習題 2-1

1.（1）3（2）1/2（3）不存在（4）-1（5）-1/6（6）e^2

2.（1）$\dfrac{-1}{\sqrt{3-2x}}$（2）$\dfrac{-1}{\sqrt{3}}$（3）$\dfrac{-1}{\sqrt{5}}$

3.$f(a)-af'(a)$　4.略　5.$y-1=-2(x+1)$

習題 2-2

1.（1）$f'(x)=9x^8-7$（2）$f'(x)=1-\dfrac{1}{(x-1)^2}$（3）$f'(x)=\dfrac{-1}{x^2}-\dfrac{2}{x^3}$（4）$f'(x)=1-4x$

（5）$g'(x)=2(3x^2-5x)(6x-5)$（6）$g'(x)=(3x^2+2)(x^4-5x)+(x^3+2x+1)(4x^3-5)$

（7）$g'(x)=2x(x^2+3)(x^2+5)+(x^2+1)2x(x^2+5)+(x^2+1)(x^2+3)2x$

（8）$g'(x)=\dfrac{-30x}{(3x^2+2)^2}$（9）$h'(x)=\dfrac{-25}{(3x-4)^2}$（10）$h'(x)=\dfrac{-(4x^2+8x-3)}{(4x^2-3x)^2}$

（11）$h'(x)=-6x^{-3}+(4x^3-7)(3x+5)+(x^4-7x)3$

（12）$\dfrac{(7x-6)[(3x^2-4)(x^2+x)+(x^3+4x-9)(2x+1)]-(x^3+4x-9)(x^2+x)7}{(7x-6)^2}$

2.$f'(1)$ 不存在

3.$f'(x)=\begin{cases} 2x+1 &,x>0 \\ 2x-1 &,x<0 \\ 不存在 &,x=0 \end{cases}$

4.$y-2=-\dfrac{3}{2}(x-1)$

習題 2-3

1.（1）$f'(x)=20(x-1)(x^2-2x+5)^9$（2）$y'=3x\sqrt{x^2-5}$

（3）$g'(x)=(x^3+x-1)(x^2+3)^2[2(3x^2+1)(x^2+3)+6x(x^3+x-1)^2]$（4）$y'=\dfrac{96x^2}{(5-4x^3)^5}$

（5）$h'(s)=-\dfrac{6(2s+3)^2(s^2+3s+5)}{(s^2-5)^4}$（6）$y'=\dfrac{-w^2+8w+4}{(4-3w^2)^{4/3}}$（7）$l'(x)=\dfrac{5}{3\sqrt[3]{x^2}(1-\sqrt[3]{x})^6}$

（8）$y'=-\dfrac{5}{t^2}\left(1+\dfrac{1}{t}\right)^4$（9）$k'(x)=\dfrac{1}{2\sqrt{x+\sqrt{x+\sqrt{x}}}}\left(1+\dfrac{1}{2\sqrt{x+\sqrt{x}}}\left(1+\dfrac{1}{2\sqrt{x}}\right)\right)$

（10）$y'=-3x^{-4}+\dfrac{1}{5}(x^3+2x)^{-\frac{4}{5}}(3x^2+2)$

2. -475　3. $w'(x) = \dfrac{-3(3z^2+2)}{x^4}$　　4. $\dfrac{dy}{dx} = -\dfrac{1}{2\sqrt[3]{x^2}}(6u + \dfrac{1}{2\sqrt{u}})(24v^2+5)$

5. $f'(2) = 12$　　6. $f'(27) = \dfrac{2}{9}$　　7. $D_x f(2x+3) = 2g(2x+3)$

8. $y - \sqrt{10} = \dfrac{13}{2\sqrt{10}}(x-2)$

習題 2-4

1. (1) $-\dfrac{x^2}{y^2}$　(2) $\dfrac{1-y^2-2xy}{2xy+x^2+1}$　(3) $-\dfrac{\sqrt[3]{y}}{\sqrt[3]{x}}$　(4) $\dfrac{4x\sqrt{xy}+y}{4y\sqrt{xy}-x}$

2. $\dfrac{dy}{dx} = \dfrac{2xy^2-3x^2-y}{x-4y^3-2x^2y}$, $\dfrac{dx}{dy} = \dfrac{x-4y^3-2x^2y}{2xy^2-3x^2-y}$　　3. $\dfrac{1}{4y^3-6y}$　　4. 0

5. $f(1)=3, f^{-1}(3)=1, f'(1)=6, (f^{-1})'(3)=\dfrac{1}{6}$　　6. $\dfrac{1}{2}$

7. 切線斜率：$\dfrac{13}{9}$，切線方程式：$y-1=\dfrac{13}{9}(x-3)$

8. $y-5 = \dfrac{5}{2}(x-2)$　　9. $y - \dfrac{2}{\sqrt{3}} = 2(x - \dfrac{4}{\sqrt{3}})$

習題 2-5

1. (1) $e^{\frac{1}{2}}$　(2) e^r　(3) $e^{\frac{1}{3}}$　(4) e

2. (1) $1+\ln x$　(2) $\dfrac{3}{x}$　(3) $\dfrac{5(\ln x)^4}{x}$　(4) $\dfrac{2x}{1+x^2}$　(5) $\dfrac{1}{1+x} + \dfrac{1}{1-x}$　(6) $\dfrac{1}{x} - \dfrac{x^2}{1+x^3}$

　(7) $\dfrac{3}{(3x+1)\ln 2}$　(8) $\dfrac{(2x+1)\ln x - (x+1)\ln(x^2+x)}{(x^2+x)(\ln x)^2}$　(9) $\dfrac{-(y^3+2x^2y\ln y)}{x^3+2xy\ln x}$

　(10) $-\dfrac{2x+y(x^2+y^2)\ln 3}{2y+x(x^2+y^2)\ln 3}$

3. (1) $(1+x)e^x$　(2) $2e^{2x}$　(3) $e^x\left(\ln x + \dfrac{1}{x}\right)$　(4) $2xe^{x^2}$　(5) $3^x\ln 3 + 3x^2$

　(6) $(2x+1)5^{x^2+x}\ln 5$　(7) $\dfrac{4}{(e^x+e^{-x})^2}$　(8) $\dfrac{xe^{(x+1)(x+2)}}{(x+1)^2(x+2)^3}[\dfrac{1}{x}+2x+3-\dfrac{2}{x+1}-\dfrac{3}{x+2}]$

　(9) $x^{x^2}(2x\ln x + x)$　(10) $\dfrac{y^x\ln y - y\cdot x^{y-1}}{x^y\ln x - x\cdot y^{x-1}}$

4. $\pi(1+\ln\pi)$　5. $f(e)=1, f'(e)=\dfrac{1}{e}$　6. $y-e=3e(x-1)$

7. 切線斜率：2，切線方程式：$y=2x+1$。

習題 2-6

1. (1) $\dfrac{1}{4}$ (2) $\dfrac{2}{5}$ (3) $\dfrac{1}{2}$ (4) $\dfrac{1}{2}$

2. (1) $3\cos x + 4\sin x$ (2) $3\sin^2 x \cdot \cos x$ (3) $\dfrac{-2+\cos x}{(1-2\cos x)^2}$

(4) $\dfrac{1}{\sqrt{x^3}}\csc^2 \sec^2 \dfrac{1}{\sqrt{x}} \cdot \sec^2 \dfrac{1}{\sqrt{x}} \cdot \tan \dfrac{1}{\sqrt{x}}$ (5) $2x\sec x + x^2 \sec x \tan x$

(6) $12\tan^3 3x \sec^2 3x$ (7) $\csc x$ (8) $e^{\sin x}(1+x\cos x)$

(9) $\dfrac{-(2x+1)}{3\sqrt[3]{(x^2+x+1)^2}} \cdot \sin(2\sqrt[3]{x^2+x+1})$ (10) $\dfrac{6\sin^2 x \cos x(1-3\cos x)-3\sin^4 x}{2\sqrt{(1-3\cos x)^3}}$ (11) 0

(12) $\dfrac{-1}{2\sqrt{x}\sqrt{1-x}}$ (13) $\dfrac{1-2x^2}{\sqrt{1-x^2+x^4}\sqrt{1-x^2}}$ (14) $\dfrac{x}{|x|(x^2+1)}$ (15) $\dfrac{2}{1+x^2}$

(16) $\dfrac{1}{1+x^2}$ (17) $\dfrac{-1}{\sqrt{e^{2x}-1}}$ (18) $2x\sec^{-1}\sqrt{1+x^2}+\dfrac{x^3}{|x|(1+x^2)}$ (19) $4x\cosh(2x^2+1)$

(20) $20x\tanh(5x^2)\sec h^2(5x^2)$ (21) $\sinh x \cdot e^{\cosh x}$ (22) $\coth(3x)-3x\csc h^2(3x)$

(23) $\coth^{-1}(3x)+\dfrac{3x}{1-9x^2}$ (24) $\dfrac{1}{\sqrt{a^2+x^2}}$ (25) $\sec x$

(26) $(\sinh x)^{\sin x}(\cos x \cdot \ln(\sinh x)+\sin x \cdot \coth x)$

3. (1) $\dfrac{dy}{dx}=\dfrac{-\sin(x+y)}{1+\sin(x+y)}$ (2) $\dfrac{dy}{dx}=\dfrac{2x\cos y+\cos(x-y)}{x^2\sin y+\cos(x-y)}$ (3) $\dfrac{dy}{dx}=-\dfrac{y}{x}$

(4) $\dfrac{dy}{dx}=\dfrac{y-2\tan(x+y)\sec^2(x+y)}{2\tan(x+y)\sec^2(x+y)-x+\csc^2 y}$

(5) $\dfrac{dy}{dx}=\dfrac{\csc(x-y)\cot(x-y)-\sec(x+y)\tan(x+y)+1}{\csc(x-y)\cot(x-y)+\sec(x+y)\tan(x+y)}$

(6) $\dfrac{dy}{dx}=\dfrac{y^{\sin x}\cos x \cdot \ln y - x^{y-1}\cdot y}{x^y \cdot \ln x - \sin x \cdot y^{\sin x-1}}$ (7) $\dfrac{dy}{dx}=\dfrac{y\sqrt{1-(x+y)^2}+\sqrt{1-(xy)^2}}{-\sqrt{1-(xy)^2}-x\sqrt{1-(x+y)^2}}$

(8) $\dfrac{dy}{dx}=\dfrac{(1+y^2)(\sin y+2x)}{1-x(1+y^2)\cos y}$ (9) $\dfrac{dy}{dx}=\dfrac{2xy+y\cosh(x+y^2)}{1-2y^2\cosh(x+y^2)}$

(10) $\dfrac{dy}{dx}=\dfrac{1}{1+\sqrt{(x-y)^2+1}}$

4. 略 5. 略 6. 略 7. 略

8. 切線斜率 $= -\dfrac{1}{2\sqrt{3}}$ ，切線方程式： $y-(1+\dfrac{\sqrt{3}}{2})=-\dfrac{1}{2\sqrt{3}}(x-1)$

9. 切線斜率 $= -\dfrac{1}{2}$ ，切線方程式： $y=-\dfrac{1}{2}x+\pi$

習題 2-7

1. $(1)\,10x^9 - 35x^6$ $(2)\,90x^8 - 210x^5$ $(3)\,10!$ 2. $f''(2) = 8$ 3. $y^{(n)} = \dfrac{3^n n!}{(1-3x)^{n+1}}$

4. $y^{(n)} = -\dfrac{1\cdot 3\cdot 5\cdots(2n-3)}{2^n}\cdot\dfrac{1}{(1-x)^{\frac{2n-1}{2}}}$ 5. $y^{(n)} = (-1)^n\dfrac{n!}{3}\left[\dfrac{4}{(x+1)^{n+1}} - \dfrac{1}{(x-2)^{n+1}}\right]$

6. $f'(x) = \begin{cases} 2x, & x \ge 0 \\ -2x, & x < 0 \end{cases}$, $f''(x) = \begin{cases} 2, & x > 0 \\ 不存在, & x = 0 \\ -2, & x < 0 \end{cases}$ 7. $-\dfrac{x^2 + y^2}{y^3}$

8. $f^{(n)}(x) = (-1)^{n-1}(n-1)!\dfrac{1}{(1+x)^n}$, $f^{(2008)}(0) = -2007!$

9. $f^{(n)}(x) = \begin{cases} \sin x, & n = 4k \\ \cos x, & n = 4k+1 \\ -\sin x, & n = 4k+2 \\ -\cos x, & n = 4k+3 \end{cases}$ $k = 0,1,2,\cdots$ 10. $f^{(n)}(x) = a^n e^{ax}$ 11. 略。