) \quad g = 5x^2 - 4 \quad g' = 10x$$

$$+ \tan^{-1}(g) \rightarrow \frac{1}{1+g^2}$$

$$m'(x) = (10x) \left( \frac{1}{1+(5x^2-4)^2} \right)$$

$$m'(x) = \frac{10x}{1+(5x^2-4)^2}$$

$$\frac{d}{dx} (\arctan x) \text{ (or) } \frac{d}{dx} (\tan^{-1} x)$$

$$= \frac{1}{1+x^2}$$



$$8) y = \log_3 \frac{(4x-2)^6}{3^x} \rightarrow y' = \frac{(4x-2)^5 (24 - (4x-2) \ln 3)}{3^x} \cdot \left( \frac{1}{\frac{(4x-2)^6}{3^x} \ln 3} \right)$$

$$\log_3 m \rightarrow \frac{1}{m \ln 3}$$

$$m = \frac{(4x-2)^6}{3^x}$$

$$(N = (4x-2)^6) \rightarrow N' = (4)(6)(4x-2)^5$$

$$z = 4x-2 \quad z' = 4$$

$$z^6 \rightarrow 6z^5$$

$$N' = 24(4x-2)^5$$

$$m' = \frac{24(4x-2)^5 (3^x) - (4x-2)^6 (3^x \ln 3)}{3^{2x}}$$

$$m' = \frac{(4x-2)^5 (24 - (4x-2) \ln 3)}{3^x}$$

$$D = 3^x \rightarrow D' = 3^x \ln 3$$

$$(3^x)^2 = 3^{2x}$$

$$y' = \frac{(4x-2)^5 (24 - (4x-2)\ln 3)}{3^x} \cdot \left( \frac{1}{\frac{(4x-2)^6}{3^x} \ln 3} \right)$$

$$y' = \frac{(24 - (4x-2)\ln 3)}{(4x-2)(\ln 3)} = \boxed{\frac{24}{(4x-2)\ln 3} - 1}$$

$$8) y = \log_3 \frac{(4x-2)^6}{3^x}$$

$$y = \log_3 (4x-2)^6 - \log_3 3^x$$

$$y = 6(\log_3(4x-2)) - x \log_3 3$$

$$\log_3 m = \frac{1}{m \ln 3}$$

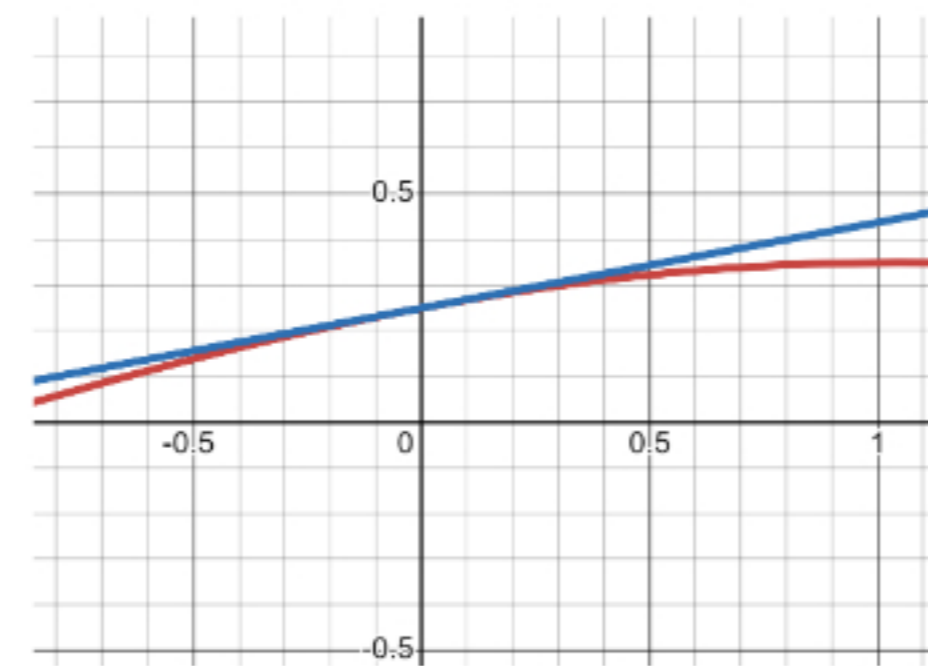
$$y = 6 \log_3(4x-2) - x$$

$$y' = (4)(6) \left( \frac{1}{(4x-2) \ln 3} \right) - 1 \quad \boxed{\frac{24}{(4x-2) \ln 3} - 1}$$

9)  $y = \frac{1+x}{3+e^x}$  at point  $(0, \frac{1}{4})$

$$y' = \frac{(1)(3+e^x) - (e^x)(1+x)}{(3+e^x)^2}$$

$$y'(0) = \frac{(1)(4) - (1)(1)}{(4)^2} = \frac{3}{16}$$



$$N = 1+x \rightarrow N' = 1$$

$$D = 3+e^x \rightarrow D' = e^x$$

$$y = mx + b$$

$$\frac{1}{4} = \frac{3}{16}(0) + b \rightarrow b = \frac{1}{4}$$

$$y = \frac{3}{16}x + \frac{1}{4}$$

10)  $3xy = 4x^2 - 4y^2 + 6$  at point  $(1, -2)$

$$3xy \xrightarrow{d/dx} 3y + 3xy'$$

$$3x \rightarrow 3$$

$$y \rightarrow y'$$

$$4x^2 \rightarrow 8x$$

$$-4y^2 \rightarrow -8yy'$$

$$6 \rightarrow 0$$

$$3y + 3xy' = 8x - 8yy'$$

$$3(-2) + 3(1)y' = 8(1) - 8(-2)y'$$

$$-6 + 3y' = 8 + 16y'$$

$$-14 = 13y'$$

$$\frac{-14}{13} = y'$$

$$y = mx + b$$

$$-2 = \frac{-14}{13}(1) + b$$

$$\frac{-12}{13} = b$$

$$y = \frac{-14}{13}x - \frac{12}{13}$$

∴

$$X^{1/2} = \sqrt[2]{X^1}$$

$$X^{a/b} = \sqrt[b]{X^a}$$

$$X^y \quad X^{(2x-1)} \quad 2x-1 \rightarrow 2$$

$$X^m \rightarrow m X^{m-1}$$

$$X^y$$

$$y \rightarrow y'$$

$$X^m \rightarrow m X^{m-1}$$

$$y'(y) X^{y-1}$$

$$(y)^x$$

$$x y'(y^{x-1})$$

Calc 1 Test Chapter 3

$$1) m(x) = \tan^{-1}(5x^3 + 3x - 1)$$

$$5x^3 + 3x - 1 \rightarrow 15x^2 + 3$$

$$\tan^{-1}(x) = \frac{1}{1+x^2}$$

$$m'(x) = \frac{15x^2 + 3}{1 + (5x^3 + 3x - 1)^2}$$



$$2) g(x) = \frac{2x^3 - 3}{\sin x}$$

$$N = 2x^3 - 3 \quad N' = 6x^2$$

$$D = \sin x \quad D' = \cos x$$

$$g'(x) = \frac{(6x^2)(\sin x) - (\cos x)(2x^3 - 3)}{\sin^2 x}$$

$$3) y = \frac{9x^3 + 2x^2 - 1}{\sqrt[4]{x}}$$

$$y = \frac{9x^3}{x^{1/4}} + \frac{2x^2}{x^{1/4}} - \frac{1}{x^{1/4}}$$

$$y = 9x^{11/4} + 2x^{7/4} - x^{-1/4}$$

$$y' = 9\left(\frac{11}{4}\right)x^{7/4} + 2\left(\frac{7}{4}\right)x^{3/4} - \left(-\frac{1}{4}\right)x^{-5/4}$$

$$y' = \frac{99}{4}x^{7/4} + \frac{7}{2}x^{3/4} + \frac{1}{4x^{5/4}}$$

$$4) \quad y = \log_4 \frac{(2x-1)^5}{4^x}$$

$$y = \log_4 (2x-1)^5 - \log_4 4^x$$

$$y = 5 \log_4 (2x-1) - x \log_4 4$$

$$y = 5 \log_4 (2x-1) - x$$

$$y' = \frac{10}{(2x-1)(\ln 4)} - 1$$

$$5) \quad y = e^{3x-2}$$
$$y' = 3e^{3x-2}$$

$$6) f(x) = -(7x^3 - 2x - 1)(\cos(x))$$

$$F = 7x^3 - 2x - 1 \quad F' = 21x^2 - 2$$

$$S = -\cos x \quad S' = \sin x$$

$$f'(x) = (21x^2 - 2)(-\cos x) + (\sin x)(7x^3 - 2x - 1)$$

$$7) h(x) = \sqrt[3]{(7-3 \ln(x))^2}$$

$$h(x) = (7-3 \ln(x))^{2/3}$$

$$7-3 \ln(x) \xrightarrow{d/dx} -\frac{3}{x}$$

$$h'(x) = \left(-\frac{3}{x}\right) \left(\frac{2}{3}\right) (7-3 \ln x)^{-1/3}$$

$$h'(x) = \frac{-2}{x^3 \sqrt[3]{7-3 \ln x}}$$

$$8) \quad x^3 + 6xy + 12y^3 = 10$$

$$3x^2 + (6y + 6xy') + 36y^2y' = 0$$

$$6xy' + 36y^2y' = -3x^2 - 6y$$

$$y'(6x + 36y^2) = -3x^2 - 6y$$

$$y' = \frac{-3x^2 - 6y}{6x + 36y^2}$$

$$9) y = \frac{1+x^2}{2-e^x}$$

$$N = 1+x^2 \quad N' = 2x$$

$$D = 2-e^x \quad D' = -e^x$$

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

Point (0, 1)

$$m = \frac{1}{1} = 1$$

$$y = mx + b$$

$$1 = 1(0) + b$$

$$1 = b$$

$$y = x + 1$$



$$10) \quad 3xy = 4x^2 - 4y^2 + 6$$

$$3y + 3xy' = 8x - 8yy'$$

$$3xy' + 8yy' = 8x - 3y$$

$$y'(3x + 8y) = 8x - 3y$$

$$y' = \frac{8x - 3y}{3x + 8y}$$

$$\left(2, -\frac{7}{2}\right)$$

$$m = \frac{8(2) - 3(-\frac{7}{2})}{3(2) + 8(-\frac{7}{2})}$$

$$m = \frac{16 + 21/2}{6 - 56/2} = \frac{53/2}{-44/2}$$

$$m = -53/44$$

$$-\frac{7}{2} = \left(-\frac{53}{44}\right)2 + b$$

$$-\frac{7}{2} = -\frac{53}{22} + b$$

$$+\frac{53}{22}$$

$$-\frac{24}{22} = b = -\frac{12}{11}$$

$$y = \frac{-53}{44}x - \frac{12}{11}$$