§3.1 p.181 Suggested HW

(7) $f(x) = x^3 - 4x + 6$ $\boxed{f'(x) = 3x^2 - 4}$

(9) $f(t) = \frac{1}{4}(t^4 + 8) = \frac{1}{4}t^4 + 2$ $\boxed{f'(t) = t^3}$

(11) $A(s) = -{}^{12}/_{s^5} = -12s^{-5}$ $\boxed{A'(s) = 60s^{-6} = {}^{60}/_{s^6}}$

(15) $y = 3e^x + {}^{4}/_{\sqrt[3]{x}} = 3e^x + 4x^{-1/3}$ $\boxed{y' = 3e^x + -\frac{4}{3}x^{-4/3} = 3e^x - \frac{4}{3x^{4/3}}}$

(17) $F(x) = \left(\frac{1}{2}x\right)^5 = \frac{1}{32}x^5$ $\boxed{F'(x) = \frac{5}{32}x^4}$

(25) $z = \frac{A}{y^{10}} + Be^y = Ay^{-10} + Be^y$ $\boxed{\frac{dz}{dy} = -10Ay^{-11} + Be^y = Be^y - \frac{10A}{y^{11}}}$

(27) $y = \sqrt[4]{x} = x^{1/4}$ Find the tangent line's equation @ $(1,1)$

$y' = \frac{1}{4}x^{-3/4}$ slope of all tangent lines

$f'(1) = \frac{1}{4}(1)^{-3/4} = \frac{1}{4}$ m @ (1,1)

$y - 1 = \frac{1}{4}(x-1) \Rightarrow y - 1 = \frac{1}{4}x - \frac{1}{4}$

$+\frac{4}{4} \qquad +\frac{4}{4}$

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

(37) $f(x) = 3x^2 - x^3$ @ $a=1$

(a) Zoom in on the graph so that the fun) looks like a straight line. A 0.5 unit wide viewing window

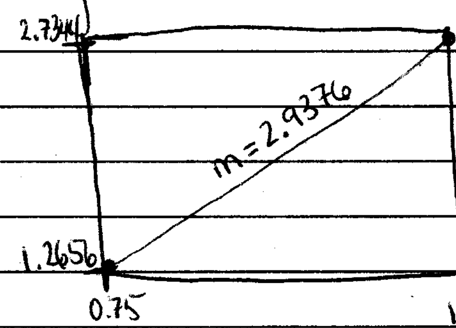
$f(1.5) = 3\left(\frac{3}{2}\right)^2 - \left(\frac{3}{2}\right)^3$

$= \frac{27}{4} - \frac{27}{8} = \frac{54}{8} - \frac{27}{8} = \frac{27}{8}$

$f(0.5) = 3\left(\frac{1}{2}\right)^2 - \left(\frac{1}{2}\right)^3 = \frac{3}{4} - \frac{1}{8} = \frac{6}{8} - \frac{1}{8} = \frac{5}{8}$

$f(1.25) = 2.7344$

$f(0.75) = 1.2656$



(b) $f'(a) = 6a - 3a^2$

$f'(1) = 6(1) - 3(1)^2 = 6 - 3 = 3$

m=3 and the approximate was 2.9376. Of course the closer the values of x are to 1 on either side, the closer the estimate will be.

§3.1 p. 181 con'd

(49) Find the points on the curve $y = 2x^3 + 3x^2 - 12x + 1$ where the tangent is horizontal

A horizontal line has zero slope, therefore we need to know where the slope is zero.

$y' = 6x^2 + 6x - 12$ $\quad\quad 6(x^2 + x - 2) = 0 \Rightarrow 6(x+2)(x-1) = 0$

$x + 2 = 0 \quad x - 1 = 0$

$x = -2 \quad x = 1$

The 2 points on the curve are

$\boxed{(-2, 21) \; \& \; (1, -6)}$

(52) Find an equation of the tangent line to the curve $y = \underset{x^{3/2}}{x\sqrt{x}}$ that is parallel to the line $y = 1 + 3x$

Lines that are parallel have the same slope so we need to know when or where $m = 3$

$y' = \frac{3}{2} x^{1/2} = \frac{3}{2}\sqrt{x}$ $\quad\quad \frac{2}{3} \cdot \frac{3}{2}\sqrt{x} = 3 \cdot \frac{2}{3} \Rightarrow \sqrt{x} = 2 \Rightarrow x = 4$

$(4, 8)$

The equation is $y - 8 = 3(x - 4) \Rightarrow \underset{8}{y - 8} = \underset{8}{3x - 12} \Rightarrow \boxed{y = 3x - 4}$

§3.2 p. 188 Suggested HW

① $f(x) = (1+2x^2)(x-x^2) = x - x^2 + 2x^3 - 2x^4$

Power Rule: $f'(x) = \boxed{-8x^3 + 6x^2 - 2x + 1}$

Product Rule: $f'(x) = 4x(x-x^2) + (-2x+1)(1+2x^2)$

$= 4x^2 - 4x^3 + {}^{-}2x + {}^{-}4x^3 + 1 + 2x^2$

$= -8x^3 + 6x^2 - 2x + 1$

The answers agree!

③ $f(x) = (x^3 + 2x)e^x$

$x^3e^x + 2xe^x$

$f'(x) = (3x^2 + 2)e^x + (x^3 + 2x)e^x$

$= (x^3 + 3x^2 + 2x + 2)e^x$

or

$f'(x) = 3x^2e^x + x^3e^x + 2e^x + 2xe^x$

$= \boxed{e^x(x^3 + 3x^2 + 2x + 2)}$

⑤ $y = \dfrac{e^x}{x^2}$ $\quad e^x \cdot x^{-2}$

$y' = \dfrac{e^x x^2 - 2xe^x}{x^4} = \dfrac{\cancel{x}e^x(x-2)}{x^{\cancel{4}3}}$

$= \boxed{\dfrac{e^x(x-2)}{x^3}}$

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

⑦ $g(x) = \dfrac{3x-1}{2x+1}$

$g'(x) = \dfrac{3(2x+1) - 2(3x-1)}{(2x+1)^2} = \dfrac{6x+3-6x+2}{(2x+1)^2}$

$= \boxed{\dfrac{5}{(2x+1)^2}}$

⑨ $F(y) = \left(\dfrac{1}{y^2} - \dfrac{3}{y^4}\right)(y + 5y^3)$

$= (y^{-2} - 3y^{-4})(y + 5y^3)$

$F'(y) = \boxed{y^{-4}(5y^4 - 45y^3 + 59y^2 - 3)}$

$F'(y) = (-2y^{-3} + 12y^{-5})(y + 5y^3)$

$+ (1 + 15y^2)(y^{-2} - 3y^{-4})$

$= -2y^{-2} - 10 + 12y^{-4} + 60y^{-2}$

$+ y^{-2} - 3y^{-4} + 15 - 45y^{-2}$

$= 5 - 45y^{-2} + 59y^{-2} - 9y^{-4} = 5 + 14y^{-2} - 9y^{-4}$

§3.2 p.188 con'd

↓ Your book ends

(17) $y = \frac{v^3 - 2v\sqrt{v}}{v} = v^2 - 2v^{1/2}$ $\quad y' = \boxed{2v - v^{-1/2} = 2v - \frac{1}{\sqrt{v}} = \frac{2v^{3/2} - 1}{v^{1/2}}}$

(21) $f(x) = \frac{A}{B+Ce^x} = A(B+Ce^x)^{-1}$ $\quad f'(x) = -A(B+Ce^x)^{-2} \cdot Ce^x$

$= \boxed{\frac{-ACe^x}{(B+Ce^x)^2}}$

(25) $f(x) = x^4e^x$ $\quad f'(x) = \boxed{4x^3e^x + x^4e^x = x^3e^x(4+x)}$

$f''(x) = 12x^2e^x + 4x^3e^x + 4x^3e^x + x^4e^x$

(29) $y = \frac{2x}{x+1}$ Find the tangent line's equation at $(1,1)$

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

$y - 1 = \frac{1}{2}(x-1) \Rightarrow \underset{+\frac{2}{2}}{y-1} = \frac{1}{2}x \underset{+\frac{2}{2}}{- \frac{1}{2}} \Rightarrow \boxed{y = \frac{1}{2}x + \frac{1}{2}}$

(25) cond $\quad f''(x) = 12x^2e^x + 8x^3e^x + x^4e^x = x^2e^x(12 + 8x + x^2)$

$= \boxed{x^2e^x(x+6)(x+2)}$

(9) $F'(y) = 5 + 14y^{-2} - 9y^{-4} = y^{-4}(5y^4 + 14y^2 - 9)$

$= \boxed{\frac{5y^4 + 14y^2 - 9}{y^4} \text{ or } 5 + \frac{14}{y^2} - \frac{9}{y^4}}$

§3.3 p. 195 Suggested HW

① $f(x) = 3x^2 - 2\cos x$ $\qquad f'(x) = 6x + 2\sin x$

③ $f(x) = \sin x + \frac{1}{2}\cot x$ $\qquad f'(x) = \cos x + \frac{-1}{2}\csc^2 x$

⑦ $y = c\cos t + t^2 \sin t$ $\qquad \boxed{\begin{aligned} y' &= -c\sin t + 2t\sin t + t^2\cos t \\ &= -c\sin t + t(2\sin t + t\cos t) \end{aligned}}$

⑬ $f(x) = xe^x \csc x =$ $\qquad f'(x) = 1e^x\csc x + xe^x\csc x + -xe^x\csc x\cot x$

$= \boxed{e^x\csc x(1 + x - x\cot x)}$

㉑ $y = x + \cos x$ Find the equation of the line tangent to the curve at $(0,1)$

$y' = 1 + -\sin x$ $\qquad f'(0) = 1 + -\sin(0) = 1$

$y - 1 = 1(x - 0) \Rightarrow y - 1 = x - 0 \Rightarrow \boxed{y = x + 1}$

$\quad {}^{+1} \qquad {}^{+1}$

§3.7 Suggested HW p. 226

(2) $f(x) = x\ln x - x$ $\qquad f'(x) = \frac{\cancel{x}}{\cancel{x}} + \ln x - 1 = \boxed{\ln x}$

(3) $f(x) = \sin(\ln x)$ $\qquad f'(x) = \boxed{\frac{\cos(\ln x)}{x}}$

(5) $f(x) = \log_2(1-3x)$ $\qquad f'(x) = \boxed{\frac{-3}{(1-3x)\ln 2} = \frac{3}{(3x-1)\ln 2}}$

Incorporate neg into denom

(11) $F(t) = \ln \frac{(2t+1)^3}{(3t-1)^4}$ $\qquad F'(t) = \frac{(3t-1)^4}{(2t+1)^3} \cdot \frac{3(2t+1)^2 \cdot 2 \cdot (3t-1)^4 - 4(3t-1)^3 \cdot 3(2t+1)^3}{(3t-1)^8}$

$$= \frac{6\cancel{(3t-1)^4}\cancel{(3t-1)^3}\cancel{(2t+1)^2}\left[(3t-1) - 2(2t+1)\right]}{\cancel{(2t+1)^3}\,\cancel{(3t-1)^8}}$$

$-4t-2$

$6t^2+t-1$

$$= \boxed{\frac{-6(t+3)}{(2t+1)(3t-1)}}$$

(15) $y = \ln[2 - x - 5x^2]$ $\qquad y' = \frac{1}{2-x-5x^2} \cdot (-1-10x)$

$-(10x+1)$

incorporate into denom.

$$= \boxed{\frac{10x+1}{5x^2+x-2}}$$

(19) $y = 2x\log_{10}(\sqrt{x})$ $\qquad y' = 2\log_{10}(\sqrt{x}) + \frac{\cancel{2x}}{\cancel{\sqrt{x}}\ln 10} \cdot \frac{1}{\cancel{2\sqrt{x}}}$

$= 2x\log_{10} x^{1/2}$ $\qquad = 2\log_{10}\sqrt{x} + \frac{1}{\ln 10} = \frac{1}{2} \cdot 2\log_{10} x + \frac{1}{\ln 10}$

$= 2 \cdot \frac{1}{2} x \log_{10} x$ $\qquad = \log_{10} x + \frac{1}{\ln 10}$

$= x\log_{10} x$ $\qquad y' = 1 \cdot \log_{10} x + \frac{x}{x\ln 10} = \boxed{\log_{10} x + \frac{1}{\ln 10}}$

§3.7 p. 226 Cont'd

(25) $y = \ln(x^2 - 3x + 1)$ Find equation of tangent line @ $(3,0)$

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

$$y - 0 = 3(x-3) \Rightarrow \boxed{y = 3x - 9}$$

(31) Let $f(x) = cx + \ln(\cos x)$ For what value of c is $f'(\pi/4) = 6$?

$$f'(x) = c + \frac{-\sin x}{\cos x} = c + {}^{-}\tan x \qquad f'(\pi/4) = c + {}^{-}\tan \pi/4 = 6$$

$$\Rightarrow c + {}^{-}1 = 6$$

$$\boxed{c = 7}$$