1-1

1. (a) $0.\dot{6}$ (b) $0.\dot{7}$ (c) $0.8\dot{3}$ (d) $1.0\dot{9}$
   (e) $0.\dot{2}5\dot{9}$ (f) $0.4\dot{2}5\dot{9}$ (g) $0.010\dot{1}$ (h) $0.111\dot{5}$
2. (a) $\frac{2}{9}$ (b) $\frac{67}{33}$ (c) $\frac{131}{999}$ (d) $\frac{7}{15}$
   (e) $\frac{133}{15}$ (f) $\frac{4568}{495}$ (g) $\frac{171}{22}$ (h) $\frac{3599}{2475}$

1-2

1. (a) $7\sqrt{2}$ (b) $2\sqrt{7}$ (c) $5\sqrt{5}$ (d) $4\sqrt{3}$
   (e) $3\sqrt{6}$ (f) $6\sqrt{5}$ (g) $5\sqrt{14}$ (h) $5a\sqrt{ak}$
   (i) $3k^2\sqrt{3a}$
2. (a) $-3\sqrt{2}$ (b) $2\sqrt{7}+7\sqrt{13}$ (c) $-3\sqrt{3}$ (d) $6\sqrt{7}$
   (e) $\sqrt{5}+4\sqrt{2}$ (f) $2\sqrt{2}-9\sqrt{3}$ (g) $-11\sqrt{3}-2\sqrt{11}$ (h) $9\sqrt{2}-\sqrt{6}$
   (i) $3\sqrt{3}-\sqrt{6}$ (j) $7\sqrt{7}-3\sqrt{14}$

1-3

1. $20\sqrt{11}$ 2. $45\sqrt{3}$ 3. 42 4. $30\sqrt{2}$ 5. 52
6. $15\sqrt{3}$ 7. 9 8. $4\sqrt{6}$ 9. $5\sqrt{14}$ 10. $33\sqrt{2}$
11. $48\sqrt{2}$ 12. $36\sqrt{7}$ 13. $15\sqrt{10}$ 14. $3ab^2\sqrt{7}$ 15. $2x^2y\sqrt{2y}$
16. $7m^2n\sqrt{5n}$ 17. $3+6\sqrt{3}$ 18. $7\sqrt{2}-7\sqrt{7}$ 19. $2\sqrt{11}-10$ 20. $-5\sqrt{2}-15$
21. $21\sqrt{7}+21\sqrt{6}$ 22. $28-4\sqrt{6}$

1-4

1. 4 2. $\frac{1}{3}$ 3. $\sqrt{3}$ 4. 4 5. $\frac{\sqrt{7}}{2}$
6. $\frac{2}{3}$ 7. $\sqrt{\frac{3}{2}}$ 8. $\frac{\sqrt{15}}{2}$ 9. $9\sqrt{2}$ 10. $\frac{4\sqrt{3}}{5}$
11. $2+\sqrt{3}$ 12. $\sqrt{3}-2$ 13. $1-\sqrt{2}$ 14. $-\frac{7}{4}-\frac{\sqrt{2}}{2}$ 15. $-\frac{1}{8}-\frac{\sqrt{2}}{5}$
16. $-10+2\sqrt{3}$ 17. $\sqrt{k}-\frac{b}{a}$ 18. $\sqrt{a}-\frac{3}{2}$

1-5

1. $8+2\sqrt{7}$ 2. $21-8\sqrt{5}$ 3. 7 4. $-17+2\sqrt{66}$
5. $21-4\sqrt{5}$ 6. -9 7. $66+40\sqrt{2}$ 8. $82+10\sqrt{21}$
9. $30+12\sqrt{6}$ 10. $51+36\sqrt{2}$ 11. $77+42\sqrt{2}$ 12. $27+12\sqrt{5}$
13. $a^2+b+2a\sqrt{b}$ 14. m^2-n 15. $9k+2-6\sqrt{2k}$ 16. $49x+4y-28\sqrt{xy}$

1-6

1. $\frac{2\sqrt{5}}{5}$ 2. $\frac{7\sqrt{11}}{11}$ 3. $25\sqrt{2}$ 4. $3\sqrt{7}$ 5. $2\sqrt{10}$
6. $\frac{2\sqrt{35}}{5}$ 7. $\frac{4\sqrt{3}}{3}$ 8. $\frac{\sqrt{5}}{15}$ 9. $\frac{\sqrt{3}}{2}$ 10. $\frac{\sqrt{5}}{3}$
11. $\frac{\sqrt{30}}{5}$ 12. $\frac{\sqrt{14}}{7}$ 13. $\frac{\sqrt{10}}{4}$ 14. $\frac{7\sqrt{6}}{18}$
15. $\frac{\sqrt{x}}{x}$ 16. $\frac{\sqrt{3mn}}{2n}$ 17. $\frac{2\sqrt{b}}{a}$ 18. $\frac{2\sqrt{5x}}{x^2}$

1-7

1. $\frac{3-\sqrt{2}}{7}$ 2. $\frac{5+\sqrt{3}}{22}$ 3. $4+\sqrt{7}$ 4. $\sqrt{13}-3$ 5. $\frac{3(6-\sqrt{5})}{31}$
6. $-(2+\sqrt{7})$ 7. $\sqrt{19}+\sqrt{13}$ 8. $5\sqrt{5}-5\sqrt{7}$ 9. $\frac{5}{3}(\sqrt{14}-\sqrt{5})$
10. $\frac{7}{2}(\sqrt{7}-\sqrt{15})$ 11. $4\sqrt{3}-6$ 12. $\frac{1}{4}(3\sqrt{5}+1)$ 13. $\frac{9}{23}(2\sqrt{7}-\sqrt{5})$
14. $-2\sqrt{13}-6\sqrt{2}$ 15. $6\sqrt{5}+4\sqrt{7}$ 16. $-\frac{3}{2}(5\sqrt{2}+4)$ 17. $3(\sqrt{3}-\sqrt{2})$
18. $18\sqrt{5}-12\sqrt{11}$ 19. $\sqrt{p}+\sqrt{q}$ 20. $\frac{x\sqrt{y}-y}{x^2-y}$

2-1

1. (a) $\sqrt{11}i$ (b) $3i$ (c) $-9i$ (d) $5\sqrt{5}i$
   (e) $3\sqrt{13}i$ (f) $-6\sqrt{2}i$ (g) $=\frac{2}{\sqrt{3}}i=\frac{2\sqrt{3}}{3}i$ (h) $\frac{5}{7}i$
2. (a) $13i$ (b) $18i$ (c) $3i$ (d) $-6i$ (e) $21i$ (f) -4 (g) 4 (h) 6
3. (a) $5i$ (b) $-4i$ (c) 7 (d) $\frac{3\sqrt{5}}{5}$ (e) $8i$ (f) -18

2-2

1. $13+6i$ 2. $3+4i$ 3. $-11+i$ 4. $9+3i$ 5. $8+4i$
6. $7+7i$ 7. $2-5i$ 8. $-15+16i$ 9. $-10+6i$ 10. $-27+i$
11. $16-i$ 12. $-i$ 13. 3 14. $-5i$ 15. $3a$
16. $7k+ki$ 17. $14+5i$ 18. $-12+6i$ 19. 0 20. $-12i$

2-3

1. (a) i (b) i (c) 1 (d) $-i$ (e) $-i$ (f) -1
   (g) -6 (h) i (i) $-64i$ (j) $(-2)^6 i^6=-64$ (k) $-2i$ (l) 5
2. (a) $=63i^9=63i$ (b) $=-55i^{18}=55$ (c) $=8i^{11}=-8i$ (d) $=96i^{14}=-96$
   (e) 1 (f) $=i^{140}\times(-1)\times i^{261}=(-1)\times i^{401}=-i$ (g) -18

(h) 35 (i) $=-8i^5=-8i$ (j) $27i$ (k) -8
(l) -72 (m) 8 (n) 65 (o) 220

2-4

1. $-3+12i$ 2. $-10+15i$ 3. $-2+3i$ 4. $-7-5i$
5. $-6+14i$ 6. $20-24i$ 7. $-8+16i$ 8. $-30-15i$
9. $6+16i$ 10. $12+6i$ 11. $-42-30i$ 12. $-56+28i$
13. $-24+18i$ 14. $-105-30i$ 15. $-8-4i$ 16. $-64-224i$
17. $9-12i$ 18. $-5-3i$ 19. $576+360i$ 20. $-4320-3456i$

2-5

1. $5+5i$ 2. $36+2i$ 3. $-9+2i$ 4. $-23-11i$
5. $1+18i$ 6. -60 7. $38-8i$ 8. $30i$
9. $24-31i$ 10. $-169i$ 11. 74 12. 153
13. $-33+6i$ 14. $-92+44i$ 15. $13+13i$ 16. $-30+25i$
17. 4 18. $4+25i$ 19. $-55+48i$ 20. $13-84i$
21. $58+44i$ 22. $-66+488i$

2-6

1. $\frac{2}{5}-\frac{1}{5}i$ 2. $\frac{3}{10}+\frac{1}{10}i$ 3. $\frac{1}{5}+\frac{1}{10}i$ 4. $\frac{3}{34}+\frac{5}{34}i$ 5. $\frac{3}{5}-\frac{4}{5}i$
6. $7-6i$ 7. $\frac{12}{97}+\frac{27}{97}i$ 8. $\frac{1}{10}+\frac{3}{10}i$ 9. $\frac{2}{5}-\frac{3}{5}i$ 10. $\frac{2}{5}+\frac{3}{10}i$
11. $-\frac{3}{2}-\frac{5}{2}i$ 12. $-\frac{7}{53}+\frac{2}{53}i$ 13. $-\frac{3}{109}+\frac{10}{109}i$ 14. $\frac{1}{13}+\frac{5}{13}i$
15. $-\frac{8}{13}-\frac{1}{13}i$ 16. $1-\frac{3}{2}i$ 17. $\frac{1}{2}-\frac{\sqrt{3}}{2}i$ 18. $-\sqrt{3}+\sqrt{2}i$
19. $\frac{12}{7}+\frac{3\sqrt{5}}{7}i$ 20. $\frac{3}{4}+\frac{\sqrt{3}}{12}i$

2-7

1. $\frac{1}{2}+\frac{3}{2}i$ 2. $\frac{7}{17}-\frac{11}{17}i$ 3. $\frac{2}{5}-\frac{26}{5}i$ 4. $-\frac{60}{53}+\frac{55}{53}i$
5. $-\frac{27}{68}-\frac{57}{68}i$ 6. $-\frac{3}{55}+\frac{4}{55}i$ 7. $-\frac{25}{19}+\frac{11\sqrt{3}}{19}i$ 8. $\frac{1}{5}+\frac{2}{5}i$
9. $\frac{168}{193}-\frac{95}{193}i$ 10. $1+\sqrt{13}i$ 11. $\frac{4\sqrt{5}}{23}+\frac{9}{23}i$ 12. $\frac{\sqrt{6}}{50}-\frac{19}{25}i$

2-8

1. $\frac{2}{6+i}=\frac{12-2i}{37}$; $\frac{4}{3+i}=\frac{12-4i}{10}=\frac{6-2i}{5}$; $\therefore \frac{2}{6+i}+\frac{4}{3+i}=\frac{12-2i}{37}+\frac{6-2i}{5}=\frac{282}{185}-\frac{84}{185}i$
2. $\frac{7i}{5-i}=\frac{-7+35i}{26}$; $\frac{4i}{2+3i}=\frac{12+8i}{13}$; $\therefore \frac{7i}{5-i}-\frac{4i}{2+3i}=\frac{-7+35i}{26}-\frac{12+8i}{13}=-\frac{31}{26}+\frac{19}{26}i$

3. $\frac{1+i}{2+4i}=\frac{6-2i}{20}=\frac{3-i}{10}$; $\frac{2-i}{i-3}=\frac{-7+i}{10}$; $\therefore \frac{1+i}{2+4i}-\frac{2-i}{i-3}=\frac{3-i}{10}-\frac{-7+i}{10}=1-\frac{1}{5}i$

4. $\frac{6-2i}{3-5i}=\frac{28+24i}{34`}=\frac{14+12i}{17}$; $\frac{1+4i}{4+i}=\frac{8+15i}{17}$; $\therefore \frac{6-2i}{3-5i}+\frac{1+4i}{4+i}=\frac{14+12i}{17}+\frac{8+15i}{17}=\frac{22}{17}+\frac{27}{17}i$

5. $\frac{3-2i}{9-6i}=\frac{3-2i}{3(3-2i)}=\frac{1}{3}$; $\frac{7+3i}{2-5i}=\frac{-1+41i}{29}$; $\therefore \frac{3-2i}{9-6i}-\frac{7+3i}{2-5i}=\frac{1}{3}-\frac{-1+41i}{29}=\frac{32}{87}-\frac{41}{29}i$

2-9

1. (a) $a=-2,\ b=3$ (b) $a=1,\ b=7$ (c) $a=-1,\ b=4$
   (d) $a=-5,\ b=-2$ (e) $a=12,\ b=-11$ (f) $a=1,\ b=-4$
   (g) $a=-3,\ b=3$ (h) $a=1,\ b=4$
2. (a) $a=35,\ b=7$ (b) $a=-6,\ b=2$ (c) $a=17,\ b=-1$
   (d) $a=-5,\ b=-44$ (e) $a=2,\ b=4$ (f) $a=3,\ b=-2$

3-1

1.	$(x-2)(x-4)$	2.	$(g+3)(g+16)$	3.	$(a-2)(a+12)$	4.	$(d-6)^2$
5.	$(k+3)(k-3)$	6.	$x(x+6)$	7.	$(11r-7)(r-3)$	8.	$(2x+11)(x+1)$
9.	$(t-5)(9t-5)$	10.	$(2f-5)(3f-2)$	11.	$(3u-2)(8u+5)$	12.	$(8w-7)(w+3)$
13.	$(5c-2)(2c+9)$	14.	$(3-2y)(1+y)$	15.	$(q+8)(q-5)$	16.	$-t(t-9)(t-11)$
17.	$2(m+2)(m+10)$	18.	$3(5h+2)(h+1)$	19.	$5(3x+17)(x-1)$	20.	$3(w-12)(w-1)$
21.	$\frac{1}{6}(y-5)(y-16)$	22.	$(x^2-3)(x^2+19)$	23.	$(k^3+3)(k^3+18)$	24.	$(r^{-1}+3)(r^{-1}-2)$

25. $(\sqrt{y}-3)(\sqrt{y}-22)$ 26. $[(m^2-m)-2][(m^2-m)-12]=(m-2)(m+1)(m-4)(m+3)$

3-2

1.	$6,\ -2$	2.	$-2,\ -9$	3.	$3,\ -18$	4.	$0,\ -2$	5.	$-\frac{4}{3},\ 2$
6.	$\frac{3}{2},\ 2$	7.	$\frac{4}{9},\ -3$	8.	$-\frac{1}{4},\ -3$	9.	$\frac{1}{4}$	10.	$\frac{1}{3},\ -3$
11.	$-\frac{1}{3},\ \frac{5}{3}$	12.	$0,\ 36$	13.	$-\frac{4}{3},\ \frac{4}{3}$	14.	$-\frac{3}{2}$	15.	$\frac{11}{3},\ 3$
16.	$\frac{1}{2},\ -2$	17.	$4,\ 5$	18.	$8,\ -\frac{9}{2}$				

3-3

1.	$12,\ 2$	2.	$0,\ -22$	3.	$2,\ 8$	4.	$2,\ -\frac{8}{3}$	5.	$-\frac{5}{6},\ -\frac{1}{2}$
6.	$-\frac{7}{5},\ \frac{11}{5}$	7.	$3,\ -1$	8.	$-1,\ 0$	9.	$-\frac{2}{5},\ -2$	10.	$\frac{7}{4},\ -\frac{7}{3}$
11.	$-9,\ -8$	12.	$2,\ 0$	13.	$\frac{8}{5},\ -\frac{8}{3}$	14.	$-\frac{3}{10},\ -\frac{1}{2}$	15.	$-1,\ -3$
16.	$-\frac{7}{12}$	17.	$\frac{3}{4},\ 1$	18.	$0,\ \frac{5}{2}$				

3-4

1. $a=1,\ b=5,\ c=-14$; 2, -7
2. $a=1,\ b=-9,\ c=20$; 5, 4
3. $a=4,\ b=-16,\ c=15$; $\frac{5}{2},\ \frac{3}{2}$
4. $a=12,\ b=8,\ c=15$; $\frac{-8\pm\sqrt{-656}}{24}$ ∴ no real roots 沒有實根
5. $a=1,\ b=3,\ c=1$; $\frac{-3\pm\sqrt{5}}{2}$
6. $a=3,\ b=-3,\ c=-2$; $\frac{3\pm\sqrt{33}}{6}$
7. $a=2,\ b=3,\ c=-9$; $\frac{3}{2},\ -3$
8. $a=25,\ b=-10,\ c=1$; $=\frac{10\pm\sqrt{0}}{50}=\frac{1}{5}$
9. $7x^2+46x-21=0$; $a=7,\ b=46,\ c=-21$; $\frac{3}{7},\ -7$
10. $10y^2-37y-12=0$; $a=10,\ b=-37,\ c=-12$; 4, $-\frac{3}{10}$
11. $5y^2-y-4=0$; $a=5,\ b=-1,\ c=-4$; $=\frac{1\pm\sqrt{81}}{10}=1,-\frac{4}{5}$
12. $x^2+5x-1=0$; $a=1,\ b=5,\ c=-1$; $\frac{-5\pm\sqrt{29}}{2}$

3-5

1. $-2\pm\sqrt{3}$
2. $3\pm\sqrt{6}$
3. $\frac{-3\pm3\sqrt{3}}{2}$
4. $\frac{5\pm\sqrt{21}}{4}$
5. $\frac{-5\pm\sqrt{17}}{6}$
6. $\frac{2\pm3\sqrt{2}}{2}$
7. no real roots 沒有實根
8. $\frac{1\pm2\sqrt{2}}{7}$
9. $\frac{7\pm2\sqrt{6}}{5}$
10. $\frac{3\pm3\sqrt{2}}{2}$
11. $\frac{-7\pm\sqrt{73}}{12}$
12. $\frac{3\pm\sqrt{7}}{3}$
13. $\frac{\sqrt{3}\pm\sqrt{7}}{2}$
14. $\frac{\sqrt{3}}{5},-\sqrt{3}$

3-6

1. $2\pm i$
2. $\frac{-5\pm\sqrt{5}}{2}$
3. $-3\pm2i$
4. $-4\pm5i$
5. $\frac{3}{2}\pm\frac{1}{2}i$
6. $\frac{2}{3},\ -3$
7. $-\frac{5}{4}\pm\frac{\sqrt{91}}{4}i$
8. $-1\pm\frac{1}{3}i$
9. $\frac{1\pm\sqrt{26}}{5}$
10. $3\pm2\sqrt{2}i$
11. $\frac{1}{4}\pm\frac{3\sqrt{3}}{4}i$
12. $\frac{2}{3}\pm\frac{2\sqrt{3}}{3}i$
13. $\frac{3}{2}\pm\frac{\sqrt{7}}{2}i$
14. $\frac{5\pm3\sqrt{17}}{4}$
15. $-1\pm\frac{1}{2}i$
16. $\frac{1}{10}\pm\frac{\sqrt{259}}{10}i$

3-7

1. $5x^2+20x-225=0$; $5,-9$
2. $x^2-12x+12=0$; $6\pm2\sqrt{6}$
3. $2x^2+18x-20=0$; $1,-10$
4. $x^2-4x-12=0$; $6,-2$
5. $6x^2-49x-45=0$; $9,-\frac{5}{6}$
6. $x^2-400x=0$; 0, 400

7. $2x^2 - 22x + 60 = 0$; 6, 5

8. $x^2 + 4x - 4 = 0$; $-2 \pm 2\sqrt{2}$

3-8

1. $x \cdot \frac{1}{3}x = x + 6$

   $x = \underline{\underline{6}}$ or 或 $x = \underline{\underline{-3}}$

3. $\frac{1}{2}(x+1)(5x+3) = 36$

   $x = \underline{3}$ or 或 $x = -\frac{23}{5}$ (rej.捨)

5. $(18 + x)(18 - \frac{x}{2}) = 18^2$

   $x = \underline{\underline{18}}$ or 或 $x = 0$ (rej.捨)

7. $\frac{100}{3x - 35} = 2x + 15$

   $x = \underline{\underline{12.5}}$ or 或 $x = -8\frac{1}{3}$ (rej.捨)

9. Sam's age 志強的年齡 = x,

   $x \cdot (x-3) = 2[x + (x-3)]$

   $x = 6$ or 或 $x = 1$ (rej.捨)

   ∴ Sam is 6 years old. 志強 6 歲。

2. score of James 偉明的得分 = x,

   $x(x-2) = 24$

   $x = 6$ or 或 $x = -4$ (rej.捨)

   ∴ James scores 6 marks. 偉明得 6 分。

4. the width 闊度 = x cm,

   $x \cdot 5x = 245$

   $x = 7$ or 或 $x = -7$ (rej.捨)

   ∴ The perimeter 周界

   = $(7 + 5 \times 7) \times 2 = \underline{\underline{84m}}$

6. the smaller number 較小的數 = x cm,

   $x \cdot (x+2) = 9(x+2) - 28$

   $x = 5$ or 或 $x = 2$ (rej.捨)

   ∴ The smaller number is 5.

   較小的數是 5。

8. $\frac{28 - x}{x} \times 100\% = 2x\%$

   $x = \underline{\underline{20}}$ or 或 $x = -70$ (rej.捨)

   ∴ The book cost him $20.

   該書的成本為 $20。

3-9

1. $(\frac{x}{4})^2 + (\frac{44 - x}{4})^2 = 73$, $x = 32$ or 或 $x = 12$

   ∴ The length of the larger square

   大正方形的邊長 = $\frac{32}{4} = 8$ cm.

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

   $x = 7$ or 或 $x = \frac{1}{2}$ (rej.捨)

   ∴ The length of the shortest side is 8.

   最短的邊長是 8.

5. the length of a side 邊長 = x cm

   $(\frac{x+11}{2})^2 + (\frac{x-3}{2})^2 = x^2$

   $x = 13$ or 或 $x = -5$ (rej.捨)

   ∴ The perimeter is 42 cm.

   周界是 42 cm。

2. the width 闊度 = x cm,

   $x^2 + (x+21)^2 = 51^2$

   $x = 24$ or 或 $x = -45$ (rej.捨)

   ∴ The width is 闊度是 24 cm.

4. the width 闊度 = x cm

   $(18 + 2x)(22 + 2x) - 18 \times 22 = 129$

   $x = 1.5$ or 或 $x = -21.5$ (rej.捨)

   ∴ The width is 1.5 cm.

   闊度是 1.5 cm。

6. $(\frac{450}{x} - 4)(x + 40) = 450$

   $x = \underline{\underline{50}}$ or 或 $x = -90$ (rej.捨)

7. $(\frac{612}{x}+10.5)(x-7)=612$

$x=\underline{\underline{24}}$ or 或 $x=-17$ (rej.捨)

8. $x^2+(x-5)^2=\frac{1}{2}[10x+(x-5)]$

$x=\underline{\underline{5}}$ or 或 $x=\frac{11}{4}$ (rej.捨)

∴ The two-digit number is 50.

該兩位數是 50。

4-1

1. (a) $\Delta=(-5)^2-4(1)(-7)=53>0$
∴ 2 distinct real roots 兩個相異實根

(b) $\Delta=(-2)^2-4(6)(7)=-164<0$
∴ no real roots 沒有實根

(c) $\Delta=(12)^2-4(3)(12)=0$
∴ 2 equal real roots 兩個相等實根

(d) $\Delta=(-4)^2-4(-5)(2)=56>0$
∴ 2 distinct real roots 兩個相異實根

(e) $\Delta=(-11)^2-4(7)(8)=-103<0$
∴ no real roots 沒有實根

(f) $\Delta=0-4(4)(-11)=176>0$
∴ 2 distinct real roots 兩個相異實根

2. (a) $6^2-4(-1)(k)>0$, $k>-9$

(b) $(-12)^2-4(k)(7)<0$, $k>\frac{36}{7}$

(c) $k^2-4(2)(32)=0$, $k=\pm 16$

(d) $18^2-4(-k)(-6)\geq 0$, $k\leq\frac{27}{2}$

(e) $(-5)^2-4(4)(-2k)=0$, $k=-\frac{25}{32}$

3. (a) $(3m)^2-4(m+1)(-2)=0$, $9m^2+8m+8=0$, ∴ no real solution 沒有實數解

(b) $(-6)^2-4(3m+1)(7)>0$, $m<\frac{2}{21}$

(c) $(-2m)^2-4(m+1)(3-m)<0$, $2m^2-2m-3<0$, ∴ $\frac{1-\sqrt{7}}{2}<m<\frac{1+\sqrt{7}}{2}$

4. (a) $(-8)^2-4(t)(8)=0$, $t=2$, $x=2$

(b) $6^2-4(3)(t-3)=0$, $t=6$, $x=-1$

(c) $(t+2)^2-4(1)(36)=0$, $t=10$ or 或 $t=-14$;
when 當 $t=10$, $x=6$; when 當 $t=-14$, $x=-6$.

5. (a) $\Delta=(3a)^2-4(3a+1)(-1)=(3a+2)^2\geq 0$ ∴ has real roots 有實根

(b) $\Delta=(-a)^2-4(1)(a-4)=(a-2)^2+12>0$ ∴ has 2 distinct real roots 有相異實根

4-2

1. (a) $\alpha+\beta=-5$, $\alpha\beta=-7$ (b) $\alpha+\beta=\frac{4}{3}$, $\alpha\beta=1$ (c) $\alpha+\beta=0$, $\alpha\beta=-\frac{9}{8}$

(d) $\alpha+\beta=\frac{2}{3}$, $\alpha\beta=0$ (e) $\alpha+\beta=-2$, $\alpha\beta=-\frac{4}{3}$ (f) $\alpha+\beta=4$, $\alpha\beta=-\frac{4}{3}$

2. (a) −60 (b) 343 (c) $-\frac{15}{7}$ 3. (a) 16 (b) −16 (c) −151

4. (a) $\frac{35}{4}$ (b) $\frac{14}{5}$ (c) 50

4-3

1. $\alpha^2+\beta^2=(\alpha+\beta)^2-2\alpha\beta$

   (a) 8 (b) 41 (c) 21 (d) $11\frac{1}{4}$ (e) $4\frac{9}{16}$ (f) $3\frac{4}{25}$

2. $(\alpha-\beta)^2=(\alpha+\beta)^2-4\alpha\beta$

   (a) 37 (b) -12 (c) 23 (d) $-\frac{191}{16}$ (e) $4\frac{1}{9}$ (f) $\frac{73}{9}$

3. $\frac{\beta}{\alpha}+\frac{\alpha}{\beta}=\frac{(\alpha+\beta)^2-2\alpha\beta}{\alpha\beta}$, $\alpha^3+\beta^3=(\alpha+\beta)[(\alpha+\beta)^2-3\alpha\beta]$

   (a) (i) -6 (ii) 378 (b) (i) $-1\frac{27}{28}$ (ii) $-1\frac{19}{64}$ (c) (i) $-\frac{16}{9}$ (ii) $3\frac{19}{27}$

4. (a) $\alpha+\beta=-\frac{5}{2}$, $\alpha\beta=-6$; $(\alpha-\beta)^2=(\alpha+\beta)^2-4\alpha\beta=\frac{121}{4}$, $\therefore\ \alpha-\beta=\pm\frac{11}{2}$

   (b) $\alpha^2-\beta^2=\frac{-5(\alpha-\beta)}{2}=\pm\frac{55}{4}$

   (c) $(\alpha^2-\beta^2)^2=\alpha^4-2\alpha^2\beta^2+\beta^4$, $\therefore\ \alpha^4+\beta^4=(\alpha^2-\beta^2)^2+2(\alpha\beta)^2=\frac{4177}{16}$

4-4

1. 3 2. 1 3. -10 4. -1 5. 0 6. 10

7. $a=-\frac{3}{14}$, $\alpha=-\frac{1}{6}$ 8. $k=3$, $\alpha=-\frac{3}{2}$

4-5

1. (a) $x^2+7x-60=0$ (b) $x^2+8x-180=0$ (c) $5x^2-4x=0$
   (d) $3x^2-8x-3=0$ (e) $12x^2+16x+5=0$ (f) $8x^2-58x+77=0$
2. (a) $x^2-2x+7=0$ (b) $x^2+3x-13=0$ (c) $5x^2-x+5=0$
   (d) $2x^2+x+9=0$ (e) $6x^2+14x-4=0$ (f) $14x^2-21x-4=0$

4-6

1. (a) sum 和 $=-\frac{\alpha+\beta}{2}$, product 積 $=\frac{\alpha\beta}{4}$, $\therefore\ 2x^2+3x-1=0$

   (b) sum 和 $=2(\alpha+\beta)+2$, product 積 $=4\alpha\beta+2(\alpha+\beta)+1$, $\therefore\ x^2-8x-1=0$

   (c) sum 和 $=(\alpha+\beta)^2-2\alpha\beta$, product 積 $=(\alpha\beta)^2$, $\therefore\ x^2-13x+4=0$

2. $\alpha+\beta=-6$, $\alpha\beta=-11$,

   (a) sum 和 $=(\alpha+\beta)+2$, product 積 $=\alpha\beta+(\alpha+\beta)+1$, $\therefore\ x^2+4x-16=0$

   (b) sum 和 $=\frac{\alpha+\beta}{\alpha\beta}$, product 積 $=\frac{1}{\alpha\beta}$, $\therefore 11x^2-6x-1=0$

   (c) sum 和 $=\pm\sqrt{(\alpha+\beta)^2-4\alpha\beta}$, product 積 $=-\alpha\beta$,
   $\therefore\ x^2-4\sqrt{5}x+11=0$ or 或 $x^2+4\sqrt{5}x+11=0$

3. $\alpha+\beta=\frac{2}{3}$, $\alpha\beta=-\frac{4}{3}$,

(a) sum 和 $= 4-(\alpha+\beta)$, product 積 $= 4-2(\alpha+\beta)+\alpha\beta$, $\therefore 3x^2-10x+4=0$

(b) sum 和 $= \alpha\beta(\alpha+\beta)$, product 積 $= (\alpha\beta)^3$, $\therefore 27x^2+24x-64=0$

5-1

1. (a) 48 (b) -37 (c) $\frac{7}{2}$ (d) 1.5
2. (a) -21 (b) 54 (c) -104 (d) $-\frac{45}{2}$
3. (a) 0 (b) -0.5 (c) 27 (d) 4
   (e) $f(-3)=11,\ f(-1)=7,\ f(-3)-f(-1)=11-7=4$
   (f) $f(5)=-5,\ f(-9)=23,\ f(5)\times f(-9)=-5\times 23=-115$
4. (a) $g(-1)=-2,\ -3-g(-1)=-3-(-2)=-1$ (b) $g(4)=28,\ 7\div g(4)=7\div 28=0.25$
   (c) $g(-2)=-2,\ -g(-2)\times 3=-(-2)\times 3=6$ (d) $g(\frac{1}{2})=\frac{7}{4},\ g(\frac{1}{2})\times 2=\frac{7}{4}\times 2=\frac{7}{2}$
   (e) $g(4)=28,\ g(2)=10,\ \frac{g(4)}{g(2)}=\frac{28}{10}=\frac{14}{5}$ (f) $g(5)=40,\ \frac{10}{g(5)}=\frac{10}{40}=\frac{1}{4}$
5. (a) $h(3)=1,\ 9+4h(3)=13$ (b) $h(1)=-5,\ h(-2)=-6.75,\ 2h(1)\times h(-2)=67.5$
   (c) $h(2)=-3,\ 3^{h(2)}=3^{-3}=\frac{1}{27}$

5-2

1. (a) 0 (b) 4 (c) 4 (d) $g[g(3)]=g(4)=15$
2. (a) $\frac{7}{3}$ (b) $h[h(0)]=h(3)=29$ (c) 83 (d) $[h(2)]^2=11^2=121$
3. (a) $g[g(3)]=g(1)=-1$ (b) $g[f(4)]=g(8)=\frac{13}{8}$
   (c) $f[g(1)]=f(-1)=-7$ (d) $f[g(\frac{1}{2})]=f(-4)=8$
   (e) $f[g(-2)]=f(\frac{7}{2})=\frac{17}{4}$ (f) $g[-f(3)]=g(-1)=5$
4. (a) $H(7)=2f(7)\times g(7)=-40$ (b) $H(0)=2f(0)\times g(0)=12$
   (c) $H(-5)=2f(-5)\times g(-5)=28$
5. (a) $R(2)=f(2)-3g(2)=-7$ (b) $6R(8)=6[f(8)-3g(8)]=1146$
   (c) $R(-1)+f(-1)=f(-1)-3g(-1)+f(-1)=-26$
6. (a) $Q(5)=\frac{f(5)}{g(5)}=10$ (b) $Q(\frac{1}{2})=\frac{f(\frac{1}{2})}{g(\frac{1}{2})}=-\frac{55}{8}$ (c) $\frac{2}{Q(-2)}=\frac{2}{f(-2)\div g(-2)}=-\frac{4}{15}$

5-3

1. $3-8a(-2)=51,\ a=3$
2. $5k(3)+k=80,\ k=5$
3. $4(-6)^2-b(-6)+(3-b)=142,\ b=-1$
4. $[-k-7(\frac{1}{3})][5+2(\frac{1}{3})]=17,\ k=-\frac{16}{3}$

5. $\frac{a+2(13)}{-(13)+a}=-\frac{8}{5}, 5a+130=-8a+104, a=-2$

6. $8\cdot 3^{a+11}+11=19, 3^{a+11}=1, a=-11$

7. $2a(8)+6(8)=2a(5)+6(5), 6a=-18, a=-3$

8. $k(\frac{1}{4})-2(\frac{1}{4})^2=k(-\frac{1}{4})-2(-\frac{1}{4})^2, \frac{1}{2}k=0, k=0$

9. $[k-(-6)](-6+k)=64, k^2-36=64, k=-10$ or 或 10

10. $\frac{7}{3[(7)-b]^2}=\frac{1}{84}, 196=(7-b)^2, b=-7$ or 或 21

11. $[a+(6)]^2+4a=-4, a^2+16a+40=0, a=-8\pm 2\sqrt{6}$

5-4

1. (a) $f(5k)=4-7(5k)=4-35k$ (b) $f(-k)=4-7(-k)=4+7k$
   (c) $f(5k)+f(-k)=4-35k+4+7k=8-28k$

2. (a) $g(\frac{n}{6})=(\frac{n}{6})^2-9(\frac{n}{6})=\frac{n^2}{36}-\frac{3n}{2}$ (b) $g(-2n)=(-2n)^2-9(-2n)=4n^2+18n$
   (c) $g(\frac{n}{6})-g(-2n)=(\frac{n^2}{36}-\frac{3n}{2})-(4n^2+18n)=-\frac{143n^2}{36}-\frac{39n}{2}$

3. (a) $h(3m)=(3m-2)^2-3m=9m^2-15m+4$
   (b) $h(m+2)=[(m+2)-2]^2-(m+2)=m^2-m-2$
   (c) $h(m-3)=[(m-3)-2]^2-(m-3)=m^2-11m+28$

4. (a) $p(2s)=\frac{2s}{2s+2}=\frac{s}{s+1}$ (b) $\frac{1}{p(2s)}=\frac{s+1}{s}$ (c) $p(\frac{1}{2s})=\frac{\frac{1}{2s}}{\frac{1}{2s}+2}=\frac{1}{1+4s}$

5. (a) $U(k)=q(k)-3r(k)=k^2-3(k+18)=k^2-3k-54$
   (b) $U(3k)=q(3k)-3r(3k)=(3k)^2-3[(3k)+18]=9k^2-9k-54$
   (c) $U(2k+1)=q(2k+1)-3r(2k+1)=(2k+1)^2-3[(2k+1)+18]=4k^2-2k-56$

6. (a) $f(x-1)=(x-1)[(x-1)-1]=(x-1)(x-2)$
   (b) $f(2-x)=(2-x)[(2-x)-1]=(2-x)(1-x)$
   (c) $f(-x)-f(x+1)=(-x)[(-x)-1]-(x+1)[(x+1)-1]=0$

7. (a) $T(2x)=[2(2x)+1][(2x)+5]=(4x+1)(2x+5)$
   (b) $T(x+5)=[2(x+5)+1][(x+5)+5]=(2x+11)(x+10)$
   (c) $T(1-2x)=[2(1-2x)+1][(1-2x)+5]=(3-4x)(6-2x)=2(3-4x)(3-x)$

5-5

1. (a) Let 設 $x=2n$, $n=\frac{x}{2}$; $f(2\times\frac{x}{2})=4(\frac{x}{2})-5, \therefore f(x)=2x-5$

   (b) Let 設 $x=4m$, $m=\frac{x}{4}$; $f(4\times\frac{x}{4})=2(\frac{x}{4})^4+6(\frac{x}{4}), \therefore f(x)=\frac{x^4}{128}+\frac{3x}{2}$

   (c) Let 設 $x=-3k$, $k=-\frac{x}{3}$; $f(x)=[6(-\frac{x}{3})+1]^2-2=4x^2-4x-1$

   (d) Let 設 $x=\frac{n}{2}$, $n=2x$; $f(x)=(2x)^2-3(2x)+1=4x^2-6x+1$

(e) Let 設 $x=\frac{k}{5}$, $k=5x$; $f(x)=\frac{10}{5x}+5(5x)=\frac{2}{x}+25x$

(f) Let 設 $x=2m$, $m=\frac{x}{2}$; $f(x)=\frac{(\frac{x}{2})^2}{4}-\frac{8}{(\frac{x}{2})}=\frac{x^2}{16}-\frac{16}{x}$

2. (a) Let 設 $x=m+2$, $m=x-2$; $g(x)=(x-2)[(x-2)+2]=x(x-2)$

(b) Let 設 $x=n-9$, $n=x+9$; $g(x)=8(x+9)-(x+9)^2=-(x+9)(x+1)$

(c) Let 設 $x=k+1$, $k=x-1$; $g(x)=[3(x-1)-1]^2+6=9x^2-24x+22$

(d) Let 設 $x=4-u$, $u=4-x$; $g(x)=2(4-x)^2+7=2x^2-16x+39$

(e) Let 設 $x=2k-1$, $k=\frac{x+1}{2}$; $g(x)=4(\frac{x+1}{2})^2-4(\frac{x+1}{2})+1=x^2$

(f) Let 設 $x=2c+3$, $c=\frac{x-3}{2}$; $g(x)=(\frac{x-3}{2})[4+2(\frac{x-3}{2})]=\frac{1}{2}(x-3)(x+1)$

3. (a) Let 設 $x=\frac{1}{n}$, $n=\frac{1}{x}$;

$p(x)=\frac{1}{x}\div 2=\frac{1}{2x}$

(b) Let 設 $x=\frac{2}{n}$, $n=\frac{2}{x}$;

$p(x)=\frac{\frac{2}{x}}{\frac{2}{x}+2}=\frac{1}{1+x}$

(c) Let 設 $x=\frac{1}{n-1}$, $n=\frac{1}{x}+1$;

$p(x)=5-\frac{1}{(\frac{1}{x}+1)}=5-\frac{x}{1+x}$

4. (a) Let 設 $x=a+3$, $a=x-3$; $U(x)=5(x-3)-(x-3)^2=(x-3)(8-x)$

(b) $U(2a)=[(2a)-3][8-(2a)]=2(2a-3)(4-a)$

(c) $U(a-1)=[(a-1)-3][8-(a-1)]=(a-4)(9-a)$

5. (a) Let 設 $k=3x$, $x=\frac{k}{3}$; $T(k)=2(\frac{k}{3})^2-7(\frac{k}{3})+2=\frac{2}{9}k^2-\frac{7}{3}k+2$

(b) $T(x+1)=\frac{2}{9}(x+1)^2-\frac{7}{3}(x+1)+2=\frac{2}{9}x^2-\frac{17}{9}x-\frac{1}{9}$

(c) $T(\frac{x}{2})=\frac{2}{9}(\frac{x}{2})^2-\frac{7}{3}(\frac{x}{2})+2=\frac{x^2}{18}-\frac{7x}{6}+2$

5-6

1. all real nos. 所有實數
2. all real nos. except 0 不包括 0 的所有實數
3. $x\geq -7$
4. all real nos. except 0 不包括 0 的所有實數
5. all real nos. except 3 不包括 3 的所有實數
6. all real nos. 所有實數
7. $x\leq 8$
8. $x>-\frac{1}{2}$
9. all real nos. except 11 and -8 不包括 11 和 -8 的所有實數
10. all real nos. except 6 and -3 不包括 6 和 -3 的所有實數
11. all real nos. except $\frac{8}{3}$ and -4 不包括$\frac{8}{3}$和 -4 的所有實數
12. all real nos. 所有實數
13. all real nos. 所有實數
14. all real nos. 所有實數

5-7

1. (a) $A(x) = 2(x)(3x) + 2(5)(x) + 2(5)(3x) = 6x^2 + 40x$ (b) $A(5) = 6(5)^2 + 40(5) = 350$

   (c) $A(x) = 6x^2 + 40x = 846,\ 3x^2 + 20x - 423 = 0,\ x = 9$ or $x = -\frac{47}{3}$ (rej.捨)

   ∴ dimensions of the base are 底部的尺寸是 9cm×27cm

2. (a) $V(4) = k\pi(4)^3 = 192\pi, k = 3$ (b) $V(\frac{1}{2}) = 3\pi(\frac{1}{2})^3 = \frac{3\pi}{8}$

   (c) $V(r) = 3\pi r^3 = 648\pi, r^3 = 216, r = 6$

   ∴ height of the cylinder 圓柱體的高 = 3(6) = 18cm

3. (a) $D(2) = 400(2) - 20(2)^2 = 720$

   (b) $D(k-2) = 400(k-2) - 20(k-2)^2 = -20k^2 + 480k - 880$

   (c) $D(k) - D(k-2) = 400k - 20k^2 - (-20k^2 + 480k - 880) = -80k + 880$

   (d) $D(k+2) - D(k) = -80(k+2) + 880 = -80k + 720$

4. (a) $P(n) = T(n) + C(n) = 1500 + 30n + 30n - 5\sqrt{n} = 1500 + 60n - 5\sqrt{n}$

   (b) $P'(n) = T(n) + 2C(n) = 1500 + 30n + 2(30n - 5\sqrt{n}) = 1500 + 90n - 10\sqrt{n}$

   (c) $P'(100) = 1500 + 90(100) - 10\sqrt{100} = 10400$

6-1

1. (a)

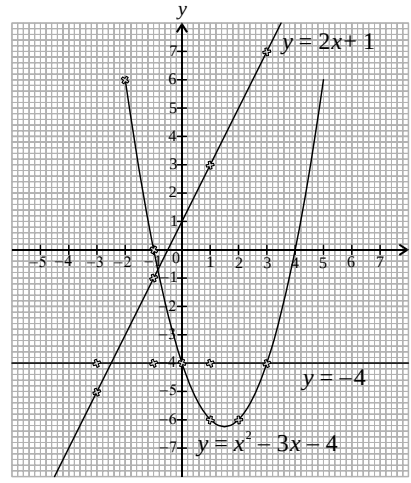
x	-3	-1	1	3
y	-4	-4	-4	-4

   (b)

x	-3	-1	1	3
y	-5	-1	3	7

   (c)

x	-2	-1	0	1	2
y	6	0	-4	-6	-6



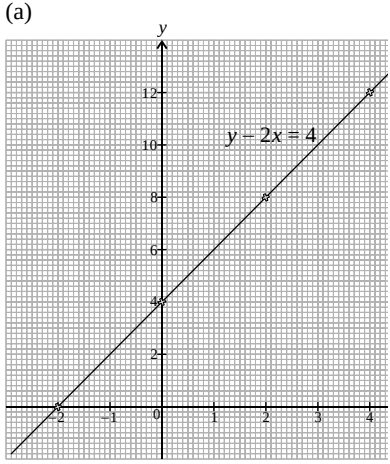
2. (a)

x	-2	0	2	4
y	0	4	8	12

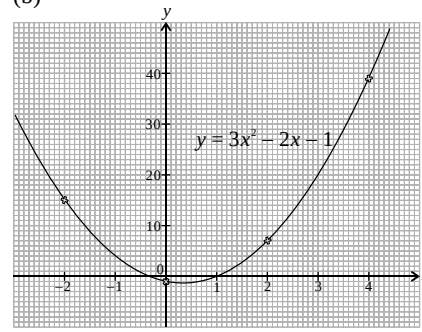
   (b)

x	-2	0	2	4
y	15	-1	7	39

(a)



(b)

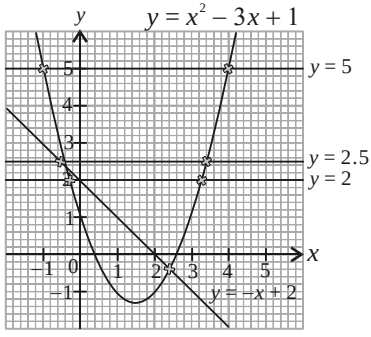


6-2

1. 4.5
2. 1.5
3. 0.5, 2
4. −2, 3
5. 2
6. −1, 1, 1.5

6-3

1.



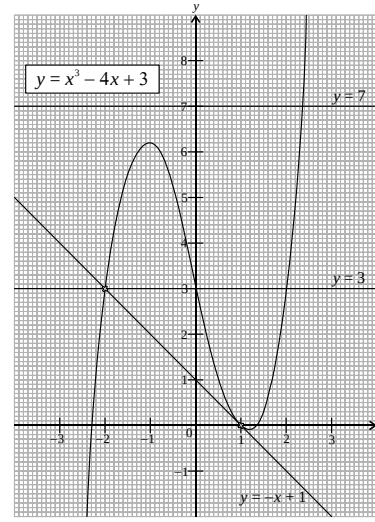
(a) $x^2 - 3x + 1 = 5$; draw 繪畫 $y = 5$;
roots 根: $\underline{\underline{-1, 4}}$.

(b) $x^2 - 3x + 1 = 2$; draw 繪畫 $y = 2$;
roots 根: $\underline{\underline{-0.3, 3.3}}$.

(c) $x^2 - 3x + 1 = -x + 2$;
draw 繪畫 $y = -x + 2$;
roots 根: $\underline{\underline{-0.4, 2.4}}$.

(d) $x^2 - 3x - 1.5 = 0$, $x^2 - 3x + 1 = 2.5$;
draw 繪畫 $y = 2.5$;
roots 根: $\underline{\underline{-0.4, 3.4}}$.

2.



(a) $x^3 - 4x + 3 = 7$; draw 繪畫 $y = 7$;
root 根 : $\underline{\underline{2.4}}$.

(b) $x^3 - 4x + 3 = 3$; draw 繪畫 $y = 3$;
roots 根: $\underline{\underline{-2, 0, 2}}$.

(c) $x^3 - 4x + 3 = -x + 1$;
draw 繪畫 $y = -x + 1$; root 根: $\underline{\underline{-2, 1}}$.

7-1

1. (a) Y 是, upward 向上, 7 (b) N 不是
   (c) Y 是, downward 向下, 0 (d) Y 是, downward 向下, 5
   (e) Y 是, upward 向上, 3 (f) Y 是, upward 向上, $-\frac{4}{3}$

2. (a) $x = -7$ (b) $x = \frac{1}{2}$ (c) $x = 0$ (d) $x = -1$

3.	(a) $y = x^2 + 16x + 64$	(b) $y = -x^2 + 3x - 2$	(c) $y = -6x^2 - \frac{54}{5}x + \frac{12}{5}$	(d) $y = \frac{1}{4}x^2 - \frac{1}{2}x - 12$
(i)	upward 向上	downward 向下	downward 向下	upward 向上
(ii)	64	-2	$\frac{12}{5}$	-12
(iii)	$x = -8$	$x = \frac{3}{2}$	$x = -\frac{9}{10}$	$x = 1$

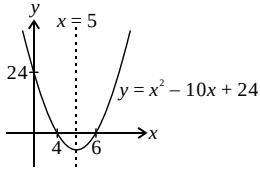
7-2

1. (a) $\Delta = (-8)^2 - 4(1)(9) = 28 > 0$; 2 (b) $\Delta = (6)^2 - 4(-3)(-4) = -12 < 0$; 0
   (c) $\Delta = (8)^2 - 4(-2)(-7) = 8 > 0$; 2 (d) $\Delta = (-12)^2 - 4(-4)(9) = 288 > 0$; 2
   (e) $\Delta = (2)^2 - 4(5)(8) = -156 < 0$; 0 (f) $\Delta = (-10\sqrt{3})^2 - 4(25)(3) = 0$; 1

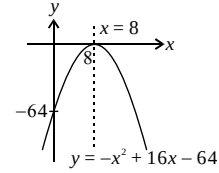
2. (a) 12, 4 (b) 0, 6 (c) $1, -\frac{15}{2}$ (d) $\frac{5}{2}, -\frac{3}{8}$ (e) $x = 7$
   (f) no x-intercepts 沒有 x 軸截距 (g) $-4 \pm \sqrt{23}$ (h) $1, -\frac{5}{3}$

7-3

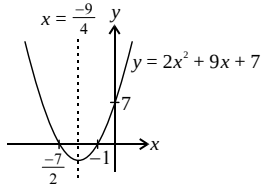
1. (a)



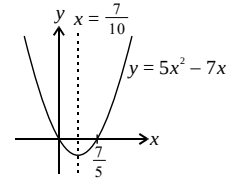
(b)



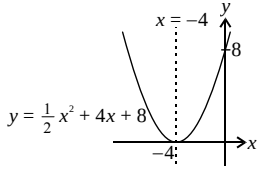
(c)



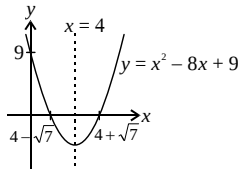
(d)



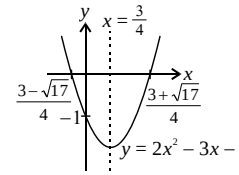
(e)



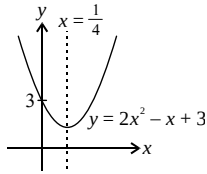
2. (a)



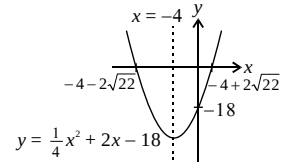
(b)



(c)



(d)



7-4

1. (a) max. pt. 極大點 = (8, –6) (b) min. pt. 極小點 = (3, 4)
   (c) max. pt. 極大點 = (–2, 3)
2. (a) min. value 極小值 = 7, $x = 6$ (b) min. value 極小值 = –17, $x = -3$
   (c) min. value 極小值 = –8, $x = 0$ (d) min. value 極小值 = 0, $x = 4$
3. (a) max. value 極大值 = 1, $x = 3$ (b) max. value 極大值 = 7, $x = -2$
   (c) max. value 極大值 = –8, $x = -5$ (d) max. value 極大值 = –13, $x = \frac{1}{2}$
4. (a) max. value 極大值 = –8, $x = -7$ (b) min. value 極小值 = –3, $x = 1$
   (c) max. value 極大值 = 0.6, $x = 0.3$ (d) min. value 極小值 = $k^2 + 3$, $x = b$
   (e) min. value 極小值 = $-8 + n$, $x = -m$ (f) max. value 極大值 = $-b + \frac{c}{3}$, $x = \frac{n}{m}$

7-5

1. $y = (x-2)^2 + 1$; 1
2. $y = (x+8)^2$; 0
3. $y = (x+9)^2 - 88$; -88
4. $y = (x - \frac{1}{2})^2 - \frac{37}{4}$; $-\frac{37}{4}$
5. $y = (x - \frac{11}{2})^2 - \frac{123}{4}$; $-\frac{123}{4}$
6. $y = (x - \frac{13}{2})^2 - \frac{181}{4}$; $-\frac{181}{4}$
7. $y = 2(x-3)^2 - 11$; -11
8. $y = 3(x+1)^2 + 9$; 9
9. $y = 3(x + \frac{3}{2})^2 - \frac{11}{4}$; $-\frac{11}{4}$
10. $y = 2(x + \frac{1}{2})^2 - \frac{19}{2}$; $-\frac{19}{2}$
11. $y = \frac{1}{3}(x - \frac{1}{4})^2 - \frac{49}{48}$; $-\frac{49}{48}$
12. $y = \frac{3}{5}(x+5)^2 - \frac{31}{2}$; $-\frac{31}{2}$
13. $y = 5(x + \frac{3}{10})^2 - \frac{23}{20}$; $(-\frac{3}{10}, -\frac{23}{20})$
14. $y = 4(x + \frac{3}{4})^2 + \frac{3}{4}$; $(-\frac{3}{4}, \frac{3}{4})$
15. $y = 3(x - \frac{1}{3})^2 + \frac{38}{3}$; $(\frac{1}{3}, \frac{38}{3})$
16. $y = \frac{1}{2}(x+2)^2 + 3$; $(-2, 3)$

7-6

1. $y = -(x+2)^2 + 5$; 5
2. $y = -(x-4)^2 + 13$; 13

3. $y=-(x-6)^2$; 0
4. $y=-(x+9)^2$; 0
5. $y=-(x-\frac{3}{2})^2+\frac{25}{4}$; $\frac{25}{4}$
6. $y=-(x+\frac{1}{2})^2+\frac{41}{4}$; $\frac{41}{4}$
7. $y=-2(x-6)^2+69$; 69
8. $y=-3(x+1)^2+10$; 10
9. $y=-3(x+\frac{3}{2})^2+\frac{47}{4}$; $\frac{47}{4}$
10. $y=-4(x+\frac{5}{2})^2+41$; 41
11. $y=-2(x+\frac{1}{2})^2-\frac{13}{2}$; $-\frac{13}{2}$
12. $y=-3(x+\frac{1}{6})^2+1$; 1
13. $y=-5(x-\frac{1}{10})^2+\frac{41}{20}$; $\frac{41}{20}$
14. $y=-2(x+\frac{7}{4})^2-\frac{31}{8}$; $-\frac{31}{8}$
15. $y=-\frac{1}{2}(x+8)^2+28$; 28
16. $y=-\frac{2}{3}(x-\frac{9}{2})^2+\frac{17}{2}$; $\frac{17}{2}$

7-7

		min. or max. value 極小或極大值	corresponding value of x 對應的 x 值
1.	$y=(x-\frac{5}{2})^2+\frac{3}{4}$	min. 極小 $=\frac{3}{4}$	$x=\frac{5}{2}$
2.	$y=-3(x-1)^2+10$	max. 極大 $=10$	$x=1$
3.	$y=-2(x-2)^2+8$	max. 極大 $=8$	$x=2$
4.	$y=(x-\frac{5}{2})^2-\frac{65}{4}$	min. 極小 $=-\frac{65}{4}$	$x=\frac{5}{2}$
5.	$y=(x-\frac{3}{2})^2+\frac{23}{4}$	min. 極小 $=\frac{23}{4}$	$x=\frac{3}{2}$
6.	$y=-(x-\frac{7}{2})^2+\frac{53}{4}$	max. 極大 $=\frac{53}{4}$	$x=\frac{7}{2}$
7.	$y=-2(x+\frac{1}{2})^2+\frac{9}{2}$	max. 極大 $=\frac{9}{2}$	$x=-\frac{1}{2}$
8.	$y=-3(x-\frac{1}{6})^2-\frac{59}{12}$	max. 極大 $=-\frac{59}{12}$	$x=\frac{1}{6}$
9.	$y=(x-2)^2-1$	min. 極小 $=-1$	$x=2$
10.	$y=(x-3)^2-13$	min. 極小 $=-13$	$x=3$
11.	$y=2(x+\frac{3}{2})^2+\frac{9}{2}$	min. 極小 $=\frac{9}{2}$	$x=-\frac{3}{2}$
12.	$y=\frac{5}{4}(x-2)^2+20$	min. 極小 $=20$	$x=2$

7-8

		x-intercept(s) x 軸截距	y-intercept y 軸截距	Vertex 頂點
1.	$y=(x+3)^2-1$	$-2, -4$	8	min. pt. 極小點 $=(-3, -1)$
2.	$y=(x-2)^2-4$	0, 4	0	min. pt. 極小點 $=(2, -4)$

3.	$y=-(x-\frac{3}{2})^2-\frac{7}{4}$	no x-intercepts 沒有 x 軸截距	–4	max. pt. 極大點 $=(\frac{3}{2},\ -\frac{7}{4})$
4.	$y=2(x+\frac{3}{4})^2-\frac{49}{8}$	$1,-\frac{5}{2}$	–5	min. pt. 極小點 $=(-\frac{3}{4},\ -\frac{49}{8})$
5.	$y=-6(x-\frac{1}{12})^2-\frac{359}{24}$	no x-intercepts 沒有 x 軸截距	–15	max. pt. 極大點 $=(\frac{1}{12},\ -\frac{359}{24})$
6.	$y=-9(x+\frac{1}{2})^2+\frac{49}{4}$	$-\frac{5}{3},\ \frac{2}{3}$	10	max. pt. 極大點 $=(-\frac{1}{2},\ \frac{49}{4})$
7.	$y=8(x-\frac{1}{2})^2$	$\frac{1}{2}$	2	min. pt. 極小點 $=(\frac{1}{2}, 0)$
8.	$y=4(x+2)^2-23$	$-2\pm\frac{\sqrt{23}}{2}$	–7	min. pt. 極小點 $=(-2, -23)$
9.	$y=-5(x-\frac{3}{2})^2+\frac{41}{4}$	$\frac{15\pm\sqrt{205}}{10}$	–1	max. pt. 極大點 $=(\frac{3}{2},\ \frac{41}{4})$
10.	$y=-3(x-\frac{5}{3})^2+\frac{34}{3}$	$\frac{5\pm\sqrt{34}}{3}$	3	max. pt. 極大點 $=(\frac{5}{3},\ \frac{34}{3})$

7-9

1. $C=6(x-80)^2+2600$
   ∴ The minimum production cost is \$ 2600. 最低成本是 \$ 2600。
2. (a) $P=-2(x-17)^2+1278$. ∴ 17 products should be sold. 須售 17 件貨物。
   (b) $\$1278\times1000=\$1278000$
3. $d=36t-3t^2=-3(t-6)^2+108$
   ∴ The greatest height is 108 m and the time is 6 seconds.
   石頭的最高點為 108 m，到達的時間為 6 秒。
4. Let the two numbers be x and $x-10$. 設該兩數為 x 和 $x-10$。
   $x(x-10)=(x-5)^2-25$
   ∴ The two numbers are 5 and –5. 該兩數為 5 和 –5。
5. Let the length be x cm, the width be $(15-x)$ cm. 設長度為 x cm，闊度$(15-x)$ cm。
   $x(15-x)=-(x-7.5)^2+56.25$
   ∴ The max. area is $56.25\,\text{cm}^2$. 最大面積是$56.25\,\text{cm}^2$。
6. Let the length be x cm, width be $(22-x)$ cm. 設長度為 x cm，闊度$(22-x)$ cm。
   $x(22-x)=-(x-11)^2+121$
   ∴ The max. area is 121 cm^2. 最大面積是 121 cm^2。
7. (a) $A=36x-2x^2$
   (b) $A=-2(x-9)^2+162$ ∴ The max. area is 162 cm^2. 最大面積是 162 cm^2。

8-1

1. $-3x^4-2x^3$
2. $2x^3-2x^2-26x+8$
3. $4x^4+7x^3+20x^2+27x-14$
4. $6x^3-29x^2+30x-7$
5. $-5x^3-53x^2-67x+8$
6. $x^5+3x^4-2x^2-6x$
7. $-x^3-x^2+3x+9$
8. $6x^3-5x^2-19x-6$
9. $2x^4-5x^2+2x+10$

10. $15x^4-18x^3+56x^2-54x+41$ 11. $-12x^4-24x^3+68x^2+50x-89$

12. $x^3-\frac{59}{3}x^2+51x-33$ 13. $x^3+\frac{33}{2}x^2-5$ 14. x^2+x+16

15. $-3a^2-7a-6$ 16. $-6x^2+12x-1$ 17. $y^2+16y-9$

18. $-4x^2-7x+50$ 19. $-3-3x^2-13x^3$ 20. $-13x^3+5x^2+2$

8-2

1. (a) $(x-7)(x-3)+2=x^2-10x+23$
   (b) $(2x+1)(x+5)-9=2x^2+11x-4$
   (c) $(x+3)(3x^2-8)-8$
   $=3x^3+9x^2-8x-32$
   (d) $(1+2x)(x^3-9x+3)+0$
   $=2x^4+x^3-18x^2-3x+3$
   (e) $(8-x)(-x^3+6x-1)+23$
   $=x^4-8x^3-6x^2+49x+15$
   (f) $(x^2-3x+1)(4x+8)+7$
   $=4x^3-4x^2-20x+15$
   (g) $(x^2+x-5)(3x^2-7)+(-6x+1)$
   $=3x^4+3x^3-22x^2-13x+36$
   (h) $(2x^2-6)(-2x^2+9x+1)+(4x+18)$
   $=-4x^4+18x^3+14x^2-50x+12$
2. (a) $f(x)=(-2x+5)(x-1)=-2x^2+7x-5$
   (b) $f(x)=(2x^2+3)(3-x)+1=-2x^3+6x^2-3x+10$
   (c) $f(x)=(-x^2+8x+9)(2x+5)-6=-2x^3+11x^2+58x+39$
   (d) $f(x)=(x^3-5x^2+12x+7)(x^2-3)-9x=x^5-5x^4+9x^3+22x^2-45x-21$
   (e) $f(x)=(2x^3-8x+10)(x^2+8x-7)+(4x-1)=2x^5+16x^4-22x^3-54x^2+140x-71$
   (f) $f(x)=(5x^2-6x+7)(2x^2-x+9)+(5-3x)=10x^4-17x^3+65x^2-64x+68$

8-3

1. $x-1$ 2. $2x-7$ 3. $-3x^2-5x-7$ 4. $4x^2-5x+2$
5. $3x^2+x-6$ 6. $7x^2-6$ 7. $4x^2-3x$ 8. x^3+2x+7
9. $3x^2+\frac{x^2}{2}-x+\frac{7}{2}$ 10. x^3-2x^2+3x-1 11. $-3x^2-2x-6$ 12. $2x^3+x^2-x+1$
13. x^2-4x+3 14. $3x^2-5x+13$ 15. $3x^3-5x+1$

8-4

1. $x^2+6x+4.....19$ 2. $5x+22.....119$ 3. $x^2+23x+250.....-2267$
4. $3x^3-5x^2+x-6.....-30$ 5. $2x^2-\frac{3}{2}x+\frac{1}{4}....-4$ 6. $-2x^4+2x^2+3x-7.....-1$
7. $3x-1.....3x$ 8. $\frac{x^4}{2}+\frac{x^3}{3}+1.....6$ 9. $4x-8.....13x-26$
10. $7x+31.....140x-219$ 11. $-x^2-14x-148.....1621$ 12. $3x-\frac{1}{2}.....\frac{5}{2}x-\frac{7}{2}$

8-5

1. 20 2. 26 3. –10 4. 67 5. –9
6. $-\frac{41}{4}$ 7. $-\frac{50}{9}$ 8. $\frac{103}{8}$ 9. 1 10. $\frac{1173}{625}$

8-6

In this exercise, let the remainder be $ax+b$. 在此練習內，設餘數為 $ax+b$ 。

1. $a+b=6...(1)$， $3a+b=24...(2)$； $\therefore 9x-3$
2. $-2a+b=5...(1)$， $a+b=11...(2)$； $\therefore 2x+9$
3. $x^2-4x-5=(x+1)(x-5)$； $-a+b=-13...(1)$， $5a+b=461...(2)$； $\therefore 79x+66$
4. $2x^2+x-3=(2x+3)(x-1)$； $-\frac{3}{2}a+b=0...(1)$， $a+b=5...(2)$； $\therefore 2x+3$
5. $4x^2+8x-5=(2x-1)(2x+5)$； $\frac{1}{2}a+b=8...(1)$， $-\frac{5}{2}a+b=8...(2)$； $\therefore 8$

8-7

1. $k=-8$ 2. $m=3$ 3. $p=24$ 4. $a=-2, b=-5$
5. $m=-51$， $n=-11$

8-8

1. (b), (d)
2. (a) $f(x)=(x-2)(x+3)(2x+5)$ (b) $f(x)=(x-2)(x-3)(2x+1)$
   (c) $f(x)=(x-2)(5x-2)(3x+1)$ (d) $f(x)=3(x-2)(2x+1)(4x+3)$

3.

	$x+1$ is a factor 是因子?	$2x-1$ is a factor 是因子?	
(a)	$f(-1)=0$，$\therefore$ yes 是	$f(\frac{1}{2})=-2.6\neq 0$，$\therefore$ no 不是	$f(x)=(x-1)(x+1)(2x+3)$
(b)	$f(-1)=0$，$\therefore$ yes 是	$f(\frac{1}{2})=0$，$\therefore$ yes 是	$f(x)=(x+1)(2x-1)(x-7)$
(c)	$f(-1)=0$，$\therefore$ yes 是	$f(\frac{1}{2})=5.25\neq 0$，$\therefore$ no 不是	$f(x)=(x+1)(5x-2)(8x+3)$
(d)	$f(-1)=-63\neq 0$，$\therefore$ no 不是	$f(\frac{1}{2})=0$，$\therefore$ yes 是	$f(x)=(2x-1)(4x+1)(x-6)$

4. (a) $(x-1)(x-3)^2$ (b) $(x+3)(x+1)(2x+3)$
   (c) $(x-2)(2x+1)(2x+3)$ (d) $(x+1)^2(x-6)(x+9)$
5. (a) $-5, 1, 6$ (b) $-8, -4, 1$ (c) $-2, 4, -\frac{2}{3}$ (d) $-2, -\frac{3}{2}, \frac{1}{2}$
6. (a) $m=-8$ (b) $q=10$ (c) $n=3$

9-1

1. (a) $7x^2yz^3(7xz-16y^5)$ (b) $11p^4q^2(3p^4+5q^4-9p^3q^8)$
   (c) $a^2b(5c^4-6a^2b^2+60abc^3)$ (d) $4mn^2(7m^2-10-14m^2n^3)$
   (e) $(m^2-n)(24-n)$ (f) $(p-q)(p^2+q)$
   (g) $5(x+y)^2(3x-y)$ (h) $9(x-y)(5x-2xy+2y^2)$
   (i) $12b(a-b)(b^2-6)$ (j) $5b(a-b)(4a^2-4ab-5b)$
2. (a) $(a+b)(a+2)$ (b) $(x+y)(x^2-y)$ (c) $(x^2-2)(7x-6)$
   (d) $a(15b^2+5ab-45bc-a)$ (e) $(3+b)(1-a)$ (f) $(p-q^2)(3q-p)$
   (g) $(s^2+2)(s+2r)$ (h) $(3-g)(g-5h)$ (i) $(b-c)(a+3-b)$
   (j) $(x^2-4-6y)(y-2x)$

9-2

1. (a) $(y-5)^2$ (b) $(2y-11)(2y+11)$ (c) $2(1+3x)^2$ (d) $(p^2+q^2)^2$
   (e) $3(r^2-2s^2)(r^2+2s^2)$ (f) $4(c-3b)(4b+c)$
   (h) $=(m+3)^2-2^2=(m+3n-2)(m+3n+2)$
   (i) $=(f-6g)^2-6^2=(f-6g-6)(f-6g+6)$
   (j) $=(u^2+2v^2)^2-(uv)^2=(u^2+2v^2-uv)(u^2+2v^2+uv)$
2. (a) $(3a-b)(9a^2+3ab+b^2)$ (b) $(x+2y)(x^2-2xy+4y^2)$
   (c) $(mn-6)(m^2n^2+6mn+36)$ (d) $5(2p+1)(4p^2-2p+1)$
   (e) $=(5+2x-1)[25-5(2x-1)+(2x-1)^2]=2(x+2)(4x^2-14x+31)$
   (f) $=2[3(y+1)-y][9(y+1)^2+3y(y+1)+y^2]=2(2y+3)(13y^2+21y+9)$
   (g) $=[(x+3)+(x-2)][(x+3)^2-(x+3)(x-2)+(x-2)^2]=(2x+1)(x^2+x+19)$
   (h) $=[(2x-1)-(1-3x)][(2x-1)^2+(2x-1)(1-3x)+(1-3x)^2]=(5x-2)(7x^2-5x+1)$
   (i) $=[(2y-4x)+(3x+3y)][(2y-4x)^2-(2y-4x)(3x+3y)+(3x+3y)^2]$
   $=(5y-x)(7y^2+8xy+37x^2)$
   (j) $=2[(x^2)^3-(4y^2)^3]=2(x^2-4y^2)(x^4+4x^2y^2+16y^4)$
   $=2(x-2y)(x+2y)(x^4+4x^2y^2+16y^4)$

9-3

1. (a) $(2x-5)(x-1)$ (b) $(3m-2)(m+9)$ (c) $(y+3z)(5y+2z)$
   (d) $(xy+2)(7xy+6)$ (e) $-(a-2)(9a-4)$ (f) $(2x+3)(7-3x)$
   (g) $7(x-y)(x+5y)$ (h) $4(2p-7)(3p+1)$ (i) $(3b+4)(9-8b)$
   (j) $(3m^2-1)(2m-3)(2m+3)$
2. (a) $=(2x^3-2x)+(3x^2-3)=2x(x^2-1)+3(x^2-1)=(x+1)(x-1)(2x+3)$
   (b) $=(x^3-x)-(6x+6)=x(x+1)(x-1)-6(x+1)=(x-3)(x+1)(x+2)$
   (c) $(x+1)$ is a factor 是因子, $\therefore=(x+1)(3x-1)(x-3)$
   (d) $(x-1)$ is a factor 是因子, $\therefore=(x-1)(x+6)^2$
   (e) $(x+1)$ is a factor 是因子, $\therefore=(x+1)(x-7)(2x-1)$
   (f) $(x-3)$ is a factor 是因子, $\therefore=(x-3)(2x+1)(5x+3)$
   (g) $(x+2)$ is a factor 是因子, $\therefore=(x+2)(4x+1)(3x+2)$
   (h) $(2x-1)$ is a factor 是因子, $\therefore=(2x-1)(3x-1)(3x+2)$

9-4

1. H.C.F. = $48x^3y^2$,
   L.C.M. = $288x^3y^4z$
2. H.C.F. = abc,
   L.C.M. = $72a^2b^2c^2$
3. H.C.F. = $2x(3x+1)$,
   L.C.M. = $12x^2(3x+1)(x-4)$
4. H.C.F. = $1-x$,
   L.C.M. = $8(x+4)^2(1-x)^3$
5. H.C.F. = $x+3$,
   L.C.M. = $5(x+3)^2$
6. H.C.F. = $a^2+3ab+9b^2$,
   L.C.M. = $2(a-3b)(a^2+3ab+9b^2)$
7. H.C.F. = $2(x+2)$,
   L.C.M. = $12(x+2)^2(x+3)$
8. H.C.F. = $2x-3y$,
   L.C.M. = $(7+2y)(2x-3y)(7x-2y)$

9. H.C.F. = $5x-4y$,
L.C.M. = $a(5x-4y)(2a+y)(x+y)$

10. H.C.F. = $x+4$,
L.C.M. = $(x-2)(x+4)(2x^2-x-2)$

11. H.C.F. = $x+1$,
L.C.M. = $2(x+1)(2x-3)(2x+1)(3x-2)$

12. H.C.F. = $3x^2-2x+4$,
L.C.M. = $(x-1)(4x+1)(3x^2-2x+4)$

9-5

1. $\frac{7}{6x+2}$
2. $\frac{3+2x}{5}$
3. $-\frac{4}{x}$
4. $\frac{1}{x+1}$
5. $\frac{x-4}{2x-1}$
6. $\frac{x-7}{3}$
7. $\frac{3x+2}{4-3x}$
8. $\frac{5x-3}{5x+3}$
9. $\frac{-3(a+2b)}{2a}$
10. $\frac{3a}{5b}$
11. $\frac{n-2}{n+4}$
12. $\frac{x(x-1)}{2}$
13. $\frac{2}{5a}$
14. $\frac{3x(7y-2x)}{2y}$
15. 2
16. $\frac{2x+3}{2x-3}$

9-6

1. $=\frac{4}{6x}+\frac{15}{6x}=\frac{19}{6x}$
2. $=\frac{2a}{3a^2}-\frac{3}{3a^2}=\frac{2a-3}{3a^2}$
3. $=\frac{2(x+3)-3(x+2)}{(x+2)(x+3)}=\frac{-x}{(x+2)(x+3)}$
4. $=\frac{8x-2(x-3)}{(x-3)(x+3)}=\frac{6(x+1)}{(x-3)(x+3)}$
5. $\frac{x-4}{(x-2)^2}$
6. $\frac{-3}{5x+1}$
7. $=\frac{2-5(x-2y)}{(x-2y)^2}=\frac{2-5x+10y}{(x-2y)^2}$
8. $=\frac{9x-2(x+7)}{(x-2)(x+7)}=\frac{7}{x+7}$
9. $=\frac{-11(x-1)+x+4}{(2x-3)(x+4)(x-1)}=\frac{-5}{(x-1)(x+4)}=\frac{5}{(1-x)(x+4)}$
10. $=\frac{7(k+3)-2k}{k(k+3)^2}=\frac{5k+21}{k(k+3)^2}$
11. $=\frac{2x(x+1)-x(x+3)}{(x-1)(x+1)(x+3)}=\frac{x}{(x+1)(x+3)}$
12. $=\frac{7(x+1)-3(2)(x+2)}{2(x-5)(x+2)(x+1)}=\frac{1}{2(x+2)(x+1)}$
13. $=\frac{3(2y-x)-2(y-x)}{6(y-x)(2y-x)(x+2y)}=\frac{4y-x}{6(y-x)(2y-x)(x+2y)}$
14. $=\frac{2x+3(x-1)}{(x-1)(x^2+x+1)}=\frac{5x-3}{(x-1)(x^2+x+1)}$
15. $=\frac{4(x+4y)-3(x-3y)}{12(x+y)(x-3y)(x+4y)}=\frac{x+25y}{12(x+y)(x-3y)(x+4y)}$
16. $=\frac{1}{(x+1)(x-1)(4x+5)}-\frac{4}{(x-1)(4x+5)^2}=\frac{(4x+5)-4(x+1)}{(x+1)(x-1)(4x+5)^2}=\frac{1}{(x+1)(x-1)(4x+5)^2}$
17. $=\frac{3(x+2)-2(x+3)}{(x+3)(x+2)(2x^2-3x+2)}=\frac{x}{(x+2)(x+3)(2x^2-3x+2)}$
18. $=\frac{1}{(x+6)(x-1)}\cdot(\frac{2}{x+3}+\frac{x}{x-3})=\frac{x^2+5x-6}{(x+6)(x-1)(x+3)(x-3)}=\frac{1}{(x+3)(x-3)}$
19. $=\frac{1}{(x+1)(x-7)}\cdot(\frac{x-1}{x+3}-\frac{3}{x-2})=\frac{x^2-6x-7}{(x+1)(x-7)(x+3)(x-2)}=\frac{1}{(x+3)(x-2)}$

9-7

1. $\frac{1}{15}$ 2. $\frac{1}{2}$ 3. $\frac{2n}{n-2}$ 4. $\frac{5+x}{5-x}$
5. $\frac{x+3}{6}$ 6. $\frac{b(1-a)}{a(1-b)}$ 7. $\frac{2x-1}{x}$ 8. $5(x+1)$

9-8

1. $= \frac{4-x(x-3)}{x-3} \cdot \frac{1}{x(x+1)} = \frac{4-x}{x(x-3)}$
2. $= x(x-1) \cdot \frac{x(x+1)}{2x-(x+1)} = x^2(x+1)$
3. $= (x-2)(x-7) \cdot \frac{(2x+1)(2-x)}{3(2-x)+(2x+1)} = (x-2)^2(2x+1)$
4. $= \frac{3(x+1)-(x+3)}{(x+3)(x+1)} \cdot \frac{x(x+3)}{x+3+x} = \frac{2x^2}{(x+1)(2x+3)}$
5. $= \frac{x(x-7)-6(1-x)}{(1-x)(x-7)} \cdot \frac{(7-x)(x+9)}{(x+9)-x(7-x)} = \frac{(x-3)(x+2)}{(1-x)(x-7)} \cdot \frac{(7-x)(x+9)}{(x-3)^2} = \frac{(x+2)(x+9)}{(x-1)(x-3)}$
6. $= \frac{1-3(x+1)}{(x-2)(x+1)} = \frac{-(3x+2)}{(x-2)(x+1)} = \frac{3x+2}{(2-x)(x+1)}$
7. $= \frac{1}{x+3} \cdot \frac{2}{x} + \frac{3}{x+3} = \frac{2+3x}{x(x+3)}$
8. $= \frac{y+4x}{8x^2} \cdot \frac{4y}{y+4x} = \frac{y}{2x^2}$
9. $= x-2 \cdot \frac{x}{2-3x} = \frac{x(2-3x)-2x}{2-3x} = \frac{3x^2}{3x-2}$
10. $= 1+x \cdot \frac{x}{x^2-1} = \frac{(x^2-1)+x^2}{x^2-1} = \frac{2x^2-1}{x^2-1}$
11. $= \frac{2-x-x}{x(2-x)} \cdot \frac{x(x+2)}{x-1-2x} = \frac{2(1-x)(x+2)}{(x-2)(x+1)}$
12. $= \frac{x+y}{y} \cdot \frac{y-x^2}{x} \cdot \frac{xy}{x^2-y^2} = \frac{y-x^2}{x-y}$
13. $= \frac{2(2x+1)(x+3)}{(x+2)(x+3)} \cdot \frac{x^2-4}{2x(2x+1)} = \frac{x-2}{x}$

9-9

1. $x = -11$
2. $x = -3$
3. $\frac{x-3+2x}{x(x-3)} = \frac{-2}{3}$, $x = -3$ or 或 $x = \frac{3}{2}$
4. $x = -1$
5. $10 = (2x-1)(x-1)$, $x = 3$ or 或 $x = -\frac{3}{2}$
6. $\frac{5(x-3)-2(x+3)}{(x+3)(x-3)} = 3$, $x = 2$ or 或 $x = -1$
7. $\frac{(x-1)(4x-7)+2(x+1)(x+2)}{(x+2)(4x-7)} = 2$, $x = 3$ or 或 $x = -\frac{13}{2}$
8. $x(2-8x) = (5-2x)(3x+1)$, $x = -5$ or 或 $x = -\frac{1}{2}$
9. $(5x+20+4x+4)(x-2) = 3(x^2+5x+4)$, $x = 4$ or 或 $x = -\frac{5}{2}$
10. $\frac{9(x-1)-(6x+2)}{(x-7)(x+2)(x-1)} = \frac{1}{6}$, $x = 4$ or 或 $x = -5$

10-1

1. $x = 4$
2. $x = -2$
3. $y = -\frac{1}{19}$
4. $n = \frac{5}{4}$
5. $x = -4$
6. $k = 2$
7. $x = 14$
8. $x = \frac{10}{3}$
9. $w = 2$
10. $y = \frac{1}{3}$
11. $a = 0$
12. $x = -\frac{23}{3}$

10-2

1. $x = 7$
2. $y = 0$
3. $k = 2$
4. $k = -0.4$
5. $x = 7$
6. $y = 5$
7. $k = 5$
8. $n = -\frac{1}{2}$
9. $w = -4$
10. $y = -5$
11. $x = -\frac{1}{7}$
12. $x = \frac{12}{5}$

10-3

1. $x = 2$, $y = 5$
2. $x = -\frac{16}{5}, y = -\frac{7}{5}$
3. $x = -2$, $y = 1$
4. $x = 3$, $y = 1$
5. $x = -\frac{2}{3}$, $y = 0$
6. $x = -\frac{62}{3}$, $y = -14$
7. $x = 0$, $y = 3$
8. $x = \frac{2}{5}$, $y = -\frac{1}{3}$
9. $x = -\frac{7}{3}$, $y = \frac{3}{2}$
10. $x = \frac{11}{10}$, $y = \frac{7}{10}$

10-4

1. $x = 5$, $y = 12$
2. $x = -2$, $y = 3$
3. $x = \frac{1}{2}$, $y = \frac{1}{2}$
4. $x = 2$, $y = 5$
5. $x = -3$, $y = 5$
6. $x = 0$, $y = 3$
7. $x = -6$, $y = 5$
8. $x = \frac{11}{25}$, $y = \frac{6}{25}$
9. $x = \frac{3}{2}$, $y = \frac{1}{2}$
10. $x = \frac{2}{3}$, $y = -\frac{1}{3}$

10-5

1. $x = 1$, $y = 0$ and 及 $x = -1$, $y = -2$
2. no real solution 沒有實數解
3. $x = -3$, $y = \frac{4}{3}$ and 及 $x = 14$, $y = 7$
4. $x = 0$, $y = 2$
5. $x = 4$, $y = 0$ and 及 $x = \frac{3}{2}$, $y = -\frac{15}{4}$
6. $x = 0$, $y = 2$ and 及 $x = 2$, $y = 0$
7. $x = 12$, $y = 6$ and 及 $x = -6$, $y = -12$
8. $x = -7$, $y = 3$ and 及 $x = 5$, $y = \frac{3}{5}$

9. $x=4,\ y=-\frac{1}{2}$ and 及 $x=\frac{7}{2},\ y=\frac{1}{2}$

10. $x=1,\ y=-1$ and 及 $x=\frac{13}{17},\ y=-\frac{23}{17}$

11. $x=1,\ y=-2$ and 及 $x=\frac{3}{13},\ y=\frac{24}{13}$

12. $x=-1,\ y=2$ and 及 $x=-4,\ y=-10$

13. $x=-5,\ y=-4$ and 及 $x=1,\ y=0$

14. $x=1,\ y=-1$ and 及 $x=-4,\ y=-3$

10-6

1. $x=-\frac{1}{2},\ y=2$ and 及 $x=\frac{19}{10},\ y=\frac{4}{5}$

2. $x=-3,\ y=-2$ and 及 $x=2,\ y=2$

3. $x=\frac{4}{3},\ y=-\frac{1}{3}$

4. no real solution 沒有實數解

5. $x=-\frac{2}{5},\ y=0$ and 及 $x=\frac{1}{5},\ y=\frac{3}{10}$

6. $x=-\frac{1}{2},\ y=1$ and 及 $x=1,\ y=2$

7. $x=2,\ y=4$ and 及 $x=-4,\ y=-2$

8. $x=1,\ y=-1$ and 及 $x=-1,\ y=\frac{3}{2}$

10-7

1. (a) draw 畫 $y=0.5$; $x=3.1$ or 或 -1.1
   (b) draw 畫 $y=2x-7$; $x=2$
   (c) draw 畫 $x+y=-1$; $x=2$ or 或 -1
2. (a) draw 畫 $y=-2$; $x=2.8$ or 或 -1.8
   (b) draw 畫 $2x+2y=1$; $x=2.9$ or 或 -0.9
   (c) draw 畫 $y=3x+5$; no real solution 沒有實數解

10-8

1. (a) $-2=x^2-9x-5, x^2-9x-3=0$
   (b) $5-3x=2x^2-7x, 2x^2-4x-5=0$
   (c) $\frac{x+6}{2}=2x^2+5, 4x^2-x+4=0$
   (d) $\frac{2x-1}{3}=x^2-3x+2, 3x^2-11x+7=0$
2. (a) $y=(2x-8)-(-2x+11)$, $\therefore 4x-y-19=0$
   (b) $y=(2x-8)-(3x-9)$, $\therefore x+y-1=0$
   (c) $y=(2x-8)+(2x+8)$, $\therefore 4x-y=0$
   (d) $y=(2x-8)+(1-4x)$, $\therefore 2x+y+7=0$
   (e) $y=(2x-8)-(4x-2)$, $\therefore 2x+y+6=0$
   (f) $2y=2(2x-8)-(-5x-2)$, $\therefore 9x-2y-14=0$
   (g) $5y=5(2x-8)-(7x-40)$, $\therefore 3x-5y=0$
   (h) $3y=3(2x-8)+(6x+1)$, $\therefore 12x-3y-23=0$

10-9

1. (a) $x^2-8x+3=0$
   $\Delta=(-8)^2-4(1)(3)=52>0$
   $\therefore$ two intersection pts. 兩個交點

   (b) $x^2-3x+11=0$
   $\Delta=(-3)^2-4(1)(11)=-35<0$
   $\therefore$ no intersection pts. 沒有交點

(c) $x^2+3x+9=0$
$\Delta=3^2-4(1)(9)=-27<0$
$\therefore$ no intersection pts. 沒有交點

2. (a) $x^2-(k+1)+9=0$
$\because \Delta=0,\ \therefore (k+1)^2-4(1)(9)=0$
$k^2+2k-35=0,\ k=5$ or -7

(c) $-x^2+kx+k-3=0$
$\because \Delta=0,\ \therefore k^2-4(-1)(k-3)=0$
$k^2+4k-12=0,\ k=2$ or -6

3. (a) $x^2+3x-3-k=0$
$\because \Delta>0,\ \therefore 3^2-4(1)(-3-k)>0$
$4k+21>0,\ k>-\frac{21}{4}$

4. (a) $2x^2-k-6=0$
$\because \Delta<0,\ \therefore 0^2-4(2)(-k-6)<0$
$-k-6>0,\ k<-6$

(d) $2x^2+7x-22=0$
$\Delta=7^2-4(2)(-22)=225>0$
$\therefore$ two intersection pts. 兩個交點

(b) $kx^2+(k+1)x+1=0$
$\because \Delta=0,\ \therefore (k+1)^2-4(k)(1)=0$
$k^2-2k+1=0,\ k=1$

(d) $kx^2+(8-k)x+(k-8)=0$
$\because \Delta=0,\ \therefore (8-k)^2-4(k)(k-8)=0$
$-3k^2+16k+64=0,\ k=-\frac{8}{3}$ or 8

(b) $2kx^2-7x+4=0$
$\because \Delta>0,\ \therefore (-7)^2-4(2k)(4)>0$
$-32k+49>0,\ k<\frac{49}{32}$

(b) $kx^2-2kx+7+k=0$
$\because \Delta<0,\ \therefore (-2k)^2-4(k)(7+k)<0$
$4k^2-28k-4k^2<0, k>0$

10-10

1. the two nos.該兩數 $=x, y$
$x+y=22$ — (1), $xy=85$ — (2)
$\therefore\ x^2-22x+85=0$
$\therefore$ The two nos. are 5 and 17.
該兩數是 5 和 17。

2. larger no.較大的數 $=x$,
smaller no.較小的數 $=y$
$x=y+2$ — (1), $xy=624$ — (2)
$y^2+2y-624=0$
$\therefore$ The two nos. are -24, -26 or 26, 24.
該兩數是-24, -26 或 26, 24。

3. larger no.較大的數 $=x$,
smaller no.較小的數 $=y$
$x^2+y^2=218$ — (1), $2y=x+1$ — (2)
$\therefore\ 5y^2-4y-217=0$
$\therefore$ The two nos. are 13, 7. 該兩數是 13, 7。
(rejected 捨去 $-\frac{67}{5}, -\frac{31}{5}$)

4. length 長度 $=x$ cm, width 闊度 $=y$ cm
$xy=192$ — (1), $x/3=y$ — (2)
$\therefore\ x^2=576$
$\therefore$ The dimensions are 24 cm × 8 cm.
尺寸是 24 cm × 8 cm。

5. length 長度 $=x$ cm, width 闊度 $=y$ cm
$2(x+y)=72$ — (1), $xy=224$ — (2)
$\therefore\ x^2-36x+224=0$
$\therefore$ The dimensions are 28 cm × 8 cm.
尺寸是 28 cm × 8 cm。

6. lengths of the shorter sides 短邊的長度
$=x$ cm, y cm
$x-y=21$ — (1)
$x^2+y^2=39^2$ — (2)
$\therefore\ y^2+21y-540=0$
$\therefore$ The lengths are 36 cm and 15 cm.
長度是 36 cm 及 15 cm。

7. original no. of children 原來人數 $= x$,
original no. of candies each gets
原來每人所得糖果數目 $= y$
$xy = 192$ — (1)
$(x-2)(y+16) = 192$ — (2)
$\therefore\ x^2 - 2x - 24 = 0$
$\therefore$ There were 6 children originally.
原來的人數為 6。

9. larger no.較大的數 $= x$,
smaller no.較小的數 $= y$
$x - y = 0.3,\ x = y + 0.3$ — (1),
$\frac{1}{y} - \frac{1}{x} = 3,\ x - y = 3xy$ — (2)
$\therefore 10y^2 + 3y - 1 = 0$
$\therefore$ The two nos. are 0.5, 0.2 or –0.2, –0.5.
該兩數是 0.5, 0.2 或 –0.2, –0.5。

8. original no. of classes 原來班數 $= x$,
original class size 原來每班人數 $= y$
$xy = 240$ — (1)
$(x-3)(y+4) = 240$ — (2)
$\therefore\ x^2 - 3x - 180 = 0$
$\therefore$ Originally there were 15 classes, each of 16 students.
原有 15 班，每班 16 人。

10. original base area 原來的底面積 $= x$ cm,
original height 原來的高 $= y$ cm
$\frac{xy}{3} = 240$ — (1)
$\frac{(x+4)(y-5)}{3} = 240(1 - \frac{1}{6})$,
$xy - 5x + 4y = 620$ — (2)
$\therefore\ x^2 - 20x - 576 = 0$
$\therefore$ The base area is 底面積為 36 cm^2,
the height is 高度為 20 cm.

10-11

1. length of rectangle 長方形的長度 $= x$ cm,
width of rectangle 長方形的闊度 $= y$ cm
$2(x + y) = 54,\ \therefore\ x = 27 - y$ — (1)
$y^2 - y(x - y) = 108$ — (2)
$\therefore\ y^2 - 9y - 36 = 0$
$\therefore$ The side of the square is 12 cm.
正方形的邊長是 12 cm。

3. tens digit 十位 $= x$,
units digit 個位 $= y$
$x = y + 3$ — (1)
$6xy - (10x + y) = 8$ — (2)
$\therefore\ 6y^2 + 7y - 38 = 0$
$\therefore$ The number is 52. 該數是 52。

5. lengths of diagonals 對角線長度
$= x$ cm and 及 y cm.
$(\frac{x}{2})^2 + (\frac{y}{2})^2 = 20^2,\ x^2 + y^2 = 1600$ — (1),
$\frac{xy}{2} = 384,\ y = \frac{768}{x}$ — (2)
$\therefore x^4 - 1600x^2 + 768^2 = 0$
$\therefore$ The lengths of diagonals 對角線長度
$= 32$ cm and 及 24 cm.

2. the man's age now 男子現今的年齡 $= x$,
daughter's age now 女兒現今的年齡 $= y$
$x = 2y + 11$ — (1)
$(x-5)(y-5) = 480$ — (2)
$\therefore\ y^2 - 2y - 255 = 0$
$\therefore$ He is 45 now, and his daughter is 17.
男子今年 45 歲，而女兒 17 歲。

4. tens digit 十位 $= x$,
units digit 個位 $= y$
$10x + y = xy + 59$ — (1)
$10y + x = (10x + y) - 45$,
$\therefore\ y = x - 5$ — (2)
$\therefore\ x^2 - 16x + 64 = 0$
$\therefore$ The number is 83. 該數是 83。

6. speed of the outward journey and
the return journey 出發及回程的速度
$= x$ km/h and 及 y km/h
$x = y + 10$ — (1)
$\frac{80}{x} + \frac{80}{y} = 2\frac{56}{60},\ \frac{y+x}{xy} = \frac{11}{300}$ — (2)
$\therefore 11y^2 - 490y - 3000 = 0$
$\therefore$ The speeds of the outward journey and the return journey are 60 km/h and 50 km/h.
出發及回程的速度是 60 km/h 及 50 km/h。

7. no. of apples 蘋果的數量 $= x$,
cost of an apple 每個蘋果的成本 $= \$ y$;

$xy = 320, \quad y = \dfrac{320}{x}$ — (1)

$(x - 50)(y + 0.4) = 420$ — (2)

$\therefore 0.4x^2 - 120x - 16000 = 0$

∴ He bought 400 apples.
他購入了 400 個蘋果。

8. AQ = x cm , AB = y cm

$(72 - x)y = 480$ — (1)

$\dfrac{x}{72} = \dfrac{y}{30}$ — (2)

$\therefore \quad x^2 - 72x + 1152 = 0$

∴ The area of ΔQAB is 480 cm^2 or 120 cm^2.
ΔQAB 的面積是 480 cm^2 或 120 cm^2。

11-1

1. (a) $k = 5, y = 5x$ (b) $k = \dfrac{1}{2}, \ y = \dfrac{1}{2}x$ (c) $k = 6, y = 6x$

2. (a) (i) $k = \dfrac{1}{3}, \ y = \dfrac{1}{3}x$ (ii)

y	2	6	10
x	6	18	30

(b) (i) $k = \dfrac{3}{2}, \ y = \dfrac{3}{2}x$ (ii)

y	3	$\dfrac{1}{3}$	$\dfrac{9}{2}$
x	2	$\dfrac{2}{9}$	3

3. (a) $y \propto \sqrt{x}, \ y = k\sqrt{x}$ (b) $y \propto x^2, \ y = kx^2$ (c) $y \propto \sqrt[3]{x}, \ y = k\sqrt[3]{x}$

(d) $y \propto \dfrac{1}{x}, \ y = \dfrac{k}{x}$ (e) $y \propto (x + 2), \ y = k(x + 2)$

11-2

1. (a) $k = 12, \ y = \dfrac{12}{x}$ (b) $k = 8, \ y = \dfrac{8}{x}$ (c) $k = \dfrac{4}{3}, \ y = \dfrac{4}{3x}$

2. (a) (i) $k = 20, \ y = \dfrac{20}{x}$ (ii)

y	15	10	4
x	$\dfrac{4}{3}$	2	5

(b) (i) $k = \dfrac{8}{3}, \ y = \dfrac{8}{3x}$ (ii)

y	24	8	4
x	$\dfrac{1}{9}$	$\dfrac{1}{3}$	$\dfrac{2}{3}$

3. (a) $y \propto \dfrac{1}{x^2}, \ y = \dfrac{k}{x^2}$ (b) $y \propto \dfrac{1}{\sqrt{x}}, \ y = \dfrac{k}{\sqrt{x}}$

(c) $y \propto \dfrac{1}{x^m}, \ y = \dfrac{k}{x^m}$ (d) $y \propto \dfrac{1}{2x - 3}, \ y = \dfrac{k}{2x - 3}$

11-3

1. (a) $y = \dfrac{3x}{2}$ (b) $y = \dfrac{4}{x}$ (c) $y = \dfrac{7}{x}$

2. (a) 8 (b) 12 (c) 180 (d) $\dfrac{25}{4}$ (e) 6 (f) $\dfrac{1}{12}$

3. (a) 64 (b) $\frac{1}{8}$ (c) 2 (d) $\frac{9}{16}$

11-4

1.		New values of x and y（x, y 的新值）	% change 百份改變
(a)	$y = kx$	$x(1+15\%) = 1.15x$; $k(1.15x) = 1.15y$	$\frac{1.15y - y}{y} \times 100\% = \underline{\underline{15\%}}$
(b)	$y = kx^2$	$x(1-23\%) = 0.77x$; $k(0.77x)^2 = 0.5929y$	$\frac{0.5929y - y}{y} \times 100\% = \underline{\underline{-40.71\%}}$
(c)	$y = k\sqrt{x}$	$x(1+44\%) = 1.44x$; $k\sqrt{1.44x} = 1.2y$	$\frac{1.2y - y}{y} \times 100\% = \underline{\underline{20\%}}$
(d)	$y = kx^3$	$x \cdot 2 = 2x$; $k(2x)^3 = 8y$	$\frac{8y - y}{y} \times 100\% = \underline{\underline{700\%}}$
(e)	$y = kx$, $x = \frac{y}{k}$	$y(1+5\%) = 1.05y$; $\frac{1.05y}{k} = 1.05x$	$\frac{1.05x - x}{x} \times 100\% = \underline{\underline{5\%}}$
(f)	$y = k\sqrt{x}$, $x = \frac{y^2}{k^2}$	$y(1-50\%) = 0.5y$; $\frac{(0.5y)^2}{k^2} = 0.25x$	$\frac{0.25x - x}{x} \times 100\% = \underline{\underline{-75\%}}$

2.		New values of x and y（x, y 的新值）	% change 百份改變
(a)	$y = \frac{k}{x}$	$x(1+20\%) = 1.2x$; $\frac{k}{(1.2x)} = \frac{5}{6}y$	$\frac{\frac{5}{6}y - y}{y} \times 100\% = \underline{\underline{-16\frac{2}{3}\%}}$
(b)	$y = \frac{k}{x}$	$x(1-20\%) = 0.8x$; $\frac{k}{0.8x} = 1.25y$	$\frac{1.25y - y}{y} \times 100\% = \underline{\underline{25\%}}$
(c)	$y = \frac{k}{x}$	$x(1+25\%) = 1.25x$; $\frac{k}{1.25x} = 0.8y$	$\frac{0.8y - y}{y} \times 100\% = \underline{\underline{-20\%}}$
(d)	$y = \frac{k}{x^2}$	$x(1-50\%) = 0.5x$; $\frac{k}{(0.5x)^2} = 4y$	$\frac{4y - y}{y} \times 100\% = \underline{\underline{300\%}}$
(e)	$y = \frac{k}{x}$, $x = \frac{k}{y}$	$y \cdot 2 = 2y$; $\frac{k}{2y} = 0.5x$	$\frac{0.5x - x}{x} \times 100\% = \underline{\underline{-50\%}}$

11-5

1. (a) $C = kx$. When 當 $t = 2$, $C = 30$.
$30 = k(2)$, $k = 15$, $\therefore \underline{\underline{C = 15t}}$

(b) When 當 $t = 10$, $C = 15(10) = 150$.
$\therefore$ The cost is 成本為 $\underline{\underline{\$150}}$.

2. (a) $W = ks^2$. When 當 $s = 8$, $W = 24$.
$24 = k(8)^2$, $k = \frac{3}{8}$, $\underline{\underline{W = \frac{3}{8}s^2}}$

(b) When 當 $W = 54$,
$54 = \frac{3}{8}s^2$, $s = 12$ or 或 -12 (rej.捨)
$\therefore$ The length of the base side is
底邊邊長為 $\underline{\underline{12\text{ cm}}}$.

3. Distance traveled 所行距離 $= d$ m,
time needed 所需時間 $= t$ s.

$d = kt^2$, $\frac{d}{t^2} = k$,

$\frac{48}{4^2} = \frac{d}{120^2}$, $d = 43200$

∴ It will travel 它行走 $\underline{\underline{43200\text{ m}}}$.

4. $e = kw$, $\frac{e}{w} = k$,

$\frac{6}{3} = \frac{e}{0.5}$, $e = 1$

∴ The extension is 伸長為 $\underline{\underline{1\text{ cm}}}$.

5. (a) $V = kr^2$. When 當 $r = 3.5$, $V = 100$.

$\therefore 100 = k(3.5)^2$, $k = \frac{400}{49}$, $\underline{\underline{V = \frac{400}{49}r^2}}$

(b) new value 新值 $r_2 = r(1+10\%) = 1.1r$;
new value 新值 V_2

$= \frac{400}{49}(1.1r)^2 = 1.21V$

% change in V (V 的百分改變)

$= \frac{1.21V - V}{V} \times 100\% = \underline{\underline{21\%}}$

6. (a) $t = kn^2$. When 當 $n = 5$, $t = 12.5$.

$\therefore 12.5 = k(5)^2$, $k = \frac{1}{2}$, $\underline{\underline{t = \frac{1}{2}n^2}}$

(b) When 當 $n = 20$,

$t = \frac{1}{2}(20)^2 = 200$ min

∴ We will finish at 完成時間為
$\underline{\underline{10:30}}$.

11-6

1. (a) $V = \frac{k}{n}$. When 當 $n = 2$, $V = 1720$,

$\therefore 1720 = \frac{k}{2}$, $k = 3440$, $\therefore \underline{\underline{V = \frac{3440}{n}}}$

(b) When 當 $n = 2.5$, $V = \frac{3440}{2.5} = 1376$.

∴ Its value is 它的價值是 $\underline{\underline{\$1376}}$.

2. (a) $h = \frac{k}{r^2}$. When 當 $r = 8$, $h = 5$,

$\therefore 5 = \frac{k}{8^2}$, $k = 320$, $\therefore \underline{\underline{h = \frac{320}{r^2}}}$

(b) $16 = \frac{320}{r^2}$,

$r = 2\sqrt{5}$ or 或 $-2\sqrt{5}$ (rej.捨)

∴ The base radius is 底半徑為
$\underline{\underline{2\sqrt{5}\text{ cm}}}$.

3. The speed needed 所需速度 $= s$ ms^{-1},
the time needed 所需時間 $= t$ s.

$t = \frac{k}{s}$, $ts = k$,

$(50)(30) = t(20)$, $t = 75$

∴ It takes $\underline{\underline{75\text{ s}}}$ to travel from A to B.
由 A 行走至 B 需時 $\underline{\underline{75\text{ s}}}$。

4. Temperature rise 上升的溫度 $= T$ °C,
diameter 直徑 $= l$ m.

$T = \frac{k}{l^3}$, $Tl^3 = k$,

$(12)(0.5)^3 = T(1)^3, T = 1.5$

∴ The temperature rise is
溫度上升 $\underline{\underline{1.5\text{ °C}}}$

5. (a) $S = \frac{k}{n}$. When 當 $n = 500$, $S = 20$,

$\therefore 20 = \frac{k}{500}, k = 1000, \therefore S = \underline{\underline{\frac{1000}{n}}}$

(b) new value 新值 $n_2 = n(1-50\%) = 0.5n$

new value 新值 $S_2 = \frac{1000}{0.5n} = 2S$

% change in S (S 的百分改變)

$S = \frac{2S - S}{S} \times 100\% = \underline{\underline{100\%}}$

6. Number of days needed 所需日數 $= t$,
number of workers 工人數目 $= n$.

$t = \frac{k}{n^2}$, $tn^2 = k$

$(180)(6)^2 = t(6+3)^2$, $t = 80$

$\therefore$ $\underline{\underline{80 \text{ days}}}$ are needed.

需時 $\underline{\underline{80 \text{ days}}}$ 日。

11-7

1. (a) $V \propto r^2 h$ (b) $m \propto \frac{F}{r^2}$ (c) $R \propto \frac{V}{I}$ (d) $P \propto \frac{F}{x^2}$

(e) $T \propto \frac{1}{PV}$ (f) $x \propto \frac{1}{y^2\sqrt{z}}$

2. (a) $y = 4x^2 z$ (b) $y = \frac{32x}{z}$ (c) $y = \frac{1}{2}z^2 x$ (d) $y = \frac{9}{xz^2}$

(e) $y = \frac{x}{6z}$ (f) $y = \frac{x^3}{2z^2}$

11-8

In this exercise, x_2, y_2 and z_2 represent the new values of x, y and z respectively.
在此練習中，x_2，y_2 及 z_2 分別代表 x, y 及 z 的新值。

1. (a) $z = kxy$,

$x_2 = (1+15\%)x = 1.15x$

$y_2 = (1-28\%)y = 0.72y$

$z_2 = k(1.15x)(0.72y) = 0.828z$

% change in z (z 的百分改變)

$= \frac{0.828z - z}{z} \times 100\% = \underline{\underline{-17.2\%}}$

(b) $z = \frac{ky}{x}$,

$x_2 = (1+33.1\%)x = 1.331x$

$y_2 = (1-12\%)y = 0.88y$

$z_2 = \frac{k(0.88y)}{1.331x} = \frac{80}{121}z$

% change in z (z 的百分改變)

$= \frac{\frac{80}{121}z - z}{z} \times 100\% = \underline{\underline{-33.9\%}}$

(3 sig. fig. 3 位有效數字)

(c) $z = \frac{k}{xy^2}$, $x_2 = (1-36\%)x = 0.64x$

$y_2 = (1+25\%)y = 1.25y$

$z_2 = \frac{k}{(0.64x)(1.25y)^2} = z$

% change in z (z 的百分改變)

$= \frac{z - z}{z} \times 100\% = \underline{\underline{0\%}}$

(d) $z = \frac{kx^2}{y}$, $x_2 = (1+5\%)x = 1.05x$

$y_2 = (1+125\%)y = 2.25y$

$z_2 = \frac{k(1.05x)^2}{(2.25y)} = 0.49z$

% change in z (z 的百分改變)

$= \frac{0.49z - z}{z} \times 100\% = \underline{\underline{-51\%}}$

2. (a) $z = kxy^2$, $x = \dfrac{z}{ky^2}$,

$y_2 = (1+25\%)y = 1.25y$

$z_2 = (1+25\%)z = 1.25z$

$x_2 = \dfrac{1.25z}{k(1.25y)^2} = 0.8x$

% change in x (x 的百分改變)

$= \dfrac{0.8x - x}{x} \times 100\% = \underline{\underline{-20\%}}$

(c) $z = \dfrac{k}{xy^2}$, $x = \dfrac{k}{zy^2}$,

$y_2 = (1+20\%)y = 1.2y$

$z_2 = (1+25\%)z = 1.25z$

$x_2 = \dfrac{k}{(1.25z)(1.2y)^2} = \dfrac{1}{1.8}x$

% change in x (x 的百分改變)

$= \dfrac{\frac{1}{1.8}x - x}{x} \times 100\% = \underline{\underline{-44.4\%}}$

(3 sig. fig. 3 位有效數字)

(b) $z = \dfrac{kx}{y}$, $x = \dfrac{zy}{k}$,

$y_2 = (1-8\%)y = 0.92y$

$z_2 = (1+15\%)z = 1.15z$

$x_2 = \dfrac{(1.15z)(0.92y)}{k} = 1.058x$

% change in x (x 的百分改變)

$= \dfrac{1.058x - x}{x} \times 100\% = \underline{\underline{5.8\%}}$

(d) $z = \dfrac{ky^2}{x}$, $x = \dfrac{ky^2}{z}$,

$y_2 = (1-20\%)y = 0.8y$

$z_2 = (1-74\%)z = 0.26z$

$x_2 = \dfrac{k(0.8y)^2}{(0.26z)} = \dfrac{32}{13}x$

% change in x (x 的百分改變)

$= \dfrac{\frac{32}{13}x - x}{x} \times 100\% = \underline{\underline{146\%}}$

(3 sig. fig. 3 位有效數字)

11-9

1. (a) $W = knr^3$.

$n = 10$, $r = 2$, $W = 0.016$,

$\therefore 0.016 = k(10)(2)^3$, $k = 0.0002$

$\therefore \underline{\underline{W = 0.0002nr^3}}$

(b) When 當 $r = 5$,

$W = 0.0002(12)(5)^3 = 0.3$

$\therefore$ The weight is 重量為 $\underline{\underline{0.3\text{kg}}}$

2. (a) $V = \dfrac{kT}{P}$.

$T = 300$, $P = 1000$, $V = 5$,

$\therefore 5 = \dfrac{k(300)}{100}$, $k = \dfrac{5}{3}$, $\therefore \underline{\underline{V = \dfrac{5T}{3P}}}$

(b) When 當 $V = 10$, $T = 150$,

$10 = \dfrac{5(150)}{3P}$, $P = 25$

$\therefore$ The pressure is 壓力為 $\underline{\underline{25}}$

3. (a) $R = \dfrac{kl}{A}$.

$A = 12$, $l = 20$, $R = 3$,

$\therefore 3 = \dfrac{k(20)}{12}$, $k = \dfrac{9}{5}$, $\therefore \underline{\underline{R = \dfrac{9l}{5A}}}$

(b) When 當 $R = 1$, $A = 3$,

$1 = \dfrac{9l}{5(3)}$, $l = \underline{\underline{\dfrac{5}{3}}}$

(c) new values 新值: A_2, R_2;

$A_2 = (1+25\%)A = 1.25A$

$R_2 = \dfrac{9l}{5(1.25A)} = 0.8R$

% change in R (R 的百分改變)

$= \dfrac{0.8R - R}{R} \times 100\% = \underline{\underline{-20\%}}$

4. $h=\dfrac{kV}{r^2}$; new values 新值: r_2, V_2, h_2;

$r_2=2r$

$V_2=(1-60\%)V=0.4V$

$h_2=\dfrac{k(0.4V)}{(2r)^2}=0.1h$

% change in h (h 的百分改變)

$=\dfrac{0.1h-h}{h}\times 100\%=\underline{\underline{-90\%}}$

5. $t=\dfrac{k}{P\times r}$, new values 新值: r_2, P_2, t_2;

$r_2=(1-10\%)r=0.9r$

$P_2=(1+10\%)=1.1P$

$t_2=\dfrac{k}{(1.1P)(0.9r)}=\dfrac{1}{0.99}t$

% change in t (t 的百分改變)

$=\dfrac{\frac{1}{0.99}t-t}{t}\times 100\%=\underline{\underline{1.01\%}}$

(3 sig. fig. 3 位有效數字)

11-10

1. $P=k_1+\dfrac{k_2}{m}$ 2. $V=k_1h+k_2r^2$ 3. $z=\dfrac{k_1}{x^2}+k_2y^3$ 4. $y=\dfrac{k_1}{x}+\dfrac{k_2}{x^2}$

5. $C=k_1\sqrt{n}+\dfrac{k_2}{n}$ 6. $E=k_1+k_2x^2$ 7. $Q=\dfrac{k_1}{t}+\dfrac{k_2}{\sqrt{r}}$

11-11

1. (a) $x=2$, $y=8$, $\therefore 8=k_1(2)+k_2(2)^2$, $4=k_1+2k_2$ — (1)

$x=8$, $y=176$, $\therefore 176=k_1(8)+k_2(8)^2$, $22=k_1+8k_2$ — (2)

(2) − (1), $18=6k_2$, $k_2=\underline{\underline{3}}$, $\therefore k_1=\underline{\underline{-2}}$

(b) $y=-2x+3x^2$; when 當 $x=5$, $y=-2(5)+3(5)^2=\underline{\underline{65}}$

2. (a) $y=k_1+\dfrac{k_2}{x}$, $x=4$, $y=3$, $3=k_1+\dfrac{k_2}{4}$, $12=4k_1+k_2$ — (1)

$x=8$, $y=1$, $1=k_1+\dfrac{k_2}{8}$, $8=8k_1+k_2$ — (2)

(2) − (1), $-4=4k_1$, $k_1=-1$, $\therefore k_2=16$, $\therefore \underline{\underline{y=-1+\dfrac{16}{x}}}$

(b) when 當 $x=10$, $y=-1+\dfrac{16}{10}=\underline{\underline{\dfrac{3}{5}}}$ (c) when 當 $y=17$, $17=-1+\dfrac{16}{x}$, $x=\underline{\underline{\dfrac{8}{9}}}$

3. (a) $z=k_1y+k_2y^2$, $y=2$, $z=2$, $\therefore 2=k_1(2)+k_2(2)^2$, $1=k_1+2k_2$ — (1)

$y=5$, $z=10$, $\therefore 10=k_1(5)+k_2(5)^2$, $2=k_1+5k_2$ — (2)

(2) − (1), $1=3k_2$, $k_2=\dfrac{1}{3}$, $\therefore k_1=\dfrac{1}{3}$, $\therefore \underline{\underline{z=\dfrac{1}{3}y+\dfrac{1}{3}y^2}}$

(b) when 當 $y=4$, $z=\dfrac{1}{3}(4)+\dfrac{1}{3}(4)^2=\underline{\underline{\dfrac{20}{3}}}$

4. (a) $P=k_1\sqrt{x}+\dfrac{k_2}{x}$, $x=4$, $P=-7$, $\therefore -7=k_1\sqrt{4}+\dfrac{k_2}{4}$, $-28=8k_1+k_2$ — (1)

$x=9$, $P=-1$, $\therefore -1=k_1\sqrt{9}+\dfrac{k_2}{9}$, $-9=27k_1+k_2$ — (2)

(2) − (1), $19=19k_1$, $k_1=1$, $\therefore k_2=-36$, $\therefore \underline{\underline{P=\sqrt{x}-\dfrac{36}{x}}}$

(b) when 當 $x=25$, $P=\sqrt{25}-\frac{36}{25}=\underline{\underline{\frac{89}{25}}}$

5. (a) $z=k_1x+\frac{k_2}{y^2}$, $x=1$, $y=2$, $z=3$, $\therefore 3=k_1(1)+\frac{k_2}{(2)^2}$, $12=4k_1+k_2$ — (1)

$x=8$, $y=1$, $z=18$, $\therefore 18=k_1(8)+\frac{k_2}{(1)^2}$, $18=8k_1+k_2$ — (2)

(2) − (1), $6=4k_1$, $k_1=\frac{3}{2}$, $\therefore k_2=6$, $\therefore \underline{\underline{z=\frac{3}{2}x+\frac{6}{y^2}}}$

(b) when 當 $z=3$, $y=1$, $3=\frac{3}{2}x+\frac{6}{1^2}$, $x=\underline{\underline{-2}}$

6. $y=k_1x+k_2x^2$, $x=1$, $y=8$, $\therefore 8=k_1(1)+k_2(1)^2$, $8=k_1+k_2$ — (1)

$x=\frac{1}{2}$, $y=\frac{11}{4}$, $\therefore \frac{11}{4}=k_1(\frac{1}{2})+k_2(\frac{1}{2})^2$, $11=2k_1+k_2$ — (2)

(2) − (1), $k_1=3$, $k_2=5$, $\therefore y=3x+5x^2$

when 當 $y=2$, $2=3x+5x^2$, $(x+1)(5x-2)=0$, $x=\frac{2}{5}$ or 或 -1 (rej.捨), $\therefore \underline{\underline{x=\frac{2}{5}}}$

11-12

1. (a) $f=k_1+k_2d$, $d=20$, $f=46$, $\therefore 46=k_1+k_2(20)$, $46=k_1+20k_2$ — (1)

$d=30$, $f=61$, $\therefore 61=k_1+k_2(30)$, $61=k_1+30k_2$ — (2)

(2) − (1), $15=10k_2$, $k_2=\frac{3}{2}$, $\therefore k_1=16$, $\therefore \underline{\underline{f=16+\frac{3}{2}d}}$

(b) when 當 $d=72$, $f=16+\frac{3}{2}(72)=124$, ∴ the taxi fare is 計程車車資為 $\underline{\underline{\$124}}$.

2. (a) $P=k_1+\frac{k_2}{d^2}$, $d=4$, $P=11.5$, $\therefore 11.5=k_1+\frac{k_2}{(4)^2}$, $184=16k_1+k_2$ — (1)

$d=1$, $P=4$, $\therefore 4=k_1+\frac{k_2}{(1)^2}$, $4=k_1+k_2$ — (2)

(1) − (2), $180=15k_1$, $k_1=12$, $\therefore k_2=-8$, $\therefore \underline{\underline{P=12-\frac{8}{d^2}}}$

(b) when 當 $d=2$, $P=12-\frac{8}{(2)^2}=10$, ∴ the price is 價格為 $\underline{\underline{\$10}}$.

3. (a) $S=k_1t+k_2t^2$, $t=10$, $S=470$, $\therefore 470=k_1(10)+k_2(10)^2$, $47=k_1+10k_2$ — (1)

$t=5$, $S=110$, $\therefore 110=k_1(5)+k_2(5)^2$, $22=k_1+5k_2$ — (2)

(1) − (2), $25=5k_2$, $k_2=5$, $\therefore k_1=-3$, $\therefore \underline{\underline{S=-3t+5t^2}}$

(b) when 當 $t=2$, $S=-3(2)+5(2)^2=14$, ∴ the distance travelled is 行走距離為 $\underline{\underline{14\text{m}}}$.

4. (a) $C=k_1+k_2dn$,

$d=20$, $n=40$, $C=10800$, $\therefore 10800=k_1+k_2(20)(40)$, $10800=k_1+800k_2$ — (1)

$d=30$, $n=30$, $C=12400$, $\therefore 12400=k_1+k_2(30)(30)$, $12400=k_1+900k_2$ — (2)

(2) − (1), $1600=100k_2$, $k_2=16$, $\therefore k_1=-2000$, $\therefore \underline{\underline{C=-2000+16dn}}$

(b) when 當 $n = 32$ and 及 $d = 50$, $C = -2000 + 16(50)(32) = 23600$,
$\therefore$ the cost is 成本為 $\underline{\underline{\$23600}}$.

5. (a) $A = k_1 r^2 + k_2 rh$,
$h = 5$, $r = 5$, $A = 125$, $\therefore 125 = k_1(5)^2 + k_2(5)(5)$, $5 = k_1 + k_2$ — (1)
$h = 3$, $r = 2$, $A = 24$, $\therefore 24 = k_1(2)^2 + k_2(2)(3)$, $6 = k_1 + \frac{3}{2}k_2$ — (2)
(2) − (1), $1 = \frac{1}{2}k_2$, $k_2 = 2$, $\therefore k_1 = 3$, $\therefore \underline{\underline{A = 3r^2 + 2rh}}$

(b) when 當 $r = 5$, $A = 200$, $200 = 3(5)^2 + 2(5)h$, $h = \underline{\underline{12.5}}$

12-1

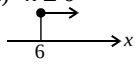
1. $x > 4$ 2. $x \geq -1$ 3. $x > 14$ 4. $x \leq -2$ 5. $x \leq -6$
6. $x < 0$ 7. $x < 5$ 8. $x \geq 11$ 9. $x < -\frac{12}{7}$ 10. $x \geq \frac{3}{2}$
11. $x \leq -3$ 12. $x < -3$ 13. $x < 8$ 14. $x \geq -7$ 15. $x \leq -1$
16. $x < -\frac{1}{3}$ 17. $x > -\frac{3}{2}$ 18. $x > 0$

12-2

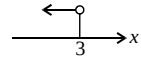
1. $x \geq -7$ 2. $x < -2$ 3. $x > -3$ 4. $x < -\frac{1}{8}$ 5. $x \leq 4$
6. $x < -7$ 7. $x > 2$ 8. $x < \frac{37}{7}$ 9. $x \leq -1$ 10. $x \leq -\frac{9}{2}$
11. $x > 4$ 12. $x > \frac{4}{3}$

12-3

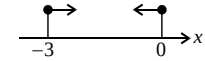
1. (a) $x \geq 6$



(b) $x < 3$

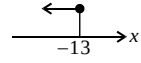


(c) $-3 \leq x \leq 0$



(d) no solution
沒有解

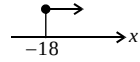
(e) $x \leq -13$



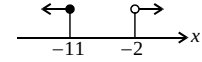
(f) $x = 3$

2. (a) all real numbers
所有實數

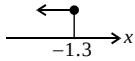
(b) $x \geq -18$



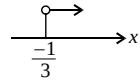
(c) $x \leq -11$ or 或 $x > -2$



(d) $x \leq -1.3$



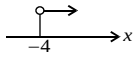
(e) $x > -\frac{1}{3}$



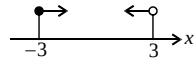
(f) all real numbers except 2
不包括 2 的所有實數

12-4

1. (a) $x > -4$

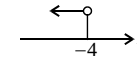


(b) $-3 \le x < 3$

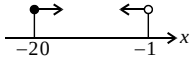


(c) $x < -4$ and 及 $x > -1$
no solution
沒有解

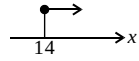
(d) $x < -4$



(e) $-20 \le x < -1$

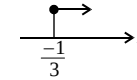


(f) $x \ge 14$

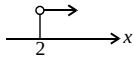


(g) $x < -4$ and 及 $x > 3$
no solution
沒有解

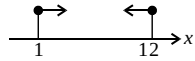
(h) $x \ge -\frac{1}{3}$



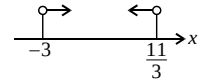
2. (a) $x > 2$



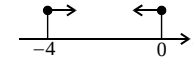
(b) $1 \le x \le 12$



(c) $-3 < x < \frac{11}{3}$



(d) $-4 \le x \le 0$



12-5

1. (a) $-2 \le x \le 1$ (b) $-1 \le x < 3$ (c) $-4 \le x < 0$ (d) $3 < x \le 7$
   (e) $-15 < x < 6$ (f) $20 \le x \le 44$ (g) $-23 < x \le 7$ (h) $6 < x < 21$
2. (a) $-2x \le -4$ and 及 $2x \le 16$，$\therefore 2 \le x \le 8$
   (b) $3x > 6$ and 及 $-3x \ge -15$，$\therefore 2 < x \le 5$
   (c) $x \ge 5$ and 及 $2x > -4$，$\therefore x \ge 5$
   (d) $x \le -3$ and 及 $-4x < 8$，$\therefore$ no solution 沒有解
   (e) $-3x < -9$ and 及 $-5x \le 9$，$\therefore x > 3$
   (f) $2x - 6 \ge 1 + x$ and 及 $1 + x \ge 6x - 26$，$x \ge 7$ and 及 $-5x \ge -27$，$\therefore$ no solution 沒有解
   (g) $x < 12$ and 及 $8 < x$，$\therefore 8 < x < 12$
   (h) $21 - 3x \le 4x$ and 及 $x \le 24 + 9x$，$-7x \le -21$ and 及 $-8x \le 24$，$\therefore x \ge 3$

12-6

1. $x \ge 18$ or 或 $x < 3$ 2. $x < -2$ 3. $x < 0$ or 或 $x > \frac{1}{3}$ 4. $x > -4$
5. $x > -3$ 6. all real nos. 所有實數 7. all real nos. 所有實數
8. $x > -11$ 9. $x < 44$ 10. $x < 4$ 11. $x \le \frac{11}{2}$
12. all real nos. except 2 不包括 2 的所有實數

12-7

1. $8x - 3x + 1 < 2x + 1$，$3x < 0$，$\therefore x < 0$
2. $18x + 42 - 20x - 40 \ge 6 - 2x$，$2 \ge 6$，$\therefore$ no solution 沒有解
3. $3(4x - 2) < 14x - 2 - 2x$，$12x - 6 < 12x - 2$，$-6 < -2$，$\therefore$ all real nos. 所有實數
4. $9x - 9 - 2x + 9 \le 24x + 30$，$-17x \le 30$，$\therefore x \ge -\frac{30}{17}$

13-1

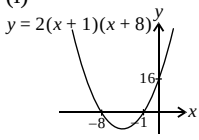
1. (i) $x=\frac{1}{2}$ or 或 $x=6$ (ii) $x<\frac{1}{2}$ or 或 $x>6$ (iii) $\frac{1}{2}<x<6$
2. (i) $x=-7$ or 或 $x=-3$ (ii) $x<-7$ or 或 $x>-3$ (iii) $-7<x<-3$
3. (i) $x=-5$ or 或 $x=\frac{2}{3}$ (ii) $-5<x<\frac{2}{3}$ (iii) $x<-5$ or 或 $x>\frac{2}{3}$
4. (i) $x=-8$ or 或 $x=-2$ (ii) $-8<x<-2$ (iii) $x<-8$ or 或 $x>-2$
5. (i) $x=-\frac{16}{5}$ or 或 $x=\frac{3}{4}$ (ii) $x<-\frac{16}{5}$ or 或 $x>\frac{3}{4}$ (iii) $-\frac{16}{5}<x<\frac{3}{4}$
6. (i) $x=0$ or 或 $x=9$ (ii) $0<x<9$ (iii) $x<0$ or 或 $x>9$

13-2

1. (i) $-2,4$ (ii) $-2<x<4$
2. (i) $-6,-3$ (ii) $x\le -6$ or 或 $x\ge -3$
3. (i) $-1,6$ (ii) $x<-1$ or 或 $x>6$
4. (i) $-6,1$ (ii) $x<-6$ or 或 $x>1$
5. (i) $-2,\frac{5}{3}$ (ii) $x<-2$ or 或 $x>\frac{5}{3}$
6. (i) $\frac{7}{2},6$ (ii) $x\le \frac{7}{2}$ or 或 $x\ge 6$
7. (i) $-\frac{1}{2},0$ (ii) $x\le -\frac{1}{2}$ or 或 $x\ge 0$
8. (i) $-7,0$ (ii) $x<-7$ or 或 $x>0$

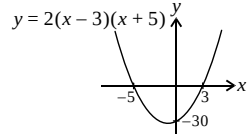
13-3

1. (i)



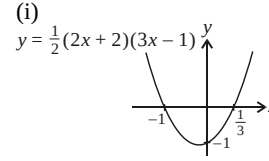
(ii) $-8\le x\le -1$

2. (i)



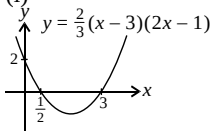
(ii) $x<-5$ or 或 $x>3$

3. (i)



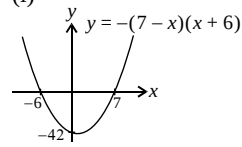
(ii) $-1<x<\frac{1}{3}$

4. (i)



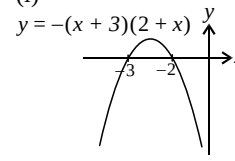
(ii) $x\le \frac{1}{2}$ or 或 $x\ge 3$

5. (i)



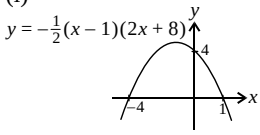
(ii) $-6\le x\le 7$

6. (i)



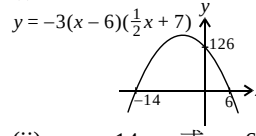
(ii) $-3<x<-2$

7. (i)



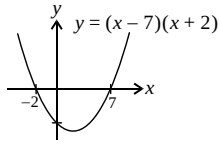
(ii) $x\le -4$ or 或 $x\ge 1$

8. (i)



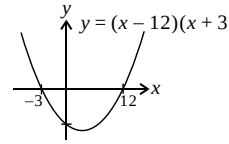
(ii) $x<-14$ or 或 $x>6$

9. (a) $y=(x-7)(x+2)$



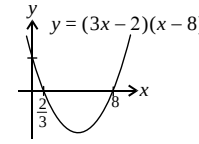
(b) $-2<x<7$

10. (a) $y=(x-12)(x+3)$



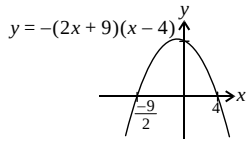
(b) $-3\le x\le 12$

11. (a) $y=(3x-2)(x-8)$



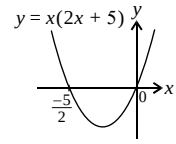
(b) $x<\frac{2}{3}$ or 或 $x>8$

12. (a) $y=-(2x+9)(x-4)$



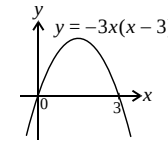
(b) $x\le -\frac{9}{2}$ or 或 $x\ge 4$

13. (a) $y=x(2x+5)$



(b) $x<-\frac{5}{2}$ or 或 $x>0$

14. (a) $y=-3x(x-3)$



(b) $0\le x\le 3$

13-4

1. (a) $x=\dfrac{-3\pm\sqrt{3^2-4(1)(1)}}{2(1)}=\dfrac{-3\pm\sqrt{5}}{2}$

(b) $x<\dfrac{-3-\sqrt{5}}{2}$ or 或 $x>\dfrac{-3+\sqrt{5}}{2}$

2. (a) $x=\dfrac{-(-2)\pm\sqrt{(-2)^2-4(2)(-1)}}{2(2)}=\dfrac{1\pm\sqrt{3}}{2}$

(b) $\dfrac{1-\sqrt{3}}{2}\le x\le\dfrac{1+\sqrt{3}}{2}$

3. (a) $x=\dfrac{-5\pm\sqrt{5^2-4(-1)(3)}}{2(-1)}=\dfrac{5\pm\sqrt{37}}{2}$

(b) $x<\dfrac{5-\sqrt{37}}{2}$ or 或 $x>\dfrac{5+\sqrt{37}}{2}$

4. (a) $x=\dfrac{-(-1)\pm\sqrt{(-1)^2-4(-1)(1)}}{2(-1)}=\dfrac{-1\pm\sqrt{5}}{2}$

(b) $\dfrac{-1-\sqrt{5}}{2}<x<\dfrac{-1+\sqrt{5}}{2}$

5. (a) $x=\dfrac{-(-5)\pm\sqrt{(-5)^2-4(7)(-3)}}{2(7)}=\dfrac{5\pm\sqrt{109}}{14}$

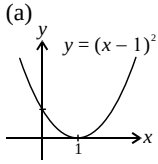
(b) $x\le\dfrac{5-\sqrt{109}}{14}$ or 或 $x\ge\dfrac{5+\sqrt{109}}{14}$

6. (a) $x=\dfrac{-2\pm\sqrt{2^2-4(-3)(2)}}{2(-3)}=\dfrac{1\pm\sqrt{7}}{3}$

(b) $\dfrac{1-\sqrt{7}}{3}\le x\le\dfrac{1+\sqrt{7}}{3}$

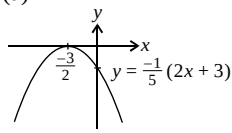
13-5

1. (a)



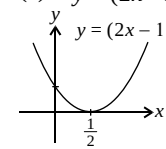
(b) $x<1$ or 或 $x>1$

2. (a)



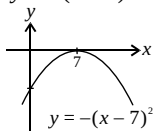
(b) all real numbers
所有實數

3. (a) $y=(2x-1)^2$



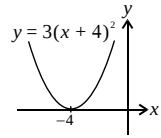
(b) no real solution
沒有實數解

4. (a) $y = -(x-7)^2$



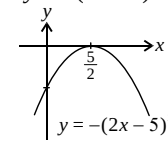
(b) $x = 7$

5. (a) $y = 3(x+4)^2$



(b) all real numbers
所有實數

6. (a) $y = -(2x-5)^2$



(b) no real solution
沒有實數解

13-6

1. (a) When 當 $y = 0$,
$\Delta = 1^2 - 4(1)(1) = -3 < 0$,
$\therefore$ no x-intercept. 沒有 x 軸截距。
(b) x can be any real numbers.
x 可以是任何實數。

2. (a) When 當 $y = 0$,
$\Delta = 3^2 - 4(4)(1) = -7 < 0$,
$\therefore$ no x-intercept. 沒有 x 軸截距。
(b) no real solution. 沒有實數解。

3. (a) When 當 $y = 0$,
$\Delta = 5^2 - 4(-1)(-8) = -7 < 0$,
$\therefore$ no x-intercept. 沒有 x 軸截距。
(b) x can be any real numbers.
x 可以是任何實數。

4. (a) When 當 $y = 0$,
$\Delta = (-1)^2 - 4(9)(7) = -251 < 0$,
$\therefore$ no x-intercept. 沒有 x 軸截距。
(b) x can be any real numbers.
x 可以是任何實數。

5. (a) When 當 $y = 0$,
$\Delta = 6^2 - 4(-3)(-9) = -72 < 0$,
$\therefore$ no x-intercept. 沒有 x 軸截距。
(b) no real solution. 沒有實數解。

6. (a) $y = x^2 + 6x + 30$
$= (x+3)^2 + 21 \geq 21$
(b) no real solution. 沒有實數解。

7. (a) $y = 2x^2 - 8x + 9$
$= 2(x-2)^2 + 1 \geq 1$
(b) x can be any real numbers.
x 可以是任何實數。

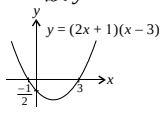
8. (a) $y = -2x^2 - x - 3 = -2(x^2 + \frac{1}{2}x) - 3$
$= -2(x + \frac{1}{4})^2 - \frac{23}{8} \leq -\frac{23}{8}$
(b) x can be any real numbers.
x 可以是任何實數。

9. (a) $y = 3x^2 - 9x + 100$
$= 3(x - \frac{3}{2})^2 + \frac{373}{4} \geq \frac{373}{4}$
(b) x can be any real numbers.
x 可以是任何實數。

10. (a) $y = -\frac{3}{2}x^2 + \frac{3}{5}x - 1$
$= -\frac{3}{2}(x - \frac{1}{5})^2 - \frac{47}{50} \leq -\frac{47}{50}$
(b) no real solution. 沒有實數解。

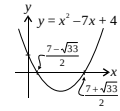
13-7

1. Let 設 $y = 2x^2 - 5x - 3 = (2x+1)(x-3)$.



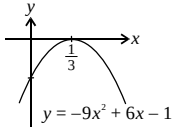
$\therefore x < -\frac{1}{2}$ or 或 $x > 3$

2. Let 設 $y = x^2 - 7x + 4$;
when 當 $y = 0$, $x = \frac{7 \pm \sqrt{33}}{2}$



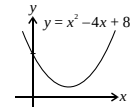
$\therefore \frac{7-\sqrt{33}}{2} \leq x \leq \frac{7+\sqrt{33}}{2}$

3. Let 設 $y = -9x^2 + 6x - 1 = -(3x-1)^2$.



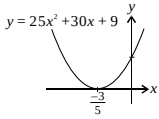
∴ x can be any real numbers.
x 可以是任何實數。

4. Let 設 $y = x^2 - 4x + 8$; when 當 $y = 0$,
$\Delta = (-4)^2 - 4(1)(8) = -16 < 0$
∴ no x-intercept. 沒有 x 軸截距。



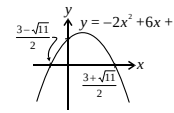
∴ no real solution.
沒有實數解。

5. Let 設 $y = 25x^2 + 30x + 9 = (5x+3)^2$.



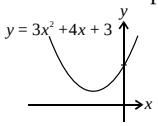
$\therefore x = -\frac{3}{5}$

6. Let 設 $y = -2x^2 + 6x + 1$;
when 當 $y = 0$, $x = \frac{3 \pm \sqrt{11}}{2}$



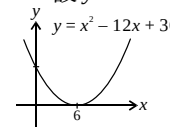
$\therefore \frac{3-\sqrt{11}}{2} \le x \le \frac{3+\sqrt{11}}{2}$

7. Let 設 $y = 3x^2 + 4x + 3$; when 當 $y = 0$,
$\Delta = 4^2 - 4(3)(3) = -20 < 0$
∴ no x-intercept. 沒有 x 軸截距。



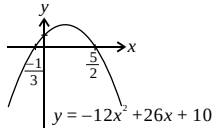
∴ x can be any real numbers.
x 可以是任何實數。

8. Let 設 $y = x^2 - 12x + 36 = (x-6)^2$.



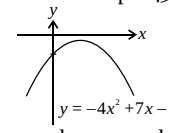
$x < 6$ or 或 $x > 6$

9. Let 設 $y = -12x^2 + 26x + 10$
$= -2(3x+1)(2x-5)$.



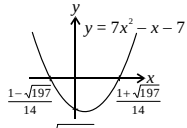
$\therefore -\frac{1}{3} \le x \le \frac{5}{2}$

10. Let 設 $y = -4x^2 + 7x - 4$; when 當 $y = 0$,
$\Delta = 7^2 - 4(-4)(-4) = -15 < 0$
∴ no x-intercept. 沒有 x 軸截距。



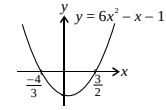
∴ x can be any real numbers.
x 可以是任何實數。

11. Let 設 $y = 7x^2 - x - 7$;
when 當 $y = 0$, $x = \frac{1 \pm \sqrt{197}}{14}$



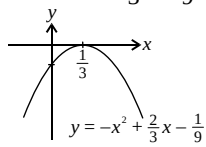
$\therefore x < \frac{1-\sqrt{197}}{14}$ or 或 $x > \frac{1+\sqrt{197}}{14}$

12. Let 設 $y = 6x^2 - x - 12 = (3x+4)(2x-3)$.



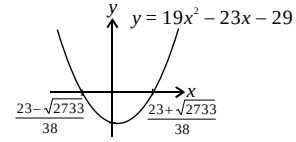
$\therefore -\frac{4}{3} < x < \frac{3}{2}$

13. Let 設 $y = -x^2 + \frac{2}{3}x - \frac{1}{9} = -(x - \frac{1}{3})^2$.



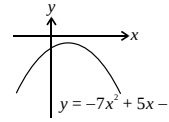
∴ no real solution.
沒有實數解。

14. Let 設 $y = 19x^2 - 23x - 29$;
when 當 $y = 0$, $x = \frac{23 \pm \sqrt{2733}}{38}$

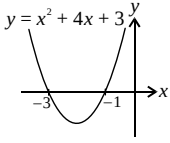


∴ $x \le \frac{23 - \sqrt{2733}}{38}$ or 或 $x \ge \frac{23 + \sqrt{2733}}{38}$

15. Let 設 $y = -7x^2 + 5x - 1$; when 當 $y = 0$,
$\Delta = 5^2 - 4(-7)(-1) = -3 < 0$,
∴ no x-intercept. 沒有 x 軸截距。
∴ no real solution. 沒有實數解。

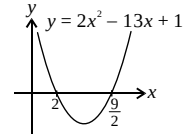


16. $x^2 + 4x + 3 < 0$
Let 設 $y = x^2 + 4x + 3 = (x + 3)(x + 1)$.



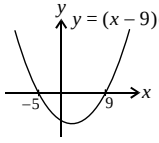
∴ $-3 < x < -1$

17. $2x^2 - 13x + 18 > 0$
Let 設 $y = 2x^2 - 13x + 18 = (2x - 9)(x - 2)$.



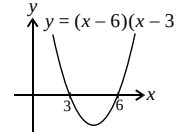
∴ $x < 2$ or 或 $x > \frac{9}{2}$

18. $(x - 2)^2 - 49 \le 0$
Let 設 $y = (x - 2)^2 - 49 = (x - 9)(x + 5)$.



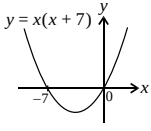
∴ $-5 \le x \le 9$

19. $x^2 - 9x + 18 > 0$
Let 設 $y = x^2 - 9x + 18 = (x - 6)(x - 3)$.



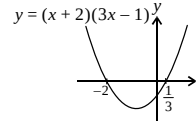
∴ $x < 3$ or 或 $x > 6$

20. $x^2 + 7x \ge 0$
Let 設 $y = x^2 + 7x = x(x + 7)$.



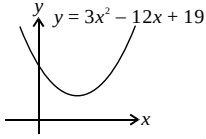
∴ $x \le -7$ or 或 $x \ge 0$

21. $(x + 2)(3x - 1) \le 0$
Let 設 $y = (x + 2)(3x - 1)$.



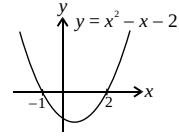
∴ $-2 \le x \le \frac{1}{3}$

22. $3x^2 - 12x + 19 \le 0$
Let 設 $y = 3x^2 - 12x + 19$; when 當 $y = 0$,
$\Delta = (-12)^2 - 4(3)(19) = -84 < 0$
∴ no x-intercept. 沒有 x 軸截距。



∴ no real solution. 沒有實數解。

23. $x^2 - x - 2 > 0$
Let 設 $y = x^2 - x - 2 = (x - 2)(x + 1)$.

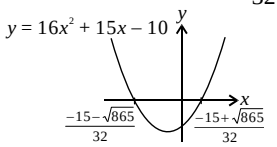


∴ $x < -1$ or 或 $x > 2$

24. $16x^2+15x-10>0$

Let 設 $y=16^2+15x-10$;

when 當 $y=0$, $x=\dfrac{-15\pm\sqrt{865}}{32}$

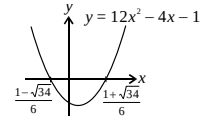


$\therefore x<\dfrac{-15-\sqrt{865}}{32}$ or 或 $x>\dfrac{-15+\sqrt{865}}{32}$

25. $3x^2-x-2\le\dfrac{3}{4}$, $12x^2-4x-11\le 0$

Let 設 $y=12x^2-4x-11$;

when 當 $y=0$, $x=\dfrac{1\pm\sqrt{34}}{6}$



$\therefore \dfrac{1-\sqrt{34}}{6}\le x\le\dfrac{1+\sqrt{34}}{6}$

13-8

1. (a) $\begin{cases}x+1>0\\x-3>0\end{cases}$ or 或 $\begin{cases}x+1<0\\x-3<0\end{cases}$

$x>3$ or 或 $x<-1$

(b) $\begin{cases}2x-3\ge 0\\x+7\ge 0\end{cases}$ or 或 $\begin{cases}2x-3\le 0\\x+7\le 0\end{cases}$

$x\ge\dfrac{3}{2}$ or 或 $x\le -7$

(c) $\begin{cases}x-1>0\\6x-1<0\end{cases}$ or 或 $\begin{cases}x-1<0\\6x-1>0\end{cases}$

no solution 沒有解 or 或 $\dfrac{1}{6}<x<1$

$\therefore \dfrac{1}{6}<x<1$

(d) $\begin{cases}x+9>0\\9x+1<0\end{cases}$ or 或 $\begin{cases}x+9<0\\9x+1>0\end{cases}$

$-9<x<-\dfrac{1}{9}$ or 或 no solution 沒有解

$\therefore -9<x<-\dfrac{1}{9}$

(e) $\begin{cases}3x+8\ge 0\\2x+5\ge 0\end{cases}$ or 或 $\begin{cases}3x+8\le 0\\2x+5\le 0\end{cases}$

$x\ge-\dfrac{5}{2}$ or 或 $x\le-\dfrac{8}{3}$

(f) $\begin{cases}4x+2\le 0\\3x+6\ge 0\end{cases}$ or 或 $\begin{cases}4x+2\ge 0\\3x+6\le 0\end{cases}$

$-2\le x\le-\dfrac{1}{2}$ or 或 no solution 沒有解

$\therefore -2\le x\le-\dfrac{1}{2}$

2. (a) $\begin{cases}6-x>0\\x+1>0\end{cases}$ or 或 $\begin{cases}6-x<0\\x+1<0\end{cases}$

$-1<x<6$ or 或 no solution 沒有解

$\therefore -1<x<6$

(b) $\begin{cases}1-x\ge 0\\3-x\ge 0\end{cases}$ or 或 $\begin{cases}1-x\le 0\\3-x\le 0\end{cases}$

$x\le 1$ or 或 $x\ge 3$

(c) $\begin{cases}5-x\ge 0\\x-2\le 0\end{cases}$ or 或 $\begin{cases}5-x\le 0\\x-2\ge 0\end{cases}$

$x\le 2$ or 或 $x\ge 5$

(d) $\begin{cases}4-x>0\\2x-1<0\end{cases}$ or 或 $\begin{cases}4-x<0\\2x-1>0\end{cases}$

$x<\dfrac{1}{2}$ or 或 $x>4$

(e) $\begin{cases}1-3x\ge 0\\8x+1\ge 0\end{cases}$ or 或 $\begin{cases}1-3x\le 0\\8x+1\le 0\end{cases}$

$-\dfrac{1}{8}\le x\le\dfrac{1}{3}$ or 或 no solution 沒有解

$\therefore -\dfrac{1}{8}\le x\le\dfrac{1}{3}$

(f) $\begin{cases}3x-7>0\\7-3x<0\end{cases}$ or 或 $\begin{cases}3x-7<0\\7-3x>0\end{cases}$

$x>\dfrac{7}{3}$ or 或 $x<\dfrac{7}{3}$

3. (a) $(x+7)(x-5) \le 0$

$\begin{cases} x+7 \ge 0 \\ x-5 \le 0 \end{cases}$ or 或 $\begin{cases} x+7 \le 0 \\ x-5 \ge 0 \end{cases}$

$-7 \le x \le 5$ or 或 no solution 沒有解

$\therefore -7 \le x \le 5$

(b) $(x-2)(x+4) \le 0$

$\begin{cases} x-2 \ge 0 \\ x+4 \le 0 \end{cases}$ or 或 $\begin{cases} x-2 \le 0 \\ x+4 \ge 0 \end{cases}$

no solution 沒有解 or 或 $-4 \le x \le 2$

$\therefore -4 \le x \le 2$

(c) $(2x-3)(x+1) > 0$

$\begin{cases} 2x-3 > 0 \\ x+1 > 0 \end{cases}$ or 或 $\begin{cases} 2x-3 < 0 \\ x+1 < 0 \end{cases}$

$x > \frac{3}{2}$ or 或 $x < -1$

(d) $(3x-2)(2x+1) \le 0$

$\begin{cases} 3x-2 \ge 0 \\ 2x+1 \le 0 \end{cases}$ or 或 $\begin{cases} 3x-2 \le 0 \\ 2x+1 \ge 0 \end{cases}$

no solution 沒有解 or 或 $-\frac{1}{2} \le x \le \frac{2}{3}$

$\therefore -\frac{1}{2} \le x \le \frac{2}{3}$

(e) $(x-4)(x-11) > 0$

$\begin{cases} x-4 > 0 \\ x-11 > 0 \end{cases}$ or 或 $\begin{cases} x-4 < 0 \\ x-11 < 0 \end{cases}$

$x > 11$ or 或 $x < 4$

(f) $(3x-7)^2 \le 0$

$\begin{cases} 3x-7 \ge 0 \\ 3x-7 \le 0 \end{cases}$ or 或 $\begin{cases} 3x-7 \le 0 \\ 3x-7 \ge 0 \end{cases}$

$x = \frac{7}{3}$ or 或 $x = \frac{7}{3}$, $\therefore x = \frac{7}{3}$

(g) $(2x+5)(2x-5) < 0$

$\begin{cases} 2x+5 > 0 \\ 2x-5 < 0 \end{cases}$ or 或 $\begin{cases} 2x+5 < 0 \\ 2x-5 > 0 \end{cases}$

$-\frac{5}{2} < x < \frac{5}{2}$ or 或 no solution 沒有解

$\therefore -\frac{5}{2} < x < \frac{5}{2}$

(h) $(3x-2)(x-8) \ge 0$

$\begin{cases} 3x-2 \ge 0 \\ x-8 \ge 0 \end{cases}$ or 或 $\begin{cases} 3x-2 \le 0 \\ x-8 \le 0 \end{cases}$

$x \ge 8$ or 或 $x \le \frac{2}{3}$

13-9

1. (a) $(x-3)(x+3) < 0$

$\therefore -3 < x < 3$

(b) 1, 2

2. (a) $(3x-1)(x-1) \le 0$

$\therefore \frac{1}{3} \le x \le 1$

(b) 1

3. $\Delta = (-k)^2 - 4(2)(8) \ge 0$

$(k-8)(k+8) \ge 0$

$\therefore k \le -8$ or 或 $k \ge 8$

4. $\Delta = (-10)^2 - 4(k)(k) < 0$

$(5+k)(5-k) < 0$

$k < -5$ or 或 $k > 5$

$\because k$ is a positive integer,

k 為正整數,

$\therefore k = 6, 7, 8, \ldots$

5. $\Delta = (-3k)^2 - 4(4)(2k-5) \ge 0$

$9k^2 - 32k + 80 \ge 0$

Let 設 $y = 9k^2 - 32k + 80$; when 當 $y = 0$,

$\Delta_k = (-32)^2 - 4(9)(80) = -1856 < 0$

$\therefore$ no k-intercept. 沒有 k 軸截距。

$\therefore$ k can be any real numbers.

k 可以是任何實數。

6. $\Delta = (-2)^2 - 4(3m)(3) < 0$ and 及 $3m > 0$

$4 - 36m < 0$ and 及 $m > 0$

$m > \frac{1}{9}$ and 及 $m > 0$, $\therefore m > \frac{1}{9}$

7. $\Delta = (2k)^2 - 4(-1)(-1) < 0$

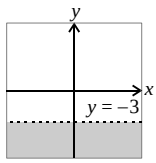
$(k-1)(k+1) < 0$

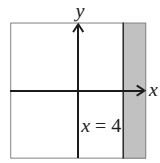
$\therefore -1 < k < 1$

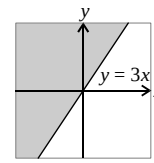
14-1

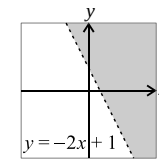
1. (a) Yes 是 (b) Yes 是 (c) Yes 是 (d) No 不是
2. (a) A, B, E (b) C, F (c) D, G

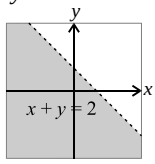
14-2

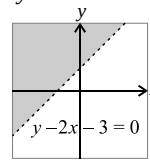
1. (a) $y > -2$ (b) $y < -x$ (c) $y > x - 2$
2. (a) $y \geq 5 - x$ (b) $y \geq 22x$ (c) $y \leq 3x - \frac{1}{2}$
3. (a) 

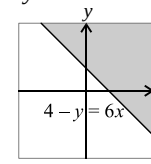
(b) 

(c) 

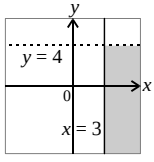
(d) 

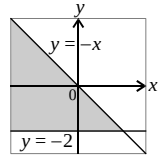
4. (a) $y < 2 - x$ 

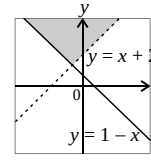
(b) $y > 2x + 3$ 

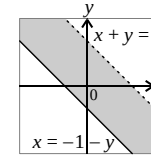
(c) $y \geq 4 - 6x$ 

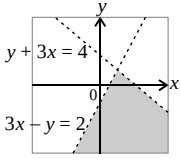
14-3

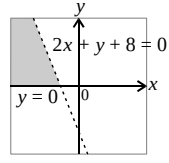
1. 

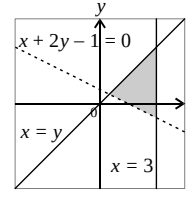
2. 

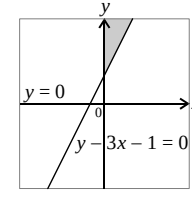
3. 

4. 

5. 

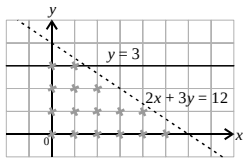
6. 

7. 

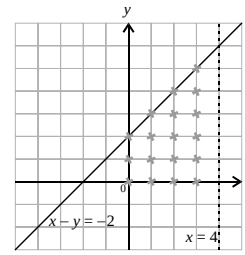
8. 

14-4

1. (a)



(b)



2. (a) (0, 0), (1, 0), (2, 0), (0, 1) (b) (2, 0), (3, 0), (4, 0) (c) (3, 0), (4, 0), (5, 0)
(d) (3, 2), (4, 3) (e) (1, 2), (0, 3), (1, 3), (2, 3), (0, 4), (1, 4), (0, 5) (f) (2, 0), (3, 0), (2, 1), (3, 1), (4, 1) (5, 1), (3, 2), (4, 2), (3, 3)

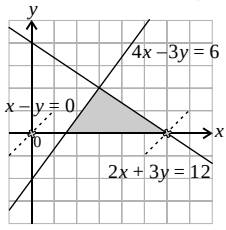
14-5

1. (a) max. at 得極大值於: (3, 1), ∴ max. value 極大值= 2(3) + 1 = 7;
min. at 得極小值於: (−5, − 2), ∴ min. value 極小值= 2(−5) − 2 = −17
(b) max. at 得極大值於: (3, 2), ∴ max. value 極大值= 3(3) − 2 = 7;
min. at 得極小值於: (0, 8), ∴ min. value 極小值= 3(0) − 8 = −8
(c) max. at 得極大值於: (3, 6), ∴ max. value 極大值= 3(6) − 2(3) = 12;
min. at 得極小值於: (4, 0), ∴ min. value 極小值= 3(0) − 2(4) = −8

2. (a) $\begin{cases} x + y \le 5 \\ x - y \le 1 \\ x, y \ge 0 \end{cases}$ (b) (0, 0), (1, 0), (3, 2), (0, 5)

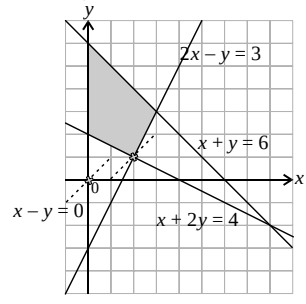
(c) (i) $P(0, 0) = 0$, $P(1, 0) = 2$, $P(3, 2) = 8$, $P(0, 5) = 5$
∴ max. at 得極大值於: (3, 2), max. value 極大值= 8
min. at 得極小值於: (0, 0), min. value 極小值= 0
(ii) $P(0, 0) = 0$, $P(1, 0) = 1$, $P(3, 2) = -5$, $P(0, 5) = -20$
∴ max. at 得極大值於: (1, 0), max. value 極大值= 1
min. at 得極小值於: (0, 5), min. value 極小值= −20
(iii) $P(0, 0) = 0$, $P(1, 0) = 3$, $P(3, 2) = 5$, $P(0, 5) = -10$
∴ max. at 得極大值於: (3, 2), max. value 極大值= 5
min. at 得極小值於: (0, 5), min. value 極小值= −10

3. (a)



max. at 得極大值於: (6, 0),
max. value 極大值 = 6 − 0 = 6

(b)



max. at 得極大值於: (2, 1),

max. value 極大值 = 2 − 1 = 1

14-6

1. (a) $5x + y \geq 30$ (b) $10x + 15y \leq 150$ (c) $x > 3y$ (d) $3y < 20$

2. $\begin{cases} x \geq 2y \\ 5x + 10y \geq 700 \\ x, y \text{ are non-negative integers} \\ (x、y \text{ 為非負整數}) \end{cases}$

3. $\begin{cases} 3x + 5y \leq 92 \\ 1500x + 1000y \leq 50000 \\ x, y \text{ are non-negative integers} \\ (x、y \text{ 為非負整數}) \end{cases}$

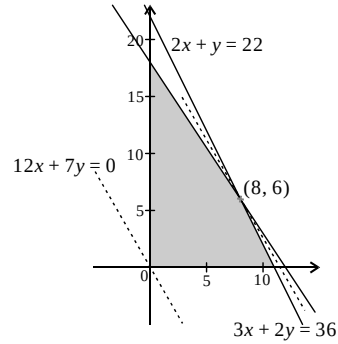
4. $\begin{cases} 1.5x + 3.5y \leq 85 \\ 3x + 2y \leq 100 \\ 100x + 200y \leq 5000 \\ 8x \leq 240 \\ x, y \text{ are non-negative integers} \\ (x、y \text{ 為非負整數}) \end{cases}$

5. $\begin{cases} x + y \leq 200 \\ x + 2y \geq 250 \\ y < 3x \\ x, y \text{ are non-negative integers} \\ (x、y \text{ 為非負整數}) \end{cases}$

14-7

1. (a) The constraints are 約束條件是:

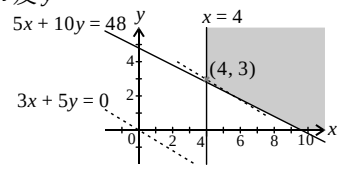
$\begin{cases} 2.88x + 1.92y \leq 34.56, \text{ i.e. } 3x + 2y \leq 36 \\ 0.6x + 0.3y \leq 6.6, \text{ i.e. } 2x + y \leq 22 \\ x, y \text{ are non-negative integers} \\ (x、y \text{ 為非負整數}) \end{cases}$



(b) Let $\$P$ be the profit, then $P = 120x + 70y$.
設盈利為$\$P$，則 $P = 120x + 70y$ 。
From the graph, P is maximum at $(8, 6)$
由圖像得知，P 的最大值在 $(8, 6)$
∴ 8 tables and 6 chair should be produced.
∴ 應製造 8 張檯及 6 張椅。

2. Let the numbers of five-seated vans and ten-seated vans be x and y respectively.
設五座位客貨車和十座位客貨車的數目分別為 x 及 y。
The constraints are 約束條件是:

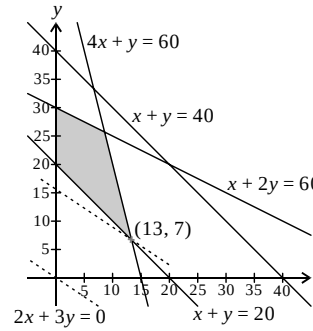
$\begin{cases} 5x + 10y \geq 48 \\ 18x \geq 48(1.5), \text{ i.e. } x \geq 4 \\ x, y \text{ are non-negative integers} \\ (x、y \text{ 為非負整數}) \end{cases}$



Let $\$C$ be the cost, then $C = 300x + 500y$.
設成本為$\$C$，則 $C = 300x + 500y$ 。
From the graph, C is minimum at $(4, 3)$
由圖像得知，C 的最少值在 $(4, 3)$
∴ 4 five-seated vans should be rented.
∴ 應租用 4 輛五座位客貨車

3. (a) The constraints are 約束條件是:

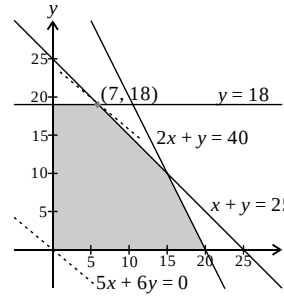
$$\begin{cases} x+2y \le 60 \\ 4x+y \le 60 \\ 1.5x+1.5y \le 60, \text{ i.e. } x+y \le 40 \\ x+y \ge 20 \\ x, y \text{ are non-negative integers} \\ (x、y \text{ 為非負整數}) \end{cases}$$



(b) Let t days are needed to finish the production, then $t = 2x + 3y$.
設需要 t 天完成生產，則 $t = 2x + 3y$。
From the graph, t is minimum at $(13, 7)$
由圖像得知，t 的最少值在 $(13, 7)$
∴ Minimum time 最少需要
$= 2(13) + 3(7) = \underline{\underline{47 \text{ days天}}}$
Number of item A 產品 A 的數目: 13

4. (a) The constraints are 約束條件是:

$$\begin{cases} 2x+2y \le 50, \text{ i.e. } x+y \le 25 \\ 140x+70y \le 2800, \text{ i.e. } 2x+y \le 40 \\ 60y \le 1080, \text{ i.e. } y \le 18 \\ x, y \text{ are non-negative integers} \\ (x、y \text{ 為非負整數}) \end{cases}$$



(b) Let $\$P$ be the profit, then $P = 5x + 6y$.
設盈利為 $\$P$，則 $P = 5x + 6y$。
From the graph, P is maximum at $(7, 18)$
由圖像得知，P 的最大值在 $(7, 18)$
∴ Maximum profit 最高盈利
$= 5(7) + 6(18) = \underline{\underline{\$143}}$.
7 Type A and 18 type B are made.
應製作 7 份甜點 A 及 18 份甜點 B。

15-1

1. (a) 64 (b) $\frac{1}{343}$ (c) 1 (d) $\frac{27}{125}$ (e) -243
   (f) 1 (g) $-\frac{1}{64}$ (h) 49 (i) -4096

2. (a) $-\frac{3}{2}$ (b) $\frac{1}{729}$ (c) 1000 (d) 36 (e) $\frac{243}{8}$ (f) 375
   (g) $\frac{1}{64}$ (h) -9 (i) $\frac{1}{16}$ (j) 16 (k) $\frac{1}{324}$ (l) 216

15-2

1. (a) $\frac{b}{a^6}$ (b) $\frac{x^4}{y^4}$ (c) a^8b^{12} (d) $\frac{y^9}{x^4}$

2. (a) $\frac{1}{216w^6}$ (b) $\frac{n^6}{8m^9}$ (c) $\frac{x^4y^6}{9}$ (d) $\frac{1}{8k^6}$ (e) $\frac{a^4}{5b^7}$ (f) $\frac{64a^6b^3}{27}$

3. (a) $\frac{4a^4}{9}$ (b) $15a^8$ (c) $\frac{n^6}{2}$ (d) $\frac{75}{b^2}$ (e) $\frac{m^8}{2n^8}$ (f) $\frac{m^{16}}{8n^5}$

   (g) $\frac{3}{8a^2b^{14}}$ (h) $= \frac{18e(d^{-2}f^{-4})}{(e^{-2}f^2)(d^{-3}f^{-3})(8f^{-9}e^3d^6)} = \frac{18e^0d^{-5}f^6}{8} = \frac{9f^6}{4d^5}$

15-3

1. (a) $-\frac{1}{27a^6}$ (b) $-\frac{n^{25}}{m^{10}}$ (c) $-\frac{x^3y^6}{4}$ (d) $-\frac{8}{125k^9}$

   (e) $= \frac{(-1)^3x^6y^{-2}}{-y^2} = \frac{x^6}{y^4}$ (f) $= \frac{(-2)^{-5}m^{-15}}{n^{10}} = \frac{-1}{32n^{10}m^{15}}$

2. (a) $3k^5$ (b) $\frac{1}{36x^3}$ (c) $= -125a^9(2^{-2}a^2) = \frac{-125a^{11}}{4}$ (d) $-18a^6$

   (e) $= \frac{5^{-2}x^{-4}y^2}{-4x^{-6}y^2} = -\frac{x^2}{100}$ (f) $= \frac{-3^{-3}m^{-3}(3^{-2}n^{-1})}{2^{-4}m^8n^{12}} = -\frac{16}{243m^{11}n^{13}}$

   (g) $= -8(a^6b^{-6}) \times \frac{b^{-18}}{-8a^3} = \frac{a^3}{b^{24}}$ (h) $= \frac{x^2y^{-4}}{2^{-2}y^2} \cdot \frac{-2x^{-3}}{1} \cdot \frac{2^3}{x^3} = -\frac{64}{x^4y^6}$

15-4

1. (a) 5 (b) 7 (c) -2 (d) $\frac{1}{2}$ (e) $= (8^2)^{\frac{3}{2}} = 512$

   (f) $= (3^3)^{-\frac{4}{3}} = \frac{1}{81}$ (g) $= [(\frac{3}{2})^4]^{\frac{1}{4}} = \frac{3}{2}$ (h) $= [(\frac{4}{5})^3]^{\frac{2}{3}} = (\frac{4}{5})^2 = \frac{16}{25}$

   (i) $= [(\frac{5}{7})^2]^{-\frac{3}{2}} = (\frac{5}{7})^{-3} = \frac{343}{125}$

2. (a) $= (2^3)^{\frac{2}{3}} \cdot 5^2 = 100$ (b) $= 4 \cdot (2^3)^{-\frac{4}{3}} = \frac{1}{4}$ (c) $= (3^3)^{-\frac{4}{3}} \cdot (5^2)^{\frac{3}{2}} = \frac{125}{81}$

   (d) $= (3 \times 9)^{\frac{1}{3}} = 3$ (e) $= (4^3 \times 4^2)^{\frac{1}{5}} = 4$ (f) $= (2^{-1} \times 2^4)^{-\frac{1}{3}} = \frac{1}{2}$

   (g) $= [(\frac{1}{2})^3]^{-\frac{1}{3}} \times [(\frac{2}{3})^2]^{\frac{1}{2}} = (\frac{1}{2})^{-1} \times \frac{2}{3} = \frac{4}{3}$ (h) $= (3 \cdot 9)^{\frac{1}{3}} = 3$

   (i) $= (2^4)^{\frac{2}{5}} \times (2^3)^{-\frac{1}{5}} = 2^{\frac{8}{5}} \times 2^{-\frac{3}{5}} = 2$

15-5

1. (a) $x^{\frac{3}{4}}$ (b) $y^{\frac{1}{2}}$ (c) $x^{\frac{5}{2}}$ (d) $a^{\frac{1}{3}}$ (e) $\frac{1}{b^{\frac{3}{2}}}$ (f) $\frac{1}{m^6}$

   (g) $\frac{1}{n^{\frac{6}{7}}}$ (h) $k^{\frac{10}{3}}$ (i) $\frac{1}{p^{\frac{4}{9}}}$

2. (a) $x^{\frac{19}{30}}$ (b) $\frac{1}{a^{\frac{5}{12}}}$ (c) $\frac{1}{a^{\frac{4}{9}}}$ (d) $a^{\frac{4}{3}}b^{\frac{5}{6}}$ (e) $\frac{1}{m^{\frac{2}{15}}n^{\frac{7}{5}}}$ (f) $\frac{1}{k^{\frac{1}{12}}h^{\frac{1}{4}}}$

   (g) $\frac{2}{m^{\frac{4}{3}}}$ (h) $\frac{4}{9y^{\frac{4}{9}}}$ (i) $= \frac{3^{-\frac{1}{3}}}{p^{-\frac{1}{6}}} \times \frac{(3^2)^3 p^{\frac{3}{2}}}{2^3} = \frac{3^{\frac{17}{3}} p^{\frac{5}{3}}}{8}$

15-6

1. (a) $x^{\frac{5}{2}}$ (b) $y^{\frac{1}{5}}$ (c) $\frac{1}{a^{\frac{3}{4}}}$ (d) $\frac{1}{x^{\frac{1}{2}}}$ (e) $\frac{1}{x^{\frac{3}{5}}}$ (f) $\frac{1}{k^{\frac{1}{6}}}$

2. (a) $= a^{\frac{3}{2}} \cdot a^{\frac{2}{3}} = a^{\frac{13}{6}}$ (b) $x^{\frac{5}{3}} \cdot x^{-\frac{3}{2}} = x^{\frac{1}{6}}$ (c) $= m^{-2} m^{\frac{1}{6}} = \frac{1}{m^{\frac{11}{6}}}$

   (d) $= a^{\frac{2}{3}} \cdot a^{\frac{1}{6}} \cdot a^{-3} = \frac{1}{a^{\frac{13}{6}}}$ (e) $m^{\frac{1}{6}} n^{\frac{1}{4}}$ (f) $= 2y^{\frac{3}{2}} \cdot 2y^{\frac{2}{3}} = 4y^{\frac{13}{6}}$

   (g) $= 3ab^{\frac{2}{3}} \cdot \frac{1}{3} b^{\frac{1}{4}} = ab^{\frac{11}{12}}$ (h) $= m^{-\frac{1}{2}} n^{-\frac{3}{2}} \cdot 2^{-3} m^{-\frac{3}{4}} = \frac{1}{8m^{\frac{5}{4}} n^{\frac{3}{2}}}$

   (i) $= \frac{1}{8} \cdot 2^{\frac{3}{2}} a^{\frac{3}{2}} \cdot 2^{\frac{1}{2}} a^{\frac{-1}{2}} = \frac{a}{2}$ (j) $= x^{\frac{1}{2}} \cdot x^{\frac{1}{6}} = x^{\frac{2}{3}}$

   (k) $x^{\frac{2}{3}} \cdot x^{\frac{1}{2} \times \frac{1}{3}} \cdot x^{\frac{3}{3} \times \frac{1}{2} \times \frac{1}{3}} = x^{\frac{13}{12}}$ (l) $\sqrt{2 \cdot 2^{\frac{3}{2}} x^{\frac{3}{2}} \cdot 2^{\frac{1}{2}} x^{-\frac{5}{2}}} = (2^3 x^{-1})^{\frac{1}{2}} = \frac{2^{\frac{3}{2}}}{x^{\frac{1}{2}}}$

15-7

1. (a) 2^{-n+4} (b) $= \frac{3^{n+1} \cdot 4^{n+1}}{3^{n-1} \cdot 4^n} = 36$ (c) $= \frac{3^{n-3} \cdot 6^{n+1}}{3^{n+2} \cdot 6^{n+2}} = \frac{1}{1458}$ (d) $= \frac{2^{3n} \cdot 2^{3n-6}}{2^{4n+2}} = 2^{2n-8}$

   (e) $= \frac{3^{2n+2} \cdot 3^{-3n-3}}{3^{-5n}} = 3^{4n-1}$ (f) $= \frac{2^{2m}}{3^{2m}} \cdot 3^{2m+2} = 9 \cdot 2^{2m}$ (g) $= 2^{x+3} \cdot 2^{2x-1} = 2^{3x+2}$

   (h) $= 2^{2x+6} \cdot 2^{-3x+3} = 2^{-x+9}$ (i) $= (\frac{4}{3})^{1-2x} \cdot 6^{2x+3} = \frac{2^{2-4x} \cdot 2^{2x+3} \cdot 3^{2x+3}}{3^{1-2x}} = 2^{5-2x} \cdot 3^{4x+2}$

2. (a) 7^{4x-3y} (b) 3^{5x+4y} (c) 2^{x+2y} (d) 2^{8x-3y} (e) $2a^{7a}$ (f) $\frac{2^{x-2y}}{5^{11y}}$

15-8

1. $= 27 \cdot 3^n - 3^n = 26 \cdot 3^n$
2. $= 5^{n-1} + 25 \cdot 5^{n-1} = 26 \cdot 5^{n-1}$
3. $= \dfrac{2^{n-1}(1-2)}{2^{n-1} \cdot 2^2} = -\dfrac{1}{4}$
4. $= \dfrac{3^{n-1}(3^2-1)}{3^{n-1}(3+1)} = 2$
5. $= 20 \cdot 2^n - 2^n = 19 \cdot 2^n$
6. $5 \cdot 2^{n-1}$
7. $= \dfrac{3^{n-2}(4 \cdot 3^3 - 2)}{3^{n-2}(4 \cdot 3^3 + 2)} = \dfrac{53}{55}$
8. $6 \cdot 5^{3n}$
9. -3^{2n}
10. $= 7^{n+2} + 6 \cdot 7^n = 55 \cdot 7^n$
11. $= 2^{2n+1} - 2^{2n-6} = 127 \cdot 2^{2n-6}$
12. $= \dfrac{3^{2n-3} - 3^{2n}}{2 \cdot 3^{2n-1} + 3^{2n}} = \dfrac{-26}{45}$

15-9

1. (a) $\dfrac{1}{2}$ (b) $\dfrac{2}{3}$ (c) $\dfrac{3}{2}$ (d) 49 (e) 4 (f) $\dfrac{1}{6561}$
   (g) $\dfrac{4}{9}$ (h) $\dfrac{1}{16}$ (i) 4
2. (a) 2 (b) -1 (c) 8 (d) $\dfrac{4}{5}$ (e) $\dfrac{1}{5}$ (f) $-\dfrac{1}{2}$
   (g) $\dfrac{-7}{3}$ (h) 4 (i) -4

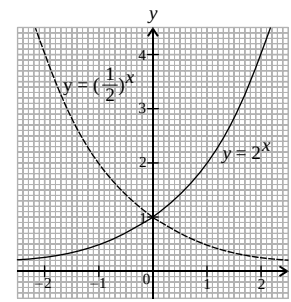
15-10

1. $2^x(2^2+1) = 160$, $x = 5$
2. $3^x(3-1) = \dfrac{2}{9}$, $x = -2$
3. $5^{x-1}(5^2-1) = \dfrac{24}{5}$, $x = 0$
4. $4^x(12+1) = 832$, $x = 3$
5. $3^{2x-1}(1+3^2) = 10$, $x = \dfrac{1}{2}$
6. $4^{3x}(4-5) = -16$, $x = \dfrac{2}{3}$
7. $9^{3y+1}(9^2-1) = 80$, $y = -\dfrac{1}{3}$
8. $2^{4x} - 2^{4x-1} = 1$, $2^{4x-1}(2-1) = 1$, $x = \dfrac{1}{4}$
9. $5^{3x+3} - 3 \cdot 5^{3x-1} = \dfrac{622}{25}$, $5^{3x-1}(5^4-3) = \dfrac{622}{25}$, $x = -\dfrac{1}{3}$
10. $2^{6x+3} + 2^{6x-4} = 129$, $2^{6x-4}(2^7+1) = 129$, $x = \dfrac{2}{3}$

15-11

1. (a) 0.8 (b) 2.6 (c) 1.4
   (d) 2.8 (e) 0.6
2. (a) 0.9 (b) $n - 1 = 1.6$,
   $\therefore n = 2.6$ (c) $-4m - 2 = 1.2$, $m = -0.8$

3.



16-1

1. (a) $x = \log_8 y$ (b) $k = \log_{13} a$
   (c) $3 = \log_p r$ (d) $2p = \log_7 s$ (e) $a = \log_5 4$ (f) $n = \log_{16} 8$
   (g) $10 = \log_x 2$ (h) $6 = \log_y x$ (i) $n = \log_x a$

2. (a) $=\log_5 5^3 = 3$ (b) $=\log_2 2^4 = 4$ (c) $=\log_3 3^{-\frac{3}{2}} = -\frac{3}{2}$

(d) $=\log_6 6^{\frac{2}{3}} = \frac{2}{3}$ (e) $=\log_{49} 49^{\frac{1}{2}} = \frac{1}{2}$ (f) $=\log_{125} 125^{\frac{1}{3}} = \frac{1}{3}$

(g) $=\log_{11} 11^{-2} = -2$ (h) $=\log_{64}(64^{\frac{1}{2}})^5 = \frac{5}{2}$ (i) $=\log_4 4^{\frac{3}{2}} = \frac{3}{2}$

(j) $=\log_{27} 27^{\frac{2}{3}} = \frac{2}{3}$ (k) $=\log_{81} 81^{\frac{3}{4}} = \frac{3}{4}$ (l) $=\log_4(4^{\frac{5}{2}})^{\frac{1}{2}} = \frac{5}{4}$

(m) $=\log_8(8^{\frac{2}{3}})^{-1} = -\frac{2}{3}$ (n) $=\log_{16}(16^{\frac{3}{4}})^{-\frac{1}{2}} = -\frac{3}{8}$ (o) $=\log_{16}(16^{\frac{5}{4}})^{\frac{1}{2}} = \frac{5}{8}$

16-2

1. (a) $=\log(0.5\times 2) = 0$ (b) $=\log(\frac{8}{80}) = -1$ (c) $=\log(\frac{15}{5\times 3}) = 0$

(d) $=\log(\frac{7}{30}\times\frac{21}{25}\times\frac{5}{98}) = \log(\frac{1}{100}) = -2$ (e) $=\log(\sqrt[3]{20\times 50}) = \frac{1}{3}\log 1000 = 1$

(f) $=\log(10^{-2})^{\frac{1}{2}} - 10 = -1 - 10 = -11$ (g) $=\log 125 + \log 8 = \log 1000 = 3$

(h) $=\log 225 - \log\frac{9}{4} = \log(225\times\frac{4}{9}) = \log 100 = 2$

(i) $=\log 10^{\frac{1}{2}} - \log 10^{-1} = \frac{1}{2} - (-1) = \frac{3}{2}$ (j) $=\log\frac{1}{125} - \log 8 = \log\frac{1}{1000} = -3$

(k) $=\log 3 + \log\frac{1}{2} - \log 15 = \log(3\times\frac{1}{2}\div 15) = \log\frac{1}{10} = -1$

(l) $=\frac{1}{3}(\log 180 - \log 8 - \log 225) = \frac{1}{3}\log(\frac{180}{8\times 225}) = \frac{1}{3}\log\frac{1}{10} = -\frac{1}{3}$

(m) $\frac{1}{3}$ (n) $=10^{\log 5^{\frac{1}{3}}} = 5^{\frac{1}{3}}$ (o) $=10^{-2\log 7 + 7\log 2} = 10^{\log\frac{1}{49} + \log 128} = 10^{\log\frac{128}{49}} = \frac{128}{49}$

2. (a) No 否 (b) No 否 (c) No 否 (d) No 否 (e) No 否
(f) No 否 (g) Yes 是 (h) Yes 是 (i) No 否 (j) Yes 是
(k) Yes 是

3. (a) $=\log(\frac{5x}{x}\cdot 2) = 1$ (b) $=\log\frac{(p^4q)(pq^3)}{(pq)^4} = \log p$

(c) $=\log[(\sqrt{a}b)^3 \div \sqrt{\frac{a}{b}}\times\frac{a}{\sqrt{b}}] = \log a^2b^3$ (d) $=10^{\log x^3} = x^3$

16-3

1. (a) $=\frac{\log 2^5}{\log 2^4} = \frac{5}{4}$ (b) $=\frac{\log 3^{\frac{3}{2}}}{\log 3^2} = \frac{3}{4}$ (c) $=\frac{\log 5^3}{\log 5^{-\frac{1}{2}}} = -6$

(d) $=\frac{\log p^{\frac{3}{5}}}{\log p^2} = \frac{3}{10}$ (e) $=\frac{\log(x-y)^2}{\log(x-y)} = 2$ (f) $=\frac{\log(2a+b)^{\frac{1}{2}}}{\log(2a+b)^2} = \frac{1}{4}$

2. (a) $=\log(2^2\times3\times10)=2p+q+1$ (b) $=\log(\frac{2^2}{3})=2p-q$ (c) $=\log(\frac{10}{2})=1-p$

(d) $=\log(\frac{3\times10}{2})=q-p+1$ (e) $=\log(\frac{10^2}{2^2\times3})=2-2p-q$

(f) $=\log(2^5\times3)^{-1}=-5p-q$ (g) $=\log(\frac{2\times3^3}{100})=p+3q-2$ (h) $=\log(3\times\sqrt{2})=\frac{1}{2}p+q$

16-4

1. (a) 1.40 (b) 1.43 (c) –1.30 (d) 0.628

2. (a) $=\log_5(\frac{20}{4})=1$ (b) $=\frac{\log_9 7^2}{\log_9 7}=2$ (c) $=\log_8(12\times\frac{1}{6})=\log_8 8^{\frac{1}{3}}=\frac{1}{3}$

(d) $=\frac{\log3^2}{\log6}\times\frac{\log6^2}{\log3}=4$ (e) $=\log_4(\frac{80}{5})=2$ (f) $=\log_{27}27^{\frac{4}{3}}=\frac{4}{3}$

(g) $=\log_8(8^{\frac{1}{3}})^{-\frac{1}{2}}=-\frac{1}{6}$ (h) $=\frac{1}{2}\log_2 18-\log_2 12=\frac{1}{2}\log_2 2^{-3}=-\frac{3}{2}$

(i) $=\frac{\log3}{\log5}\cdot\frac{\log5}{\log9}=\frac{1}{2}$ (j) $=\frac{\log9}{\log2^{-1}}\div\frac{\log81}{\log2}=-\frac{1}{2}$

16-5

1. (a) 6 (b) $=\frac{\log a}{\log3}\times\frac{\log3^2}{\log a}=2$ (c) $=\frac{\log p^{\frac{3}{2}}}{\log2}\div\frac{\log p^{-1}}{\log8}=-\frac{9}{2}$

(d) $=\frac{\log a^2b}{\log5^{-1}}\div\frac{\log a\sqrt{b}}{\log25}=-4$ (e) $=\log_9[\frac{x^2y}{3}\div(xy)^2\times\frac{y}{3}]=-1$

2. (a) $=\frac{\log(2^3\times3)}{\log(2\times3)}=\frac{3r+s}{r+s}$ (b) $=\frac{\log(3^2\times10\div2)}{\log3^2}=\frac{2s-r+1}{2s}$

(c) $=\frac{1}{2}\cdot\frac{\log(2\times3\times10)}{\log(10\div2)}=\frac{r+s+1}{2(1-r)}$

16-6

1. $x^2+x-9=0$ 2. $x=-3$ 3. $x^3+x^2-100=0$ 4. $x=1$

5. $x^2-27=0$ 6. $40x^3-x-1=0$ 7. $1000x^2-3x+9=0$ 8. $x=\frac{7}{4}$

9. $x\cdot\sqrt{y}=32$ 10. $\sqrt[3]{y}\cdot x^2=9$

16-7

1. $2x-7=10^3$, $x=\frac{1007}{2}$ 2. $x+2=10^3$, $x=998$ 3. $5x+1=10^{-2}$, $x=-\frac{99}{500}$

4. $\frac{x-3}{2}=9^{\frac{1}{2}}$, $x=9$ 5. $3x=2^5$, $x=\frac{32}{3}$ 6. $2-5x=4^{-1}$, $x=\frac{7}{20}$

7. $\frac{5^3}{x}=15$, $x=\frac{25}{3}$ 8. $\frac{4x+3}{3x}=6$, $x=\frac{3}{14}$ 9. $\frac{2x-7}{3x}=5^1$, $x=-\frac{7}{13}$ (rej.捨)

10. $\frac{2x+1}{x-1}=10^0$, $x=-2$ (rej.捨)
11. $\frac{4x-1}{1-x}=2^{-1}$, $x=\frac{1}{3}$
12. $x(4x)=10^0$, $x=\frac{1}{2}$ (rej.捨 $x=-\frac{1}{2}$)
13. $x^3(2x)=1250$, $x=5$ (rej.捨 $x=-5$)
14. $\log_2 x=\frac{\log_2 \frac{3x}{2}}{\log_2 4}$, $2\log x=\log\frac{3x}{2}$, $x^2=\frac{3x}{2}$, $x=\frac{3}{2}$ (rej.捨 $x=0$)
15. $x^2-5x=x+7$, $x=7$ or 或 $x=-1$
16. $2x^2-3=5x$, $x=3$ (rej.捨 $x=-\frac{1}{2}$)
17. $(x+12)(x+1)=6$, $x=-0.479$ (rej.捨 $x=-12.5$)
18. $\log_4(2-x)-\frac{\log_4(x+6)}{\log_4 16}=\log_4 4^{\frac{1}{2}}$, $\frac{(2-x)^2}{x+6}=4$, $x=-2$ (rej.捨 $x=10$)

16-8

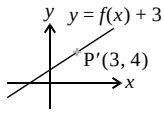
1. $x=0.431$
2. $x=2.54$
3. $x=0.815$
4. $x=-0.737$
5. $x=0.290$
6. $x=-1.5$
7. $x=1.87$
8. $x=-1.51$
9. $x=1.23$
10. $(x+1)\log 4=\log 20$, $x=1.16$
11. $(x-2)\log 7=\log 14$, $x=3.36$
12. $(2x+1)\log 5=-\log 8$, $x=-1.15$
13. $(1-x)\log 9=\log 4$, $x=0.369$
14. $(2x+1)\log 8=x\log 3$, $x(2\log 8-\log 3)=-\log 8$, $x=-0.679$
15. $(4x-1)\log 7=2x\log 11$, $x(4\log 7-2\log 11)=\log 7$, $x=0.651$
16. $-2x\log 5=(2x-1)\log 10$, $1=x(2+2\log 5)$, $x=0.294$
17. $-3x\log 3=(1-x)\log 6$, $x(\log 6-3\log 3)=\log 6$, $x=-1.19$
18. $(x+1)\log 4=(x-2)\log 3$, $x(\log 4-\log 3)=-2\log 3-\log 4$, $x=-12.5$
19. $(x+3)\log 2=(2-x)\log 5$, $x(\log 2+\log 5)=2\log 5-3\log 2$, $x=0.495$
20. $\log 4+(x+1)\log 3=(x+1)\log 5$, $x(\log 3-\log 5)=\log 5-\log 4-\log 3$, $x=1.71$

16-9

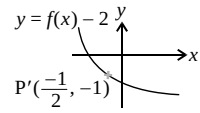
1. (a) 1.5 (b) 2.3 (c) −1.5
2. (a) $m=5.2$ (b) $k=0.8$ (c) $t=1.9$ (d) $x=4.2$
3. (a) $a=1.6$ (b) $p=14.0$ (c) $k=-0.8$

17-1

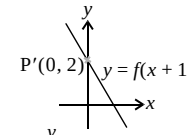
1. (a)



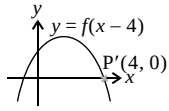
(b)



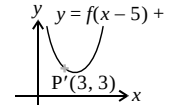
(c)



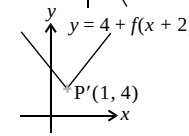
(d)



(e)



(f)



2. (a) right 向右, 7 units 單位, $g(x)=x-2$
   (b) left 向左, 4 units 單位, $g(x)=-(x+4)=-x-4$

(c) downward 向下, 9 units 單位, $g(x)=x^2-8$

(d) right 向右, 1 unit 單位, $g(x)=-x^2-x+3$

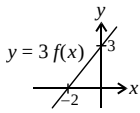
(e) downward 向下, 2 units 單位, $g(x)=\dfrac{3x-3}{4}$

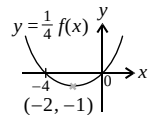
(f) downward 向下, 5 units 單位, $g(x)=5^x-5$

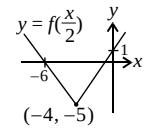
3. (a) $g(x)=x^2-22x+117$ (b) $g(x)=\dfrac{8x+25}{x+3}$

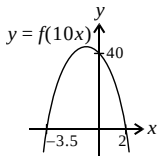
(c) $g(x)=5^x-5$ (d) $g(x)=(x+4)^3$

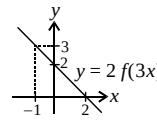
17-2

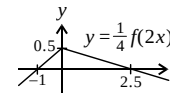
1. (a) 

(b) 

(c) 

(d) 

(e) 

(f) 

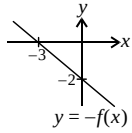
2. (a) $g(x)=\dfrac{2}{3}f(x)=\dfrac{4}{3}x+\dfrac{20}{3}$ (b) $g(x)=f(2x)=-2x+9$

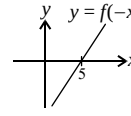
(c) $g(x)=\dfrac{3}{2}f(x)=-3x^2+6x+24$

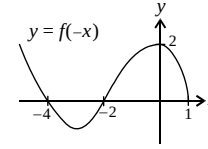
3. (a) $g(x)=3f(x)=6x^2$ (b) $g(x)=f(\dfrac{x}{2})=16^{\frac{x}{2}}=4^x$

(c) $g(x)=\dfrac{1}{3}(x^2+3x)=\dfrac{1}{3}x^2+x$ (d) $g(x)=f(4x)=(8x+1)^2$

17-3

1. (a) 

(b) 

(c) 

2. (a) $g(x)=-f(x)=-4x+6$ (b) $g(x)=f(-x)=x^2+6x-27$

(c) $g(x)=f(-x)=2(x+1)^2+7$

3. (a) $g(x)=f(-x)=3x^2+2x$ (b) $g(x)=-f(x)=4x-8$

(c) $g(x)=f(-x)=(x+1)^2-2$ (d) $g(x)=f(-x)=2^{x+3}$

17-4

1. (a) (i) Translate upwards by 6 units and then reflect along the *y*-axis.
向上平移 6 個單位，然後沿 *y* 軸反射。

(ii) $g(x) = f(x)+6$, $h(x) = f(-x)+6$

(b) (i) Translate to the right by 14 units and then reflect along the *x*-axis.
向右平移 14 個單位，然後沿 *x* 軸反射。

(ii) $g(x) = f(x-14)$, $h(x) = -f(x-14)$

(c) (i) Reflect along *y*-axis and then enlarge to 3 times along the *y*-axis.
沿 *y* 軸反射，然後沿 *y* 軸放大至 3 倍。

(ii) $g(x) = f(-x)$, $h(x) = 3f(-x)$

(d) (i) Enlarge to $\frac{5}{3}$ times along the *x*-axis and then translate to the right by 10 units.

沿 *x* 軸放大至$\frac{5}{3}$倍，然後向右平移 10 個單位。

(ii) $g(x) = f(\frac{3}{5}x)$, $h(x) = g(x-10)$, $\therefore\ h(x) = f[\frac{3}{5}(x-10)] = f(\frac{3}{5}x-6)$

2. (a) $g(x) = f(x)-2$, translate downward by 2 units 向下平移 2 個單位
(b) $g(x) = -f(x)$, reflect along the *x*-axis 沿 *x* 軸反射
(c) $g(x) = f(x+4)$, translate to the left by 4 units 向左平移 4 個單位
(d) $g(x) = 16f(x)$, enlarge to 16 times along the *y*-axis 沿 *y* 軸放大至 16 倍
(e) $g(x) = f(9x)$, reduce to $\frac{1}{9}$ times along the *x*-axis 沿 *x* 軸縮小至$\frac{1}{9}$倍
(f) $g(x) = f(-x)$, reflect along the *y*-axis 沿 *y* 軸反射
(g) $g(x) = 5f(x)$, enlarge to 5 times along the *y*-axis 沿 *y* 軸放大至 5 倍
(h) $g(x) = f(-x)$, reflect along the *y*-axis 沿 *y* 軸反射
(i) $g(x) = f(\frac{x}{2})$, enlarge to 2 times along the *x*-axis 沿 *x* 軸放大至 2 倍
(j) $g(x) = f(-x)$, reflect along the *y*-axis 沿 *y* 軸反射

3. Let $g(x)$ be the function after the first transformation. 設經過一次變換後的函數為 $g(x)$。

(a) $g(x) = -6x+1$, $h(x) = -12x+2$ (b) $g(x) = -2-3x$, $h(x) = -2-6x$

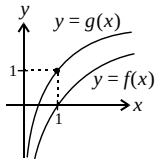
(c) $g(x) = (\frac{1}{2})^{\frac{x}{4}}$, $h(x) = (\frac{1}{2})^{\frac{x-2}{4}}$ (d) $g(x) = 5^{-x}+9$, $h(x) = -5^{-x}-9$

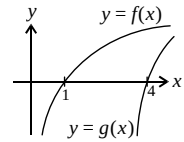
(e) $g(x) = -x^3+5x$, $h(x) = -(x+2)^3+5(x+2)$ (f) $g(x) = \frac{x^2}{2}$, $h(x) = \frac{(x-5)^2}{2}$

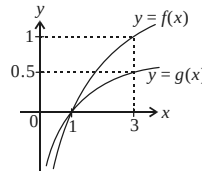
17-5

1. (a) Translate to the right by 3 units. 向右平移 3 個單位。
(b) Enlarge to 2 times along the *y*-axis. 沿 *y* 軸放大至 2 倍。
(c) Reflect along the *y*-axis. 沿 *y* 軸反射。
(d) Reflect along the *x*-axis. 沿 *x* 軸反射。
(e) Enlarge to 7 times along the *y*-axis. 沿 *y* 軸放大至 7 倍。
(f) Reduce to $\frac{1}{2}$ times along the *y*-axis. 沿 *y* 軸縮小至$\frac{1}{2}$倍。

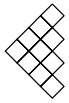
2. (a) Translate downward by 1 unit. 向下平移 1 個單位。
(b) Enlarge to 4 times along the *y*-axis. 沿 *y* 軸放大至 4 倍。
(c) Reduce to $\frac{1}{6}$ times along the *y*-axis. 沿 *y* 軸縮小至$\frac{1}{6}$倍。
(d) Reflect along the *x*-axis. 沿 *x* 軸反射。
(e) Reduce to $\frac{1}{3}$ times along the *y*-axis. 沿 *y* 軸縮小至$\frac{1}{3}$倍。
(f) Reflect along the *x*-axis. 沿 *x* 軸反射。

3. (a) 

(b) 

(c) 

18-1

1. (a) $T_1 = -4, T_2 = -4, T_3 = 0, T_4 = 8$
(b) $T_1 = 2, T_2 = 6, T_3 = 12, T_4 = 20$
(c) $T_1 = 3, T_2 = 2, T_3 = 1, T_4 = 0$
(d) $T_1 = 1, T_2 = \frac{1}{3}, T_3 = 0, T_4 = -\frac{1}{5}$
(e) $T_1 = -4, T_2 = -\frac{9}{4}, T_3 = -\frac{5}{3}, T_4 = -\frac{11}{8}$
(f) $T_1 = 1, T_2 = 3, T_3 = 9, T_4 = 27$
(g) $T_1 = -2, T_2 = 4, T_3 = -8, T_4 = 16$
(h) $T_1 = -1, T_2 = 0, T_3 = \frac{1}{3}, T_4 = \frac{1}{2}$
2. (a) $T_n = -3 + 7n$; 32, 39, 46
(b) $T_n = 2 \times 3^n$; 486, 1458, 4374
(c) $T_n = 25 - 6n$; –5, –11, –17
(d) $T_n = 3n^2$; 75, 108, 147
(e) $T_n = n(n+2)$; 35, 48, 63
(f) $T_n = -33 + 5n$; –8, –3, 2
(g) $T_n = (-1)^{n-1}(7 + 2n)$; 17, –19, 21
(h) $T_n = \frac{7}{8}n$; $\frac{35}{8}, \frac{21}{4}, \frac{49}{8}$
(i) $T_n = -\frac{7}{3} + n$; $\frac{8}{3}, \frac{11}{3}, \frac{14}{3}$
(j) $T_n = 1\frac{1}{2} + (2\frac{5}{6})n$; $15\frac{2}{3}, 18\frac{1}{2}, 21\frac{1}{3}$
3. 
4. (a) 14 (b) 19 (c) 6
(d) 6 (e) 5 (f) 17

18-2

1. (a) Yes 是 ; $T_1 = 3, d = 3$
(b) No 不是
(c) Yes 是 ; $T_1 = 83, d = -6$
(d) Yes 是 ; $T_1 = -15, d = 6$
(e) No 不是
(f) Yes 是 ; $T_1 = \frac{1}{4}, d = \frac{1}{12}$
(g) No 不是
(h) No 不是
(i) Yes 是 ; $T_1 = a, d = b$
(j) Yes 是 ; $T_1 = \frac{2}{x}, d = \frac{2}{x}$
2. (a) $7(n+1) - 7n = 7$; yes 是
(b) $[8 - 5(n+1)] - (8 - 5n) = -5$; yes 是
(c) $2(n+1)(n+2) - 2n(n+1) = 4(n+1)$; no 不是
(d) $\frac{2}{n+1} - \frac{2}{n} = -\frac{2}{n(n+1)}$; no 不是
(e) $\frac{2}{3}(n+2) - \frac{2}{3}(n+1) = \frac{2}{3}$; yes 是
(f) $3(n+1)^2 - 3n^2 = 6n + 3$; no 不是

18-3

1. (a) $8n - 5$
(b) $7n - 80$
(c) $\frac{23}{2} - 9n$
(d) $-\frac{1}{4} - \frac{3}{4}n$
(e) $2nk - k$

2.	First term 首項	Common difference 公差	The 4^{th} term 第 4 項
(a)	-8	9	19
(b)	1	-5	-14
(c)	$\frac{7}{2}$	4	$\frac{31}{2}$

3. (a) $a=17, d=-6, T_n=23-6n$ (b) $a=4, d=19, T_n=19n-15$
   (c) $a=6, d=-24, T_n=30-24n$ (d) $a=-5, d=13, T_n=13n-18$
   (e) $a=4y, d=-2y, T_n=6y-2ny$ (f) $a=k(k+1), d=-k, T_n=k^2+2k-kn$
   (g) $a=\frac{5}{12}, d=-\frac{1}{12}, T_n=\frac{1}{2}-\frac{1}{12}n$ (h) $a=\frac{3}{4}, d=-\frac{1}{3}, T_n=\frac{13}{12}-\frac{1}{3}n$
4. (a) $6=86+(n-1)(-5)$, $n=17$ (b) $35=-37+(n-1)6$, $n=13$
   (c) $-24=72+(n-1)(-8)$, $n=13$ (d) $61=-47+(n-1)12$, $n=10$
   (e) $2=-52+(n-1)6$, $n=10$ (f) $-\frac{3}{4}=5+(n-1)(-\frac{1}{4})$, $n=24$
   (g) $-\frac{7}{8}=\frac{7}{8}+(n-1)(-\frac{1}{4})$, $n=8$ (h) $-\frac{29}{12}=-\frac{13}{24}+(n-1)(-\frac{1}{8})$, $n=16$

18-4

1. (a) $b=\frac{-3+12}{2}, b=4.5$ (b) $-\frac{1}{3}=\frac{2+w}{2}, w=-\frac{8}{3}$
   (c) $18=\frac{g+(3g+1)}{2}, g=\frac{35}{4}$ (d) $3-h=\frac{2h-30}{2}, h=9$
   (e) $k=\frac{(5k-3)+(2k-7)}{2}, k=2$ (f) $2=\frac{\frac{k}{9}+\frac{11}{k}}{2}, k=33$ or 或 3
2. (a) $-9=\frac{y+(x+3)}{2}, y=-x-21$ (b) $y+1=\frac{(x-5)+13}{2}, y=\frac{x}{2}+3$
   (c) $x+y=\frac{\frac{x}{2}+(3y+1)}{2}, y=\frac{3}{2}x-1$ (d) $y=\frac{(2x-y)+(2y+x)}{2}, y=3x$
3. (a) $12=(-3)+(5-1)d, d=\frac{15}{4}$, $\therefore a=\frac{3}{4}, b=\frac{9}{2}, c=\frac{33}{4}$
   (b) $-44=28+(7-1)d, d=-12$, $\therefore a=16, b=4, c=-8, d=-20, e=-32$
4. $6=(-8)+(6-1)d$, $d=\frac{14}{5}$; $-\frac{26}{5}, -\frac{12}{5}, \frac{2}{5}, \frac{16}{5}$
5. $\because$ arith. sequence 等差數列, $\therefore$ common difference 公差 $=d=q-p=r-q$
   $(3q-5)-(3p-5)=3(p-q)=3d$, $(3r-5)-(3q-5)=3(r-q)=3d$
   $\because$ $(3q-5)-(3p-5)=(3r-5)-(3q-5)$,
   $\therefore$ they form an arith. sequence 它們組成等差數列

18-5

1. (a) $28-3>0, n<9\frac{1}{3}$
   $\therefore$ 9 positive terms. 9 個正數項。
   $T_{10}=28-3(10)=-2$
   (b) $-7n+73>0, n<10\frac{3}{7}$
   $\therefore$ 10 positive terms. 10 個正數項。
   $T_{11}=-7(11)+73=-4$

(c) $96+(n-1)(-5)>0, n<20\frac{1}{5}$

$\therefore$ 20 positive terms. 20 個正數項。

$T_{21}=96+(21-1)(-5)=-4$

(d) $128+(n-1)(-4)>0, n<33$

$\therefore$ 32 positive terms. 32 個正數項。

$T_{33}=128+(33-1)(-4)=0$

$T_{34}=128+(34-1)(-4)=-4$

2. (a) $-29+(n-1)(11)>0, n>3\frac{7}{11}$,

$n=4$; $T_4=-29+(4-1)(11)=4$

(b) $-29+(n-1)(11)<300, n<30\frac{10}{11}$,

$n=30$; $T_{30}=-29+(30-1)(11)=290$

3. (a) $-74+(n-1)6>50$, $n>21\frac{2}{3}$;

$-74+(n-1)6<270$, $n<58\frac{1}{3}$;

$\because 21\frac{2}{3}<n<58\frac{1}{3}$

$\therefore$ no. of terms 項數 $=58-21=37$

(b) $510+(n-1)(-7)<270$, $n>35\frac{2}{7}$;

$510+(n-1)(-7)>50$, $n<66\frac{5}{7}$;

$\because 35\frac{2}{7}<n<66\frac{5}{7}$

$\therefore$ no. of terms 項數 $=66-35=31$

(c) $18n-33>50$, $n>4\frac{11}{18}$;

$18n-33<270$, $n<16\frac{5}{6}$;

$\because 4\frac{11}{18}<n<16\frac{5}{6}$

$\therefore$ no. of terms 項數 $=16-4=12$

(d) $213-6n<270$, $n>-9\frac{1}{2}$, $n>0$;

$213-6n>50$, $n>27\frac{1}{6}$

$\because 0<n<27\frac{1}{6}$

$\therefore$ no. of terms 項數 $=27-0=27$

4. (a) $57+(n-1)(-4)<0$, $n>15\frac{1}{4}$;

$57+(n-1)(-4)>-150$, $n<52\frac{3}{4}$;

$\because 15\frac{1}{4}<n<52\frac{3}{4}$

$\therefore$ no. of terms 項數 $=52-15=37$

(b) $22-5n<0$, $n>4\frac{2}{5}$;

$22-5n>-150$, $n<34\frac{2}{5}$;

$\because 4\frac{2}{5}<n<34\frac{2}{5}$

$\therefore$ no. of terms 項數 $=34-4=30$

5. (a) The first multiple is 首個倍數是 40.

$40+(n-1)4\le 1000$, $n\le 241$. $\therefore$ There are 241 multiples. 共 241 個倍數。

(b) The first multiple is 首個倍數是 105.

$105+(n-1)7\le 500$, $n\le 57\frac{3}{7}$. $\therefore$ There are 57 multiples. 共 57 個倍數。

(c) The first multiple is 首個倍數是 150.

$150+(n-1)15\le 4000$, $n\le 257\frac{2}{3}$. $\therefore$ There are 257 multiples. 共 257 個倍數。

18-6

1. (a) $T_3=a+(3-1)d=26$ — (1)

$T_9=a+(9-1)d=20$ — (2)

$\therefore a=28$, $d=-1$, $T_n=29-n$

(b) $T_5=a+(5-1)d=26$ — (1)

$T_9=a+(9-1)d=54$ — (2)

$\therefore a=-2, d=7, T_n=-9+7n$

(c) $T_3+T_5=[a+(3-1)d]+[a+(5-1)d]=-8$ — (1)

$T_7=a+(7-1)d=-13$ — (2)

$\therefore a=5, d=-3, T_n=8-3n$

(d) $T_8 - T_3 = [a+(8-1)d]-[a+(3-1)d] = -16$ — (1)
$T_2 + T_7 = [a+(2-1)d]+[a+(7-1)d] = -26$ — (2)
$\therefore a = -\frac{9}{5}, d = -\frac{16}{5}, T_n = \frac{7}{5} - \frac{16}{5}n$

(e) $2[a+(4-1)d] = a+(6-1)d+1$ — (1)
$a+(8-1)d = 25$ — (2)
$\therefore a = -3, d = 4, T_n = -7+4n$

(f) $a\cdot[a+(4-1)d] = 100$ — (1)
$[a+(2-1)d]+[a+(3-1)d] = 25$ — (2)
When 當 $a = 5, d = 5, T_n = 5n$.
When 當 $a = 20, d = -5, T_n = 25-5n$.

2. (a) $T_2 = a+(2-1)d = 7$ — (1)
$T_5 = a+(5-1)d = 13$ — (2)
$\therefore a = 5, d = 2, T_7 = 5+(7-1)2 = 17$

(b) $T_3 = a+(3-1)d = -8$ — (1)
$T_6 = a+(6-1)d = -20$ — (2)
$\therefore a = 0, d = -4, T_{20} = 0+(20-1)(-4) = -76$

(c) $T_4 = a+(4-1)d = 7$ — (1)
$T_7 = a+(7-1)d = 28$ — (2)
$\therefore a = -14, d = 7, T_2 = -14+(2-1)7 = -7$

(d) $T_4 - T_7 = [a+(4-1)d]-[a+(7-1)d] = 21$ — (1)
$T_6 = a+(6-1)d = -25$ — (2)
$\therefore a = 10, d = -7, T_{10} = 10+(10-1)(-7) = -53$

18-7

1. (a) No 不是 (b) Yes 是; $T_1 = 5, r = 5$ (c) Yes 是; $T_1 = 7, r = -1$
(d) Yes 是; $T_1 = -64, r = \frac{1}{4}$ (e) Yes 是; $T_1 = 27, r = \frac{4}{3}$
(f) Yes 是; $T_1 = 9^9, r = \frac{1}{9^4}$ (g) No 不是 (h) Yes 是; $T_1 = -3\frac{1}{8}, r = -\frac{2}{5}$
(i) No 不是 (j) Yes 是; $T_1 = m,\ p = \frac{m}{r}$
(k) Yes, $T_1 = a(1+10\%), r = a(1+10\%)^2$ (l) No 不是

2. (a) $\frac{T_{n+1}}{T_n} = \frac{2^{n+1}}{2^n} = 2$; yes 是
(b) $\frac{T_{n+1}}{T_n} = \frac{7(n+1)^2}{7n^2} = \frac{(n+1)^2}{n^2}$; no 不是
(c) $\frac{T_{n+1}}{T_n} = \frac{n+1}{3} \div \frac{n}{3} = \frac{n+1}{n}$; no 不是
(d) $\frac{T_{n+1}}{T_n} = \frac{4(0.3)^{n+1-3}}{4(0.3)^{n-3}} = 0.3$; yes 是
(e) $\frac{T_{n+1}}{T_n} = \frac{6^{3-2(n+1)}}{6^{3-2n}} = \frac{1}{36}$; yes 是
(f) $\frac{T_{n+1}}{T_n} = \frac{8^{n+1}\cdot 4^{2(n+1)}}{8^n \cdot 4^{2n}} = 128$; yes 是
(g) $\frac{T_{n+1}}{T_n} = \frac{1000\times(1-75\%)^{n+1}}{1000\times(1-75\%)^n} = 25\%$; yes 是

18-8

1. (a) $T_n = (-7)\cdot 7^{n-1} = -7^n$
(b) $T_n = \frac{1}{2}\cdot 6^{n-1} = 3\cdot 6^{n-2}$
(c) $T_n = \frac{4}{3}\cdot 12^{n-1} = 16\cdot 12^{n-2}$
(d) $T_n = (-k)\cdot 4^{n-1}$

2. (a) $a=-1, r=\dfrac{-4}{-1}=4, T_n=(-1)\cdot 4^{n-1}=-4^{n-1}$ (b) $a=3, r=\dfrac{12}{3}=4, T_n=3\cdot 4^{n-1}$

(c) $a=5, r=\dfrac{-1}{5}, T_n=5\cdot(\dfrac{-1}{5})^{n-1}=\dfrac{(-1)^{n-1}}{5^{n-2}}$

(d) $a=54, r=\dfrac{36}{54}=\dfrac{2}{3}, T_n=54\cdot(\dfrac{2}{3})^{n-1}=\dfrac{2^n}{3^{n-4}}$

(e) $a=\dfrac{8}{9}, r=\dfrac{4}{3}\div\dfrac{8}{9}=\dfrac{3}{2}, T_n=\dfrac{8}{9}\cdot(\dfrac{3}{2})^{n-1}=\dfrac{3^{n-3}}{2^{n-4}}$

3. (a) $T_3=ar^{3-1}=2$ — (1)

$T_7=ar^{7-1}=32$ — (2)

When 當 $r=2, a=\dfrac{1}{2}, T_n=\dfrac{1}{2}\cdot 2^{n-1}=2^{n-2}$.

When 當 $r=-2$,

$a=\dfrac{1}{2}, T_n=\dfrac{1}{2}\cdot(-2)^{n-1}=(-1)^{n-1}2^{n-2}$.

(b) $T_4=ar^{4-1}=3$ — (1)

$T_6=ar^{6-1}=27$ — (2)

When 當 $r=3, a=\dfrac{1}{9}, T_n=\dfrac{1}{9}\cdot 3^{n-1}=3^{n-3}$.

When 當 $r=-3$,

$a=-\dfrac{1}{9}, T_n=-\dfrac{1}{9}\cdot(-3)^{n-1}=(-1)^n\cdot 3^{n-3}$.

(c) $T_2+T_4=ar^{2-1}+ar^{4-1}=-101$ — (1)

$T_4+T_6=ar^{4-1}+ar^{6-1}=-\dfrac{101}{100}$ — (2)

When 當 $r=\dfrac{1}{10}, a=-1000,\ T_n=(-1000)\cdot(\dfrac{1}{10})^{n-1}=-\dfrac{1}{10^{n-4}}$.

When 當 $r=-\dfrac{1}{10}, a=1000,\ T_n=1000\cdot(-\dfrac{1}{10})^{n-1}=\dfrac{(-1)^{n-1}}{10^{n-4}}$.

(d) $T_5-T_3=ar^{5-1}-ar^{3-1}=-3;\ \ ar^2(r+1)(r-1)=-3$ — (1)

$T_2+T_3=ar^{2-1}+ar^{3-1}=12;\ \ ar(1+r)=12$ — (2)

$\therefore r=\dfrac{1}{2}, a=16, T_n=16\cdot(\dfrac{1}{2})^{n-1}=\dfrac{1}{2^{n-5}}$

4. (a) $T_3=ar^{3-1}=8$

$T_6=ar^{6-1}=64$

$\therefore a=2, r=2, T_{12}=2\cdot 2^{12-1}=4096$

(b) $T_7=ar^{7-1}=\dfrac{1}{8}$

$T_4=ar^{4-1}=-1$

$\therefore a=8, r=-\dfrac{1}{2}, T_3=8\cdot(-\dfrac{1}{2})^{3-1}=2$

(c) $T_2=ar^{2-1}=-27$

$T_5=ar^{5-1}=1$

$\therefore a=81, r=-\dfrac{1}{3}, T_8=81\cdot(-\dfrac{1}{3})^{8-1}=-\dfrac{1}{27}$

(d) $T_3-T_1=ar^{3-1}-a=40$

$T_4-T_2=ar^{4-1}-ar^{2-1}=60$

$\therefore a=32, r=\dfrac{3}{2}, T_7=32\cdot(\dfrac{3}{2})^{7-1}=\dfrac{729}{2}$

18-9

1. (a) $a=\dfrac{1}{8}, r=\dfrac{1}{2}\div\dfrac{1}{8}=4,\ T_g=\dfrac{1}{8}(4)^{g-1}=128,\ g=6$

(b) $a=-180, r=\dfrac{-60}{-180}=\dfrac{1}{3},\ T_g=-180(\dfrac{1}{3})^{g-1}=-\dfrac{20}{81},\ g=7$

(c) $a=64, r=\dfrac{96}{64}=\dfrac{3}{2},\ T_g=64(\dfrac{3}{2})^{g-1}=486,\ g=6$

(d) $a=\frac{1}{729}, r=\frac{-1}{243}\div\frac{1}{729}=-3,\ T_g=\frac{1}{729}(-3)^{g-1}=1,\ g=7$

(e) $T_g=-\frac{3}{4}\times(\frac{1}{2})^g=-\frac{3}{64}, g=4$ (f) $T_g=\frac{162}{5}\times(\frac{-1}{3})^g=\frac{2}{405}, g=8$

2. (a) $a=1, r=\frac{1}{2}\div 1=\frac{1}{2}, T_n=1\cdot(\frac{1}{2})^{n-1}=\frac{1}{2048},\ n=12$

(b) $a=-7, r=\frac{-7}{3}\div(-7)=\frac{1}{3},\ T_n=-7\cdot(\frac{1}{3})^{n-1}=\frac{-7}{729},\ n=7$

(c) $a=12, r=\frac{-18}{12}=-\frac{3}{2},\ T_n=12\cdot(-\frac{3}{2})^{n-1}=\frac{-6561}{32},\ n=8$

(d) $a=1, r=\frac{1.1}{1}=1.1,\ T_n=1\cdot(1.1)^{n-1}=1.61051,\ n=6$

(e) $a=\frac{15}{2}, r=\frac{160}{243}\div\frac{80}{81}=\frac{2}{3},\ T_n=\frac{15}{2}\cdot(\frac{2}{3})^{n-1}=\frac{160}{243},\ n=7$

18-10

1. (a) $\frac{k}{12}=\frac{3}{k}, k=\pm 6$ (b) $\frac{4}{-8}=\frac{w}{4}, w=-2$

(c) $\frac{-16}{g}=\frac{-25}{-16}, g=-\frac{256}{25}$ (d) $\frac{6}{h}=\frac{2h-1}{6}, h=\frac{9}{2}$ or 或 -4

(e) $\frac{3u}{5u+1}=\frac{5u-1}{3u}, u=\pm\frac{1}{4}$ (f) $\frac{3w}{2w+1}=\frac{5w-4}{3w}, w=4$ or 或 -1

2. (a) $\frac{3}{y}=\frac{3x}{3}, y=\frac{3}{x}$ (b) $\frac{y}{18x^2}=\frac{2}{y}, y=\pm 6x$

(c) $\frac{5}{x-y}=\frac{x+y}{5}, y=\pm\sqrt{x^2-25}$ (d) $\frac{2x}{7y}=\frac{14y}{2x}, y=\pm\frac{\sqrt{2}}{7}x$

3. (a) $32=8\cdot r^{5-1},\ r=\pm\sqrt{2}$

When 當 $r=\sqrt{2}, a=8\sqrt{2}, b=16, c=16\sqrt{2}$.

When 當 $r=-\sqrt{2}, a=-8\sqrt{2}, b=16, c=-16\sqrt{2}$.

(b) $23328=(-3)\cdot r^{6-1}, r=-6,\ \ \therefore a=18, b=-108, c=648, d=-3888$

4. $\frac{3}{4}=(-6)\cdot r^{4-1}, r=-\frac{1}{2};\ \ 3,\ -\frac{3}{2}$

19-1

1. (a) $a=29,\ d=-4,\ n=20,\ \therefore S_{20}=\frac{20}{2}[2(29)+(20-1)(-4)]=-180$

(b) $a=-18,\ d=6,\ n=35,\ \therefore S_{35}=\frac{35}{2}[2(-18)+(35-1)(6)]=2940$

(c) $a=-25,\ d=6,\ n=16,\ \therefore S_{16}=\frac{16}{2}[2(-25)+(16-1)(6)]=320$

(d) $a=7,\ d=-6,\ n=40,\ \therefore S_{40}=\frac{40}{2}[2(7)+(40-1)(-6)]=-4400$

(e) $a=\frac{3}{5},\ d=\frac{7}{10},\ n=12,\ \therefore S_{12}=\frac{12}{2}[2(\frac{3}{5})+(12-1)(\frac{7}{10})]=\frac{267}{5}$

2. (a) $T_1=1$, $d=3$, $\therefore 1+(n-1)(3)=133$, $n=45$, $\therefore S_{45}=\frac{45}{2}(1+133)=3015$

(b) $T_1=19$, $d=-5$, $\therefore 19+(n-1)(-5)=-26$, $n=10$, $\therefore S_{10}=\frac{10}{2}[19+(-26)]=-35$

(c) $T_1=-65$, $d=17$, $\therefore -65+(n-1)(17)=122$, $n=12$, $\therefore S_{12}=\frac{12}{2}(-65+122)=342$

(d) $T_1=-27$, $d=4$, $\therefore -27+(n-1)(4)=57$, $n=22$, $\therefore S_{22}=\frac{22}{2}(-27+57)=330$

(e) $T_1=\frac{2}{3}$, $d=\frac{5}{3}$, $\therefore \frac{2}{3}+(n-1)(\frac{5}{3})=19$, $n=12$, $\therefore S_{12}=\frac{12}{2}(\frac{2}{3}+19)=118$

3. (a) $T_1=16$, $T_{20}=-60$, $\therefore S_{20}=\frac{20}{2}[16+(-60)]=-440$

(b) $T_1=-70$, $T_{17}=58$, $\therefore S_{17}=\frac{17}{2}(-70+58)=-102$

(c) $T_1=11$, $T_{13}=23$, $\therefore S_{13}=\frac{13}{2}(11+23)=221$

(d) $T_1=-30$, $T_9=-86$, $\therefore S_9=\frac{9}{2}[-30+(-86)]=-522$

(e) $T_1=\frac{3}{4}$, $T_{28}=21$, $\therefore S_{28}=\frac{28}{2}(\frac{3}{4}+21)=\frac{609}{2}$

(f) $T_1=-\frac{4}{5}$, $T_6=\frac{1}{5}$, $\therefore S_6=\frac{6}{2}(-\frac{4}{5}+\frac{1}{5})=-\frac{9}{5}$

19-2

1. (a) $T_9=S_9-S_8=107$ (b) $T_6=S_6-S_5=-76$ (c) $T_{11}=S_{11}-S_{10}=-\frac{61}{6}$
2. (a) $T_3+T_4+T_5+T_6=S_6-S_2=384$ (b) $T_{10}+T_{11}+\cdots+T_{22}=S_{22}-S_9=169$
   (c) $T_5+T_6+\cdots+T_{28}=S_{28}-S_4=1500$
3. (a) $T_n=S_n-S_{n-1}=-4+6n$ (b) $T_n=S_n-S_{n-1}=8-2n$
   (c) $T_n=S_n-S_{n-1}=9-3n$
4. (a) $T_1=4$, $d=3$, $\therefore \frac{n}{2}[2(4)+(n-1)(3)]=246$, $n=12$ or 或 $n=-\frac{41}{3}$ (rej.捨)

   (b) $T_1=5$, $d=-9$, $\therefore \frac{n}{2}[2(5)+(n-1)(-9)]=-1444$, $n=19$ or 或 $n=-\frac{152}{9}$ (rej.捨)

   (c) $T_1=40$, $d=-11$, $\therefore \frac{n}{2}[2(40)+(n-1)(-11)]=-680$, $n=16$ or 或 $n=-\frac{85}{11}$ (rej.捨)

   (d) $T_1=\frac{10}{3}$, $d=\frac{3}{4}$, $\therefore \frac{n}{2}[2(\frac{10}{3})+(n-1)(\frac{3}{4})]=114\frac{11}{12}$, $n=14$ or 或 $n=-\frac{197}{9}$ (rej.捨)

19-3

1. (a) $\frac{n}{2}[2(5)+(n-1)(-3)]=-280$, $n=16$ or 或 $n=-\frac{35}{3}$ (rej.捨)

   (b) $\frac{n}{2}[2(-1)+(n-1)(7)]=243$, $n=9$ or 或 $n=-\frac{54}{7}$ (rej.捨)

(c) $T_9 = 14 + 8d = 12$, $d = -\frac{1}{4}$, $\therefore \frac{n}{2}[2(14) + (n-1)(-\frac{1}{4})] = 117$, $n = 9$ or 或 $n = 104$

(d) $T_{21} = T_1 + 20(\frac{3}{2}) = -2$, $T_1 = -32$, $\therefore \frac{n}{2}[2(-32) + (n-1)(\frac{3}{2})] = -355$,

$n = 20$ or 或 $n = \frac{71}{3}$ (rej.捨)

2. (a) $d = -2$, $T_2 = 4$, $\therefore$ $T_1 = 6$.

$\therefore$ $\frac{n}{2}[2(6) + (n-1)(-2)] = -690$, $n = 30$ or 或 $n = -23$ (rej.捨)

(b) $T_4 = T_1 + 3d = 26$, $T_6 = T_1 + 5d = 18$, $\therefore$ $d = -4$, $T_1 = 38$.

$\therefore$ $\frac{n}{2}[2(38) + (n-1)(-4)] = 0$, $n = 20$ or 或 $n = 0$ (rej.捨)

(c) $T_2 = T_1 + d = -24$, $T_5 = T_1 + 4d = -12$, $\therefore$ $d = 4$, $T_1 = -28$.

$\therefore$ $\frac{n}{2}[2(-28) + (n-1)(4)] = 68$, $n = 17$ or 或 $n = -2$ (rej.捨)

(d) $T_3 = T_1 + 2d = -18$, $T_5 = T_1 + 4d = -15$, $\therefore$ $d = \frac{3}{2}$, $T_1 = -21$.

$\therefore$ $\frac{n}{2}[2(-21) + (n-1)(\frac{3}{2})] = -115.5$, $n = 7$ or 或 $n = 22$

3. (a) $d = -2$, $S_n = \frac{n}{2}[2(12) + (n-1)(-2)] = 13n - n^2$. The sum 總和 $= S_{13} - S_7 = 0 - 42 = -42$.

(b) $d = 3, S_n = \frac{n}{2}[2(-26) + (n-1)(3)] = \frac{n(3n-55)}{2}$.

The sum 總和 $= S_{22} - S_4 = 121 - (-86) = 207$.

(c) $T_4 = T_1 + 3d = 28$, $T_8 = T_1 + 7d = 22.5$, $\therefore$ $d = -\frac{11}{8}$, $T_1 = \frac{257}{8}$.

$S_n = \frac{n}{2}[2(\frac{257}{8}) + (n-1)(-\frac{11}{8})] = \frac{1}{16}(-11n^2 + 525n)$. The sum 總和 $= \frac{425}{2} - \frac{1377}{8} = \frac{323}{8}$.

(d) $T_3 = T_1 + 2d = -5$, $T_9 = T_1 + 8d = -32$, $\therefore$ $d = -\frac{9}{2}$, $T_1 = 4$.

$S_n = \frac{n}{2}[2(4) + (n-1)(-\frac{9}{2})] = \frac{1}{4}(25n - 9n^2)$. The sum 總和 $= -2104 - (-\frac{3}{2}) = -\frac{4205}{2}$.

19-4

1. (a) $r = 3$, $\therefore S_{10} = \frac{7(3^{10} - 1)}{3 - 1} = 206668$ (b) $r = 2$, $\therefore S_{15} = \frac{-4(2^{15} - 1)}{2 - 1} = -131068$

(c) $r = \frac{1}{2}$, $\therefore S_{20} = \frac{12[1 - (\frac{1}{2})^9]}{1 - \frac{1}{2}} = \frac{1533}{64}$ (d) $r = -4$, $\therefore S_{10} = \frac{-6[1 - (-4)^{10}]}{1 - (-4)} = 1258290$

(e) $r = -3$, $\therefore S_{11} = \frac{\frac{1}{9}[1 - (-3)^{11}]}{1 - (-3)} = \frac{44287}{9}$

2. (a) $T_1 = 9$, $r = 2$, $T_n = 9(2)^{n-1}$. $73728 = 9(2)^{n-1}$, $n = 14$, $S_{14} = \frac{9[2^{14} - 1]}{2 - 1} = 147447$

(b) $T_1=2$, $r=3$, $T_n=2(3)^{n-1}$. $39366=2(3)^{n-1}$, $n=10$, $S_{10}=\dfrac{2[3^{10}-1]}{3-1}=59048$

(c) $T_1=7$, $r=-4$, $T_n=7(-4)^{n-1}$. $7340032=7(-4)^{n-1}$, $n=11$, $S_{11}=\dfrac{7[1-(-4)^{11}]}{1-(-4)}=5872027$

(d) $T_1=-6$, $r=-3$, $T_n=-6(-3)^{n-1}$. $-28697814=-6(-3)^{n-1}$, $n=15$,

$S_{15}=\dfrac{-6[1-(-3)^{15}]}{1-(-3)}=-21523362$.

(e) $T_1=54$, $r=\dfrac{1}{3}$, $T_n=54(\dfrac{1}{3})^{n-1}$. $\dfrac{2}{2187}=54(\dfrac{1}{3})^{n-1}$, $n=11$,

$S_{11}=\dfrac{54[1-(\frac{1}{3})^{11}]}{1-\frac{1}{3}}=81.0$ (3 sig. fig. 3 個有效數字)

3. (a) $T_1=\dfrac{1}{4}$, $r=\dfrac{1}{4}$, $S_3=\dfrac{\frac{1}{4}[1-(\frac{1}{4})^3]}{1-\frac{1}{4}}=\dfrac{21}{64}$

(b) $T_1=125$, $r=\dfrac{1}{5}$, $S_7=\dfrac{125[1-(\frac{1}{5})^7]}{1-\frac{1}{5}}=\dfrac{19531}{125}$

(c) $T_1=6$, $r=2$, $S_5=\dfrac{6(2^5-1)}{2-1}=186$ (d) $T_1=\dfrac{5}{12}$, $r=6$, $S_3=\dfrac{\frac{5}{12}(6^3-1)}{6-1}=\dfrac{215}{12}$

(e) $T_1=\dfrac{7}{4}$, $r=3$, $S_4=\dfrac{\frac{7}{4}(3^4-1)}{3-1}=70$

19-5

1. (a) $\begin{cases}ar=15\\ar^2=75\end{cases}$, $a=3$, $r=5$; $S_5=\dfrac{3(5^5-1)}{5-1}=2343$

(b) $\begin{cases}ar^2=144\\ar^4=5184\end{cases}$, $a=4$, $r=\pm6$.

When 當 $r=6$, $S_6=\dfrac{4(6^6-1)}{6-1}=37324$; when 當 $r=-6$, $S_6=\dfrac{4[1-(-6)^6]}{1-(-6)}=-26660$.

(c) $\begin{cases}ar^3=-54\\ar^7=-4374\end{cases}$, $r=\pm3$. When 當 $r=3$, $a=-2$, $S_8=\dfrac{-2(3^8-1)}{3-1}=-6560$;

when 當 $r=-3$, $a=2$, $S_8=\dfrac{-2[1-(-3)^8]}{1-(-3)}=-3280$.

(d) $\begin{cases}ar^2=\dfrac{2}{9}\\ar^5=-\dfrac{2}{243}\end{cases}$, $a=2$, $r=-\dfrac{1}{3}$; $S_9=\dfrac{2[1-(-\frac{1}{3})^9]}{1-(-\frac{1}{3})}=\dfrac{9841}{6561}$

2. (a) $T_1 = 10$, $r = 3$. $S_k = \dfrac{10(3^k - 1)}{3 - 1} = 32800$, $3^k = 6561$, $k = 8$.

(b) $T_1 = -96$, $r = \dfrac{1}{2}$. $S_k = \dfrac{-96[1 - (\frac{1}{2})^k]}{1 - \frac{1}{2}} = -189$, $(\frac{1}{2})^k = \dfrac{1}{64}$, $k = 6$.

(c) $T_1 = -256$, $r = -\dfrac{5}{2}$. $S_k = \dfrac{-256[1 - (-\frac{5}{2})^k]}{1 - (-\frac{5}{2})} = -44716$, $(-\frac{5}{2})^k = -\dfrac{78125}{128}$, $k = 7$.

(d) $T_1 = 6561$, $r = -\dfrac{1}{3}$. $S_k = \dfrac{6561[1 - (-\frac{1}{3})^k]}{1 - (-\frac{1}{3})} = 4920$, $(-\frac{1}{3})^k = \dfrac{1}{6561}$, $k = 8$.

(e) $T_1 = 6$, $r = \dfrac{1}{2}$. $S_k = \dfrac{6[1 - (\frac{1}{2})^k]}{1 - \frac{1}{2}} = 11\dfrac{125}{128}$, $(\frac{1}{2})^k = \dfrac{1}{512}$, $k = 9$.

3. (a) $S_k = \dfrac{9(2^k - 1)}{2 - 1} = 36855$, $2^k = 4096$, $k = 12$.

(b) $S_k = \dfrac{-24[1 - (\frac{1}{2})^k]}{1 - \frac{1}{2}} = -47.625$, $(\frac{1}{2})^k = \dfrac{1}{128}$, $k = 7$.

(c) $\because S_k < 0$, $T_2 > 0$, $\therefore r < 0$. $\begin{cases} ar = 243 \\ ar^5 = 3 \end{cases}$, $r = -\dfrac{1}{3}$ or 或 $\dfrac{1}{3}$ (rej. 捨); $a = -729$.

$S_k = \dfrac{-729[1 - (-\frac{1}{3})^k]}{1 - (-\frac{1}{3})} = -547$, $-729[1 - (-\frac{1}{3})^k] = -\dfrac{2188}{3}$, $(-\frac{1}{3})^k = -\dfrac{1}{2187}$, $k = 7$.

(d) $r = \dfrac{5}{2}$, $\dfrac{a(2.5^2 - 1)}{2.5 - 1} = 16.8$, $\therefore a = 4.8$;

$\therefore S_k = \dfrac{4.8(2.5^k - 1)}{2.5 - 1} = 778.05$, $(2.5^k - 1) = \dfrac{15561}{64}$, $(\dfrac{5}{2})^k = \dfrac{15625}{64}$, $k = 6$.

19-6

1. (a) $T_1 = \dfrac{1}{4}$, $r = \dfrac{1}{4}$. Yes 可以, $S_\infty = \dfrac{1}{3}$.

(b) $T_1 = \dfrac{2}{3}$, $r = \dfrac{1}{3}$. Yes 可以, $S_\infty = 1$.

(c) $T_1 = -\dfrac{1}{6}$, $r = \dfrac{1}{6}$. Yes 可以, $S_\infty = -\dfrac{1}{5}$.

(d) $T_1 = \dfrac{1}{4}$, $r = 3$. No 不可以.

(e) $T_1 = -\dfrac{3}{5}$, $r = -\dfrac{1}{5}$. Yes 可以, $S_\infty = -\dfrac{1}{2}$.

(f) $T_1 = 512$, $r = \dfrac{1}{8}$. Yes 可以, $S_\infty = \dfrac{4096}{7}$.

2. (a) $r = \dfrac{1}{3}$, $S_\infty = \dfrac{18}{1 - \frac{1}{3}} = 27$

(b) $r = -\dfrac{1}{2}$, $S_\infty = \dfrac{16}{1 - (-\frac{1}{2})} = 10\dfrac{2}{3}$

(c) $r=\frac{1}{2}$, $S_\infty=\frac{2}{1-\frac{1}{2}}=4$

(d) $r=\frac{3}{4}$, $S_\infty=\frac{16}{1-\frac{3}{4}}=64$

(e) $r=-\frac{2}{3}$, $S_\infty=\frac{-\frac{3}{4}}{1-(-\frac{2}{3})}=-\frac{9}{20}$

(f) $r=-\frac{2}{5}$, $S_\infty=\frac{-\frac{25}{4}}{1-(-\frac{2}{5})}=-\frac{125}{28}$

3. (a) $S_\infty=\frac{a}{1-\frac{1}{2}}=12$, $a=6$.

(b) $S_\infty=\frac{-18}{1-r}=-27$, $r=\frac{1}{3}$.

(c) $S_\infty=\frac{a}{1-(-\frac{1}{5})}=15$, $a=18$. $T_4=18(-\frac{1}{5})^3=-\frac{18}{125}$

4. (a) $0.\dot{3}\dot{8}=0.38+0.0038+\ldots=\frac{0.38}{1-0.01}=\frac{38}{99}$

(b) $0.0\dot{6}=0.06+0.006+\ldots=\frac{0.06}{1-0.1}=\frac{1}{15}$

(c) $2.5\dot{9}=2.5+(0.09+0.009+\ldots)=\frac{5}{2}+\frac{0.09}{1-0.1}=\frac{13}{5}$

19-7

1. Multiples of 4 (4 的倍數): 2012, 2016, 2020, … , 2996

$d=4$, $T_1=2012$. $T_k=2012+(k-1)(4)=2996$, $\therefore\ k=247$.

$S_k=\frac{247}{2}(2012+2996)=618488$.

2. (i) First term 首項 $=73$, common diff. 公差 $=-8$, no. of sides 邊的數目 $=n$

$\therefore$ Sum of ext.$\angle$s 外角和 $=360=\frac{n}{2}[2(73)+(n-1)(-8)]$

$n=8$ or 或 $n=11.25$ (rej.捨)

(ii) 17

3. Let T_n cm be the Perimeter of A_n. 設A_n的周界為T_n cm。

(a) $T_1=(1+3)(2)=8$, $d=T_2-T_1=8$, $S_{11}=\frac{11}{2}[2(8)+(11-1)(8)]=528$ cm

(b) $T_1=4\times3=12$, $d=T_2-T_1=7.5$, $S_{18}=\frac{18}{2}[2(12)+(18-1)(7.5)]=1363.5$ cm

(c) $T_1=2+\frac{1}{2}(3.14)(2)=5.14$, $d=T_2-T_1=7.71$,

$S_{15}=\frac{15}{2}[2(5.14)+(15-1)(7.71)]=886.65$ cm

4. (a) B_1 area 面積 $=1$, B_2 area 面積 $=1+2$, B_3 area 面積 $=1+2+3$,

$\therefore$ B_{15} area 面積 $=\frac{15(1+15)}{2}=120$

(b) B_1 area 面積 $=3$, B_2 area 面積 $=3+7$, B_3 area 面積 $=3+7+11$,

$\therefore$ B_{15} area 面積 $=\frac{15[2(3)+(15-1)(4)]}{2}=465$

19-8

1. Let T_n cm^2 be the area of A_n. 設 A_n 的面積為T_n cm^2 。

   (a) $T_1 = 3$, $r = 2$, $S_7 = 381$ cm^2 (b) $T_1 = 32$, $r = \frac{1}{4}$, $S_9 = \frac{87381}{2048}$

   (c) $T_1 = 23176.7325$, $T_2 = 10300.77$, $r = \frac{4}{9}$, $S_8 = 41654.605$ (3 d.p.小數點後 3 位)

2. (a) (i) Perimeters are 周界是: B_1: 64 cm, B_2:16 cm, B_3: 4 cm;

   $\therefore$ common ratio 公比 $= \frac{16}{64} = \frac{1}{4}$; $S_\infty = \frac{64}{1-\frac{1}{4}} = \frac{256}{3}$ cm

   (ii) B_1 area 面積 = 256 cm^2, B_2 area 面積 = 16 cm^2, B_3 area 面積 = 1 cm^2;

   $\because \frac{16}{256} = \frac{1}{16}$, $\therefore$ it is a G.S. with common ratio $\frac{1}{16}$. 它是公比為$\frac{1}{16}$的等比數列。

   $\therefore S_\infty = \frac{256}{1-\frac{1}{16}} = \frac{4096}{15}$ cm^2

   (b) (i) Perimeters are 周界是: B_1: 81 cm, B_2: 54 cm, B_3: 36 cm;

   $\therefore$ common ratio 公比 $= \frac{54}{81} = \frac{2}{3}$; $S_\infty = \frac{81}{1-\frac{2}{3}} = 243$ cm

   (ii) B_1 area 面積 $= \frac{729\sqrt{3}}{4}$ cm^2, B_2 area 面積 $= 81\sqrt{3}$ cm^2, B_3 area 面積 $= 36\sqrt{3}$ cm^2;

   $\because \frac{81\sqrt{3}}{\frac{729\sqrt{3}}{4}} = \frac{36\sqrt{3}}{81\sqrt{3}} = \frac{4}{9}$, $\therefore$ it is a G.S. with common ratio $\frac{4}{9}$.它是公比為$\frac{4}{9}$的等比數列。

   $\therefore S_\infty = \frac{\frac{729\sqrt{3}}{4}}{1-\frac{4}{9}} = \frac{6561\sqrt{3}}{20}$ cm^2

3. Let the number of 50m-distances he swam be n. 設他游了 n 段 50m 距離。

   $100 + 100(1.1) + 100(1.1)^2 + ... 100(1.1)^{n-1} = 610.51$, $\frac{100(1.1^n - 1)}{1.1 - 1} = 610.51$,

   $1.1^n = 1.61051$, $n = 5$; $x = 50n = 50(5) = 250$.

4. (a)	$A_1B_1C_1D_1$	$A_2B_2C_2D_2$	$A_3B_3C_3D_3$
longer side 長邊	20 cm	$A_2B_2 = B_1C_1 = 15$ cm	$A_3B_3 = B_2C_2 = \frac{45}{4}$ cm
shorter side 短邊	15 cm	$B_2C_2 = B_1C_1 \times \frac{15}{20} = \frac{45}{4}$ cm	$B_3C_3 = B_2C_2 \times \frac{15}{20} = \frac{135}{16}$ cm

(b) The longer sides of the rectangles form a geometric sequence with common ratio 3/4.
各長方形的長邊組成等比數列，公比 3/4。

Sum of all segments 所有線段的長度總和

= $2B_1C_1 + 2 \times$(sum of the longer sides of all rectangles 各長方形的長邊的總和)

= $2(15) + 2(\frac{20}{1-\frac{3}{4}}) = 190$ cm

19-9

1. (a) A.S.等差數列, $a = 5$, $d = 7$. $\therefore$ $S_x = \frac{x}{2}[2(5) + (x-1)(7)] = 1430$,

$7x^2+3x-2860=0$, $x=20$ or 或 $x=-\frac{143}{7}$ (rej.捨)

(b) The length of the longest portion 最長一段的長度 $=5+(20-1)(7)=138\,\text{cm}$

2. G.S.等比數列, $a=1.5$, common ratio = r, $T_8=192$.

$\therefore\ T_8=(1.5)r^7=192$, $\therefore\ r=2$.

The length of the original rope 繩子原來的長度 $=S_8=\frac{1.5(2^8-1)}{2-1}=382.5\,\text{cm}$

3. The amount Peter saved in 2000 彼得在 2000 年儲起的零用錢 = \$$a$.

A.S.等差數列, common difference 公差 = 100, $T_{10}=2000$,

$\therefore\ a+(10-1)(100)=2000$, $a=1100$. No. of years 年數 = 2010 − 1999 = 11;

$\therefore$ the sum 總金額 $=S_{11}=\frac{11}{2}[2(1100)+(11-1)(100)]=\$17600.$

4. The amount Mr. Wong saved in 2005 黃先生在 2005 年儲起的薪金 = \$$a$.

G.S.等比數列, common ratio 公比 $=1+\frac{1}{4}=\frac{5}{4}$, $T_5=2500$,

$\therefore\ a(\frac{5}{4})^{5-1}=2500$, $a=1024$. No. of years 年數 = 2010 − 2004 = 6;

$\therefore$ the sum 總金額 $=S_6=\frac{1024[(\frac{5}{4})^6-1]}{\frac{5}{4}-1}=\$11529.$

5. Incomes 收入: A.S.等差數列, running costs 營運支出: A.S.等差數列.

$\therefore$ total net profit 淨盈利

$=\frac{20}{2}[2(8000)+(20-1)(2000)]-\frac{20}{2}[2(15000)+(20-1)(500)]=\$145000$

6. Incomes 收入: G.S.等比數列, running costs 營運支出: A.S.等差數列.

$\therefore$ net profit 淨盈利 $=\frac{3200(1.5^{20}-1)}{1.5-1}-\frac{20}{2}[2(15000)+(20-1)(500)]=\$20880243.07$

7. The no. of years needed 所需年數 = n.

A.S.等差數列, $a=1500$, common difference 公差 = 800,

$\therefore\ \frac{n}{2}[2(1500)+(n-1)(800)]\ge 40000$, $4n^2+11n-400\ge 0$,

$n\ge 8.72$ or 或 $n\le -11.47$ (rej.捨),

$\therefore\ n=9$. 9 years is needed. 需時 9 年。

8. (i) Total amount at the end of the 2nd year 直至第二年年底的本利和

$=[10000(1.04)+10000](1.04)=10000(1.04)^2+10000(1.04)=\$21216$

(ii) Total amount at the end of the 3rd year 直至第三年年底的本利和

$=[10000(1.04)^2+10000(1.04)+10000](1.04)$

$=10000(1.04)^3+10000(1.04)^2+10000(1.04)$

$=10000(1.04)^3+10000(1.04)^2+10000(1.04)$

$=10000(1.04)\times\frac{[(1.04)^3-1]}{1.04-1}=\$32465$ (nearest integer 最接近的整數)

(iii) Total amount at the end of the 10th year 直至第十年年底的本利和

$=10000(1.04)^{10}+10000(1.04)^9+...+10000(1.04)^2+10000(1.04)$

$=10000[1.04+(1.04)^2+...+(1.04)^9+(1.04)^{10}]$

$=10000\times\frac{1.04[(1.04)^{10}-1]}{1.04-1}=\$124864$ (nearest integer 最接近的整數)