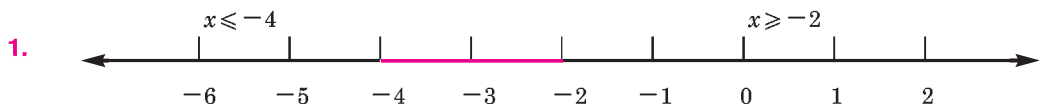


習題答案

第 0 章

➡ 習題 0-1



2. $[-1, 3]$ 3. $(3, 8]$

4. (1) $(-\infty, -3) \cup (2, 8)$ (2) $[-3, 1)$ (3) $\left(1, \frac{7}{2}\right)$ (4) $(-\infty, -4] \cup \left[-\frac{1}{2}, \infty\right)$
 (5) $\left(1, \frac{3}{2}\right)$ (6) $(-\infty, -18] \cup [-10, \infty)$ (7) $\left(-13, \frac{11}{5}\right)$ (8) $(-\infty, -2) \cup (3, \infty)$

5. 略

➡ 習題 0-2

1. $4x - y - 5 = 0$ 2. $y = -2x + 4$ 3. $5x - 2y - 4 = 0$

4. $y = -\frac{2}{3}x - 1$ 5. $m = -\frac{4}{5}$, y -截距為 $\frac{4}{5}$ 6. $y = \frac{3}{4}x - \frac{15}{4}$

6. x -軸之截距 $a = 2$, y -軸之截距 $b = 2$

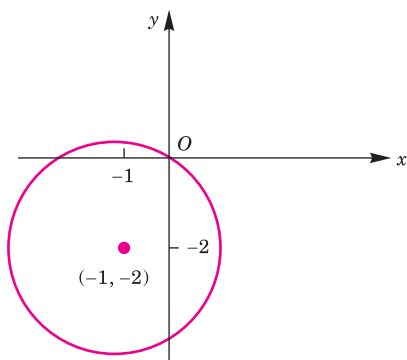
➡ 習題 0-3

1. 圓心 $(1, -1)$, 半徑為 4

2. $x^2 + y^2 + 2x + 4y = 0$

3. $x^2 + y^2 + x + y - 2 = 0$

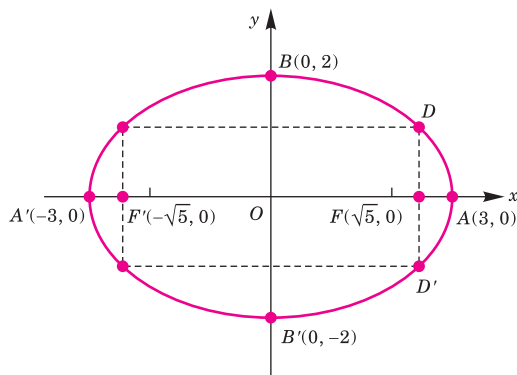
4. $x^2 = -\frac{16}{3}y$ 5. 略



6. 頂點： $(-3, 3)$, 焦點： $(-3+1, 3) = (-2, 3)$, 準線： $x = -4$, 對稱軸： $y = 3$

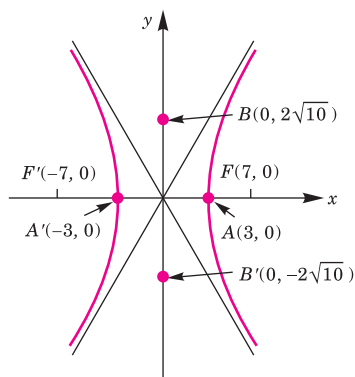
7. 焦點： $F(\sqrt{5}, 0)$, $F'(-\sqrt{5}, 0)$, 頂點： $A(3, 0)$, $A'(-3, 0)$, $B(0, 2)$, $B'(0, -2)$

長軸的長 $=2a=6$, 短軸的長 $=2b=4$, 正焦弦的長 $=\overline{DD'}=\frac{8}{3}$



8. $\frac{x^2}{16} + \frac{y^2}{25} = 1$ 9. $\frac{x^2}{25} + \frac{y^2}{9} = 1$ 10. $\frac{x^2}{9} + \frac{y^2}{3} = 1$

11. 頂點： $A(3, 0)$, $A'(-3, 0)$, 焦點： $F(7, 0)$, $F'(-7, 0)$, 實軸的長 $=2a=6$, 共軛軸的長 $=2b=4\sqrt{10}$, 正焦弦的長 $=\frac{80}{3}$



12. $\frac{y^2}{1} - \frac{x^2}{8} = 1$ 13. $\frac{x^2}{9} - \frac{y^2}{27} = 1$ 14. $4x - 3y = 0$ 與 $4x + 3y = 0$ 15. $\frac{x^2}{16} - \frac{y^2}{9} = 1$

► 習題 0-4

1. $f(1)=2$, $f(3)=\sqrt{2}+6$, $f(10)=23$
2. (1) $D_f=\{x|x \in \mathbb{R}\}$, R_f (f 的值域) $=\{y|y \in \mathbb{R}, y \leq 4\}$
 (2) $D_f=\{x|x \in \mathbb{R}, x \geq 2 \text{ 或 } x \leq -2\}$, $R_f=\{y|y \in \mathbb{R}, y \geq 0\}$
 (3) $D_f=\{x|x \in \mathbb{R}\}$, $R_f=\{y|y \in \mathbb{R}, y \geq 0\}$
 (4) $D_f=\{x|x \in \mathbb{R}\}$, $R_f=\{y|y \in \mathbb{R}, y \geq -4\}$
 (5) $D_f=\{x|x \neq 0\}$, $R_f=\{-1, 1\}$

(6) $D_f = \{x | x < -1 \text{ 或 } x > 3\}$, $R_f = \{y | y \in \mathbb{R}, y > 0\}$

3. (1) 不為一函數 (2) 為一函數 (3) 為一函數 (4) 為一函數

4. (1) f 是一對一函數 (2) f 是一對一函數 (3) $f(x)$ 非一對一函數
(4) $f(x)$ 非一對一函數 (5) $f(x)$ 非一對一函數

5. (1) 滿足 $f(x+y) = f(x) + f(y)$ (2) 不滿足 $f(x+y) = f(x) + f(y)$
(3) 不滿足 $f(x+y) = f(x) + f(y)$ (4) 滿足 $f(x+y) = f(x) + f(y)$

6. $\frac{4}{(a+h+4)(a+4)}$ 7. $\frac{5}{2}, \frac{5}{2}$

8. $D_f = \{x | x \in \mathbb{R}, 0 \leq x \leq 1\}$, $R_f = \left\{y \mid y \in \mathbb{R}, 0 \leq y \leq \frac{1}{2}\right\}$

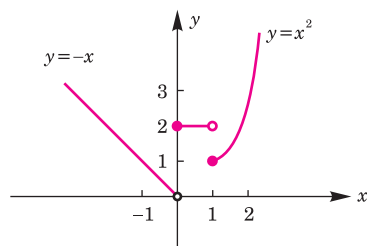
9. (1) 偶函數 (2) 奇函數 (3) 偶函數 (4) 偶函數 (5) 奇函數

10. (1) $f(x) = 0$ 為偶函數, 亦為奇函數 (2) $g(x) = (x^3 + x)^{1/3}$ 為奇函數 (3) $h(x)$ 為奇函數
(4) $k(x)$ 為偶函數 (5) F 不為奇函數亦不為偶函數 (6) G 不為奇函數亦不為偶函數
(7) f 不為奇函數亦不為偶函數 (8) f 不為奇函數亦不為偶函數

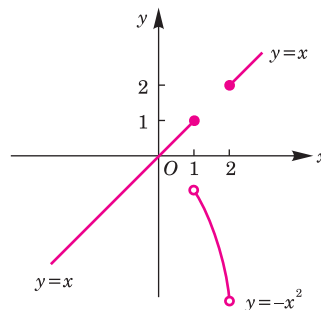
11. 略 12. 略 13. $f(x) = \frac{3}{2}x^2 + \frac{1}{2}x + 1$

➡ 習題 0-5

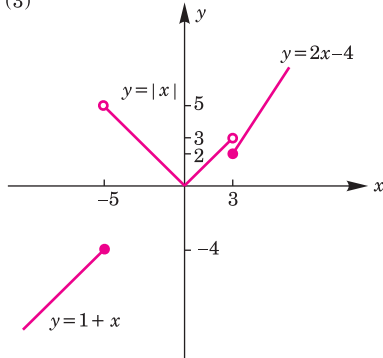
1. (1)



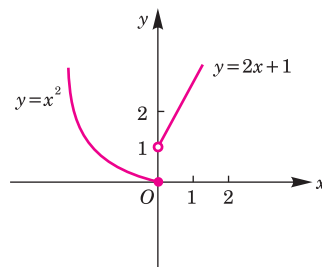
(2)



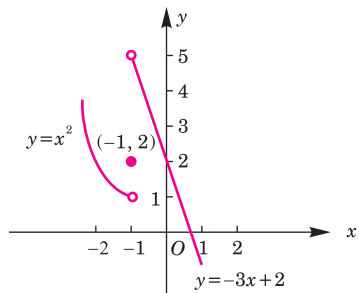
(3)



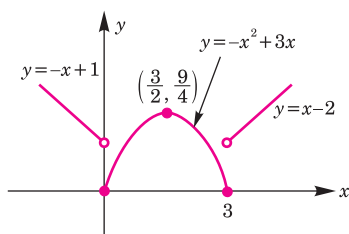
(4)



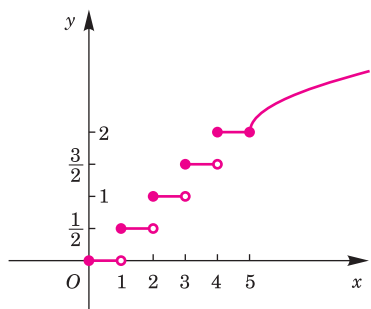
(5)



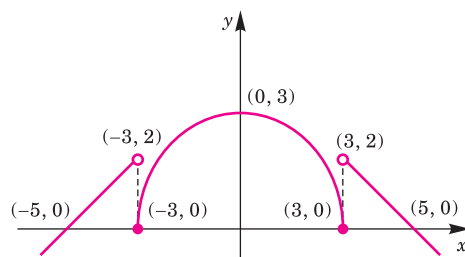
(6)



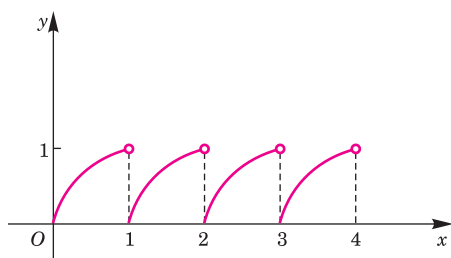
(7)



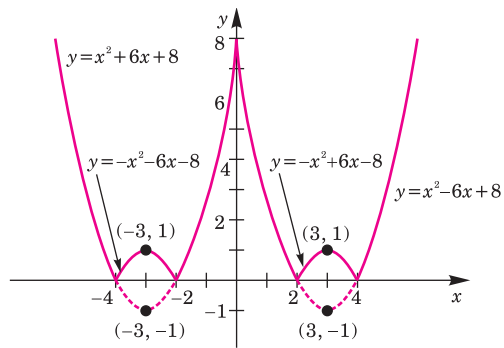
(8)



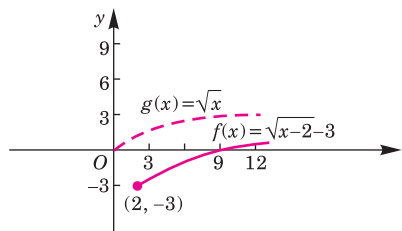
(9)



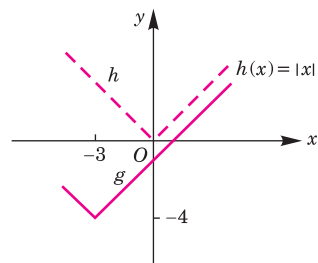
(10)



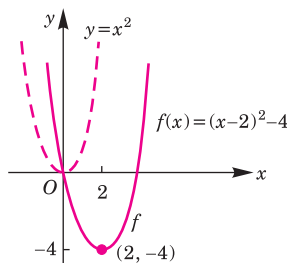
2.



3.



4.



➡ 習題 0-6

$$\begin{aligned}
 1. \quad & (f+g)(x)=f(x)+g(x)=\sqrt{x+2}+\sqrt{4-x}, \quad x \in [-2, 4] \\
 & (f-g)(x)=f(x)-g(x)=\sqrt{x+2}-\sqrt{4-x}, \quad x \in [-2, 4] \\
 & (f \cdot g)(x)=f(x) \cdot g(x)=\sqrt{x+2} \cdot \sqrt{4-x}=\sqrt{(x+2)(4-x)}, \quad x \in [-2, 4] \\
 & \left(\frac{f}{g}\right)(x)=\frac{f(x)}{g(x)}=\frac{\sqrt{x+2}}{\sqrt{4-x}}, \quad x \in [-2, 4]
 \end{aligned}$$

$$\begin{aligned}
 2. \quad & (f \circ g)(2)=1 \quad (f \circ g)(4)=2 \\
 & (g \circ f)(1)=3 \quad (g \circ f)(3)=4
 \end{aligned}$$

3. 略

$$4. (1) (f \circ g)(x)=\sqrt{7x^2+5}, (g \circ f)(x)=\sqrt{7x^2+29}$$

$$(2) (f \circ g)(x)=\frac{18x^4+24x^2+11}{9x^4+12x^2+4}, (g \circ f)(x)=\frac{1}{27x^4+36x^2+14}$$

$$(3) (f \circ g)(x)=x, (g \circ f)(x)=x$$

$$5. g^3(x)=x^6+3x^4+3x^2+1, (g \circ g \circ g)(x)=x^8+4x^6+8x^4+8x^2+5$$

$$6. g(x)=x^2+x-1$$

$$7. (1) f(x)=\sqrt{x}, g(x)=x^2+x-1 \quad (2) f(x)=x^2, g(x)=1-\frac{1}{x^2}$$

$$(3) f(x)=\sqrt[3]{x}, g(x)=2-3x \quad (4) f(x)=\sqrt[3]{x}, g(x)=\sqrt{x}-1$$

$$8. \text{略} \quad 9. (1) 225 \quad (2) 7 \quad 10. \text{略} \quad 11. p=-1 \quad 12. \text{略}$$

➡ 習題 0-7

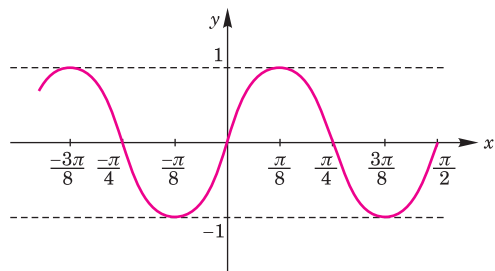
$$1. \text{略} \quad 2. \text{略} \quad 3. f^{-1}(x)=\sqrt{6-x}, 0 \leq x \leq 6 \quad 4. f^{-1}(x)=\sqrt[3]{\frac{x+5}{2}}$$

$$5. f^{-1}(x)=\frac{\sqrt{1-x^2}}{2}, 0 \leq x \leq 1 \quad 6. f^{-1}(x)=(x-2)^3 \quad 7. y=f^{-1}(x)=\frac{3x^2+1}{x^2}$$

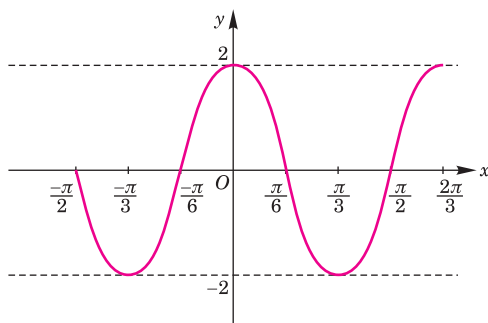
$$8. \text{略} \quad 9. \text{略} \quad 10. \text{略} \quad 11. x=10$$

➔ 習題 0-8

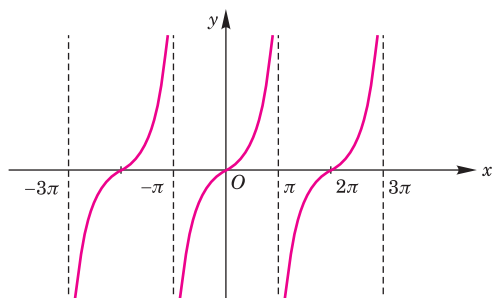
1. (1)



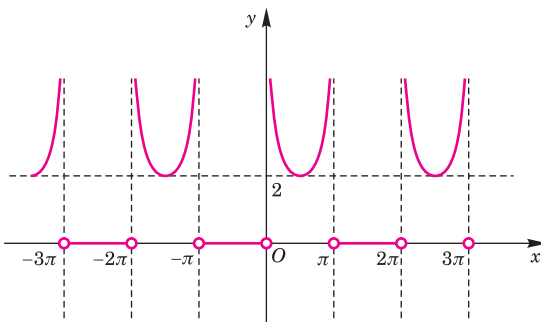
(2)



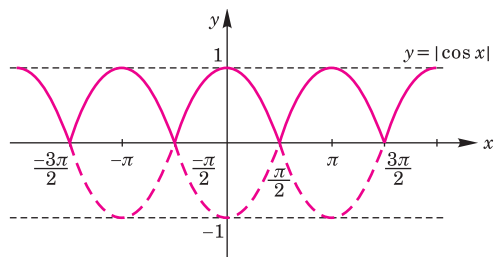
(3)



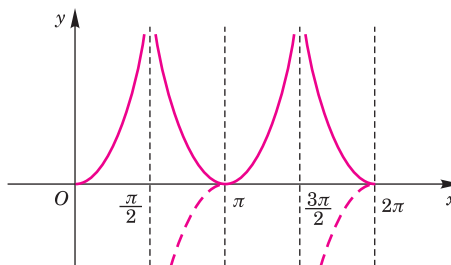
(4)



(5)



(6)



2. (1) $y = \sin \frac{x}{2}$ 的週期為 4π (2) $y = \tan 2x$ 的週期為 $\frac{\pi}{2}$

(3) $y = |\tan 3x|$ 的週期為 $\frac{\pi}{3}$ (4) $y = |\csc 2x|$ 的週期為 $\frac{\pi}{2}$

(5) $y = \sin^2 x$ 之週期為 π (6) $p = \frac{2\pi}{3}$ (7) $p = \pi$

➔ 習題 0-9

1. (1) $\sin^{-1}\left(-\frac{1}{2}\right) = -\frac{\pi}{6}$ (2) $\sin\left(\sin^{-1}\frac{2}{3}\right) = \frac{2}{3}$ (3) $\frac{\pi}{3}$ (4) $\sqrt{3}$

(5) $\cos\left(\sin^{-1}\frac{4}{5}\right) = \frac{3}{5}$ (6) $\frac{24}{25}$ (7) $-\frac{56}{65}$ (8) $-\frac{24}{25}$

$$(9) \frac{\pi}{4} \quad (10) -4\sqrt{5} \quad (11) \frac{5\pi}{6}$$

$$2. (1) \sqrt{1-x^2} \quad (2) \frac{\sqrt{1-x^2}}{x} \quad (3) \frac{1-x^2}{1+x^2} \quad (4) \frac{x}{\sqrt{1+x^2}}$$

$$(5) \frac{x}{\sqrt{1-x^2}} \quad (6) \frac{\sqrt{x^2-1}}{x} \quad (7) 2x\sqrt{1-x^2}$$

$$3. (1) D_f = \left[-\frac{1}{3}, \frac{1}{3}\right], R_f = \left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$$

$$(2) D_f = [0, 2], R_f = \left[-\frac{\pi}{6}, \frac{\pi}{6}\right]$$

$$(3) D_f = [1, 3], R_f = \left[-\frac{3\pi}{10}, \frac{3\pi}{10}\right]$$

$$(4) D_f = [-2, 2], R_f = [0, \pi]$$

$$(5) D_f = \left[-\frac{1}{2}, \frac{3}{2}\right], R_f = [0, \pi]$$

$$(6) D_f = [0, \infty), R_f = \left[0, \frac{\pi}{2}\right)$$

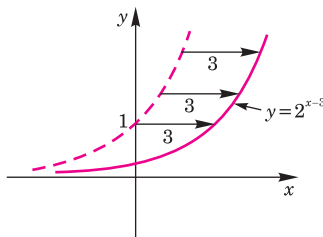
$$(7) D_f = (-\infty, \infty), R_f = (0, \sqrt{\pi})$$

4. 略

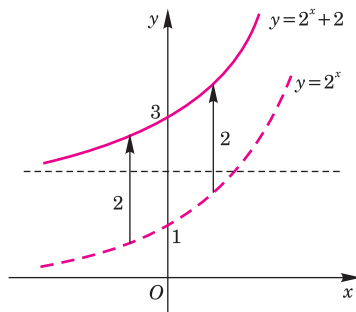
► 習題 0-10

$$1. (1) x = \frac{1}{3}(\ln 2 + 4) \quad (2) x = \ln(\ln 10) \quad (3) x = \ln 3 \text{ 或 } x = \ln 4$$

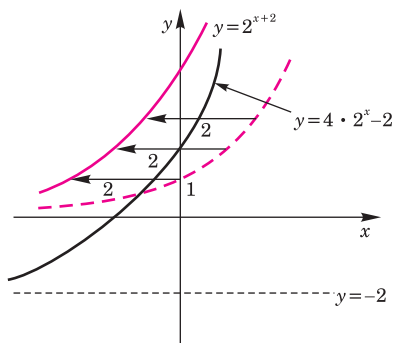
2. (1)



(2)



(3)



3. (1) $y=f(x)=\log_{10}(\log_2 x)$ (2) $y=(\ln x)^2$ (3) $y=\log_{10}\left(\frac{x}{1-x}\right)$ (4) $y=\ln\left(\frac{x-1}{x+1}\right)$

→ 習題 0-11

1. (1) $x(x-1)$ (2) $\frac{3}{x}$ (3) $2(\ln x - x)$ (4) $3x$

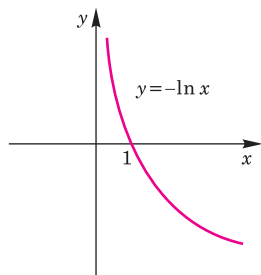
2. (1) $D_f=(-\infty, 1)$, $R_f=\mathbb{R}$ (2) $D_g=(-2, 2)$, $R_g=(-\infty, \ln 4]$

(3) $D_F=(1, \infty)$, $R_F=\mathbb{R}$ (4) $D_G=(-1, 0) \cup (1, \infty)$, $R_G=\mathbb{R}$

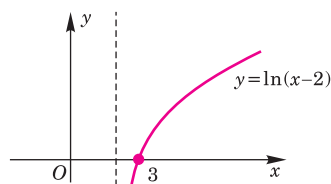
3. (1) $y=f^{-1}(x)=e^x-3$ (2) $y=f^{-1}(x)=e^{\sqrt{x}}$

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

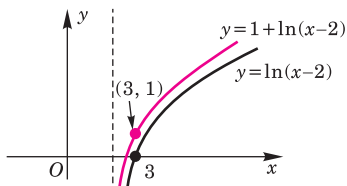
5. (1)



(2)



(3)



→ 習題 1-1

1. $\frac{1}{3}$

2. 不存在 $(-\infty)$

3. $\frac{1}{2}$

4. 略

5. 略

6. 略

7. 略

8. 略

9. 略

10. 略

11. 略

12. 略

13. 略

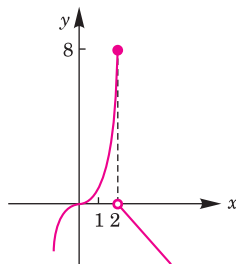
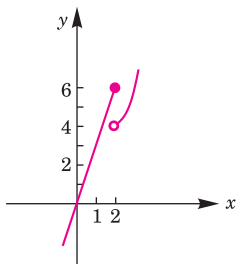
14. 略

➡ 習題 1-2

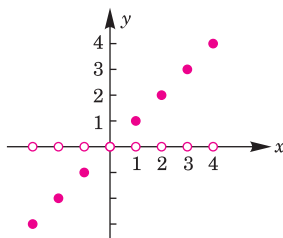
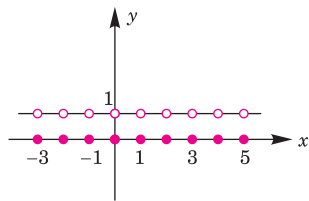
1. -64 2. $\frac{1}{8}$ 3. $\frac{4}{3}$ 4. 108 5. -3 6. -2 7. n 8. $-\frac{1}{2}$
 9. $\frac{1}{108}$ 10. $\frac{1}{2}$ 11. $\frac{2}{3} a^{-2/3}$ 12. 0 13. $-\frac{\sqrt{6}}{12}$ 14. $\frac{1}{4}$ 15. $\frac{n(n+1)}{2}$
 16. -1 17. 0 18. 略 19. 略 20. 略 21. $\frac{1}{n!}$ 22. $a=\frac{1}{2}, b=-\frac{3}{8}$

➡ 習題 1-3

1. 6 2. 6 3. -6 4. -1 5. $\frac{1}{\sqrt{2a}}$ 6. 0 7. 0 8. 1
 9. 0 10. -1 11. 不存在 12. 0 13. 0 14. -1 15. 略
 16. $\lim_{x \rightarrow 2^+} f(x)=4, \lim_{x \rightarrow 2^-} f(x)=6$ 17. $\lim_{x \rightarrow 2^+} f(x)=0, \lim_{x \rightarrow 2^-} f(x)=8$



18. 不存在, 32 19. 不存在
 20. $\lim_{x \rightarrow n^+} f(x)=1, \lim_{x \rightarrow n^-} f(x)=1$ 21. $\lim_{x \rightarrow n^+} f(x)=0, \lim_{x \rightarrow n^-} f(x)=0$ 22. 3



➡ 習題 1-4

1. $\left\{x \mid x \neq -1, x \neq \frac{3}{2}\right\}$ 2. $(0, \infty)$ 3. $(-\infty, -1) \cup (1, \infty)$ 4. $(-1, 1)$
 5. $\{x \mid x \neq -9\}$ 6. $\mathbb{R}$ 7. $x \neq 1$ 時連續 8. $\{x \mid x \neq n, n \text{ 為整數}\}$
 9. 1, 2 10. $c=-2, d=-6$ 11. $\left(\frac{5}{\sqrt{5}+1}\right)^{3/2}$ 12. $\frac{8}{5}$ 13. $\frac{\sqrt{5}}{2} \pi$
 14. 0 15. 1 16. $\frac{\pi}{6}$ 17. $\frac{\pi}{6}$ 18. 1 19. 0 20. 1 21. 1

22. $\frac{\sqrt{2}}{2}$ 23. 0 24. $\frac{1}{2}$ 25. (1) -3 (2) -1
 26. 在 $x=-3$ 不連續, 在 $x=0$ 為連續, 在 $x=3$ 為連續 27. $x=\frac{1}{2}$ 28. 略 29. 略
 30. 是 31. 略 32. 略 33. 略 34. 略 35. 略 36. 略 37. 略 38. 略

➡ 習題 1-5

1. $\frac{3}{5}$ 2. 0 3. $\sqrt[3]{\frac{3}{2}}$ 4. $\frac{1}{2}$ 5. $\frac{\sqrt{6}}{6}$ 6. $\sqrt{3}$ 7. $\sqrt{3}$ 8. 4
 9. $\frac{1}{2}$ 10. $\frac{a}{2}$ 11. $\frac{a-b}{2}$ 12. -1 13. $\frac{1}{2}$ 14. -3 15. 0
 16. 0 17. 0 18. 1 19. $\frac{\pi}{2}$ 20. 2 21. -1 22. 0
 23. $\frac{\pi}{6}$ 24. 0 25. $-\frac{\pi}{2}$ 26. -1 27. 1 28. 0
 29. 垂直漸近線: $x=-2$, 水平漸近線: $y=0$
 30. 垂直漸近線: $x=1$, $x=-1$, 水平漸近線: $y=2$
 31. 垂直漸近線: $x=\sqrt{2}$, $x=-\sqrt{2}$, 水平漸近線: $y=0$
 32. 無垂直漸近線, 水平漸近線: $y=1$ 33. 水平漸近線: $y=2$, $y=-2$
 34. 垂直漸近線: $x=2$, 斜漸近線: $y=2x+3$
 35. 垂直漸近線: $x=0$, 斜漸近線: $y=-\frac{1}{2}x$ 36. 斜漸近線: $y=x$
 37. $x=n\pi$ ($n \in \mathbb{Z}$) 均為 $y=\csc x$ 圖形之垂直漸近線
 38. $y=\pi$ 或 $y=0$ (x -軸) 為 $y=\cot^{-1}\left(\frac{x}{2}\right)$ 圖形之水平漸近線
 39. $x=5$ 為 $y=\ln(x-5)$ 圖形之垂直漸近線
 40. $y=0$ 或 $y=\pi$ 為 $y=\csc^{-1} x$ 圖形之水平漸近線
 41. $y=4$ 為 $y=4-2^x$ 圖形之水平漸近線
 42. $y=-1$ 為 $y=\frac{1}{2}e^{-x}-1$ 圖形之水平漸近線
 43. $y=2$ 為函數圖形之水平漸近線
 44. 略 45. $a=1$, $b=\frac{1}{2}$, $c=-\frac{1}{8}$ 46. $a=1$, $b=-\frac{1}{2}$

第 2 章

➡ 習題 2-1

1. $\frac{1}{4}$ 2. $-\frac{1}{2}$ 3. 切線方程式: $5x-y-8=0$, 法線方程式: $x+5y-12=0$
 4. 切線方程式: $x-4y+4=0$, 法線方程式: $4x+y-18=0$

5. 切線方程式： $2x+y-3=0$ ，法線方程式： $x-2y+1=0$
 6. 切線方程式： $2\sqrt{2}x+2y-3\sqrt{2}=0$ ，法線方程式： $2x-2\sqrt{2}y+3=0$
 7. 切線方程式為 $2x+y-2=0$ ，法線方程式為 $2x-4y+3=0$
 8. $\left(\frac{5}{4}, \frac{1}{2}\right)$ 9. $f(a)-af'(a)$ 10. $5f'(a)$ 11. 1 12. $f'(x)=2x$, f' 之定義域為 $\mathbb{R}$
 13. $f'(x)=-\frac{1}{(x-1)^2}$, f' 之定義域為 $\{x|x \neq 1\}$
 14. $f'(x)=\frac{-1}{2\sqrt{4-x}}$, f' 之定義域為 $(-\infty, 4)$
 15. $f'(x)=-\frac{1}{2x\sqrt{x}}$, f' 之定義域為 $(0, \infty)$
 16. $f'(x)=14x$, f' 之定義域為 $\mathbb{R}$
 17. $f'(x)=\frac{-1}{(x-2)^2}$, f' 之定義域為 $\{x|x \neq 2\}$
 18. 略 19. 略 20. 不可微分 21. 可微分 22. 略 23. 略
 24. 0 25. $a=1, b=-1$ 26. 略 27. 0 28. 略

➡ 習題 2-2

1. $18x^2-10x+1$ 2. $10x^4+15x^2-28x+3$ 3. $-\frac{3}{2\sqrt{x+1}\sqrt{(x-2)^3}}$
 4. $-\frac{2(4t^2+15t-27)}{(t^2-2t+3)^2}$ 5. $-\frac{1+2x+3x^2}{(1+x+x^2+x^3)^2}$ 6. $\frac{x(x^2+6)}{(x^2+4)^{3/2}}$
 7. $(1+x)(2+x^2)^{1/2}(3+x^3)^{1/3}\left(\frac{1}{1+x}+\frac{x}{2+x^2}+\frac{x^2}{3+x^3}\right)$
 8. $72z^5+60z^4-64z^3-66z^2-82z-42$ 9. $(x^2+1)^3(9x^2+1)$
 10. $6\left(\frac{3x^2-1}{2x+1}\right)^2\frac{3x^2+3x+1}{(2x+1)^2}$ 11. $6(5x^2-4x+1)^5(10x-4)$ 12. 2
 13. $\frac{dy}{dx}=\begin{cases} -2, & \text{若 } x < -1 \\ 0, & \text{若 } -1 < x < 5 \\ 2, & \text{若 } x > 5 \end{cases}$ 14. $a=-3, b=2, c=1$
 15. 略 16. $a=2, b=-1$ 17. $g'(x)=\begin{cases} \frac{2}{3}(2x)^{-2/3}, & x > 0 \\ \text{不存在}, & x = 0 \\ 0, & x < 0 \end{cases}$
 18. $40x-16y-99=0$ 19. $2x+y+7=0, x-2y+1=0$ 20. $\left(\frac{1}{2}, \frac{17}{4}\right)$

21. $(0, 2)$, $(1, 1)$ 與 $(-1, 1)$ 有水平切線

22. 當 $x=0$ 時 $f'(x)=0$; 當 $x=\pm 1$ 時, $f'(x)$ 不存在

23. $2 - \frac{2x+1}{\sqrt{x^2+x}}$ 24. $2x+y-9=0$ 或 $2x-y+1=0$ 25. 1 26. $2\sqrt{5}$

27. (1) $\frac{dy}{dx} = -2x^{-3}$, $\frac{d^2y}{dx^2} = \frac{6}{x^4}$

(2) $\frac{dy}{dx} = \frac{2\sqrt{x}-1}{2\sqrt{x}}$, $\frac{d^2y}{dx^2} = \frac{1}{4x^{3/2}}$

(3) $\frac{dy}{dx} = \frac{3(1+\sqrt{x})^2}{2\sqrt{x}}$, $\frac{d^2y}{dx^2} = \frac{3(x-1)}{4x^{3/2}}$

(4) $\frac{dy}{dx} = 4(3x-2)^{1/3}$, $\frac{d^2y}{dx^2} = 4(3x-2)^{-2/3}$

(5) $\frac{dy}{dx} = 2x + \frac{1}{2}(x+1)^{-1/2}$, $\frac{d^2y}{dx^2} = 2 - \frac{1}{4}(x+1)^{-3/2}$

28. $f''(2) = -\frac{4}{125}$ 29. $2(-1)^n n!(1+x)^{-n-1}$

30. $f^{(n)}(x) = (-1)^{n-1} 2^{-n} 1 \cdot 3 \cdot 5 \cdots (2n-3) x^{\frac{1}{2}-n}$, $n \geq 2$ 且 $n \in \mathbb{Z}$

31. $f^{(n)}(x) = (n+1)!(1-x)^{-(n+2)}$ 32. 略

33. $f'(x) = \begin{cases} 2x, & \text{若 } x \leq 1 \\ 2, & \text{若 } x > 1 \end{cases}$ $f''(x) = \begin{cases} 2, & \text{若 } x < 1 \\ 0, & \text{若 } x > 1 \end{cases}$

34. 切線方程式為 $24x - y - 45 = 0$; 法線方程式為 $x + 24y - 74 = 0$

35. $56(2)^6$ 36. 略 37. 略 38. 略 39. $f''(x) = \begin{cases} 2, & \text{若 } x < 0 \text{ 或 } x > 1 \\ -2, & \text{若 } 0 < x < 1 \end{cases}$

→ 習題 2-3

1. (1) $r'(8) = \frac{1}{4\sqrt[3]{4}}$ 厘米/分 (2) $V'(8) = 36\pi$ 立方厘米/分

(3) $S'(8) = 6\sqrt[3]{4}\pi$ 平方厘米/分

2. $V'(5) = -\frac{8}{5}$ 立方厘米/分

3. t 秒末的速度為 $v(t) = s'(t) = 144 - 32t$ 呎/秒; 加速度為 $a(t) = v'(t) = -32$ 呎/秒². 3 秒末的速度為 $v(3) = 48$ 呎/秒; 加速度為 $a(3) = -32$ 呎/秒² 最大高度為 324 呎, 砲彈在 9 秒後撞擊地面 4. 10 吋/秒, 20 吋/秒, 2.8 秒

5. 加速度為 $a(2) = -6$ 米/秒², $a(3) = 6$ 米/秒², 速度為 $v\left(\frac{10}{3}\right) = \frac{44}{3}$ 米/秒

6. -0.12 單位/呎 7. 略 8. 略 9. $\frac{9}{5}$ 10. 1115.67 元

$$11. \frac{dq}{dp} = -\frac{q^2}{p^2} \quad 12. \frac{dR}{dt} = 0.096 \text{ 歐姆/秒} \quad 13. -\frac{1}{4\pi} \frac{1}{C\sqrt{LC}}$$

$$14. 50.3 \text{ (安培)} \quad 15. 8 \text{ (安培)}, t=4 \text{ 秒}$$

► 習題 2-4

$$1. 20x - y - 19 = 0 \quad 2. mv \frac{dv}{dt} \quad 3. 15 \quad 4. \text{略} \quad 5. 1 \quad 6. \frac{8x^2 - 6x + 1}{(2x - 1)}, x \neq \frac{1}{2}$$

$$7. 27 \quad 8. 16 \quad 9. \text{略} \quad 10. \text{略} \quad 11. \text{略} \quad 12. g''(h(x))(h'(x))^2 + g'(h(x))h''(x)$$

$$13. \frac{3x^2}{x^6 + 4x^3 + 5} \quad 14. -\frac{5}{2} \quad 15. (1) \text{略} \quad (2) f'(x) = \begin{cases} 2x-1, & \text{若 } x < 0 \text{ 或 } x > 1 \\ 1-2x, & \text{若 } 0 < x < 1 \end{cases}$$

$$16. f'(x) = \frac{1}{8\sqrt{1-\sqrt{2-\sqrt{3-x}}}\sqrt{2-\sqrt{3-x}}\sqrt{3-x}} \quad 17. 0$$

► 習題 2-5

$$1. \frac{dy}{dx} = \frac{1-2xy-2y^3}{x(x+6y^2)} \quad 2. \frac{dy}{dx} = -\frac{y^2}{x^2} \quad 3. \frac{dy}{dx} = -\sqrt{\frac{y}{x}}$$

$$4. \frac{dy}{dx} = \frac{y}{2\sqrt{xy}-x} \quad 5. \frac{1}{\sqrt{x}(3\sqrt{y}+2)} \quad 6. 3x+y-4=0 \quad 7. 2x+y-1=0 \quad 8. \text{略}$$

$$9. (1) \text{無窮多個隱函數} \quad (2) \text{僅有一個隱函數 } f(x)=0, \text{ 其定義為 } \{0\}.$$

$$10. \frac{d^2y}{dx^2} = -\frac{2x}{y^5} \quad 11. \frac{d^2y}{dx^2} = -\frac{3}{(y-x)^3} \quad 12. \frac{d^2y}{dx^2} = -\frac{36}{y^3} \quad 13. -6 \quad 14. \text{略}$$

$$15. \text{略} \quad 16. \text{略} \quad 17. \frac{ds}{dt} = -\frac{s^2+3t^2}{2st}; \frac{dt}{ds} = -\frac{2st}{s^2+3t^2} \quad 18. y = \pm \frac{\sqrt{3}}{3}x$$

$$19. \text{略} \quad 20. \text{略}$$

► 習題 2-6

$$1. \Delta y = (6x+5)\Delta x + 3(\Delta x)^2, dy = (6x+5)dx, dy - \Delta y = -3(\Delta x)^2$$

$$2. \Delta y = -\frac{\Delta x}{x(x+\Delta x)}, dy = -\frac{1}{x^2} dx, dy - \Delta y = -\frac{(\Delta x)^2}{x^2(x+\Delta x)}$$

$$3. \Delta y = 4x^3\Delta x + 6x^2(\Delta x)^2 + 4x(\Delta x)^3 + (\Delta x)^4, dy = 4x^3 dx, dy - \Delta y = -6x^2(\Delta x)^2 - 4x(\Delta x)^3 - (\Delta x)^4$$

$$4. \Delta y = \frac{-2x(\Delta x) - (\Delta x)^2}{x^2(x+\Delta x)^2}, dy = -\frac{2}{x^3} dx, dy - \Delta y = \frac{-3x(\Delta x)^2 - 2(\Delta x)^3}{x^3(x+\Delta x)^2}$$

$$5. dy = (3x^2 - 6x + 2) dx, \Delta y \approx dy = -1.3 \quad 6. 2.9967 \quad 7. 253.44 \quad 8. 2.0117$$

$$9. L(x) = 1 + \frac{x}{3}, \sqrt[3]{0.95} \div 0.9833 \quad 10. 0.400733 \quad 11. (1) 1.01 \quad (2) 1.003$$

12. (1) ± 1875 立方厘米 (2) 邊長之百分誤差大約 $\pm 4\%$, 體積之百分誤差大約 $\pm 12\%$.
 13. 0.251 平方米 14. 0.236 立方厘米 15. 略 16. 略

➔ 習題 2-7

1. $\frac{1}{11}$ 2. $\frac{1}{8}$ 3. $\frac{1}{5}$ 4. $\frac{1}{9}$ 5. $x - 13y + 16 = 0$
 6. $\frac{1}{13}$ 7. $x - 12y - 12 = 0$ 8. $\frac{88}{7}$ 9. 略

第 3 章

➔ 習題 3-1

1. 極大值 7, 極小值 -20 2. 極大值 $\frac{\sqrt{2}}{4}$, 極小值 $-\frac{1}{3}$ 3. 極大值 $2\sqrt[3]{18}$, 極小值 0
 4. 極大值 17, 極小值 1 5. 極大值 18, 極小值 0 6. 極大值 2, 極小值 $-\frac{1}{4}$
 7. $p = -2$, $q = 4$; 極小值

➔ 習題 3-2

1. $c = \frac{2}{\sqrt{3}}$ 2. 略 3. 略 4. 略 5. 略 6. 略 7. 略 8. 略 9. $c = 3$
 10. $c = 1$ 11. $c = 2 - \sqrt{3}$ 12. $c = \frac{5}{4}$ 13. $c = 2\sqrt{3}$ 14. 略 15. 略
 16. 略 17. 2.00026 18. 略 18. 略 20. 略 21. 略 22. 略 23. 略

➔ 習題 3-3

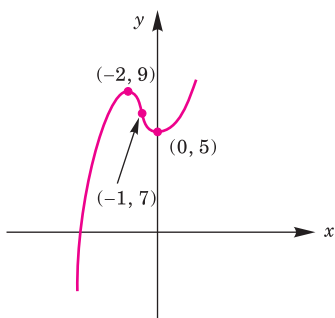
1. 略
 2. (1) 遞增區間: $(-\infty, -2]$ 與 $[0, \infty)$; 遞減區間: $[-2, 0]$
 (2) 遞增區間: $[-1, 1]$; 遞減區間: $(-\infty, -1]$ 與 $[1, \infty)$
 (3) 遞增區間: $[1, \infty)$; 遞減區間: $[0, 1]$
 (4) 遞增區間: $(-\infty, 1]$ 與 $[3, \infty)$; 遞減區間: $[1, 3]$
 3. 相對極大值 $1 + \frac{2}{3\sqrt{3}}$, 相對極小值 $1 - \frac{2}{3\sqrt{3}}$
 4. 相對極大值 1, 相對極小值 0 5. 相對極大值 $\frac{1}{2}$, 相對極小值 $-\frac{1}{2}$
 6. 相對極大值 $\frac{1}{4}$ 7. 相對極大值 $\frac{1}{2}$, 相對極小值 $-\frac{1}{2}$
 8. 相對極大值 -2 , 相對極小值 2 9. 相對極大值 4, 相對極小值 0
 10. $f(x) = \frac{1}{9}(2x^3 + 3x^2 - 12x + 7)$ 11. 略 12. 略

➡ 習題 3-4

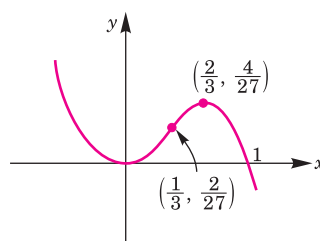
1. 相對極大值 1, 相對極小值 0 2. 相對極小值 0 3. 相對極小值 $-\frac{43}{16}$
4. 相對極大值 0, 相對極小值 -1 5. 相對極大值 0, 相對極小值 $-\frac{1}{4}$
6. 相對極小值 0, 相對極大值 4 7. 略 8. 略
9. 上凹區間: $\left(-\frac{\sqrt{15}}{15}, \frac{\sqrt{15}}{15}\right)$, 下凹區間: $\left(-\infty, -\frac{\sqrt{15}}{15}\right)$ 與 $\left(-\frac{\sqrt{15}}{15}, \infty\right)$;
反曲點: $\left(-\frac{\sqrt{15}}{15}, \frac{7}{8}\right)$ 與 $\left(\frac{\sqrt{15}}{15}, -\frac{7}{8}\right)$
10. 相對極大值 1, f 的圖形在 $\left(-\infty, -\frac{\sqrt{3}}{3}\right)$ 與 $\left(-\frac{\sqrt{3}}{3}, \infty\right)$ 皆為上凹, 而在 $\left(-\frac{\sqrt{3}}{3}, \frac{\sqrt{3}}{3}\right)$ 為下凹
11. 略 12. $a = \frac{39}{8}, b = \frac{13}{2}$ 13. f 為遞增 14. 略
15. 略 16. $a = 1, b = -3, c = 3$ 17. 略

➡ 習題 3-5

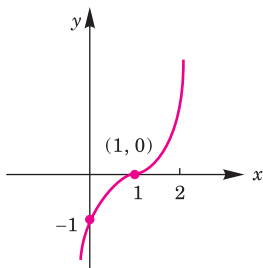
1.



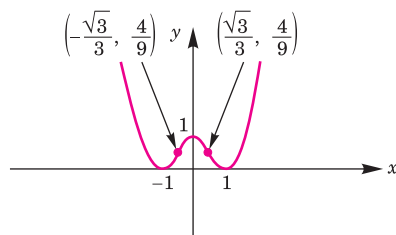
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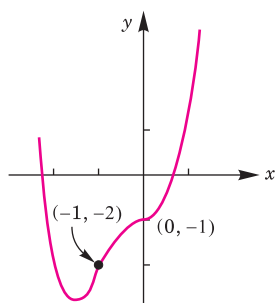
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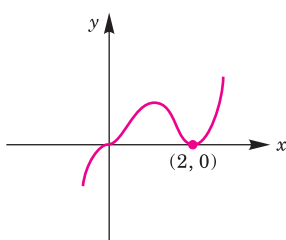
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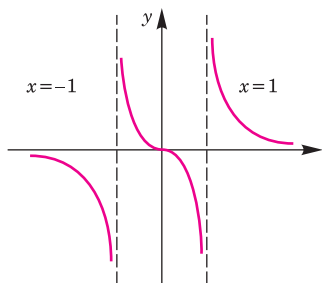
5.



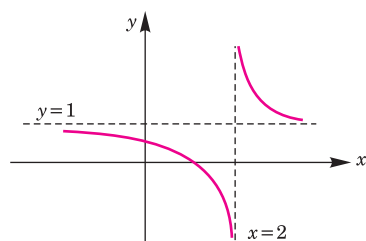
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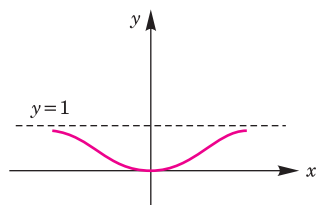
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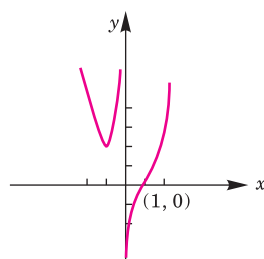
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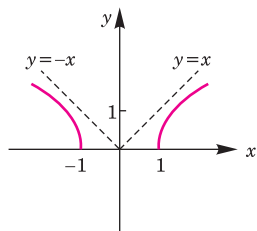
9.



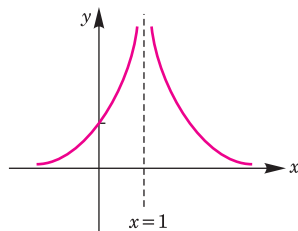
10.



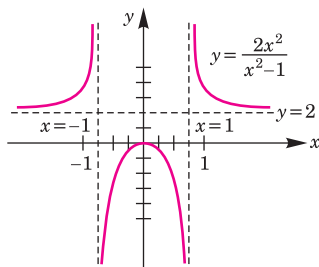
11.



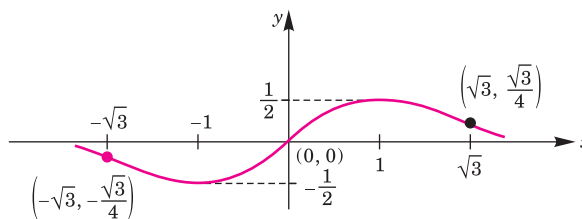
12.



13.



14.



➡ 習題 3-6

1. (1) 當 $x=1$ 時, y 為最小 (2) 當 $x=\frac{1}{2}$ 時, y 為最大
2. 截去邊長為 $\frac{10}{3}$ 吋的正方形時, 盒子有最大的體積 $V=\frac{19600}{27}$ 立方吋
3. 重籬笆的邊長 500 呎, 標準籬笆的邊長 750 呎 4. 略
5. 長與寬皆為 $\sqrt{2}r$ 6. $\sqrt{2}r$ 乘 $\frac{\sqrt{2}}{2}r$
7. 內圓錐之高為外圓錐高的 $\frac{1}{3}$ 8. 矩形的尺寸為 $\frac{8\sqrt{3}}{3} \times \frac{32}{3}$
9. 三角形的兩股分別為 $10\sqrt{2}$ 與 $10\sqrt{2}$ 10. $\sqrt{2}a$ 乘 $\sqrt{2}b$
11. (1) 7000 單位 (2) 是 12. 底半徑 $=\frac{\sqrt{6}}{3}L$, 高 $=\frac{\sqrt{3}}{3}L$
13. 底半徑 $=\frac{\sqrt{6}}{3}r$, 高 $=\frac{2\sqrt{3}}{3}r$ 14. 底半徑 $=\sqrt{\frac{5+\sqrt{5}}{10}}r$, 高 $=2\sqrt{\frac{5-\sqrt{5}}{10}}r$
15. $\frac{2\sqrt{3}}{27}\pi r^3$ 16. 略 17. (1) $M=\frac{3}{4}$ (2) $m=\frac{3}{16}$ 18. 底半徑 $=\frac{2\sqrt{2}}{3}r$, 高 $=\frac{4}{3}r$
19. 20 與 -20 20. 兩正數皆為 20 21. $\frac{p}{3}$ 乘 $\frac{p}{6}$ 體積最大
22. $r=\frac{p}{4+\pi}$ 時, 面積最大 23. 底半徑 $=\sqrt[6]{\frac{450}{\pi^2}}$ 吋, 高 $=\frac{30}{\pi}\sqrt[3]{\frac{\pi^2}{450}}$ 吋
24. 點 $(\sqrt{2}, 1)$ 與點 $(-\sqrt{2}, 1)$ 25. 斜率為 -3
26. 底半徑 $=\sqrt{2}r$, 高 $=4r$ 27. 37 棵 28. 330 元 29. 略

➔ 習題 3-7

1. (1) $\frac{dA}{dt} = 2\pi r \frac{dr}{dt}$ (2) 20π 平方吋/秒
2. (1) $\frac{dv}{dt} = \pi \left(r^2 \frac{dh}{dt} + 2rh \frac{dr}{dt} \right)$ (2) -20π 立方吋/秒, 減少
3. $\frac{5}{6}$ 呎/秒 4. (1) $\frac{d\ell}{dt} = -\frac{1}{\ell} \left(x \frac{dx}{dt} + y \frac{dy}{dt} \right)$ (2) $\frac{1}{10}$ 呎/秒, 增加
5. 180π 平方呎/秒 6. $\frac{8}{9\pi}$ 呎/分 7. 125π 立方呎/分
8. (1) $\frac{3}{2}$ 呎/秒 (2) 以 $\frac{9}{2}$ 呎/秒的速率向街燈靠近
9. $-\frac{172}{17}$ 哩/時 (負號表示兩船在下午 1 點 30 分時的距離為遞減)
10. -7.59 呎/秒 11. $\frac{2}{9\pi}$ 厘米/秒
12. 體積以 3.214 立方厘米/秒之速率減小 13. 水面以約 0.0380 呎/分之速率上升
14. 0.02 歐姆/秒 15. 4.5 公分/秒, 離開

➔ 習題 3-8

1. 2.6458 2. 1.2599 3. 1.24573 4. 0.5641 5. 1.1640

第 4 章

➔ 習題 4-1

1. $\frac{38}{3}$ 2. 18 3. $\frac{628}{3}$ 4. $\frac{19}{4}$ 5. 略

➔ 習題 4-2

1. $-\frac{279}{32}$ 2. $\int_{-4}^{-3} (\sqrt[3]{x} + 2x) dx$ 3. $\int_0^1 \frac{1}{1+x^2} dx$ 4. $\int_1^3 (3x^5 - 6) dx$
5. $\pi + 2$ 6. $\frac{13}{2}$ 7. 略 8. 90 9. $\frac{4}{3}$
10. $\frac{b^4}{4} + 2b^2$ 11. $-\frac{3}{4}$ 12. 略

➔ 習題 4-3

1. 略 2. 12 3. $5 - \sqrt{2} - \sqrt{3}$ 4. -5 5. 略 6. (1) $c = \frac{196}{81}$ (2) $c = \frac{7+2\sqrt{10}}{3}$

➡ 習題 4-4

1. $2x^3 - 2x^2 + 3x + C$ 2. $2x\sqrt{x} + 4\sqrt{x} + C$ 3. $\frac{1}{3}x^3 - 2x - \frac{1}{x} + C$
 4. $\frac{1}{3}x^3 + \frac{5}{2}x^2 + x + C$ 5. $\frac{1}{15}(x^3 - 1)^5 + C$ 6. $\frac{2}{9}(5x^3 + 3x - 2)^{3/2} + C$
 7. $\frac{3}{2}\sqrt{2x^2 + 5} + C$ 8. $\frac{2}{3}(\sqrt{x} + 3)^3 + C$ 9. $-\frac{1}{3(x^3 - 1)} + C$
 10. $-\frac{1}{4}\left(1 + \frac{1}{x}\right)^4 + C$ 11. $\frac{-2}{1 + \sqrt{x}} + C$ 12. $-\frac{2}{9}\left(1 + \frac{1}{x^3}\right)^{3/2} + C$
 13. $\frac{3}{4}x\sqrt[3]{x} + \frac{5}{4}$ 14. 略 15. $\frac{x^3}{\sqrt{2x+5}}$ 16. 略

➡ 習題 4-5

1. $f(x) = \frac{1}{168}(1 + 2x)^7 - \frac{x}{12} - \frac{1}{168}$
 2. (1) $y = \frac{2}{3}(3x^2 + 4)^{1/2} + \frac{1}{3}$ (2) $y = \sqrt{6 - \frac{2}{x}}$ (3) $y = \left(\frac{1}{3}x^{3/2} + 2\right)^2$
 (4) $y = (3x^{1/2} + 2)^{2/3}$ (5) $y = \left(\frac{1}{4}x^2 + \frac{1}{2}x + \frac{1}{4}\right)^2$
 3. $y = x^3 - 6x + 7$
 4. $y = \frac{7}{3} - \frac{1}{3}(2 - x^2)^{3/2}$ 5. $(x + 1)^2 - (y - 1)^2 = 4$ 6. $(x - 5)^2 + (y - 3)^2 = 25$
 7. 49 呎 8. 40 呎/秒 9. 25 呎/秒² 10. $s(t) = t^2$ 呎, 初速需 15 呎/秒
 11. $F = \frac{9}{5}C + 32$ 12. $T = \frac{1}{8}t^2 + 10t + 5$ 13. 4 庫侖
 14. (1) 5 秒 (2) 272.5 米 (3) 10 秒 (4) -49 米/秒 (5) 大約 12.46 秒 (6) 73.1 米/秒

➡ 習題 4-6

1. $\frac{229}{12}$ 2. $\frac{56}{3}$ 3. $3\left(\sqrt[3]{2} + \frac{19}{4}\right)$ 4. $\frac{136}{3}$ 5. 1 6. 11 7. $\frac{9}{2}$
 8. $2x\sqrt[3]{1+x^8}$ 9. $\frac{3x^2}{1+x^9} - \frac{2x}{1+x^6}$ 10. $F''(2) = \frac{2\sqrt{1+2^8}}{2} = \sqrt{257}$
 11. 相對極大值 $2\sqrt{2}$, 相對極小值 $-2\sqrt{2}$
 12. (1) $x = 3$ (2) $[3, \infty), (-\infty, 3]$ (3) $(-\infty, -1), (7, \infty)$ 下凹; $(-1, 7)$ 上凹

13. $\frac{20}{3}$ 14. $\frac{2}{3}$ 15. $\frac{16}{3}$

→ 習題 4-7

1. $-\frac{1}{3(x^3-1)}+C$ 2. $\frac{-2}{1+\sqrt{x}}+C$
 3. $\frac{1}{20}(2x-1)^{5/2}+\frac{1}{6}(2x-1)^{3/2}-\frac{3}{4}(2x-1)^{1/2}+C$ 4. $\frac{3}{7}(x+2)^{7/3}-\frac{3}{2}(x+2)^{4/3}+C$
 5. $-\frac{9}{4}(1-\sqrt[3]{x})^{4/3}+C$ 6. $-\frac{2}{9}\left(\frac{x^3+1}{x^3}\right)^{3/2}+C$ 7. $-\frac{3}{8}(1-2x^2)^{2/3}+C$
 8. $\frac{4}{9}(4+x\sqrt{x})^{3/2}+C$ 9. $\frac{2}{9}\left(x-\frac{4}{3}\right)\sqrt{3x+2}+C$ 10. $\frac{1}{5}\left(x+\frac{8}{3}\right)(2x-3)^{3/2}+C$
 11. $\frac{x}{\sqrt{2x+1}}+C$ 12. $\frac{16-8\sqrt{2}}{3}$ 13. $\frac{28}{3}$ 14. $\frac{1}{12}(16\sqrt{2}-5\sqrt{5})$
 15. $\frac{28}{3}$ 16. 0 17. 0 18. 略 19. (1) 略 (2) $\frac{3}{2}$ 20. 略

第 5 章

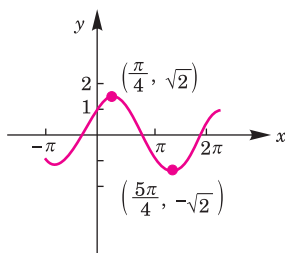
→ 習題 5-1

1. $\frac{\pi}{2}$ 2. $\frac{1}{3}$ 3. 1 4. 2 5. $2\cos a$ 6. $\frac{a}{b}$ 7. $\frac{1}{4}$ 8. $\cos a$
 9. $\frac{5}{4}$ 10. 1 11. 0 12. $\frac{1}{2}$ 13. $\frac{1}{3}$ 14. 1 15. -1 16. $-\frac{2}{3}$
 17. 1 18. 2 19. 2 20. 0 21. 0 22. $\frac{2}{\pi}$ 23. $\frac{3}{8}$ 24. 略
 25. (1) f 在點 $x=0$ 不連續 (2) 重新定義 $f(0)=2$

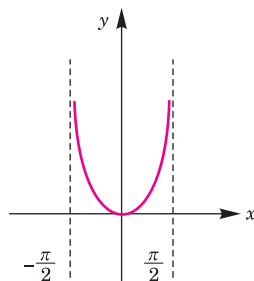
→ 習題 5-2

1. $\sin x(2-3\sin^2 x)$ 2. $-\frac{x+\sin x \cos x}{x^2 \sin^2 x}$ 3. $\frac{\sec x(2\tan x-1)}{(2+\tan x)^2}$
 4. $-\frac{\csc \sqrt{x}}{2\sqrt{x}}(1+2\cot^2 \sqrt{x})$ 5. $\frac{\sin x+\cos x-1}{(1-\sin x)^2}$ 6. $\frac{1}{2}\left(\frac{\cos \sqrt{x}}{\sqrt{x}}+\frac{\cos x}{\sqrt{\sin x}}\right)$
 7. $-8x \cos^3(\sin x^2) \sin(\sin x^2)(\cos x^2)$ 8. $-\frac{\sin \sqrt{x}}{4\sqrt{x}\sqrt{\cos \sqrt{x}}}$

9. $\frac{1}{2} \sin 2x + x \cos 2x$ 10. $2x \sin x + x^2 \cos x$ 11. $\frac{\sin(x-y) + y \cos x}{\sin(x-y) - \sin x}$
12. $\frac{y \sin x - \cos y}{\cos x - x \sin y}$ 13. $\frac{\sin y}{2 \sin 2y - x \cos y - \sin y}$ 14. $-\frac{y}{x}$ 15. 0.5151
16. 0.90966 17. 0.04 18. (1) 連續 (2) 可微分
19. 切線方程式: $6\sqrt{3}x + 2y - \sqrt{3}\pi - 2 = 0$, 法線方程式: $6\sqrt{3}x - 54y - \sqrt{3}\pi + 54 = 0$
20. $x - 3y + 3 = 0$ 21. $x + 2y = 0$ 22. 極大值 $\sqrt{2}$, 極小值 -1
23. 極大值 2, 極小值 $\sqrt{3}$ 24. 極大值 $\frac{5}{4}$, 極小值 -1 25. 略 26. 略
27. 略 28. 略 29. 略 30. 略 31. $\frac{2x \cos x^2}{1 + \sin^2 x^2}$ 32. $f'\left(\frac{\pi}{2}\right) = -1$
33. $f(4) = \frac{1}{4}$ 34. 略 35. 略 36. 略 37. $\pm \frac{\pi}{180}$ 平方厘米
38. 相對極小值 $\tan 1$ 39. 相對極大值 $\frac{\sqrt{3}}{3}$, 相對極小值 $-\frac{\sqrt{3}}{3}$
40. 相對極大值 1, 相對極小值 0
- 41.



42.



43. 略 44. 略 45. 在 $x = \pi$ 處 46. 略 47. 略 48. 8000π 呎/分
49. 2.988 50. 0.877 51. 4.493 52. 振幅 = 1, 頻率 = $\frac{4}{\pi}$
53. 振幅 = 1, 週期 = π

➔ 習題 5-3

1. (1) $x - \frac{1}{2} \cos 2x + C$ (2) $-\cos 2x + C$ 2. $\cos x + 1$ 3. $\frac{1}{6} x^3 - \cos x + 2x + 2$
4. (1) $2\sqrt{1 + \tan x} + C$ (2) $\tan x + \sec x + C$ (3) $x + \cos x + C$ (4) 3
- (5) $-2 \cos \sqrt{x} + C$ (6) $\frac{1}{3} \left[1 - \left(\frac{1}{2} \right)^{3/2} \right]$ (7) $-2\sqrt{2 - \tan x} + C$ (8) 0 (9) 0
- (10) $-\frac{5}{18} \left(\tan \left(\frac{1}{x^3} + 1 \right) \right)^{6/5} + C$ (11) $2 - \sqrt{2}$

5. $\frac{\sqrt{2}+4}{9\pi}$ 6. $-\frac{4}{\pi}$ 7. 2 8. 2 9. $\sin 3$ 10. (1) 略 (2) $\frac{\pi}{5}$
 11. 略 12. $\frac{\pi}{4}$ 13. (1) 8 (2) 8 (3) 0 14. 0

➡ 習題 5-4

1. $\frac{\sqrt{1-x^2} \sin^{-1} x - x}{\sqrt{1-x^2} (\sin^{-1} x)^2}$ 2. $-\frac{9(1+\cos^{-1} 3x)^2}{\sqrt{1-9x^2}}$ 3. $-\frac{1}{x^2+1}$
 4. $\begin{cases} 1, & \text{若 } \sin x > 0 \\ -1, & \text{若 } \sin x < 0 \end{cases}$ 5. $-\frac{1}{2(1+x^2)\sqrt{\cot^{-1} x}}$ 6. $\frac{x}{(x^2-1)\sqrt{x^2-2}}$
 7. $\tan^{-1} \sqrt{x} + \frac{\sqrt{x}}{2(1+x)}$ 8. $\frac{x \sec^{-1} \sqrt{x} + 1}{x\sqrt{x-1}}$ 9. $\frac{2 \cos 2x}{1+\sin^2 2x}$ 10. $\frac{1}{2x\sqrt{\sec^{-1} 3x}\sqrt{9x^2-1}}$
 11. -1 12. $3x^2 \sin^{-1} x + \frac{x^3}{\sqrt{1-x^2}} - \frac{1}{2\sqrt{x}\sqrt{1-x}}$, $0 < x < 1$
 13. $\frac{-1}{\sqrt{2 \sin^2 x + 2 \sin x}}$ 14. $\frac{-1}{\sqrt{1-(\sin^{-1} x)^2} \sqrt{1-x^2}}$
 15. $4[\sin^{-1}(\tan^{-1} x)]^3 \frac{1}{\sqrt{1-(\tan^{-1} x)^2}} \frac{1}{1+x^2}$ 16. $-\frac{1}{x^2+1}$ 17. $(\cos^{-1} x)^2$
 18. $-\frac{6 \sin(2 \tan^{-1} 3x)}{1+9x^2}$ 19. 0 20. $\frac{y\sqrt{1-(x-y)^2} + \sqrt{1-x^2y^2}}{\sqrt{1-x^2y^2} - x\sqrt{1-(x-y)^2}}$
 21. $\frac{0.04}{\sqrt{15}}$ 22. $(\sqrt{3}, \tan^{-1} 2\sqrt{3})$ 與 $(-\sqrt{3}, -\tan^{-1} 2\sqrt{3})$ 23. 0.744 24. 略
 25. (1) 是 (2) 是 (3) $\frac{-2x^2}{1+x^4} + \tan^{-1}\left(\frac{1}{x^2}\right)$ 26. 略

➡ 習題 5-5

1. $2\sqrt{\tan^{-1} x} + C$ 2. $-\sin^{-1}\left(\frac{\cos \theta}{2}\right) + C$ 3. $\sin^{-1}\left(\frac{\sin x}{2}\right) + C$
 4. $\sin^{-1}\left(\frac{\sqrt{3}}{3}\right)$ 5. $\frac{1}{3} \sec^{-1}\left(\frac{2x}{3}\right) + C$ 6. $\frac{1}{8} \tan^{-1}\left(\frac{x^2}{4}\right) + C$
 7. $\frac{1}{2} \sin^{-1}(2x) + C$ 8. $\frac{1}{2} (\tan^{-1} x)^2 + C$ 9. $\frac{1}{2} \sin^{-1}\left(\frac{x+1}{2}\right) + C$
 10. $-\sqrt{4-x^2} + 2 \sin^{-1} \frac{x}{2} + C$ 11. $\sin^{-1}\left(\frac{\sin x}{\sqrt{2}}\right) + C$

12. $x - \frac{1}{\sqrt{2}} \tan^{-1} \left(\frac{\tan x}{\sqrt{2}} \right) + C$ 13. π 14. $\frac{\pi}{6}$ 15. $\frac{\pi}{6}$
 16. $\frac{\pi}{12}$ 17. $\tan^{-1}(\sec x) + C$ 18. $\frac{1}{4} \tan^{-1} \left(\frac{x+3}{4} \right) + C$ 19. 略

第 6 章

➔ 習題 6-1

1. $\frac{4x^3}{x^4+1}$ 2. $\frac{30x}{5x^2+1}$ 3. $\frac{2}{6x+7}$ 4. $\frac{x(2 \ln x - 1)}{(\ln x)^2}$ 5. $\frac{1}{\ln 5} \frac{x^2 - 2x - 1}{(x^2+1)(x-1)}$
 6. $\frac{1+\sqrt{\ln x}}{2x\sqrt{\ln x}}$ 7. $\frac{1}{x \ln x}$ 8. $\frac{1}{\sqrt{x^2-1}}$ 9. $\csc x$ 10. $-\frac{1}{x} \sin(\ln x)$
 11. $\cot x$ 12. $-\tan x$ 13. $2 \csc 2x$ 14. $\frac{4x}{3(x^4-1)}$ 15. $2x \ln(x^2+1)[2 + \ln(x^2+1)]$
 16. $\frac{2}{x(2+\ln x)^2}$ 17. $\frac{2x}{(1+x^4)\tan^{-1} x^2}$ 18. $\sec x$ 19. $-\frac{y}{x(y+1)}$ 20. $\frac{\tan y}{x(\tan y - \sec^2 y)}$
 21. $\frac{y - x \sin y}{x(x \cos y - \ln x)}$ 22. $\frac{xy + y^2 - 1 - x^2 y^2}{1 + x^2 y^2 - x^2 - xy}$ 23. $\frac{1}{3}$ 24. $\frac{2}{3}$ 25. 0.6982 26. 略
 27. $10x + y - 21 = 0$ 28. 約 2.2, 約 $\pm 0.2\%$ 29. $\frac{dy}{dx} = \frac{(25x+19)(5x-4)^2}{(2x+1)^{3/2}}$
 30. $\frac{dy}{dx} = \frac{(2x-3)^4(3x+5)^5}{(5x+4)^6} \left[\frac{8}{2x-3} + \frac{15}{3x+5} - \frac{30}{5x+4} \right]$
 31. $\frac{dy}{dx} = -\frac{1+2 \cos x}{x^3(2x+1)^7} \left(\frac{2 \sin x}{1+2 \cos x} + \frac{3}{x} + \frac{14}{2x+1} \right)$
 32. 略 33. 略 34. 略 35. 略 36. 略
 37. (1) $f(-1) = \ln 2$ 為相對極小值
 (2) $f\left(\frac{1}{e}\right) = -\frac{1}{2}$ 為相對極小值; $f(e) = \frac{1}{2}$ 為相對極大值
 (3) $f\left(\frac{1}{\sqrt{e}}\right) = -\frac{1}{2e}$ 為相對極小值
 (4) $f(e^{-1}) = -\frac{1}{e}$ 為相對極小值
 (5) $f(1) = \frac{1}{2}$ 為相對極小值
 38. 略
 39. (1) $\frac{dy}{dx} = x^{x^2+4} \left(\frac{x^2+4}{x} + 2x \ln x \right)$

$$(2) \frac{dy}{dx} = (x^2+1)^e \left[\frac{2xe^x}{x^2+1} + e^x \cdot \ln(x^2+1) \right]$$

$$(3) \frac{dy}{dx} = 2x^{\ln x - 1} \cdot \ln x$$

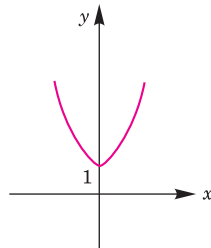
$$(4) \frac{dy}{dx} = x^{\sin x} \left(\frac{\sin x}{x} + \cos x \cdot \ln x \right)$$

➡ 習題 6-2

1. $\frac{1}{2} \ln |2x-1| + C$ 2. $-\frac{1}{\ln x} + C$ 3. $2 \ln |x+1| + \frac{2}{x+1} + C$ 4. $\frac{7}{3}$
 5. $2 \ln 10 \sqrt{\log_{10} x} + C$ 6. $\frac{1}{4} \ln 10$ 7. $\ln 2$ 8. $\frac{1}{2} \ln 5$ 9. $\frac{1}{5} [\ln (\ln x)^5] + C$
 10. $-\frac{1}{4} [\ln (1-x^2)]^2 + C$ 11. $\frac{(\ln x)^2}{2 \ln 2} + C$ 12. $\ln \left| \frac{\pi}{4} + \sin^{-1} x \right| + C$
 13. $\ln |\sec^{-1} x| + C$ 14. $\frac{1}{2}$ 15. 略 16. $\ln 2$ 17. 略

➡ 習題 6-3

1. $-\frac{3ex^2}{e^{x^3}}$ 2. $\frac{e^{2x}}{\sqrt{1+e^{2x}}}$ 3. $e^{\cos x}(1-x \sin x)$ 4. $\frac{(\ln 7)x7^{\sqrt{x^2+9}}}{\sqrt{x^2+9}}$ 5. $\frac{4}{(e^x+e^{-x})^2}$
 6. $\frac{1}{x} (\log_2 3) 3^{\log_2 x}$ 7. $-3(\ln 4)4^{\cos 3x} \sin 3x$ 8. $x^{\pi-1} \pi^x (\pi+x \ln \pi)$
 9. $(\ln 2)(\ln 3)3^x 2^{3^x}$ 10. $e^{-x} \tan e^{-x}$ 11. $\frac{e^x(x \ln x - 1)}{x(\ln x)^2}$ 12. $\frac{abe^{-x}}{(1+be^{-x})^2}$
 13. $\left(\frac{\ln 2}{\ln 10} \right) 2x$ 14. $\frac{\ln y - \frac{y}{x}}{\ln x - \frac{x}{y}} \left(\text{若 } \ln x - \frac{x}{y} \neq 0 \right)$ 15. $e(x^e)^x(1+\ln x)$
 16. $x^{(e^x)} \left(\frac{e^x}{x} + e^x \ln x \right)$ 17. $x^{x^2+1} (1+2 \ln x)$ 18. $x^{x^x} [x^{x-1} + x^x(1+\ln x) \ln x]$
 19. $(\ln x)^x \left(\ln \ln x + \frac{1}{\ln x} \right)$ 20. $x^{\ln x} \left(\frac{2 \ln x}{x} \right)$
 21. $(1+x)^{1/x} \left[\frac{1}{x(1+x)} - \frac{1}{x^2} \ln(1+x) \right]$ 22. $x^{\sin x} \left(\frac{\sin x}{x} + \cos x \ln x \right)$
 23. $(\ln x)^{\tan x} \left[\frac{\tan x}{x \ln x} + \sec^2 x (\ln \ln x) \right]$ 24. 略 25. 略
 26. $y = \ln \left[\frac{1}{2} (x + \sqrt{x^2+4}) \right]$ 27. 0.082, 2.800 28. (1) 是 (2) 否 (3)



29. 1 30. 1 31. $\ln a$ 32. 1 33. 略 34. $\frac{1}{2}$

35. (1) 略 (2) $f^{-1}(x) = \ln(\sqrt{x} - 1)$, $(f^{-1})'(x) = \frac{1}{2\sqrt{x}(\sqrt{x} - 1)}$
 (3) $x - 4y - 4 = 0$

36. (1) 相對極小值 $f(0) = 2$ (2) 相對極小值 $f\left(\frac{1}{e}\right) = e^{-1/e}$
 (3) 相對極小值 $f(0) = 0$, 相對極大值 $f(2) = \frac{4}{e^2}$

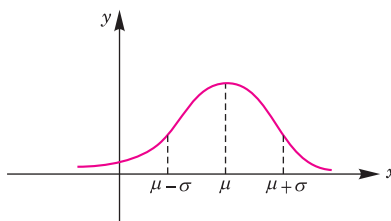
37. 略 38. 略 39. 略

40. (1) $\frac{df}{dx} = 2x$ (2) $f(0) = 0$ (3) $f(x) = x^2$ 圖形為拋物線 41. 略

42. (1) 相對極大值 $\frac{1}{\sqrt{2\pi}\sigma}$;

反曲點 : $\left(\mu - \sigma, \frac{1}{\sqrt{2\pi e}\sigma}\right)$,
 $\left(\mu + \sigma, \frac{1}{\sqrt{2\pi e}\sigma}\right)$

(2)



➡ 習題 6-4

1. $\frac{1}{3} e^{3x+1} + C$ 2. $-e^{\cos x} + C$ 3. $\ln(1+e^2) - \ln 2$ 4. $3e^{\sqrt[3]{x}} + C$ 5. $\frac{1}{4} e^2(e^2 - 1)$
 6. $e^x - x - \ln(1+e^{-x}) + C$ 7. $\frac{2}{\ln 10} 10^{\sqrt{x}} + C$ 8. $\frac{x^{\sqrt{3}+1}}{\sqrt{3}+1} + \frac{\sqrt{3}^x}{\ln \sqrt{3}} + C$
 9. $\frac{1}{4} x^{4x} + C$ 10. $-\frac{5^{(4-x)^3}}{3 \ln 5} + C$ 11. $2(e^{-1} - e^{-2}) \div 0.465$
 12. $\frac{1}{\ln 10} \cdot \ln |10^x - 10^{-x}| + C$ 13. $-\frac{1}{2} \ln(1+2e^{-x}) + C$ 14. $e - 1$

➡ 習題 6-5

1. (1) $y = 4e^{-5t}$ (2) $y = 1.884e^{0.006t}$ 2. (1) $y = 5000e^{(\ln 3/10)t}$, $y(20) = 45,000$
 3. 大約西元 2010.5 年 4. 7.74 克

➡ 習題 6-6

1. $4x \cosh(2x^2+3)$ 2. $\frac{2}{x^2} \operatorname{csch} \frac{2}{x} \coth \frac{2}{x}$ 3. $-\frac{5}{2} \sqrt{\operatorname{sech} 5x} \tanh 5x$
 4. $e^{3x}(3 - \tanh x) \operatorname{sech} x$ 5. $-\frac{\operatorname{sech}^2 x}{(1 + \tanh x)^2}$ 6. $\frac{2 \sinh x}{(1 - \cosh x)^2}$

$$7. \frac{2xy \tanh y}{1-x^2y \operatorname{sech}^2 y} \quad 8. \text{略} \quad 9. \frac{1}{2} \tanh x^2 + C \quad 10. 2 \sinh \sqrt{x} + C$$

$$11. \ln |\cosh x| + C \quad 12. \frac{1}{2} \sinh^2 x + C \text{ 或 } \frac{1}{2} \cosh^2 x + C$$

第 7 章

► 習題 7-1

$$1. -\sqrt{4-x^2} + 2 \sin^{-1}\left(\frac{x}{2}\right) + c \quad 2. x - \frac{1}{\sqrt{2}} \tan^{-1}\left(\frac{\tan x}{\sqrt{2}}\right) + c \quad 3. \frac{\pi}{6} \quad 4. 2e(e-1)$$

$$5. \frac{\pi}{12} \quad 6. \pi \quad 7. \ln 10 \quad 8. \frac{1}{2} \ln |\sec x^2 + \tan x^2| + C$$

$$9. \ln 2 \quad 10. \frac{1}{5} [\ln(\ln x)]^5 + C \quad 11. \ln \left| \frac{\pi}{4} + \sin^{-1} x \right| + C$$

$$12. \ln |\sec^{-1} x| + C \quad 13. 2 \ln (\sqrt{x} + 1) + C \quad 14. \frac{2^{\ln x}}{\ln 2} + C$$

$$15. -\ln |\csc(e^x + 1) + \cot(e^x + 1)| + C \quad 16. -\frac{1}{3} \sin(1-x^3) + C \quad 17. -\frac{1}{4(x^2-4x+3)^2} + C$$

$$18. \frac{1}{2} (\ln \sin x)^2 + C \quad 19. \begin{cases} \frac{(\ln x)^{n+1}}{n+1} + C, & \text{若 } n \neq -1 \\ \ln |\ln x| + C, & \text{若 } n = -1 \end{cases} \quad 20. 2\sqrt{e^x-1} + C$$

$$21. \ln(2+\sqrt{3}) \quad 22. \ln |\sin(3+\ln x)| + C \quad 23. \frac{1}{12} (4-\sqrt{2}) \quad 24. \sqrt{1+\sin^2 x} + C$$

$$25. \sin^{-1}(2 \ln x) + C \quad 26. \sin^{-1}\left(\frac{\sin x}{2}\right) + C \quad 27. \frac{1}{8} \ln(1+4 \ln^2 x) + C$$

$$28. \ln |\ln(\ln x)| + C \quad 29. \frac{4^{e^x}}{\ln 4} + C \quad 30. 2 \quad 31. -\frac{3^{1/x}}{\ln 3} + C \quad 32. \frac{2^{\tan x}}{\ln 2} + C$$

$$33. \frac{2}{3} (2 + \cosh x)^{3/2} + C \quad 34. e^{\sinh x} + C \quad 35. \pi^2$$

► 習題 7-2

$$1. \frac{1}{2} x \sin 2x + \frac{1}{4} \cos 2x + C \quad 2. \frac{1}{4} (2t-1)e^{2t} + C \quad 3. 4\left(\frac{8}{3} \ln 2 - \frac{7}{9}\right)$$

$$4. (x^3-3x^2+6x-6)e^x + C \quad 5. \frac{e^{2x}(3 \sin 3x + 2 \cos 3x)}{13} + C \quad 6. \frac{x^4 \ln x}{4} - \frac{x^4}{16} + C$$

$$7. x \sin^{-1} x + \sqrt{1-x^2} + C \quad 8. x [2-2 \ln x + (\ln x)^2] + C$$

$$9. \frac{1}{2} (x^2+1) \tan^{-1} x - \frac{1}{2} x + C \quad 10. -\frac{1}{3} x \cot 3x + \frac{1}{9} \ln |\sin 3x| + C$$

11. $-\cos x \ln \cos x + \cos x + C$ 12. $\frac{e-2}{2e}$
 13. $-\frac{1}{2} \csc x \cot x + \frac{1}{2} \ln |\csc x - \cot x| + C$ 14. $\frac{1}{3} (2 - \sqrt{2})$
 15. $\frac{x}{2} (\sin \ln x - \cos \ln x) + C$ 16. $\frac{1}{2} (x^2 \sin x^2 + \cos x^2) + C$
 17. $\frac{2^x}{(\ln 2)^2} (x \ln 2 - 1) + C$ 18. $2\sqrt{x} \sin \sqrt{x} + 2 \cos \sqrt{x} + C$
 19. $\frac{e^{ax}}{a^2 + b^2} (a \cos bx + b \sin bx) + C$ 20. $2x \tan 2x - \ln |\sec 2x| + C$
 21. $\frac{\pi + 6\sqrt{3} - 12}{12}$ 22. $\frac{e^x}{2} (\cos x + \sin x) + C$ 23. $x \log_2 x - \frac{x}{\ln 2} + C$
 24. 略 25. 略 26. 略 27. 略 28. 略 29. (1) $\frac{2}{3}$ (2) $\frac{3\pi}{16}$
 30. 略 31. (1) $n=4$ (2) 2 32. $\int_0^1 \ln(1+x) dx, 2 \ln 2 - 1$
 33. (1) $e^x(x^3 - 3x^2 + 8x - 8) + C$ (2) $(x^2 - 3x - 3) \sin x + (2x - 3) \cos x + C$

► 習題 7-3

1. $\frac{1}{3} \sin^3 x - \frac{1}{5} \sin^5 x + C$ 2. $\frac{1}{2} \sin 2x - \frac{1}{6} \sin^3 2x + C$
 3. $\frac{1}{8} \left(\frac{5}{2} x - 2 \sin 2x + \frac{3}{8} \sin 4x + \frac{1}{6} \sin^3 2x \right) + C$
 4. $\sin x - \sin^3 x + \frac{3}{5} \sin^5 x - \frac{1}{7} \sin^7 x + C$ 5. $\frac{\sqrt{3}}{2}$ 6. $\frac{1}{5} \cos^5 x - \frac{1}{3} \cos^3 x + C$
 7. $\frac{1}{6} \sin^6 x - \frac{1}{8} \sin^8 x + C$ 8. $\frac{1}{8} \left(\frac{x}{2} - \frac{1}{8} \sin 4x - \frac{1}{6} \sin^3 2x \right) + C$
 9. $-\csc x - \sin x + C$ 10. $\frac{1}{4} \tan^4 x + \frac{1}{6} \tan^6 x + C$ 11. $\tan x - \cot x + C$
 12. $\frac{1}{3} \csc^3 x - \frac{1}{5} \csc^5 x + C$ 13. $\frac{1}{7} \tan^7 x + \frac{1}{5} \tan^5 x + C$
 14. $\frac{2}{7} \tan^{7/2} x + \frac{2}{11} \tan^{11/2} x + C$ 15. $\frac{2}{5} \sec^{5/2} x - 2 \sec^{1/2} x + C$
 16. $\frac{1}{7} \tan^7 x + \frac{1}{9} \tan^9 x + C$ 17. $\frac{1}{2} \tan^2 x - \ln |\sec x| + C$
 18. $\frac{\sec^5 x}{5} - \frac{2}{3} \sec^3 x + \sec x + C$ 19. $\frac{1}{6} (3 \sin x + \sin 3x) + C$

$$20. \frac{1}{2} \left(\cos x - \frac{1}{9} \cos 9x \right) + C \quad 21. \frac{1}{9} \left(9 \cos \frac{x}{2} - \cos \frac{9x}{2} \right) + C \quad 22. 0$$

$$23. \ln \left| \frac{\sqrt{2}+1}{\sqrt{2}-1} \right| \quad 24. \text{略} \quad 25. \frac{1}{6} \tan^6 x - \frac{1}{4} \tan^4 x + \frac{1}{2} \tan^2 x + \ln |\cos x| + C$$

→ 習題 7-4

$$\begin{aligned} 1. & \sqrt{16-x^2} + 4 \ln \left| \frac{4-\sqrt{16-x^2}}{x} \right| + C \quad 2. -\frac{1}{16} \frac{\sqrt{16-x^2}}{x} + C \\ 3. & 2 \left(\sin^{-1} \frac{x}{2} - \frac{x}{4} \sqrt{4-x^2} \right) + C \quad 4. \ln(1+\sqrt{2}) \\ 5. & \frac{x}{2} \sqrt{4+x^2} - 2 \ln |x+\sqrt{4+x^2}| + C \quad 6. \frac{1}{2} \ln |2x+\sqrt{4x^2-9}| + C \\ 7. & \frac{1}{2} \ln \left| \frac{\sqrt{x^2+4}-2}{x} \right| + C \quad 8. \sqrt{x^2-9} - 3 \sec^{-1} \frac{x}{3} + C \\ 9. & \frac{x+2}{2} \sqrt{-x^2-4x} + 2 \sin^{-1} \left(\frac{x+2}{2} \right) + C \quad 10. \frac{1}{32} \left(\frac{4x}{4-x^2} + \ln \left| \frac{2+x}{2-x} \right| \right) + C \\ 11. & \frac{1}{432} \left(\tan^{-1} \frac{x}{6} + \frac{6x}{x^2+36} \right) + C \quad 12. \frac{1}{27} \left(\frac{3x}{\sqrt{1-9x^2}} - \sin^{-1} 3x \right) + C \\ 13. & \frac{e^x}{2} \sqrt{1-e^{2x}} + \frac{1}{2} \sin^{-1} e^x + C \quad 14. \frac{1}{2} \ln (e^{2x} + \sqrt{e^{4x}-1}) + C \\ 15. & \frac{1}{2} \ln (x^2+4) + C \quad 16. \frac{3\pi a^4}{8} \quad 17. \frac{\pi}{6} - \frac{\sqrt{3}}{4} \end{aligned}$$

→ 習題 7-5

$$\begin{aligned} 1. & \tan^{-1}(x+3) + C \quad 2. \frac{1}{2} \ln (x^2-4x+8) + \tan^{-1} \left(\frac{x-2}{2} \right) + C \quad 3. \frac{\sqrt{3}}{2} + \frac{\pi}{3} \\ 4. & \ln(1+\sqrt{2}) \quad 5. \sqrt{3} + \frac{1}{2} \ln(2-\sqrt{3}) \quad 6. \sqrt{x^2-2x} + \ln |x-1+\sqrt{x^2-2x}| + C \\ 7. & \pi \quad 8. \sin^{-1}(x-2) + C \quad 9. \frac{x^2}{2} - \frac{1}{2} x \sqrt{x^2-1} + \frac{1}{2} \ln |x+\sqrt{x^2-1}| + C \end{aligned}$$

→ 習題 7-6

$$\begin{aligned} 1. & \ln |(x-2)^4 (x+1)^3| + C \quad 2. \ln \left| \frac{x^2-1}{x} \right| + C \quad 3. \frac{1}{6} \ln \left| \frac{(x+2)(x-1)^2}{x^3} \right| + C \\ 4. & \frac{1}{27} \left[\ln |3x+2| + \frac{4}{3x+2} - \frac{13}{2(3x+2)^2} \right] + C \quad 5. -\frac{1}{x^2} + \ln \left| \frac{x^3}{x+1} \right| + C \end{aligned}$$

$$6. 6 \ln 3 - \frac{26}{3} \ln 2 \quad 7. \ln(x^2+4) + \frac{1}{2} \tan^{-1} \frac{x}{2} + 3 \ln|x+5| + C$$

$$8. \frac{x^2}{2} - \frac{3}{4} \ln|x| + \frac{27}{8} \ln|x-2| + \frac{27}{8} \ln|x+2| + C$$

$$9. \frac{x^2}{2} - 4 \ln(x^2+4) - \frac{8}{x^2+4} + C \quad 10. \frac{1}{2} \ln \left| \frac{e^x-1}{e^x+1} \right| + C$$

$$11. -\frac{3}{x-2} - \frac{6}{(x-2)^2} - \frac{11}{3(x-2)^3} + C$$

$$12. \frac{1}{4} \tan^{-1} \frac{x}{2} - \frac{x}{2(x^2+4)} + C \quad 13. -\cos x + \sqrt{5} \tan^{-1} \left(\frac{\cos x}{\sqrt{5}} \right) + C$$

$$14. \ln \left(\frac{(e^x+2)^2}{e^x+1} \right) + C \quad 15. -\frac{1}{3} \ln \left| \frac{\cos x-1}{\cos x+2} \right| + C$$

→ 習題 7-7

$$1. \frac{1}{28} (2x+1)^{7/2} - \frac{1}{10} (2x+1)^{5/2} + \frac{1}{12} (2x+1)^{3/2} + C$$

$$2. \frac{3}{7} (x+9)^{7/3} - \frac{27}{4} (x+9)^{4/3} + C$$

$$3. \frac{15}{4} (x+3)^{4/3} - 45 (x+3)^{1/3} + C \quad 4. 2xe^{\sqrt{x}} - 4\sqrt{x} e^{\sqrt{x}} + 4e^{\sqrt{x}} + C$$

$$5. 6 \left(\frac{x\sqrt[6]{x}}{7} - \frac{\sqrt[6]{x^5}}{5} + \frac{\sqrt{x}}{3} - \sqrt[6]{x} + \tan^{-1} \sqrt[6]{x} \right) + C \quad 6. 2 + 8 \ln \frac{6}{7}$$

$$7. \frac{28}{3} \quad 8. \frac{2}{\sqrt{3}} \tan^{-1} \left(\frac{\sqrt{x-2}}{\sqrt{3}} \right) + C \quad 9. 2\sqrt{1+e^x} + \ln \left| \frac{\sqrt{1+e^x}-1}{\sqrt{1+e^x}+1} \right| + C$$

$$10. \frac{2}{\sqrt{3}} \tan^{-1} \left(\frac{\tan(x/2)}{\sqrt{3}} \right) + C \quad 11. \frac{1}{5} \ln \left| \frac{3 \tan(x/2)-1}{\tan(x/2)+3} \right| + C$$

$$12. \frac{1}{2} \left(\ln \left| \tan \frac{x}{2} \right| - \frac{1}{2} \tan^2 \frac{x}{2} \right) + C$$

$$13. \frac{1}{5} \ln \left| \tan \frac{x}{2} + 2 \right| - \frac{1}{5} \ln \left| 2 \tan \frac{x}{2} - 1 \right| + C$$

$$14. \frac{1}{2} \ln \left| \frac{\sqrt{3} \tan(x/2)-1}{\sqrt{3} \tan(x/2)+3} \right| + C \quad 15. \frac{2}{3} \tan^{-1} \left(3 \tan \frac{x}{2} \right) + C$$

$$16. \ln \left(\frac{\sqrt{3}+1}{2} \right) \quad 17. \text{略}$$

➡ 習題 7-8

1. (1) 1.397 (2) 1.387 2. (1) 0.880 (2) 0.881 3. (1) 4.103 (2) 4.100
 4. (1) 0.393 (2) 0.393 5. (1) 2.238 (2) 2.335 6. (1) 1.828 (2) 1.828
 7. (1) 1.00260 (2) $|E_e| < 0.00261$ 8. $n=8$ 9. 3.1416

第 8 章

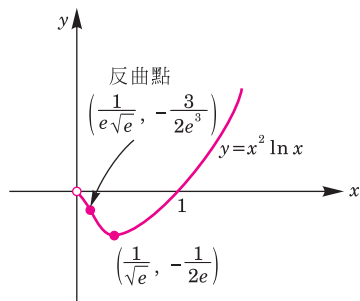
➡ 習題 8-1

1. $\frac{1}{40}$ 2. $\ln 3$ 3. $\frac{1}{3}$ 4. $-\frac{1}{2}$ 5. $-\frac{1}{2}$ 6. $\frac{1}{6}$ 7. 0 8. $\frac{1}{3}$
 9. 1 10. 0 11. 0 12. $\frac{2}{5}$ 13. 0 14. 0 15. $-\infty$ 16. ∞ 17. -1
 18. $\frac{1}{3}$ 19. 1 20. $\sin 3$ 21. $\sqrt{\sin x}$ 22. 略 23. 略 24. 0 25. 1
 26. $a=-3, b=\frac{9}{2}$ 27. $a=-3, b=4, c=\frac{6}{\pi}$ 28. 0

➡ 習題 8-2

1. 0 2. 1 3. 0 4. 1 5. $\frac{1}{2}$ 6. 0 7. $\frac{2}{\pi}$ 8. 0 9. 0 10. $-\frac{1}{2}$ 11. 0
 12. $\frac{1}{2}$ 13. $\ln a$ 14. 1 15. 1 16. $-\frac{1}{6}$ 17. $-\frac{1}{3}$ 18. $a=-1$, 極限值為 $\frac{1}{2}$

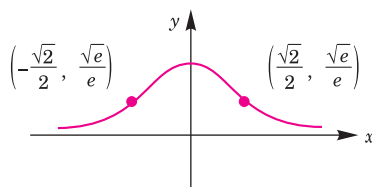
19.



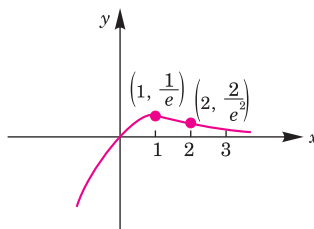
➡ 習題 8-3

1. $e^{1/e}$ 2. 1 3. 1 4. 1 5. 1 6. 1 7. e^a 8. e^{ab} 9. $e^{1/6}$ 10. 6 11. $e^{-1/2}$ 12. e^2
 13. $\frac{1}{\sqrt{e}}$ 14. 1 15. 0 16. e 17. $e^{1/e}$ 18. e 19. $e^{-1/6}$ 20. $f(0)=1$ 21. 略 22. 2

23.



24.



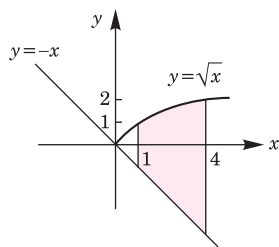
→ 習題 8-4

1. 1 2. $\frac{\pi}{2a}$ 3. $-\frac{1}{4}$ 4. 0 5. $\frac{1}{\ln 2}$ 6. 0 7. $\frac{1}{2} \ln 2$ 8. 1 9. $\ln 2$ 10. $\frac{\pi}{32}$
11. 發散 12. 發散 13. $\frac{1}{\ln 2}$ 14. 發散 15. 發散 16. π 17. $\ln 5 + \tan^{-1} 2 - \frac{\pi}{2}$
18. 發散 19. $\frac{\pi}{2} + 1$ 20. π 21. 發散 22. 收斂 23. $p > 1$
24. (1) 發散 (2) 收斂 (3) 收斂 25. 收斂 26. $\sqrt{\pi}$ 27. $\frac{\sqrt{\pi}}{3}$

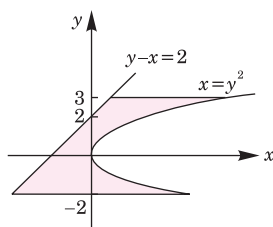
第 9 章

→ 習題 9-1

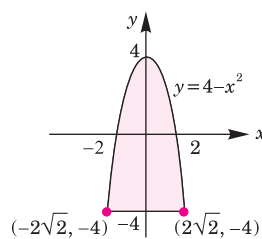
1. $\frac{73}{6}$



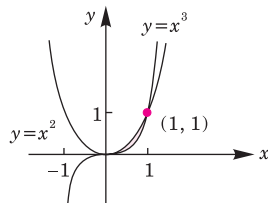
2. $\frac{115}{6}$



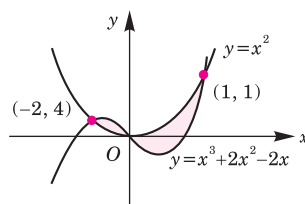
3. $\frac{64\sqrt{2}}{3}$



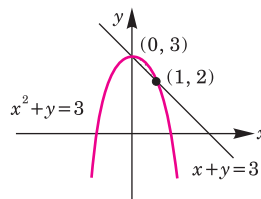
4. $\frac{1}{12}$



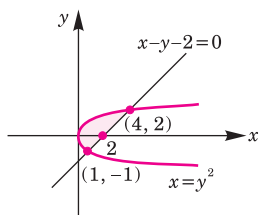
5. $\frac{37}{12}$



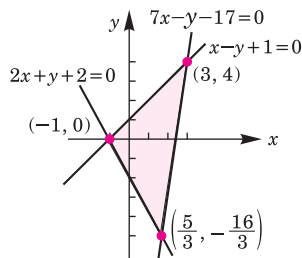
6. $\frac{1}{6}$



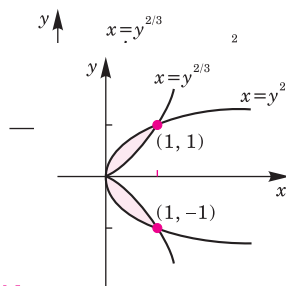
7. $\frac{9}{2}$



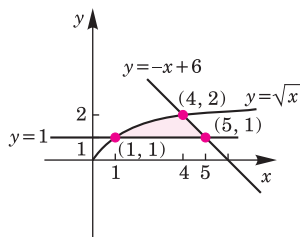
8. 16



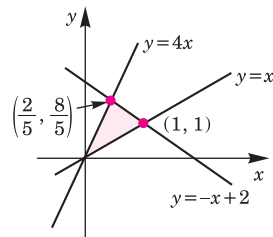
9. $\frac{8}{15}$



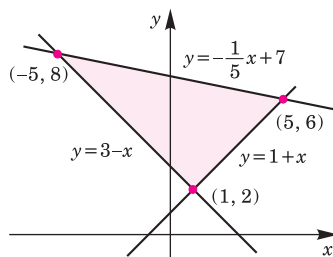
10. $\frac{13}{6}$



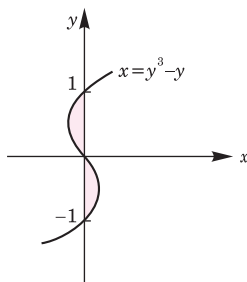
11. $\frac{3}{5}$



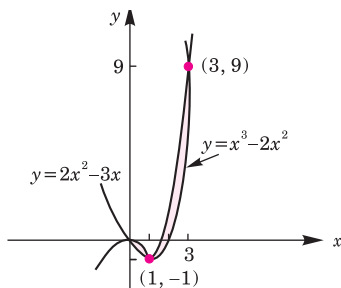
12.



13. $\frac{1}{2}$



14. $\frac{37}{12}$



15. $k = \sqrt[3]{4}$ 16. $k = \frac{9}{\sqrt[3]{4}}$

17. $\frac{a^2}{6}$ 18. πab

19. $4\sqrt{2}$ 20. 略

21. 略 22. $\ln 2 + \frac{1}{e^2} - \frac{1}{e}$

23. 4.15

➔ 習題 9-2

1. $\frac{5}{12} \pi r^3$ 2. $36\sqrt{3}$ 3. $\frac{2}{3} r^3 \tan \theta$ 4. $\frac{1}{4} (\pi + 2)$ 5. $\frac{3\pi}{4}$ 6. $\frac{\pi}{2}$ 7. $\frac{117\pi}{5}$

8. $\frac{2\pi}{35}$ 9. $\frac{7\pi}{3}$ 10. $2\sqrt{3}\pi$ 11. π 12. $\frac{8\pi}{3}$ 13. $\frac{28\pi}{3}$ 14. $\frac{3\pi}{10}$ 15. $\frac{\pi}{e} (e - 1)$

16. 2π 17. (1) $\frac{7\pi}{15}$ (2) $\frac{\pi}{2}$ 18. $\frac{4}{3} \pi ab^2$ 19. $\frac{\pi}{2}$ 20. $\frac{\pi}{5}$ 21. $\frac{844\pi}{5}$ 22. $\frac{3\pi}{10}$

23. $\frac{\pi}{2}$ 24. $\frac{32\pi}{5}$ 25. (1) $\frac{128\pi}{3}$ (2) 64π 26. $\frac{1}{3} \pi r^2 h$ 27. π 28. $\frac{4\pi}{3} (r^2 - a^2)^{3/2}$

29. $2\pi^2 a^2 b$ 30. $\frac{11}{24} \pi r^3$

➡ 習題 9-3

1. $\frac{8}{27} \left(10\sqrt{10} - \frac{13\sqrt{13}}{8} \right)$ 2. $\frac{8}{27} \left(10\sqrt{10} - \frac{13\sqrt{13}}{8} \right)$ 3. $\frac{21}{16}$ 4. $\frac{95\sqrt{85}-8}{243}$
 5. $\frac{4}{3}$ 6. $\frac{33}{16}$ 7. 9.0734 8. 0.8814 9. $\sqrt{2} + \ln(1+\sqrt{2})$ 10. $\sqrt{3} - \frac{1}{3}$
 11. $\frac{13}{4}$ 12. $y=\sqrt{x}$ 或 $y=-\sqrt{x}+2$ 13. $6a$

➡ 習題 9-4

1. $\frac{\pi}{6} (17\sqrt{17} - 5\sqrt{5})$ 2. $\frac{5\pi}{27} (29\sqrt{145} - 2\sqrt{10})$ 3. $4\sqrt{2}\pi$
 4. $\pi \left(2 + \sqrt{2} - \frac{\sqrt{1+e^2}}{e^2} + \ln \frac{1+\sqrt{2}}{1+\sqrt{1+e^2}} \right)$ 5. $\frac{128}{3} \pi (2\sqrt{2} - 1)$
 6. $\frac{\pi}{27} (296\sqrt{37} - 13\sqrt{13})$ 7. $\pi \left(2\sqrt{5} - \sqrt{2} + \ln \frac{2+\sqrt{5}}{1+\sqrt{2}} \right)$ 8. $40\sqrt{2}\pi$
 9. $\frac{\pi}{9} (17^{3/2} - 1)$ 10. $\pi [e\sqrt{1+e^2} + \ln(e+\sqrt{1+e^2}) - \sqrt{2} - \ln(\sqrt{2}+1)]$
 11. $\frac{\pi}{8} [21 - 8 \ln 2 - (\ln 2)^2]$ 12. $\frac{\pi a^2(e^2+4-e^{-2})}{2}$
 13. $\pi \left[\frac{315}{16} - 8 \ln 2 - (\ln 2)^2 \right]$ 14. 略 15. $\pi(\sqrt{2} + \ln(1+\sqrt{2}))$

➡ 習題 9-5

1. 1000 磅 2. 500 磅 3. $\frac{232000}{3}$ 磅 4. $\frac{15625}{3}$ 磅 5. $\frac{7000}{3}$ 磅
 6. 540 磅 7. $\frac{\sqrt{2}}{2} \rho a^3$ 8. $62.5 \pi r h^2$ 磅 9. 1497.6 磅

➡ 習題 9-6

1. (1) $k=9$ 達因/厘米 (2) 40.5 達因·厘米 (3) 337.5 達因·厘米
 2. 24 牛頓·米 3. 56250π 呎·磅 4. 75000 呎·磅 5. 2550 呎·磅 6. 276 呎·磅
 7. 32250 呎·磅 8. 120000 呎·噸 9. $2ak$ 磅

➡ 習題 9-7

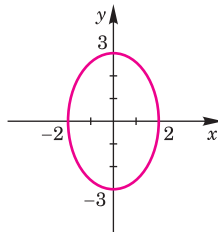
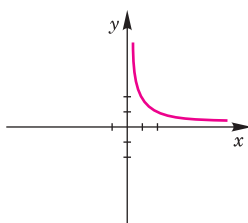
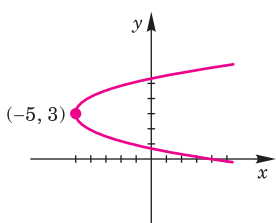
1. $M_x = -27, M_y = -46, \left(-\frac{23}{7}, -\frac{23}{14} \right)$ 2. $\left(\frac{4}{5}, \frac{2}{7} \right)$ 3. $\left(\frac{\pi}{2}, \frac{\pi}{8} \right)$
 4. $\left(-\frac{1}{2}, -\frac{3}{5} \right)$ 5. $\left(\frac{1}{\ln 2}, \frac{\tan^{-1}(3/4)}{8 \ln 2} \right)$ 6. $\left(\frac{3-e^2}{2(e^2-1)}, \frac{e^2+1}{4e^2} \right)$

7. $\left(0, \frac{e^4+4e^2-1}{8e(e^2-1)}\right)$ 8. $\left(\frac{4a}{3\pi}, \frac{4a}{3\pi}\right)$ 9. $\left(0, -\frac{20a}{3(8+\pi)}\right)$ 10. 4π

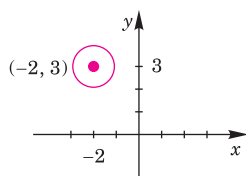
第 10 章

► 習題 10-1

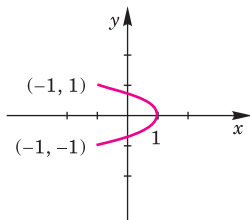
1. $x^2-24x+16y=0$ 2. $x^2+xy-2x-y+2=0$
 3. $x^2-2xy+y^2-y=0$ 4. $x(y-3)^2=4$ 5. $(x^2+y^2)^3=4x^2y^2$
 6. 7. 8.



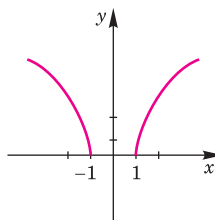
9.



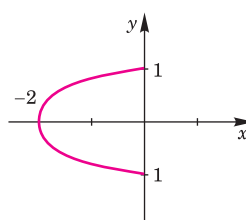
10.



11.



12.



13. P 點由 $(1, 0)$ 沿著圓 $x^2+y^2=1$ 依逆時鐘方向繞到 $(-1, 0)$
 14. P 點由 $(0, 1)$ 沿著圓 $x^2+y^2=1$ 依順時鐘方向繞到 $(0, -1)$
 15. P 點由 $(-1, 0)$ 沿著圓 $x^2+y^2=1$ 依順時鐘方向繞到 $(1, 0)$ 16. 略 17. 略

► 習題 10-2

1. $\frac{dy}{dx}=t, \frac{d^2y}{dx^2}=\frac{1}{6t}$ 2. $\frac{dy}{dx}=\frac{2t^2-3}{2t^2+3}, \frac{d^2y}{dx^2}=\frac{24t^3}{(2t^2+3)^3}$
 3. $\frac{dy}{dx}=3 \cot t, \frac{d^2y}{dx^2}=-3 \csc^3 t$ 4. $\frac{dy}{dx}=2(2t-3)\sqrt{t+1}, \frac{d^2y}{dx^2}=2(6t+1)$
 5. $\frac{dy}{dx}=-e^{3t}(2t+1), \frac{d^2y}{dx^2}=e^{4t}(6t+5)$ 6. $\frac{dy}{dx}=\frac{5}{3} \sin t, \frac{d^2y}{dx^2}=\frac{5}{9} \cos^3 t$

7. $2x-y+2=0$ 8. $2x+y-2\sqrt{3}=0$ 9. $x+6y-4=0$ 10. $x-36y+52=0$
 11. $3x+2y-6\sqrt{2}=0$
 12. 水平切線所在位置之二切點為 $(16, -16)$, $(16, 16)$, 垂直切線所在位置之切點為

(0, 0)

13. 水平切線所在位置之切點為 (2, -1), 垂直切線所在位置之切點為 (1, 0)

14. 水平切線所在位置之切點為 (0, -9), 垂直切線所在位置之切點為 (-2, -6),
(2, -6)

15. 水平切線所在位置之切點為 (0, 0), $(\sqrt[3]{2}, \sqrt[3]{4})$, 垂直切線所在位置之切點為
 $(\sqrt[3]{4}, \sqrt[3]{2})$

16. $y=x$, $y=-x$

17. (1) $\frac{dy}{dx} = \frac{\sin t}{1 - \cos t}$ (2) 在點 $(a(2n+1)\pi, 2a)$ 的切線是水平, 在點 $(2an\pi, 0)$ 的

切線是垂直 (3) 在點 $\left(a\left(2n\pi + \frac{\pi}{2} - 1\right), a\right)$ 之切線的斜率為 1

18. (1) $-\frac{44}{3}$ (2) $\frac{2(4-\sqrt{2})}{3}$ (3) $\frac{1304}{15}$

➡ 習題 10-3

1. 8 2. $4\left(\frac{20}{9} - \ln 3\right)$ 3. $\frac{2\sqrt{2}}{3}$ 4. $\frac{1}{4}[2\sqrt{5} + \ln(2+\sqrt{5})]$ 5. $\sqrt{2}(e^{\pi}-1)$

6. $-\ln(\sqrt{2}-1)$ 7. $\sqrt{13}$ 8. $6a$

➡ 習題 10-4

1. $(2, 2\sqrt{3})$ 2. $\left(\frac{3\sqrt{2}}{2}, \frac{3\sqrt{2}}{2}\right)$ 3. $\left(-\frac{5\sqrt{3}}{2}, -\frac{5}{2}\right)$

4. $\left(2, \frac{\pi}{3} + 2n\pi\right)$ 或 $\left(-2, \frac{4\pi}{3} + 2n\pi\right)$, 此處 n 為任意整數

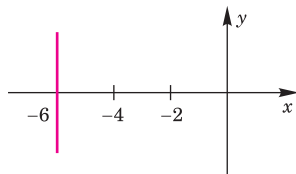
5. $\left(-4, \frac{\pi}{6} + 2n\pi\right)$ 或 $\left(4, \frac{7\pi}{6} + 2n\pi\right)$, 此處 n 為任意整數

6. $\left(1, \frac{3\pi}{4} + 2n\pi\right)$ 或 $\left(-1, -\frac{\pi}{4} + 2n\pi\right)$, 此處 n 為任意整數 7. $\theta = \frac{\pi}{2}$

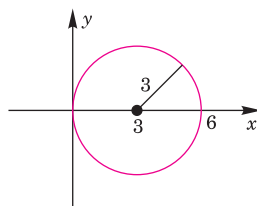
8. $r = -5 \csc \theta$ 9. $\theta = \frac{3\pi}{4}$ 10. $r = 4p \cot \theta \csc \theta$ 11. $r = 8 \tan \theta \sec \theta$

12. $r^2 = 16 \sec 2\theta$ 13. $r^2 = \frac{36}{4+5 \cos^2 \theta}$

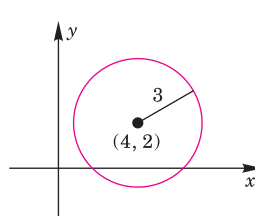
14. $x = -6$



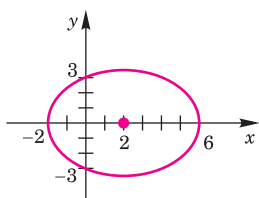
15. $(x-3)^2 + y^2 = 9$



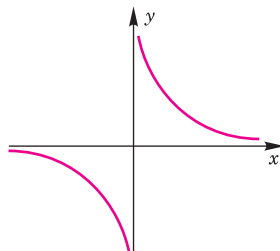
16. $(x-4)^2 + (y-2)^2 = 9$



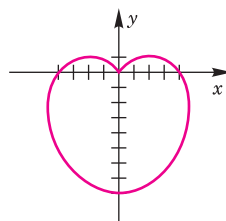
17. $\frac{(x-2)^2}{16} + \frac{y^2}{12} = 1$



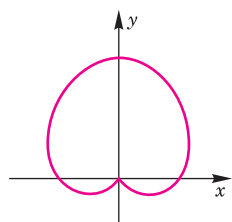
18. $xy = 2$



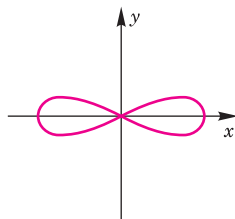
19.



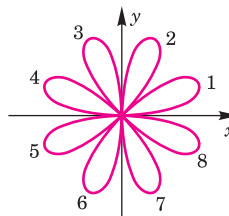
20.



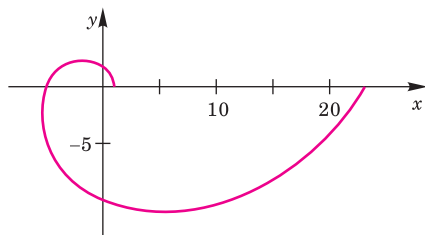
21.



22.



23.



24. $\left(6, \frac{\pi}{3}\right)$ 與 $\left(6, -\frac{\pi}{3}\right)$

25. $\left(1, \frac{\pi}{2}\right), \left(1, \frac{3\pi}{2}\right)$ 與極點

26. $\left(\sqrt{2}, \frac{\pi}{6}\right), \left(\sqrt{2}, \frac{5\pi}{6}\right)$ 與極點

27. $\frac{\sqrt{3}}{3}$ 28. -1 29. 2 30. $\frac{1}{\ln 2}$

➔ 習題 10-5

1. 24π 2. $\frac{147\pi}{2}$ 3. 5 4. 4 5. $\frac{19\pi}{2}$ 6. $\frac{\pi}{2}$ 7. $\frac{33\pi}{2}$ 8. π 9. $\frac{4(3\sqrt{3}-\pi)}{3}$
 10. $\frac{2(2\pi+3\sqrt{3})}{3}$ 11. 8 12. $\sqrt{2}(1-e^{-2\pi})$ 13. $\frac{\sqrt{1+(\ln 2)^2}}{\ln 2}(2^\pi-1)$ 14. 2

15. $\frac{128\pi}{5}$ 16. $8\pi(2-\sqrt{2})$ 17. $4\pi^2 a^2$

第 11 章

► 習題 11-1

1. $\frac{1}{2}$ 2. 0 3. 1 4. 0 5. 0 6. 0 7. e 8. $\frac{1}{2}$ 9. 0 10. 0 11. $\frac{1}{2}$
 12. 1 13. 0 14. 5 15. 1 16. 0 17. 0 18. 0 19. 0 20. 1
 21. $a_n = \frac{n}{2^{n+1}}$, $\lim_{n \rightarrow \infty} a_n = 0$, 收斂 22. $a_n = \frac{(-1)^n n}{2n-1}$, 發散
 23. $a_n = \frac{n}{n^2 - (n-1)^2}$, $\lim_{n \rightarrow \infty} a_n = \frac{1}{2}$, 收斂 24. $a_n = \frac{1}{n(n+1)}$, $\lim_{n \rightarrow \infty} a_n = 0$, 收斂
 25. $a_n = \frac{2^n}{n^2}$, $\lim_{n \rightarrow \infty} a_n = \infty$, 發散 26. 收斂, $\lim_{n \rightarrow \infty} a_n = e^2$ 27. 略 28. 略 29. 略
 30. 略 31. 遞減 32. 遞增 33. 非單調 34. 遞減 35. 遞增
 36. 遞增數列 $\forall n \geq 2$ 37. 略 38. 略 39. 略
 40. (1) 略 (2) 2 (3) 2 41. (1) 略 (2) 略

► 習題 11-2

1. 收斂, $\frac{5}{3}$ 2. 收斂, $\frac{2}{3}$ 3. 收斂, $\frac{e^2}{\pi(\pi-e)}$ 4. 發散 5. 收斂, $\frac{45}{2}$
 6. 收斂, $\frac{33}{5}$ 7. 收斂, $\frac{1}{2}$ 8. 發散 9. 收斂, 1 10. 2
 11. (1) 收斂 (2) $\sum_{n=1}^{\infty} \frac{4}{(n+1)(n+2)}$ 12. 略 13. (1) $\frac{784}{999}$ (2) $\frac{21}{99}$ (3) $\frac{125}{999}$ 14. 略
 15. 略 16. (1) 1, 1, 2, 3, 5, 8, 13, 21, 34, 55 (2) $\frac{1+\sqrt{5}}{2}$ (3) 1

► 習題 11-3

1. 收斂 2. 發散 3. 發散 4. 收斂 5. 收斂 6. 收斂 7. 發散
 8. 發散 9. 收斂 10. 收斂 11. 發散 12. 收斂 13. 收斂 14. 略
 15. 收斂, $0.92037 < S < 0.920869$ 16. $n \geq 2.7 \times 10^{43}$
 17. (1) 誤差至多為 0.1 (2) $S \approx 1.64522$ 且誤差 ≤ 0.005 (3) $n > 1000$
 18. 略 19. $3.09954 < S < 3.19954$, 最大誤差小於 0.1 20. 發散
 21. 收斂 22. 收斂 23. 收斂 24. 發散 25. 收斂 26. 收斂 27. 收斂 28. 收斂
 29. 發散 30. 收斂 31. 發散 32. 發散 33. 發散 34. 收斂 35. 發散 36. 收斂
 37. 發散 38. 發散 39. 收斂 40. 發散 41. 收斂 42. 收斂 43. 收斂 44. 發散

45. 收斂 46. 收斂 47. 收斂 48. 收斂 49. 收斂 50. 收斂 51. $p > 1$ 收斂
 52. $p > 1$ 53. $p > 1$ 54. $p > 1$ 55. 略 56. $p > 1$ 57. 收斂 58. 收斂 59. 發散
 60. 發散 61. 發散 62. 收斂 63. 發散 64. 收斂

➡ 習題 11-4

1. 收斂 2. 收斂 3. 收斂 4. 收斂 5. 收斂 6. 收斂 7. 發散 8. 發散 9. 收斂
 10. 收斂 11. 收斂 12. 收斂 13. 收斂 14. 收斂 15. $0.63174 \leq S \leq 0.63214$
 16. (1) $0.12021 < S < 0.14021$ (2) $-0.1631328 < S < -0.1591328$

➡ 習題 11-5

1. 條件收斂 2. 絕對收斂 3. 絕對收斂 4. 條件收斂 5. 絕對收斂
 6. 條件收斂 7. 絕對收斂 8. 絕對收斂 9. 絕對收斂 10. 絕對收斂
 11. 絕對收斂 12. 絕對收斂 13. 絕對收斂 14. 略 15. 略 16. 收斂
 17. 收斂 18. 收斂 19. 收斂 20. 略 21. 略

➡ 習題 11-6

1. 收斂區間為 $(-\infty, \infty)$ 2. 收斂區間為 $(-1, 1)$ 3. 收斂區間為 $[-1, 1)$
 4. 收斂區間為 $[-1, 1]$ 5. 收斂區間為 $(-2, 2)$ 6. 收斂區間為 $[0, 2)$
 7. 收斂區間為 $(-\infty, \infty)$ 8. 收斂區間為 $[1, 3]$ 9. 收斂區間為 $[-6, -4]$
 10. 收斂區間為 $[1, 3]$ 11. $x=0$ 時才收斂 12. 收斂區間為 $(-3, 3]$
 13. 收斂區間為 $(-2, 4)$ 14. 收斂半徑為 $\frac{3}{2}$ 15. 收斂半徑為 3
 16. 收斂半徑為 $\frac{3}{2}$ 17. 收斂半徑為 $\frac{1}{e}$ 18. 收斂半徑為 0 19. 略
 20. 收斂半徑為 $\frac{\sqrt{5}-1}{2}$ 21. 略 22. $x^2 - \frac{x^4}{3} + \frac{x^6}{5} - \frac{x^8}{7} + \cdots, x \in [-1, 1]$
 23. 略 24. (1) 略 (2) 略 (3) 0.920 25. 略 26. (1) 略 (2) $\sum_{n=1}^{\infty} a_n x^n, a_n = \frac{1}{n \cdot n!}$ 27. 略

➡ 習題 11-7

1. $\cos x = \frac{1}{2} - \frac{\sqrt{3}\left(x - \frac{\pi}{3}\right)}{2} - \frac{\left(x - \frac{\pi}{3}\right)^2}{4} + \frac{\sqrt{3}\left(x - \frac{\pi}{3}\right)^3}{12} + \cdots, -\infty < x < \infty$
 2. $\tan x = 1 + 2\left(x - \frac{\pi}{4}\right) + \frac{4}{2!}\left(x - \frac{\pi}{4}\right)^2 + \frac{16}{3!}\left(x - \frac{\pi}{4}\right)^3 + \cdots, x \neq 2n\pi \pm \frac{\pi}{2}$
 3. $\ln(1+x) = x - \frac{1}{2}x^2 + \frac{1}{3}x^3 - \cdots + (-1)^{n-1}\frac{1}{n}x^n + \cdots = \sum_{n=1}^{\infty} (-1)^{n-1}\frac{x^n}{n}, -1 < x \leq 1$
 4. $e^{2x} = \sum_{n=0}^{\infty} \frac{2^n e^{-2}}{n!} (x+1)^n, -\infty < x < \infty$

$$5. \ln \cos x = -\ln 2 - \sqrt{3} \left(x - \frac{\pi}{3}\right) - 2 \left(x - \frac{\pi}{3}\right)^2 - \frac{4\sqrt{3}}{3} \left(x - \frac{\pi}{3}\right)^3 - \cdots$$

$$6. e^{-x} = 1 - x + \frac{x^2}{2!} - \frac{x^3}{3!} + \cdots + (-1)^n \frac{x^n}{n!} + \cdots, \quad -\infty < x < \infty$$

$$7. e^{2x} = 1 + 2x + \frac{2^2}{2!} x^2 + \cdots + \frac{2^n}{n!} x^n + \cdots, \quad -\infty < x < \infty$$

$$8. \sin x = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \cdots, \quad -\infty < x < \infty \quad 9. \text{略}$$

$$10. \sin(0.1) \approx 0.099833, \text{精確到 } 5 \text{ 位小數} \quad 11. \text{略}$$

$$12. f(x) = xe^{-2x} = x - 2x^2 + \frac{2^2}{2!} x^3 - \frac{2^3}{3!} x^4 + \cdots + (-1)^n \frac{2^n}{n!} x^{n+1} + \cdots, \quad -\infty < x < \infty,$$

收斂半徑為 ∞

$$13. \cos x \ln(1+x) = x - \frac{x^2}{2} - \frac{x^3}{6} + \frac{3x^5}{40} + \cdots, \quad -1 < x < 1, \text{收斂半徑為 } 1$$

$$14. e^{-x} \cos x = 1 - x + \frac{x^3}{3} - \frac{x^4}{6} + \frac{x^5}{20} - \cdots, \quad -\infty < x < \infty, \text{收斂半徑為 } \infty$$

$$15. \sin^2 x = \frac{2}{2!} x^2 - \frac{2^3}{4!} x^4 + \frac{2^5}{6!} x^6 - \cdots + (-1)^{n+1} \frac{2^{2n-1}}{(2n)!} x^{2n} + \cdots, \quad -\infty < x < \infty,$$

收斂半徑為 ∞

$$16. (1) \frac{1}{2} \quad (2) 1 \quad (3) -\frac{1}{2} \quad (4) -\frac{3}{2}$$

$$17. f(x) = x + \frac{x^2}{2 \cdot 2!} + \frac{x^3}{3 \cdot 3!} + \cdots + \frac{x^n}{n \cdot n!} + \cdots$$

$$18. f(x) = \frac{x^3}{3} - \frac{x^5}{2 \cdot 5} + \frac{x^7}{3 \cdot 7} - \frac{x^9}{4 \cdot 9} + \cdots + (-1)^n \frac{x^{2n+3}}{(n+1)(2n+3)}, \quad |x| < 1$$

$$19. 0.09967 \quad 20. 0.4873611 \quad 21. 0.31028, \text{誤差小於 } \frac{1}{2} \times 10^{-4} \quad 22. \frac{10!}{5} \quad 23. \text{略}$$

$$24. 1.6487 \quad 25. 0.0175 \quad 26. 0.4054 \quad 27. 0.7468 \quad 28. 3.140$$

➡ 習題 11-8

$$1. \sqrt{1+x} = (1+x)^{1/2} = 1 + \frac{1}{2}x + \frac{\frac{1}{2}\left(\frac{1}{2}-1\right)}{2!}x^2 + \frac{\frac{1}{2}\left(\frac{1}{2}-1\right)\left(\frac{1}{2}-2\right)}{3!}x^3$$

$$\begin{aligned}
& + \cdots + \frac{\frac{1}{2} \left(\frac{1}{2} - 1 \right) \left(\frac{1}{2} - 2 \right) \cdots \left(\frac{1}{2} - n + 1 \right)}{n!} x^n + \cdots \\
& = 1 + \frac{1}{2}x - \frac{1}{2^2 2!}x^2 + \frac{1 \cdot 3}{2^3 3!}x^3 + \cdots + (-1)^{n-1} \frac{1 \cdot 3 \cdots (2n-3)}{2^n n!} x^n \\
& + \cdots, |x| < 1 \text{ 其收斂半徑爲 } 1
\end{aligned}$$

$$\begin{aligned}
2. \sqrt{1-x^3} &= (1-x^3)^{1/2} = 1 + \frac{1}{2}(-x^3) + \frac{\frac{1}{2} \left(\frac{1}{2} - 1 \right)}{2!} (-x^3)^2 \\
& + \frac{\frac{1}{2} \left(\frac{1}{2} - 1 \right) \left(\frac{1}{2} - 2 \right)}{3!} (-x^3)^3 + \cdots + \frac{\frac{1}{2} \left(\frac{1}{2} - 1 \right) \cdots \left(\frac{1}{2} - n + 1 \right)}{n!} (-x^3)^n + \cdots \\
& = 1 - \frac{1}{2}x^3 - \frac{1}{2^2 2!}x^6 - \frac{1 \cdot 3}{2^3 3!}x^9 - \cdots - \frac{1 \cdot 3 \cdot 5 \cdots (2n-3)}{2^n n!} x^{3n} - \cdots, |x| < 1
\end{aligned}$$

其收斂半徑爲 1

$$\begin{aligned}
3. f(x) &= (1+x)^{-3} = 1 - 3x + \frac{(-3)(-3-1)}{2!}x^2 + \frac{(-3)(-3-1)(-3-2)}{3!}x^3 \\
& + \cdots + \frac{(-3)(-3-1)(-3-2) \cdots (-3-n+1)}{n!} x^n + \cdots \\
& = 1 - 3x + \frac{3 \cdot 4}{2!}x^2 - \frac{3 \cdot 4 \cdot 5}{3!}x^3 + \cdots + (-1)^n \frac{3 \cdot 4 \cdots (n+2)}{n!} x^n + \cdots \\
& = 1 - 3x + \frac{3 \cdot 4}{2}x^2 - \frac{4 \cdot 5}{2}x^3 + \cdots + (-1)^n \frac{(n+1)(n+2)}{2} x^n + \cdots, |x| < 1
\end{aligned}$$

其收斂半徑爲 1

$$\begin{aligned}
4. f(x) &= \frac{1}{\sqrt[3]{1+x}} = (1+x)^{-1/3} \\
& = 1 - \frac{1}{3}x + \frac{\left(-\frac{1}{3}\right) \left(-\frac{1}{3} - 1\right)}{2!} x^2 + \frac{\left(-\frac{1}{3}\right) \left(-\frac{1}{3} - 1\right) \left(-\frac{1}{3} - 2\right)}{3!} x^3 \\
& + \cdots + \frac{\left(-\frac{1}{3}\right) \left(-\frac{1}{3} - 1\right) \cdots \left(-\frac{1}{3} - n + 1\right)}{n!} x^n + \cdots
\end{aligned}$$

$$= 1 - \frac{1}{3}x + \frac{1 \cdot 4}{3^2 2!}x^2 - \frac{1 \cdot 4 \cdot 7}{3^3 3!}x^3 + \cdots$$

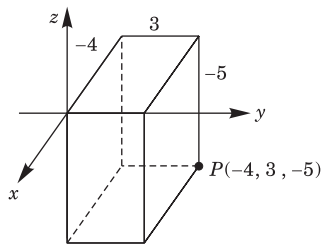
$$+ (-1)^n \frac{1 \cdot 4 \cdot 7 \cdots (3n-2)}{3^n n!}x^n + \cdots, |x| < 1 \quad \text{其收斂半徑爲 } 1$$

5. 0.300162, 其精確至小數第 6 位

第 12 章

➡ 習題 12-1

1.



2. 略 3. 略 4. 略

5. 以 $\left(3, -1, \frac{1}{2}\right)$ 爲球心, 半徑爲 4 的球面

6. 方程式的圖形爲一點 $(0, 1, -2)$

7. $(x-2)^2 + (y-4)^2 + (z-5)^2 = 25$

8. $(x-1)^2 + (y-1)^2 + \left(z - \frac{11}{2}\right)^2 = \frac{53}{4}$

➡ 習題 12-2

1. $x = \left\langle -\frac{8}{3}, \frac{1}{2}, \frac{8}{3} \right\rangle$ 2. $k = \pm \frac{4}{\sqrt{30}}$ 3. $\sqrt{466}$ 4. $\frac{3}{7}\mathbf{i} + \frac{6}{7}\mathbf{j} - \frac{2}{7}\mathbf{k}$ 5. 略

6. (1) $\mathbf{i} + 2\mathbf{j} - 3\mathbf{k}$ (2) $\mathbf{j} + 2\mathbf{k}$ (3) $-2\mathbf{k}$ 7. $a = -2, b = 1, c = -3, \mathbf{a}_4 = -2\mathbf{a}_1 + \mathbf{a}_2 - 3\mathbf{a}_3$

➡ 習題 12-3

1. $\angle ABC \approx 0.2288$ 弧度 (約 13.11°) 2. (1) 直角 (2) 鈍角 (3) 銳角 (4) 鈍角

3. $\cos \alpha = \frac{4}{\sqrt{29}}, \cos \beta = \frac{-3}{\sqrt{29}}, \cos \gamma = \frac{2}{\sqrt{29}}$ 4. 略 5. 24 呎磅 6. 略

7. 略 8. 略 9. $\text{proj}_{\mathbf{a}} \mathbf{b} = \frac{5}{19}\mathbf{i} + \frac{15}{19}\mathbf{j} - \frac{15}{19}\mathbf{k}, \text{comp}_{\mathbf{a}} \mathbf{b} = \frac{5}{\sqrt{19}} \approx 1.1471$

10. $\left\langle -\frac{6}{7}, -\frac{2}{7}, \frac{11}{7} \right\rangle$

➡ 習題 12-4

1. (1) $-44\mathbf{i} + 55\mathbf{j} - 22\mathbf{k}$ (2) $-14\mathbf{i} - 20\mathbf{j} - 82\mathbf{k}$

2. $\frac{4}{9}\mathbf{i} + \frac{1}{9}\mathbf{j} + \frac{8}{9}\mathbf{k}$ 與 $-\frac{4}{9}\mathbf{i} - \frac{1}{9}\mathbf{j} - \frac{8}{9}\mathbf{k}$

3. 略 4. $3\sqrt{5}$ 5. $\frac{\sqrt{374}}{2}$ 6. (1) $\frac{\sqrt{26}}{2}$ (2) $\frac{\sqrt{26}}{3}$ 7. $\sqrt{\frac{474}{17}}$ 8. 16

9. (1) $\mathbf{u}$ 、 $\mathbf{v}$ 與 $\mathbf{w}$ 不在同一平面上 (2) $\mathbf{u}$ 、 $\mathbf{v}$ 與 $\mathbf{w}$ 在同一平面上 10. 略 11. 略

➡ 習題 12-5

1. $x=3+2t$, $y=-1+t$, $z=2+3t$ 2. $\frac{x-1}{5}=\frac{y+1}{-2}=\frac{z-2}{3}$

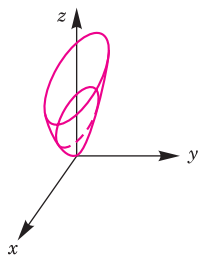
3. $\frac{x-4}{1}=\frac{y}{-5}=\frac{z-6}{2}$ 4. 直線與平面平行

5. $x=-\frac{173}{3}$, $y=-\frac{43}{3}$, $z=\frac{49}{3}$ 6. $6x-5y-z+84=0$

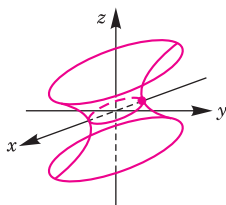
7. $y+2z=9$ 8. $\theta \approx 79^\circ$ 9. 略 10. 3

➡ 習題 12-6

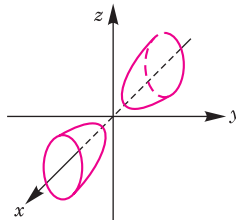
1. 橢圓拋物面



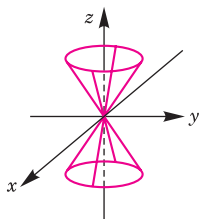
2. 單葉雙曲面



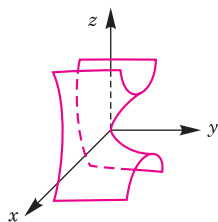
3. 雙葉雙曲面



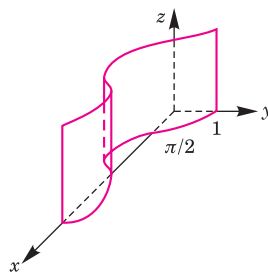
4. 橢圓圓錐面



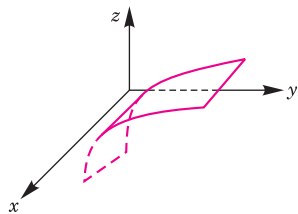
5. 雙曲拋物面



6. 餘弦柱面



7. 指數柱面

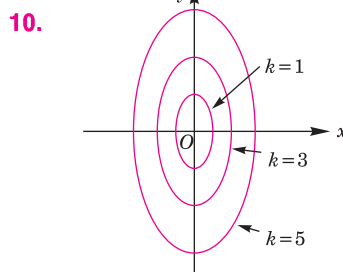
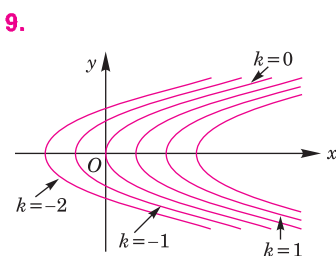
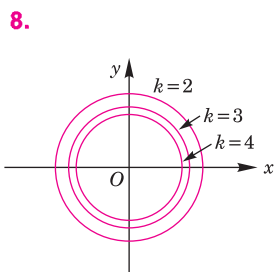


➔ 習題 12-7

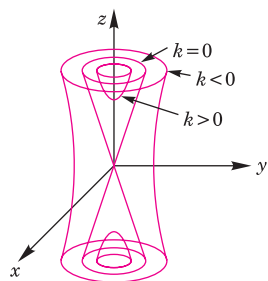
1. (1) $(-1, \sqrt{3}, 1)$ (2) $(1, 1, \sqrt{2})$ (3) $(-1, -\sqrt{3}, 8)$
2. (1) $(1, \pi, 0)$ (2) $\left(2, \frac{\pi}{6}, 4\right)$ (3) $\left(4\sqrt{2}, \frac{\pi}{4}, 4\right)$
3. (1) $r^2 + z^2 = 16$ (2) $r \cos \theta + 2r \sin \theta + 3z = 6$ (3) $r^2 + z^2 - 2r \cos \theta = 0$
4. (1) $\left(\sqrt{\frac{3}{2}}, \sqrt{\frac{3}{2}}, 1\right)$ (2) $\left(\frac{\sqrt{3}}{4}, \frac{1}{4}, \frac{\sqrt{3}}{2}\right)$ (3) $(0, \sqrt{2}, -\sqrt{2})$
5. (1) $\left(2, \frac{\pi}{4}, \frac{\pi}{4}\right)$ (2) $\left(2, \frac{7\pi}{4}, \frac{3\pi}{4}\right)$ 6. $\rho - 2 \sin \phi \cos \theta = 0$

➔ 習題 13-1

1. f 之定義域 $= \{(x, y) | x \neq 0\}$ 2. f 之定義域 $= \{(x, y) | x \neq 2y\}$
3. f 之定義域 $= \{(x, y) | x \leq 1, y \neq 0\}$ 4. f 之定義域 $= \{(x, y, z) | x^2 + y^2 + z^2 \leq 25\}$
5. f 之定義域 $= \{(x, y) | x^2 + y^2 \leq 1, x \neq 0\}$ 6. f 之定義域 $= \{(x, y) | x + y < 4\}$
7. f 之定義域 $= \{(x, y) | -1 \leq x + y \leq 1\}$



11.



12. $(f \circ g)(x, y) = x^2 + 2y^2$

13. $(f \circ g)(x, y) = \sin^2(x^2 + y^2)$

14. $(f \circ g)(x, y, z) = 2(3xy + 3yz + xz) + 1$

➔ 習題 13-2

1. $-\frac{5}{2}$ 2. 1 3. 1 4. 不存在 5. 不存在 6. 不存在 7. 0 8. 0 9. 1 10. 0
11. 0 12. 0 13. 不存在 14. 3 15. 3 16. 2 17. e^2 18. 0 19. 極限不存在

20. 0 21. (1) 0 (2) 0 (3) 不存在 22. 略 23. 略 24. 0 25. 略 26. 略

27. f 在 $\{(x, y)|x^2+y^2<1\}$ 為連續 28. f 在 $\{(x, y)|x \neq y, x \neq -y\}$ 為連續

29. f 在 $\{(x, y)|x^2+y^2<4\}$ 為連續

30. f 在 $\left\{(x, y, z) \mid xy > 0, z \neq n\pi + \frac{\pi}{2}\right\}$ 為連續

31. f 在 $\{(x, y)|x, y \in \mathbb{R}\}$ 為連續 32. f 在點 $(0, 0)$ 為不連續 33. $g(x)=2x$

34. $f(x, y)$ 在 $(0, 0)$ 處不連續

➔ 習題 13-3

$$1. f_x(x, y) = \frac{3x}{\sqrt{3x^2+y^2}}, f_y(x, y) = \frac{y}{\sqrt{3x^2+y^2}}$$

$$2. f_x(x, y) = \frac{2x}{x^2-y^2}, f_y(x, y) = \frac{-2y}{x^2-y^2} \quad 3. f_x(x, y) = \frac{-y^2}{x^2+y^4}, f_y(x, y) = \frac{2xy}{x^2+y^4}$$

$$4. f_x(x, y, t) = \frac{2x}{1+\sin 3y}, f_y(x, y, t) = \frac{-3(x^2-t^2)\cos 3y}{(1+\sin 3y)^2}, f_t(x, y, t) = \frac{-2t}{1+\sin 3y}$$

$$5. f_x(x, y, z) = (y^2+z^2)^x \ln(y^2+z^2), f_y(x, y, z) = 2xy(y^2+z^2)^{x-1}, \\ f_z(x, y, z) = 2xz(y^2+z^2)^{x-1}$$

$$6. f_x(x, y, z) = e^z - ye^x, f_y(x, y, z) = -e^x - ze^{-y}, f_z(x, y, z) = xe^z + e^{-y}$$

$$7. f_x(x, y, z) = \frac{y}{z} x^{\frac{y}{z}-1}, f_y(x, y, z) = \frac{1}{z} x^{\frac{y}{z}} \ln x, f_z(x, y, z) = -\frac{y}{z^2} x^{\frac{y}{z}} \ln x$$

$$8. f_x(x, y) = -\frac{e^x}{x}, f_y(x, y) = \frac{e^y}{y}$$

$$9. f_x(x, y) = e^y - \frac{1}{y} \cos\left(\frac{x}{y}\right) + 3x^2y^2, f_y(x, y) = xe^y + \frac{x}{y^2} \cos\left(\frac{x}{y}\right) + 2x^3y$$

$$10. f_x(x, y) = -\frac{y}{x^2} e^{1/x} \sec^2(ye^{1/x}), f_y(x, y) = 2y + e^{1/x} \sec^2(ye^{1/x})$$

$$11. f_x(x, y) = \cos(x+y)^2 - \cos x^2, f_y(x, y) = \cos(x+y)^2$$

$$12. f_x(x, y, z) = \sqrt{x^3+1}, f_y(x, y, z) = \sqrt{y^3+1}, f_z(x, y, z) = -2\sqrt{z^3+1}$$

$$13. \frac{\partial f}{\partial x} = \frac{y}{(1-xy)^2}, \frac{\partial f}{\partial y} = \frac{x}{(1-xy)^2}$$

$$14. \text{略} \quad 15. \text{略} \quad 16. 1 \quad 17. \begin{cases} 3x-z=9/2 \\ y=1 \end{cases} \quad 18. \begin{cases} y-z=0 \\ x=3 \end{cases} \quad 19. x-y-z=0 \quad 20. x+z=-1$$

$$21. x - \sqrt{3}y + z = 1 - \frac{\sqrt{3}\pi}{6} \quad 22. z - e^3y + e^3 = 0 \quad 23. z - x - y = 0 \quad 24. z - 2x - y + 1 = 0$$

25. $2x+ez=0$ 26. $2x+4y-14=0$ 27. $(2, 3, 20)$

28. $z_{xx} = \frac{3(2x^2+y^2)}{\sqrt{x^2+y^2}}, z_{xy} = \frac{3xy}{\sqrt{x^2+y^2}}, z_{yy} = \frac{3(x^2+2y^2)}{\sqrt{x^2+y^2}}$

29. $z_{tt}=0, z_{tx} = \frac{1}{2\sqrt{x-x^2}}, z_{xx} = \frac{t(2x-1)}{4(x-x^2)^{3/2}}$ 30. $V_{zy} = \frac{4z^2(3x^2-z^4)}{(x^2+z^4)^2}$

31. $\frac{\partial^3 w}{\partial z \partial y \partial x} = (1-x^2 y^2 z^2) \cos xyz - 3xyz \sin xyz$ 32. 略 33. 略 34. 略 35. 略

36. 略 37. 略 38. 略 39. 略 40. 略 41. 略 42. 略 43. 略 44. 略 45. 略

46. 略 47. 略 48. 略 49. 略 50. 略

➡ 習題 13-4

1. $dw = \left(2x \sin y - \frac{y}{x^2} \right) dx + \left(x^2 \cos y + \frac{1}{x} \right) dy$

2. $dw = \left(2xe^{xy} + x^2 ye^{xy} + \frac{1}{y^2} \right) dx + x \left(x^2 e^{xy} - \frac{2}{y^3} \right) dy$

3. $dw = \left(\frac{2x}{x^2+y^2} + \tan^{-1} y \right) dx + \left(\frac{2y}{x^2+y^2} + \frac{x}{1+y^2} \right) dy$

4. $dw = 2xe^{yz} dx + (x^2 ze^{yz} + \ln z) dy + \left(x^2 ye^{yz} + \frac{y}{z} \right) dz$

5. $dw = 2e^t \left(\frac{dx}{x} + \frac{dy}{y} + \frac{dz}{z} \right) + e^t (\ln xy + \ln xz + \ln yz) dt$

6. 7.38 7. 1.87 8. (1) 18.0056 (2) 0.5956 9. 2.96 10. 0.07% 11. 130 平方單位

12. 7% 13. $L(x, y) = -e^3 x + 2e^3 y - 2e^3$ 14. $L(x, y) = 1 + x + y$

15. $L(x, y, z) = x - y - z + \frac{\pi}{2} + 1$

➡ 習題 13-5

1. $-\frac{3(t^2+1)}{(t+1)^4}$ 2. $\frac{1-\tan^2 t}{\tan t}$ 3. $\frac{2(e^{4t}-e^{-4t})}{\sqrt{e^{4t}+e^{-4t}}}$

4. $4 \sin^3 t \cos t + \tan 4t \sin t - 4 \cos t \sec^2 4t$ 5. (1) 略 (2) $2\sqrt{10}$

6. $\frac{dT}{dt} = \frac{\lambda(-a^2+b^2) \sin t \cos t + \lambda c^2 t}{\sqrt{a^2 \cos^2 t + b^2 \sin^2 t + c^2 t^2}}$ 7. 2

8. $\frac{\partial r}{\partial u} = 3 \ln(uvt) + 3 + \frac{vt}{u}, \frac{\partial r}{\partial v} = t \ln(uvt) + \frac{3u}{v} + t, \frac{\partial r}{\partial t} = v \ln(uvt) + \frac{3u}{t} + v$

$$9. \frac{\partial z}{\partial r} \Big|_{(1, \pi/3)} = \frac{3}{4}, \quad \frac{\partial z}{\partial \theta} \Big|_{(1, \pi/3)} = -\frac{\sqrt{3}}{4} \quad 10. \frac{\partial w}{\partial t} = \frac{s^4 t}{\sqrt{1+s^4 t^2}}$$

11. 72 12. 5 13. -8 14. 略 15. 略 16. 略 17. 略 18. 略

$$19. \frac{\partial y}{\partial s} \Big|_{(1, 3)} = 22, \quad \frac{\partial y}{\partial t} \Big|_{(1, 3)} = -3 \quad 20. \text{略} \quad 21. \text{略} \quad 22. \text{略} \quad 23. \text{略}$$

$$24. -\frac{6x^2+2xy}{x^2+3y^2} \quad 25. -\frac{12\sqrt{xy}+y}{x-6\sqrt{xy}} \quad 26. \frac{y \sin x - \sin y}{x \cos y + \cos x}$$

$$27. \frac{\partial z}{\partial x} = -\frac{e^{yz} + yze^{xz}}{xy(e^{yz} + e^{xz})}, \quad \frac{\partial z}{\partial y} = -\frac{xze^{yz} + e^{xz} - 2y}{xy(e^{yz} + e^{xz})}$$

$$28. \frac{\partial z}{\partial x} = -\frac{2xy - yz \sin xyz}{2z - xy \sin xyz}, \quad \frac{\partial z}{\partial y} = -\frac{x^2 - xz \sin xyz}{2z - xy \sin xyz}$$

$$29. \frac{\partial z}{\partial x} = -\frac{z^2 + 4xy}{2xz - 4y^2}, \quad \frac{\partial z}{\partial y} = -\frac{2x^2 - 8yz + 3}{2xz - 4y^2} \quad 30. \text{略} \quad 31. \text{略} \quad 32. 3$$

33. 2 34. 2 35. 0

➡ 習題 13-6

$$1. 5 + \sqrt{3} \quad 2. \frac{13-3\sqrt{3}}{2} \quad 3. -\frac{8}{5} \quad 4. \frac{7}{52} \quad 5. \frac{29\sqrt{13}}{13} \quad 6. \frac{1}{6} \quad 7. -\frac{\sqrt{14}e}{7}$$

$$8. -\frac{\sqrt{3}\pi}{12} \quad 9. \frac{\sqrt{17}}{6} \quad 10. \frac{2\sqrt{5}}{5} \quad 11. \frac{\sqrt{26}}{2} \quad 12. \frac{\sqrt{17}}{2}$$

$$13. (1) \frac{32\sqrt{3}}{3} \quad (2) 38\mathbf{i} + 6\mathbf{j} + 12\mathbf{k} \quad (3) 2\sqrt{406}$$

14. f 遞增最快的方向為 $\mathbf{u} = \frac{2}{7}\mathbf{i} + \frac{3}{7}\mathbf{j} + \frac{6}{7}\mathbf{k}$, f 遞減最快的方向為

$$-\mathbf{u} = -\frac{2}{7}\mathbf{i} - \frac{3}{7}\mathbf{j} - \frac{6}{7}\mathbf{k}, \quad (D_{\mathbf{u}}f)_{(1, 1, 0)} = 7, \quad (D_{-\mathbf{u}}f)_{(1, 1, 0)} = -7$$

15. (1) 2.4 (2) P 沿 $-\mathbf{i} - 3\mathbf{j} + 2\mathbf{k}$ 的方向, T 增加得很快; 最大變化率為 $3.8^\circ\text{C}/\text{公分}$

16. 略

17. 切平面方程式為 $3x - 6y + 2z + 18 = 0$; 法線方程式為 $\frac{x+2}{-1} = \frac{y-1}{2} = \frac{z+3}{-\frac{2}{3}}$

18. 略 19. 略 20. 略 21. $7x + 6y + 2z = 5$

➡ 習題 13-7

1. $f(1, -1) = -6$ 為 f 之相對極小值 2. $(0, 0)$ 為 f 之鞍點

3. $(0, 0)$ 為 f 之鞍點, $f(2, 2) = -8$ 為 f 之相對極小值

4. $f(1, 2) = 6$ 為 f 之相對極小值 5. $f(0, 2) = e^4$ 為 f 之相對極大值

6. f 無相對極值 7. $(0, n\pi)$ 為 f 的鞍點
8. $(0, 0)$ 為 f 的鞍點, $f\left(\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right) = \frac{1}{2}e^{-1}$ 為 f 的相對極大值,
 $f\left(\frac{1}{\sqrt{2}}, -\frac{1}{\sqrt{2}}\right) = -\frac{1}{2}e^{-1}$ 為 f 的相對極小值
9. 絕對極小值為 $f(1, 2) = f(1, -1) = -1$, 絕對極大值為 $f(-1, -2) = 13$
10. 絕對極小值為 $f\left(\frac{3}{5}, \frac{4}{5}\right) = -2$, 絕對極大值為 $f\left(-\frac{3}{5}, -\frac{4}{5}\right) = 18$
11. 絕對極大值為 61, 發生在點 $(9, 0)$ 和點 $(0, 9)$ 處
 絕對極小值為 -4 , 發生在點 $(1, 1)$ 處
12. $\frac{1}{\sqrt{26}}$ 13. $x=8, y=16, z=8$ 14. $\left(\frac{\sqrt{14}}{7}, \frac{2\sqrt{14}}{7}, \frac{3\sqrt{14}}{7}\right)$
15. $x=12(2-\sqrt{3})$ 呎, $y=2(3-\sqrt{3})$ 呎, $\theta=\frac{\pi}{6}$ 16. $\sqrt{6}$

➔ 習題 13-8

1. 相對極小值為 $f\left(\frac{1}{3}, \frac{2}{3}\right) = \frac{2}{3}$ 2. $f(360, 75) = 48,643$ 為極大值
3. $f\left(\frac{3}{\sqrt{2}}, 2\sqrt{2}\right) = 24$ 為極大值 4. 極大值為 $\frac{1}{3}$ 5. 極小值為 $\frac{9}{2}$
6. 極小值為 7200 7. 最大體積為 $\frac{64}{9}$ 8. $\frac{8\sqrt{3}}{9} abc$
9. 極小值為 $f\left(\frac{5}{11}, \frac{30}{11}, \frac{8}{11}\right) = \frac{120}{11}$ 10. $\left(\frac{2\sqrt{3}}{3}, \frac{2\sqrt{3}}{3}, \frac{2\sqrt{3}}{3}\right)$
11. $\frac{33}{23}$ 為絕對極小值, 無絕對極大值 12. 長 6 米, 寬 6 米, 高 6 米
13. 最近點為 $\left(-1+\frac{\sqrt{2}}{2}, -1+\frac{\sqrt{2}}{2}, -1+\sqrt{2}\right)$,
 最遠點為 $\left(-1-\frac{\sqrt{2}}{2}, -1-\frac{\sqrt{2}}{2}, -1-\sqrt{2}\right)$

第 14 章

➔ 習題 14-1

1. 18 2. 略 3. 240 4. 略 5. (1) 9 (2) 0 6. 略

7. (1) 9 (2) 0 (3) $5-\sqrt{3}-\sqrt{2}$ 8. $\frac{1}{4} \ln 2$ 9. 234 10. $\sqrt{2}$ 11. e^2-1 12. 0 13. 2
14. $\frac{1}{3} (3\sqrt{3}-4\sqrt{2}+1)$ 15. $\frac{1}{2} e-1$ 16. $\frac{\pi^2}{144}$ 17. $\sqrt{3}+\frac{2\pi}{3}$
18. $\frac{\sqrt{2}+\sqrt{3}}{4}$ 19. $1+\sqrt[3]{2}$ 20. π^2 21. $\frac{1}{2}$ 22. $\frac{75}{2}$ 23. $-\frac{5}{6}$
24. $\frac{\sqrt{3}-1}{2}-\frac{\pi}{12}$ 25. $\frac{1}{3\pi}$ 26. 20 27. 44
28. $\cos 1-\cos 9-4$ 29. $\frac{e(4-e^3)}{2}$ 30. $-\frac{\sqrt{2}}{2\pi}$ 31. $\frac{3 \ln 2-\pi}{9}$ 32. $\frac{1}{6}$ 33. $\frac{16}{3}$
34. $\frac{e^2+1}{4}$ 35. $\frac{\pi-2 \ln 2}{4}$ 36. $2(e-1)$ 37. $\frac{61}{3}$ 38. -2.55 39. $\frac{1}{2} [(\ln 3)^2-(\ln 2)^2]$
40. $\frac{5}{6}$ 41. $e-2$ 42. $\frac{e^9-1}{6}$ 43. $\frac{1}{4} \sin 16$ 44. $\frac{1}{4} (e^4-1)$ 45. $\frac{e-2}{2}$
46. $\frac{2}{9} (2^{3/2}-1)$ 47. $\frac{\pi}{8}$ 48. $\frac{2}{3} (e-1)$ 49. $\frac{3}{4}$ 50. $\frac{e(e^3-4)}{2}$
51. $\frac{1}{2}$ 52. $\frac{\ln 17}{4}$ 53. $\frac{27}{70}$ 54. $\frac{1-\cos 1}{2}$ 55. 6 56. $\frac{81\pi}{8}$ 57. $\frac{11}{6}$
58. 27π 59. 16π 60. 18 61. $\frac{343}{12}$ 62. 2 63. $\frac{5}{4}$ 64. $2(e-1)$ 65. $\ln \frac{q}{p}$

➡ 習題 14-2

1. $\frac{\pi}{8}$ 2. $\frac{1}{12}$ 3. $\frac{4}{3}$ 4. $\frac{\pi}{2} (1-e^{-a^2})$ 5. $\ln (\sqrt{2}+1)$ 6. $\frac{\pi}{2}$ 7. $\frac{\pi}{2} (2-\sqrt{3})$
8. $\frac{\pi}{4} (1-\cos 1)$ 9. $\frac{\pi}{2}$ 10. 2 11. $\frac{16-3\pi}{6}$ 12. $\frac{\pi}{8} (e-1)$ 13. $\frac{2(2\pi+3\sqrt{3})}{3}$
14. $\frac{a^2}{8} (12-\pi)$ 15. $\frac{\pi a^2}{8}$ 16. 54π 17. $\sqrt{65}-4 \cos^{-1} \frac{4}{9}$ 18. $\frac{2\pi}{3}$ 19. $\frac{\pi}{8} \ln 2$
20. 12π 21. $\frac{256\pi}{3}$ 22. $\frac{\pi}{3} (64-24\sqrt{3})$ 23. 2π

➡ 習題 14-3

1. 6π 2. π 3. $\frac{\pi}{6} (5^{3/2}-1)$ 4. $\sqrt{2}\pi$ 5. $\frac{(5\sqrt{5}-1)\pi}{6}$ 6. $\frac{27-5\sqrt{5}}{12}$
7. $\frac{(10\sqrt{10}-1)\pi}{18}$ 8. $\frac{52\pi}{3}$ 9. 8π 10. $4\pi r^2$ 11. 10π 12. 128 13. 略

➡ 習題 14-4

1. $\frac{7}{3}$ 2. -40 3. $\frac{1}{3}$ 4. $\frac{1}{12}$ 5. $\frac{7561}{5}$ 6. $\frac{e^2-8e+15}{-8}$ 7. $-\frac{\pi}{2}$

8. $\frac{1}{2} \ln 2 - \frac{5}{16}$ 9. $\frac{128}{15}$ 10. 2 11. $\frac{32\sqrt{2}}{5}$ 12. $\frac{243\pi}{4}$ 13. 2π
14. 81π 15. 4π

→ 習題 14-5

1. (1) $9\sqrt{3}$ (2) $-\frac{3\sqrt{3}}{64} + \frac{\pi}{24}$ (3) $\frac{16}{9}(3\pi-4)$ (4) $\frac{\pi}{3}$ (5) $\frac{\pi^2}{2}$ (6) $\frac{\pi}{4}$
2. 24π 3. 8π 4. $\frac{4\pi}{3}(8\sqrt{2}-7)$ 5. 8π 6. $\frac{32\pi}{3}$ 7. 1.27×10^5 8. $\frac{8\pi}{35}$
9. $4\pi(2-\sqrt{3})$ 10. $\frac{\pi}{30}$ 11. $\frac{64\sqrt{2}\pi}{3}$ 12. $\frac{\pi}{8}$ 13. $\frac{5\pi}{2}$ 14. $\frac{7\pi}{16}$
15. $\frac{256\pi(\sqrt{2}-1)}{5}$ 16. 略

→ 習題 14-6

1. $m=30$, $(\bar{x}, \bar{y}) = \left(2, \frac{9}{5}\right)$ 2. $m=\frac{16}{3}$, $(\bar{x}, \bar{y}) = \left(0, \frac{3\pi}{8}\right)$
3. $m=\frac{\pi}{4}$, $(\bar{x}, \bar{y}) = \left(\frac{\pi}{2}, \frac{16}{9\pi}\right)$ 4. $m=8k$, $(\bar{x}, \bar{y}) = \left(0, \frac{8}{3}\right)$
5. $m=\frac{1-e^{-2}}{4}$, $(\bar{x}, \bar{y}) = \left(0, \frac{4(1-e^{-3})}{9(1-e^{-2})}\right)$
6. $m=\frac{e^2+8e-13}{4}$, $(\bar{x}, \bar{y}) = \left(\frac{e^2-8e+33}{2(e^2+8e-13)}, \frac{27e^2+8e^3-53}{18(e^2+8e-13)}\right)$
7. $m=\frac{5\pi}{3}$, $(\bar{x}, \bar{y}) = \left(\frac{21}{20}, 0\right)$ 8. $m=\frac{32k}{9}$, $(\bar{x}, \bar{y}) = \left(\frac{6}{5}, 0\right)$
9. $m=\frac{22k}{3}$, $(\bar{x}, \bar{y}) = \left(\frac{27}{11}, 0\right)$
10. $m = \int_0^{8/5} \int_{y/4}^{\frac{\sqrt{4-y^2}}{3}} \int_0^{4-9x^2-y^2} k\sqrt{x^2+y^2+z^2} dz dx dy,$
 $M_{yz} = \int_0^{8/5} \int_{y/4}^{\frac{\sqrt{4-y^2}}{3}} \int_0^{4-9x^2-y^2} kx\sqrt{x^2+y^2+z^2} dz dx dy, \quad \bar{x} = \frac{M_{yz}}{m}$
11. $(\bar{x}, \bar{y}, \bar{z}) = \left(\frac{4}{15}, \frac{4}{15}, \frac{4}{15}\right)$ 12. $(\bar{x}, \bar{y}, \bar{z}) = \left(0, 0, \frac{150}{59}\right)$

$$13. (\bar{x}, \bar{y}, \bar{z}) = \left(\frac{3a}{8}, \frac{3a}{8}, \frac{3a}{8} \right)$$

$$14. (\bar{x}, \bar{y}, \bar{z}) = \left(0, 0, \frac{4}{3} \right)$$

$$15. (\bar{x}, \bar{y}, \bar{z}) = \left(0, 0, \frac{3}{4} \right)$$

$$16. m = 9k\pi, (\bar{x}, \bar{y}, \bar{z}) = \left(0, 0, \frac{9}{4} \right)$$

$$17. (\bar{x}, \bar{y}, \bar{z}) = \left(0, 0, \frac{2a}{5} \right)$$

$$18. m = \frac{124k\pi}{5}$$

$$19. I_x = \frac{96}{5}, I_y = \frac{1024}{3}, I_o = \frac{5408}{15}$$

$$20. I_x = \frac{7a^6}{180}, I_y = \frac{7a^6}{180}, I_o = \frac{7a^6}{90}$$

$$21. \sqrt{\frac{5}{12}} a \quad 22. \frac{\rho a^4 \pi}{4}, \frac{a}{2} \quad 23. \frac{4096k\pi}{15}, 4\sqrt{\frac{2}{5}}$$

► 習題 14-7

$$1. 4(u^2 + v^2) \quad 2. 4v \quad 3. 2e^{4u} \quad 4. -4 \quad 5. 144vw^2 \quad 6. -\ln 2 \quad 7. \frac{3}{2} \sin 1$$

$$8. \frac{2}{3} \ln(\sec 1 + \tan 1) \quad 9. \frac{\pi}{6} (1 - \cos 1) \quad 10. e - \frac{1}{e} \quad 11. \frac{1}{90} \quad 12. \frac{4}{3} \pi abc$$

第 15 章

► 習題 15-1

$$1. (1) [1, 5] \quad (2) (0, 1) \cup (1, \infty)$$

$$2. (1) 2\mathbf{i} + 3\mathbf{j} + 4\mathbf{k} \quad (2) < -1, e^{-\pi}, \sqrt{\pi} > \quad (3) \mathbf{j} + \frac{\pi}{2}\mathbf{k} \quad (4) \left\langle 2, \frac{1}{2}, \sin 3 \right\rangle$$

$$3. (1) \cos t\mathbf{i} - \sin t\mathbf{j} \quad (2) \text{略} \quad (3) t = n\pi, n = 0, \pm 1, \pm 2, \dots \quad (4) \text{是} \quad (5) \text{是} \\ (6) -\sin t\mathbf{i} - \cos t\mathbf{j}$$

$$4. (1) 2\mathbf{i} + 3t^2\mathbf{j} \quad (2) \cos t\mathbf{i} - e^{-t}\mathbf{j} + \mathbf{k} \quad (3) 2t\mathbf{i} - (5t^4 + e^t)\mathbf{j} + (3t^2 - e^t)\mathbf{k} \\ (4) (\cos t + 2t)\mathbf{i} + (\cos t + 2t)\mathbf{j} + 3(\cos t + 2t)\mathbf{k} \quad (5) 0$$

$$5. (1) 6t - 10t \sin t - 5t^2 \cos t \quad (2) \frac{8t}{\sqrt{8t^2 + 1}} \quad (3) 1 - 12t^3 \quad 6. \text{略} \quad 7. \text{略} \quad 8. \text{略}$$

$$9. (1 + \sin t)\mathbf{i} - \cos t\mathbf{j} \quad 10. 2(t - 2)\mathbf{i} + \frac{1}{2} \ln \left(\frac{t^2 + 1}{2} \right) \mathbf{j} + \frac{1}{2} (t^2 - 1)\mathbf{k}$$

$$11. (t^2 + 2)\mathbf{i} - (t^2 + 4)\mathbf{j}$$

► 習題 15-2

$$1. \frac{\sqrt{5}}{5} (\mathbf{j} + 2\mathbf{k}) \quad 2. \frac{\sqrt{17}}{17} (-4\mathbf{i} + \mathbf{k}) \quad 3. \frac{\sqrt{3}}{3} (\mathbf{i} - \mathbf{j} + \mathbf{k}) \quad 4. \frac{\sqrt{10}}{10} (-3\mathbf{i} + \mathbf{k})$$

$$5. \frac{\sqrt{3}}{3} (\mathbf{i} + \mathbf{j} + \mathbf{k}) \quad 6. e - \frac{1}{e} \quad 7. e^2 \quad 8. 2\pi\sqrt{10} \quad 9. \frac{3}{2}$$

➔ 習題 15-3

1. 略 2. 略 3. $\sqrt{2}/(1+\cos^2 t)^{3/2}$ 4. 2 5. $\frac{\sqrt{2}}{4}$ 6. $\frac{2\sqrt{5}}{25}$ 7. 1 8. $\frac{\sqrt{2}}{2}$
9. $(x-2)^2+y^2=\frac{81}{4}$, $x^2+(y-3)^2=\frac{16}{9}$ 10. $\frac{1}{2}$, $-\frac{1}{2}$
11. $(-a \sin ti + a \cos tj + c\mathbf{k})/\sqrt{a^2+c^2}$, $-\cos ti - \sin tj$,
 $(c \sin ti - c \cos tj + a\mathbf{k})/\sqrt{a^2+c^2}$, $a/(a^2+c^2)$, $c/(a^2+c^2)$
12. $\frac{\sqrt{10}}{10}(-\mathbf{j}+3\mathbf{k})$, $\frac{\sqrt{10}}{10}(-3\mathbf{j}-\mathbf{k})$, $\mathbf{i}$, $\frac{3\sqrt{5}}{25}$, 0

➔ 習題 15-4

1. $\mathbf{i}-\mathbf{j}$, $\mathbf{i}+\mathbf{j}$, $\sqrt{2}$ 2. $-\sqrt{2}\mathbf{i}+\sqrt{2}\mathbf{j}+\mathbf{k}$, $-\sqrt{2}\mathbf{i}-\sqrt{2}\mathbf{j}$, $\sqrt{5}$
3. $2\mathbf{i}+4\mathbf{j}+\frac{1}{2}\mathbf{k}$, $2\mathbf{j}-\frac{1}{4}\mathbf{k}$, $\frac{9}{2}$
4. $\sqrt{3}e^t$, $\sqrt{3}e^t$, $\sqrt{2}e^t$, $\frac{\sqrt{3}}{3}[(\cos t - \sin t)\mathbf{i} + (\sin t + \cos t)\mathbf{j} + \mathbf{k}]$, $\frac{\sqrt{2}}{3}e^{-t}$
5. $10\sqrt{5}$, 0, 80, $\frac{\sqrt{5}}{5}(2 \cos 4t\mathbf{i} - 2 \sin 4t\mathbf{j} + \mathbf{k})$, $\frac{4}{25}$

➔ 習題 15-5

1. (1) $\frac{4}{3}$ (2) 0 (3) $\frac{4}{3}$ 2. $-\frac{8}{3}$ 3. $1-\pi$ 4. (1) $\frac{5}{3}$ (2) $\frac{8}{3}$ (3) 2 5. 0 6. $\frac{3}{5}$
7. $1-e^3$ 8. (1) 5 (2) $\frac{23}{3}$ (3) $\frac{13}{3}$ 9. $-\frac{7}{6}$ 10. 18π

➔ 習題 15-6

1. 略 2. 略 3. 略 4. 略 5. 略 6. $1-\frac{1}{e}$ 7. (1) -4 (2) -4 (3) -4 (4) 0

➔ 習題 15-7

1. 0 2. 0 3. 9π 4. 0 5. π 6. $\frac{1}{30}$ 7. 0 8. -12π 9. (1) πab (2) πab

➔ 習題 15-8

1. 略 2. 略 3. 略 4. 略 5. 0 6. 略 7. 略 8. 略
9. (1) 略 (2) $\phi(x, y, z) = y^2 \sin x + xz^3 - 4y + 2z + c$ (3) $4\pi + 15$

➡ 習題 15-9

1. 11 2. 90 3. 24 4. $2\pi r^3$ 5. 1 6. $\frac{3}{2}$

➡ 習題 15-10

1. 84π 2. $3V$ 3. 略 4. 略 5. 略