

1장 연습문제 정답

01.

(a) $64, \frac{54}{9} = 6$

(b) $64, -6, -\sqrt{81} = -9, \frac{54}{9} = 6$

(c) $\sqrt{34}, 1.1234567532341\dots, -43.8698688672\dots, 7.129971289713\dots$

(d) $\sqrt{16} + 3i, \sqrt{3}i$

(e) $\frac{2}{3}, 64, -6, -\frac{1}{2}, -\sqrt{81}$

02.

하한항으로 구성된 유리수 : $\frac{3}{29}, \frac{16}{81}, \frac{1}{4}, \frac{7}{120}, \frac{120}{13}$

하한항으로 구성되지 않은 유리수 : $\frac{36}{60}, \frac{5}{255}, \frac{78}{234}, \frac{112}{7}, \frac{45}{145}, \frac{34}{68}, \frac{52}{117}$

03.

유리수 : $5.5252525252\dots, 12.1234123412\dots,$

$\sqrt{36} (= 6), \sqrt{625} (= 25), 79.91011011\dots, \sqrt{81} (= 9)$

무리수 : $\sqrt{91}, \sqrt{148}, 1.42736189921\dots, 4.1652538593\dots, 880.0012967377\dots, \sqrt{73}$

04.

(a) $A + B = 5 + 13 + 8i = 18 + 8i$

(b) $B - A = 13 + 8i - 5 = 8 + 8i$

(c) $AB = 5 \times (13 + 8i) = 65 + 40i$

(d) $\frac{B}{A} = \frac{13 + 8i}{5}$

(e) $C + D = 2 + 2i + 9i = 2 + 11i$

(f) $D - C = 9i - (2 + 2i) = -2 + 7i$

(g) $CD = (2 + 2i) \times 9i = 18i + 18i^2 = -18 + 18i$

(h) $\frac{C}{D} = \frac{2 + 2i}{9i} = \frac{(2 + 2i) \times (-9i)}{9i \times (-9i)} = \frac{-18i - 18i^2}{-81i^2} = \frac{18 - 18i}{81} = \frac{2 - 2i}{9}$

05.

(a) $B + C = 4 + 23i$

(b) $D - A = 7i + 4$

(c) $AC = -230 + 23i$

(d) $\frac{D}{C} = \frac{17 - 5i}{23}$

(e) $A + D = 27i + 6$

$$(f) \quad B - C = 4 - 23i$$

$$(g) \quad BD = 68i + 20$$

$$(h) \quad \frac{A}{C} = \frac{10 - i}{23}$$

06.

$$(a) \quad \sum_{i=1}^5 4 = 4 + 4 + 4 + 4 + 4 = 5 \times 4 = 20$$

$$(b) \quad \sum_{j=-2}^3 3^j = 3^{-2} + 3^{-1} + 3^0 + 3^1 + 3^2 + 3^3 = \frac{1}{9} + \frac{1}{3} + 1 + 3 + 9 + 27 = \frac{364}{9}$$

$$(c) \quad \sum_{j=-2}^3 3j = 3\{(-2) + (-1) + 0 + 1 + 2 + 3\} = 9$$

$$(d) \quad \sum_{i=1}^8 (3 + i) = (3 + 1) + (3 + 2) + (3 + 3) + (3 + 4) + (3 + 5) + (3 + 6) + (3 + 7) + (3 + 8)$$

$$= (3 \times 8) + (1 + 2 + 3 + 4 + 5 + 6 + 7 + 8) = \sum_{k=1}^8 3 + \sum_{k=1}^8 k = 60$$

$$(e) \quad \sum_{i=6}^9 i^2 + 5 = 6^2 + 7^2 + 8^2 + 9^2 + 5 = 235$$

$$(f) \quad \sum_{i=-5}^0 10 + 7 = 10 + 10 + 10 + 10 + 10 + 10 + 7 = 67$$

07.

$$(a) \quad \sum_{k=4}^6 15k + 7 = 232$$

$$(b) \quad \sum_{k=4}^6 (15k + 7) = 246$$

$$(c) \quad \sum_{k=-2}^1 (k^2 + 3k) = 0$$

$$(d) \quad \sum_{i=3}^{10} i^2 + \sum_{i=1}^4 15i = 530$$

$$(e) \quad \sum_{i=-5}^5 i + \sum_{i=5}^5 5 = 5$$

$$(f) \quad \sum_{i=0}^5 i^i = 3414$$

08.

$$(a) \quad \prod_{i=1}^5 8 = 8 \times 8 \times 8 \times 8 \times 8 = 32768$$

$$(b) \quad \prod_{j=-2}^3 2j = \{2 \times (-2)\} \times \{2 \times (-1)\} \times (2 \times 0) \times (2 \times 1) \times (2 \times 2) \times (2 \times 3) \\ = (-4) \times (-2) \times 0 \times 2 \times 4 \times 6 = 0$$

$$(c) \prod_{i=-2}^3 i + 3 = (-2) \times (-1) \times 0 \times 1 \times 2 \times 3 + 3 = 3$$

$$(d) \prod_{i=-2}^3 (i+3) = (-2+3) \times (-1+3) \times (0+3) \times (1+3) \times (2+3) \times (3+3) \\ = 1 \times 2 \times 3 \times 4 \times 5 \times 6 = \prod_{k=1}^6 k = 6! = 720$$

$$(e) \prod_{k=-3}^0 (k+2) = \{(-3)+2\} \times \{(-2)+2\} \times \{(-1)+2\} \times (0+2) = (-1) \times 0 \times 1 \times 2 = 0$$

$$(f) \prod_{i=1}^{10} i = 1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7 \times 8 \times 9 \times 10 = 10! = 3628800$$

09.

$$(a) \prod_{i=1}^5 3i^2 - i = 1478400$$

$$(b) \prod_{j=-2}^3 2^j = 8$$

$$(c) \prod_{i=1}^3 (i+1)^i = 1152$$

$$(d) \prod_{i=0}^3 (i!) = 12$$

$$(e) 0! = 1$$

$$(f) 10! = 3628800$$

10.

$$(a) \prod_{i=0}^2 \left(\prod_{k=-2}^{-1} 2k \right) = \{(2 \times (-2)) \times (2 \times (-1))\} \times \{(2 \times (-2)) \times (2 \times (-1))\} \times \{(2 \times (-2)) \times (2 \times (-1))\} \\ = 512$$

$$(b) \sum_{i=1}^3 \left(\sum_{k=3}^7 (i+k) \right) = 105$$

$$(c) \sum_{k=0}^2 \left(\prod_{i=1}^3 (2i+1) \right) = \{(2 \times 1+1) \times (2 \times 2+1) \times (2 \times 3+1)\} + \\ \{(2 \times 1+1) \times (2 \times 2+1) \times (2 \times 3+1)\} + \{(2 \times 1+1) \times (2 \times 2+1) \times (2 \times 3+1)\} = 315$$

$$(d) \prod_{k=0}^2 \left(\sum_{i=1}^3 (2i+1) \right) = 3375$$

$$(e) \prod_{i=1}^3 \left(\sum_{k=3}^7 (i+k) \right) = \{(1+3) + (1+4) + (1+5) + (1+6) + (1+7)\} \\ \times \{(2+3) + (2+4) + (2+5) + (2+6) + (2+7)\} \\ \times \{(3+3) + (3+4) + (3+5) + (3+6) + (3+7)\} \\ = (4+5+6+7+8) \times (5+6+7+8+9) \times (6+7+8+9+10) = 42000$$

$$(f) \sum_{i=1}^2 \left(\prod_{k=3}^5 (i+k) \right) = 330$$

11.

$$(a) \ 3+4+5+6+7+8+9+10+11+12 = \sum_{i=3}^{12} i$$

$$(b) \ (-5)+(-4)+(-3)+(-2)+(-1)+0 = \sum_{i=-5}^0 i$$

$$(c) \ (3+9)+(4+16)+(5+25)+(6+36)+(7+49) = \sum_{i=3}^7 (i+i^2)$$

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

$$(e) \ 1\times 2\times 3\times 4\times 5\times 6\times 7 = \prod_{i=1}^7 i = 7!$$

$$(f) \ (1+3)\times(4+6)\times(9+9)\times(16+12)\times(25+15) = \prod_{i=1}^5 (i^2+3i)$$

12.

$$(a) \ 10+20+30+40+50+7 = \sum_{i=1}^5 10i+7$$

$$(b) \ 10\times 20\times 30\times 40\times 50\times 7 = 7\times \prod_{i=1}^5 10i$$

$$(c) \ 7^7 = \prod_{i=1}^7 7$$

$$(d) \ 7+7+7+7+7+7+7+7 = \sum_{i=1}^7 7$$

$$(e) \ 11+15+19+23+27+31 = \sum_{i=2}^7 (4i+3)$$

$$(f) \ 21\times 42\times 63\times 84\times 105 = \prod_{i=1}^5 21i$$

$$(g) \ i \in \mathbb{Z}, -3 \leq i \leq 3 \text{ 일 때 } -3+0+3+6+9+12+15 = \sum_{i=-3}^3 3(i+2)$$

$$(h) \ \frac{-15}{(-125+25)^3} \times \frac{-12}{(-64+16)^3} \times \frac{-9}{(-27+9)^3} \times \frac{-6}{(-8+4)^3} = \prod_{i=-5}^{-2} \frac{3i}{(i^3+i^2)^3}$$

13.

$$(a) \ \{(1-3)+(1-2)+(1-1)\} + \{(2-3)+(2-2)+(2-1)\} + \{(3-3)+(3-2)+(3-1)\} \\ = \sum_{i=1}^3 \left(\sum_{k=1}^3 (i-k) \right)$$

$$(b) \ \{(1-3)\times(1-2)\times(1-1)\} \times \{(2-3)\times(2-2)\times(2-1)\} \times \{(3-3)\times(3-2)\times(3-1)\} \\ = \prod_{i=1}^3 \left(\prod_{k=1}^3 (i-k) \right)$$

$$(c) \ \{(1-3)+(1-2)+(1-1)\} \times \{(2-3)+(2-2)+(2-1)\} \times \{(3-3)+(3-2)+(3-1)\}$$

$$= \prod_{i=1}^3 \left(\sum_{k=-3}^{-1} (i+k) \right) = \prod_{i=1}^3 \left(\sum_{k=1}^3 (i-k) \right)$$

$$\begin{aligned} \text{(d)} \quad & \{(1-3) \times (1-2) \times (1-1)\} + \{(2-3) \times (2-2) \times (2-1)\} + \{(3-3) \times (3-2) \times (3-1)\} \\ &= \sum_{i=1}^3 \left(\prod_{k=-3}^{-1} (i+k) \right) = \sum_{i=1}^3 \left(\prod_{k=1}^3 (i-k) \right) \end{aligned}$$

14.

(a) $n = 72, d = 6 : 6 \mid 72$	$72 \div 6 = 12$	$72 \bmod 6 = 0$
(b) $n = 90, d = 8 : 8 \nmid 90$	$90 \div 8 = 11$	$90 \bmod 8 = 2$
(c) $n = 124, d = 4 : 4 \mid 124$	$124 \div 4 = 31$	$124 \bmod 4 = 0$
(d) $n = 211, d = 10 : 10 \nmid 211$	$211 \div 10 = 21$	$211 \bmod 10 = 1$
(e) $n = 9, d = 2 : 2 \nmid 9$	$9 \div 2 = 4$	$9 \bmod 2 = 1$
(f) $n = 142, d = 6 : 6 \nmid 142$	$142 \div 6 = 23$	$142 \bmod 6 = 4$
(g) $n = 198, d = 18 : 18 \mid 198$	$198 \div 18 = 11$	$198 \bmod 18 = 0$
(h) $n = 294, d = 6 : 6 \mid 294$	$294 \div 6 = 49$	$294 \bmod 6 = 0$

15.

(a) $n = -113, d = 4 : 4 \nmid -113$	$(-113) \div 4 = -29$	$(-113) \bmod 4 = 3$
(b) $n = -86, d = 43 : 43 \mid -86$	$(-86) \div 43 = -2$	$(-86) \bmod 43 = 0$
(c) $n = -333, d = 9 : 9 \mid -333$	$(-333) \div 9 = -37$	$(-333) \bmod 9 = 0$
(d) $n = -712, d = 11 : 11 \nmid -712$	$(-712) \div 11 = -65$	$(-712) \bmod 11 = 3$
(e) $n = -49, d = 3 : 3 \nmid -49$	$(-49) \div 3 = -17$	$(-49) \bmod 3 = 2$
(f) $n = -529, d = 88 : 88 \nmid -529$	$(-529) \div 88 = -7$	$(-529) \bmod 88 = 87$
(g) $n = -218, d = 8 : 8 \nmid -218$	$(-218) \div 8 = -28$	$(-218) \bmod 8 = 6$
(h) $n = -1274, d = 32 : 32 \nmid -1274$	$(-1274) \div 32 = -40$	$(-1274) \bmod 32 = 6$

16.

- (a) $17.5_{10} = 1 \times 10^1 + 7 \times 10^0 + 5 \times 10^{-1}$
- (b) $11.01_2 = 1 \times 2^1 + 1 \times 2^0 + 0 \times 2^{-1} + 1 \times 2^{-2}$
- (c) $890.5625_{10} = 8 \times 10^2 + 9 \times 10^1 + 0 \times 10^0 + 5 \times 10^{-1} + 6 \times 10^{-2} + 2 \times 10^{-3} + 5 \times 10^{-4}$
- (d) $1001.11101_2 = 1 \times 2^3 + 0 \times 2^2 + 0 \times 2^1 + 1 \times 2^0 + 1 \times 2^{-1} + 1 \times 2^{-2} + 1 \times 2^{-3} + 0 \times 2^{-4} + 1 \times 2^{-5}$
- (e) $3921.2711_{10} = 3 \times 10^3 + 9 \times 10^2 + 2 \times 10^1 + 1 \times 10^0 + 2 \times 10^{-1} + 7 \times 10^{-2} + 1 \times 10^{-3} + 1 \times 10^{-4}$
- (f) $11011.101101_2 = 1 \times 2^4 + 1 \times 2^3 + 0 \times 2^2 + 1 \times 2^1 + 1 \times 2^0$
 $+ 1 \times 2^{-1} + 0 \times 2^{-2} + 1 \times 2^{-3} + 1 \times 2^{-4} + 0 \times 2^{-5} + 1 \times 2^{-6}$

17.

- (a) $42.1_8 = 4 \times 8^1 + 2 \times 8^0 + 1 \times 8^{-1}$
- (b) $D0.12_{16} = 13 \times 16^1 + 0 \times 16^0 + 1 \times 16^{-1} + 2 \times 16^{-2}$

$$(c) 302.107_8 = 3 \times 8^2 + 0 \times 8^1 + 2 \times 8^0 + 1 \times 8^{-1} + 0 \times 8^{-2} + 7 \times 8^{-3}$$

$$(d) BF9.CE3_{16} = 11 \times 16^2 + 15 \times 16^1 + 9 \times 16^0 + 12 \times 16^{-1} + 14 \times 16^{-2} + 3 \times 16^{-3} + 1 \times 16^{-4}$$

$$(e) 716.24_8 = 7 \times 8^2 + 1 \times 8^1 + 6 \times 8^0 + 2 \times 8^{-1} + 4 \times 8^{-2}$$

$$(f) A40E.10C_{16} = 10 \times 16^3 + 4 \times 16^2 + 0 \times 16^1 + 14 \times 16^0 + 1 \times 16^{-1} + 0 \times 16^{-2} + 12 \times 16^{-3}$$

18.

$$(a) 19.5_{10} = 10011.1_2 = 23.4_8 = 13.8_{16}$$

$$\begin{array}{r} 2 \overline{) 19} \\ 2 \overline{) 9} \dots 1 \\ 2 \overline{) 4} \dots 1 \\ 2 \overline{) 2} \dots 0 \\ 2 \overline{) 1} \dots 0 \\ \hline 0 \dots 1 \end{array} \quad \begin{array}{r} 0.5 \\ \times 2 \\ \hline 1.0 \end{array}$$

$$\begin{array}{r} 8 \overline{) 19} \\ 8 \overline{) 2} \dots 3 \\ \hline 0 \dots 2 \end{array} \quad \begin{array}{r} 0.5 \\ \times 8 \\ \hline 4.00 \end{array} \quad \begin{array}{r} 16 \overline{) 19} \\ 16 \overline{) 1} \dots 3 \\ \hline 0 \dots 1 \end{array} \quad \begin{array}{r} 0.5 \\ \times 16 \\ \hline 8.00 \end{array}$$

$$(b) 23.375_{10} = 10111.011_2 = 27.3_8 = 17.6_{16}$$

$$\begin{array}{r} 2 \overline{) 23} \\ 2 \overline{) 11} \dots 1 \\ 2 \overline{) 5} \dots 1 \\ 2 \overline{) 2} \dots 1 \\ 2 \overline{) 1} \dots 0 \\ \hline 0 \dots 1 \end{array} \quad \begin{array}{r} 0.375 \\ \times 2 \\ \hline 0.750 \end{array} \sqrt{\quad} \quad \begin{array}{r} 0.75 \\ \times 2 \\ \hline 1.50 \end{array} \sqrt{\quad} \quad \begin{array}{r} 0.5 \\ \times 2 \\ \hline 1.0 \end{array}$$

$$\begin{array}{r} 8 \overline{) 23} \\ 8 \overline{) 2} \dots 7 \\ \hline 0 \dots 2 \end{array} \quad \begin{array}{r} 0.375 \\ \times 8 \\ \hline 3.000 \end{array} \quad \begin{array}{r} 16 \overline{) 23} \\ 16 \overline{) 1} \dots 7 \\ \hline 0 \dots 1 \end{array} \quad \begin{array}{r} 0.375 \\ \times 16 \\ \hline 6.000 \end{array}$$

$$(c) 149.6875_{10} = 10010101.1011_2 = 225.54_8 = 95.B_8$$

$$\begin{array}{r} 2 \overline{) 149} \\ 2 \overline{) 74} \dots 1 \\ 2 \overline{) 37} \dots 0 \\ 2 \overline{) 18} \dots 1 \\ 2 \overline{) 9} \dots 0 \\ 2 \overline{) 4} \dots 1 \\ 2 \overline{) 2} \dots 0 \\ 2 \overline{) 1} \dots 0 \\ \hline 0 \dots 1 \end{array} \quad \begin{array}{r} 0.6875 \\ \times 2 \\ \hline 1.3750 \end{array} \sqrt{\quad} \quad \begin{array}{r} 0.375 \\ \times 2 \\ \hline 0.750 \end{array} \sqrt{\quad} \quad \begin{array}{r} 0.75 \\ \times 2 \\ \hline 1.50 \end{array} \sqrt{\quad} \quad \begin{array}{r} 0.5 \\ \times 2 \\ \hline 1.0 \end{array}$$

$$\begin{array}{r} 8 \overline{) 149} \\ 8 \overline{) 18} \dots 5 \\ 8 \overline{) 2} \dots 2 \\ \hline 0 \dots 2 \end{array} \quad \begin{array}{r} 0.6875 \\ \times 8 \\ \hline 5.5000 \end{array} \sqrt{\quad} \quad \begin{array}{r} 0.5 \\ \times 8 \\ \hline 4.0 \end{array} \quad \begin{array}{r} 16 \overline{) 149} \\ 16 \overline{) 9} \dots 5 \\ \hline 0 \dots 9 \end{array} \quad \begin{array}{r} 0.6875 \\ \times 16 \\ \hline 11.0000 \end{array}$$

$$(d) \ 311.65625_{10} = 100110111.10101_2 = 467.52_8 = 137.A8_{16}$$

2	311	
2	155 ... 1	
2	77 ... 1	
2	38 ... 1	$\times \frac{0.65625}{1.31250}$
2	19 ... 0	$\sqrt{\times \frac{0.3125}{0.6250}}$
2	9 ... 1	$\sqrt{\times \frac{0.625}{1.250}}$
2	4 ... 1	$\sqrt{\times \frac{0.25}{0.50}}$
2	2 ... 0	$\sqrt{\times \frac{0.5}{1.0}}$
2	1 ... 0	
	0 ... 1	

8	311	
8	38 ... 7	
8	4 ... 6	$\times \frac{0.65625}{5.25000}$
	0 ... 4	$\sqrt{\times \frac{0.25}{2.00}}$

16	311	
16	19 ... 7	
16	1 ... 3	$\times \frac{0.65625}{10.50000}$
	0 ... 1	$\sqrt{\times \frac{0.5}{8.00}}$

$$(e) \ 823.7265625_{10} = 1100110111.1011101_2 = 1467.564_8 = 337.BA_{16}$$

2	823	
2	411 ... 1	
2	205 ... 1	
2	102 ... 1	$\times \frac{0.7265625}{1.4531250}$
2	51 ... 0	$\sqrt{\times \frac{0.453125}{0.906250}}$
2	25 ... 1	$\sqrt{\times \frac{0.90625}{1.81250}}$
2	12 ... 1	$\sqrt{\times \frac{0.8125}{1.6250}}$
2	6 ... 0	
2	3 ... 0	$\times \frac{0.625}{1.250}$
2	1 ... 1	$\sqrt{\times \frac{0.25}{0.50}}$
	0 ... 1	$\sqrt{\times \frac{0.5}{1.0}}$

8	823	
8	102 ... 7	
8	12 ... 6	
8	1 ... 4	$\times \frac{0.7265625}{5.8125000}$
	0 ... 1	$\sqrt{\times \frac{0.8125}{6.5000}}$
		$\sqrt{\times \frac{0.5}{4.0}}$

16	823	
16	51 ... 7	
16	3 ... 3	$\times \frac{0.7265625}{11.6250000}$
	0 ... 3	$\sqrt{\times \frac{0.625}{10.000}}$

$$(f) 1377.34375_{10} = 10101100001.01011_2 = 2541.26_8 = 561.58_{16}$$

2	1377	
2	688... 1	
2	344... 0	
2	172... 0	
2	86... 0	
2	43... 0	
2	21... 1	
2	10... 1	
2	5... 0	$\times \frac{0.34375}{0.68750} \sqrt{\quad} \times \frac{0.6875}{1.3750} \sqrt{\quad} \times \frac{0.375}{0.750} \sqrt{\quad} \times \frac{0.75}{1.50} \sqrt{\quad} \times \frac{0.5}{1.0}$
2	2... 1	
2	1... 0	
2	0... 1	

8	1377		16	1377	
8	172... 1	$\times \frac{0.34375}{2.75000} \sqrt{\quad} \times \frac{0.75}{6.00}$	16	86... 1	$\times \frac{0.34375}{5.50000} \sqrt{\quad} \times \frac{0.5}{8.00}$
8	21... 4		16	5... 6	
8	2... 5		16	0... 5	
8	0... 2				

19.

- (a) $48.75_{10} = 110000.11_2 = 60.6_8 = 30.C_{16}$
(b) $93.5625_{10} = 1011101.1001_2 = 135.44_8 = 5D.9_{16}$
(c) $157.40625_{10} = 10011101.01101_2 = 235.32_8 = 9D.68_{16}$
(d) $299.34375_{10} = 100101011.01011_2 = 453.26_8 = 12B.58_{16}$
(e) $516.515625_{10} = 1000000100.100001_2 = 1004.41_8 = 204.84_{16}$
(f) $1001.625_{10} = 1111101001.101_2 = 1751.5_8 = 3E9.A_{16}$

20.

- (a) $10.01_2 = 1 \times 2^1 + 0 \times 2^0 + 0 \times 2^{-1} + 1 \times 2^{-2} = 2.25_{10}$
(b) $101.1011_2 = 1 \times 2^2 + 0 \times 2^1 + 1 \times 2^0 + 1 \times 2^{-1} + 0 \times 2^{-2} + 1 \times 2^{-3} + 1 \times 2^{-4} = 5.6875_{10}$
(c) $1110.111_2 = 1 \times 2^3 + 1 \times 2^2 + 1 \times 2^1 + 0 \times 2^0 + 1 \times 2^{-1} + 1 \times 2^{-2} + 1 \times 2^{-3} = 14.875_{10}$
(d) $10101.101_2 = 1 \times 2^4 + 0 \times 2^3 + 1 \times 2^2 + 0 \times 2^1 + 1 \times 2^0 + 1 \times 2^{-1} + 0 \times 2^{-2} + 1 \times 2^{-3} = 21.625_{10}$
(e) $1011101.1101_2 = 1 \times 2^6 + 0 \times 2^5 + 1 \times 2^4 + 1 \times 2^3 + 1 \times 2^2 + 0 \times 2^1 + 1 \times 2^0 +$
 $1 \times 2^{-1} + 1 \times 2^{-2} + 0 \times 2^{-3} + 1 \times 2^{-4} = 93.8125_{10}$
(f) $11100111.101011_2 = 1 \times 2^7 + 1 \times 2^6 + 1 \times 2^5 + 0 \times 2^4 + 0 \times 2^3 + 1 \times 2^2 + 1 \times 2^1 + 1 \times 2^0 +$
 $1 \times 2^{-1} + 0 \times 2^{-2} + 1 \times 2^{-3} + 0 \times 2^{-4} + 1 \times 2^{-5} + 1 \times 2^{-6} = 231.671875_{10}$

21.

- (a) $11.1111_2 = 3.9375_{10}$
(b) $1011.110111_2 = 11.859375_{10}$
(c) $11011.1001_2 = 27.5625_{10}$
(d) $101100.11_2 = 44.75_{10}$

(e) $1110001.00101_2 = 113.15625_{10}$

(f) $1000110.0011_2 = 70.1875_{10}$

22.

(a) $4.2_8 = 4 \times 8^0 + 2 \times 8^{-1} = 4.25_{10}$

(b) $56.32_8 = 5 \times 8^1 + 6 \times 8^0 + 3 \times 8^{-1} + 2 \times 8^{-2} = 46.40625_{10}$

(c) $263.156_8 = 2 \times 8^2 + 6 \times 8^1 + 3 \times 8^0 + 1 \times 8^{-1} + 5 \times 8^{-2} + 6 \times 8^{-3} = 179.21484375_{10}$

(d) $711.653_8 = 7 \times 8^2 + 1 \times 8^1 + 1 \times 8^0 + 6 \times 8^{-1} + 5 \times 8^{-2} + 3 \times 8^{-3} = 457.833984375_{10}$

(e) $1020.75_8 = 1 \times 8^3 + 0 \times 8^2 + 2 \times 8^1 + 0 \times 8^0 + 7 \times 8^{-1} + 5 \times 8^{-2} = 528.953125_{10}$

(f) $2153.2667_8 = 2 \times 8^3 + 1 \times 8^2 + 5 \times 8^1 + 3 \times 8^0 + 2 \times 8^{-1} + 6 \times 8^{-2} + 6 \times 8^{-3} + 7 \times 8^{-4}$
 $= 1131.357177734375_{10}$

23.

(a) $22.56_8 = 18.71875_{10}$

(b) $146.74_8 = 102.9375_{10}$

(c) $376.14_8 = 254.1875_{10}$

(e) $1035.712_8 = 541.89453125_{10}$

(f) $1433.103_8 = 795.130859375_{10}$

(g) $3147.52_8 = 1639.65625_{10}$

24.

(a) $48.091_{16} = 4 \times 16^1 + 8 \times 16^0 + 0 \times 16^{-1} + 9 \times 16^{-2} + 1 \times 16^{-3} = 72.035400390625_{10}$

(b) $9D0.5C_{16} = 9 \times 16^2 + 13 \times 16^1 + 0 \times 16^0 + 5 \times 16^{-1} + 12 \times 16^{-2} = 2512.359375_{10}$

(c) $FED.BCA_{16} = 15 \times 16^2 + 14 \times 16^1 + 13 \times 16^0 + 11 \times 16^{-1} + 12 \times 16^{-2} + 10 \times 16^{-3}$
 $= 4077.73681640625_{10}$

(d) $16.15_{16} = 1 \times 16^1 + 6 \times 16^0 + 1 \times 16^{-1} + 5 \times 16^{-2} = 22.08203125_{10}$

(e) $E9.4902_{16} = 14 \times 16^1 + 9 \times 16^0 + 4 \times 16^{-1} + 9 \times 16^{-2} + 0 \times 16^{-3} + 2 \times 16^{-4} = 233.285186767578125_{10}$

(f) $5CB.101_{16} = 5 \times 16^2 + 12 \times 16^1 + 11 \times 16^0 + 1 \times 16^{-1} + 0 \times 16^{-2} + 1 \times 16^{-3} = 1483.062744140625_{10}$

25.

(a) $5A.39_{16} = 90.22265625_{10}$

(b) $BB.AC_{16} = 187.671875_{10}$

(c) $15A.269_{16} = 346.150634765625_{10}$

(d) $34D.E_{16} = 845.875_{10}$

(e) $D01.18_{16} = 3329.09375_{10}$

(f) $20AC.19E_{16} = 8364.10107421875_{10}$

26.

(a) $11001.11_2 = 31.6_8 = 19.C_{16}$

8진수				3			1				6		
2진수	0	0	0	1	1	0	0	1	.	1	1	0	0
16진수				1				9					12

(b) $1001111.101011_2 = 117.53_8 = 4F.AC_{16}$

8진수		1			1			7				5			3			
2진수	0	0	1	0	0	1	1	1	1	.	1	0	1	0	1	1	0	0
16진수		4				15					10				12			

(c) $11101111.11010111_2 = 357.656_8 = EF.D7_{16}$

8진수	3			5			7			6			5			6										
2진수	0	1	1	1	0	1	1	1	1	.	1	1	0	1	0	1	1	1	0							
16진수	14				15				13				7													

(d) $101001110110.110000111_2 = 5166.607_8 = A76.C38_{16}$

8진수	5	1	6	6	.	6	0	7																	
2진수	1	0	1	0	0	1	1	1	0	1	1	0	.	1	1	0	0	0	0	1	1	1	0	0	0
16진수	10	7	6	.	12	3	8																		

(e) $1100111010110.10111111001_2 = 14726.5762_8 = 19D6.BF2_{16}$

8진수		1		4		7		2		6	.	5		7		6		2										
2진수	0	0	0	1	1	0	0	1	1	1	0	1	0	1	1	0	.	1	0	1	1	1	1	1	0	0	1	0
16진수		1		9		13		6	.	11		15		2														

(f) $101100100011110.0001010001011_2 = 54436.05054_8 = 591E.1458_{16}$

8진수			5			4			4			3			6		.
2진수	0	1	0	1	1	0	0	1	0	0	0	1	1	1	1	0	.
16진수			5				9					1			14		.

			0			5			0			5			4		
0	0	0	1	0	1	0	0	0	1	0	1	1	0	0	0		
			1				4				5				8		

27.

(a) $101.11001_2 = 5.62_8 = 5.C8_{16}$

(b) $1011010.001101_2 = 132.15_8 = 5A.34_{16}$

(c) $11111110.001101111_2 = 376.157_8 = FE.378_{16}$

(d) $1000001110.11111101_2 = 1016.772_8 = 20E.FD_{16}$

(e) $1010101100101.11101010111_2 = 12545.7256_8 = 1565.EAE_{16}$

(f) $1111110110001.10101011_2 = 17661.526_8 = 1FB1.AB_{16}$

28.

(a) $15.36_8 = 1101.01111_2 = D.78_{16}$

8진수	1	5	.	3	6		
2진수	0	0	1	1	0	1	. 0 1 1 1 1 0 0 0
16진수		13	.	7	8		

(b) $67.1234_8 = 110111.0010100111_2 = 37.29C_{16}$

8진수		6	7		1	2	3	4
2진수	0	0	1	1	0	1	1	. 0 0 1 0 1 0 0 1 1 1 0 0
16진수		3	7		2	9		12

(c) $125.3623_8 = 1010101.011110010011_2 = 55.793_{16}$

8진수		1	2	5		3	6	2	3
2진수	0	0	0	1	0	1	0	1	. 0 1 1 1 1 0 0 1 0 0 1 1
16진수		5	5		7	9		3	

(d) $713.5272_8 = 111001011.10101011101_2 = 1CB.ABA_{16}$

8진수		7	1	3	.	5	2	7	2
2진수	0	0	0	1	1	1	0	0	1 0 1 1 . 1 0 1 0 1 0 1 1 1 0 1 0
16진수		1	12	11	.	10	11		10

(e) $1623.7715_8 = 1110010011.111111001101_2 = 393.FCD_{16}$

8진수	1	6	2	3	.	7	7	1	5
2진수	0	0	1	1	1	0	0	1	0 0 1 1 . 1 1 1 1 1 1 0 0 1 1 0 1
16진수	3	9	3	.	15	12		13	

(f) $51623.1622_8 = 101001110010011.00111001001_2 = 5393.392_{16}$

8진수		5		1		6		2		3		.		1		6		2		2										
2진수	0	1	0	1	0	0	1	1	1	0	0	1	0	0	1	1	.	0	0	1	1	1	0	0	0	1	0	0	1	0
16진수		5				3				9				3		.				3				9					2	

29.

(a) $67.214_8 = 110111.0100011_2 = 37.46_{16}$

(b) $105.772_8 = 1000101.11111101_2 = 45.FD_{16}$

(c) $471.32511_8 = 100111001.011010101001001_2 = 139.6A92_{16}$

(d) $2012.7054_8 = 10000001010.1110001011_2 = 40A.E2C_{16}$

(e) $5123.637_8 = 101001010011.110011111_2 = A53.CF8_{16}$

(f) $6410.7123_8 = 110100001000.111001010011_2 = D08.E53_{16}$

30.

(a) $12.34_{16} = 10010.001101_{16} = 22.15_8$

16진수	1				2				.	3				4			
2진수	0	0	0	1	0	0	1	0	.	0	0	1	1	0	1	0	0
8진수	2				2				.	1				5			

(b) $68.EE_{16} = 1101000.1110111_2 = 150.734_8$

16진수	6				8				.	E				E					
2진수	0	0	1	1	0	1	0	0	0	.	1	1	1	0	1	1	1	0	0
8진수	1			5			0			.	7			3			4		

(c) $9C.709B_{16} = 10011100.0111000010011011_2 = 234.341154_8$

16진수	9				C				.	7				0				9				B						
2진수	0	1	0	0	1	1	1	0	0	.	0	1	1	1	0	0	0	0	1	0	0	1	1	0	1	1	0	0
8진수	2			3			4			.	3			4			1			1			5			4		

(d) $1AC.053A_{16} = 110101100.000001010011101_2 = 654.01235_8$

16진수	1			10			12			.	0			5			3			10											
2진수	0	0	0	1	1	0	1	0	1	1	0	0	.	0	0	0	0	0	1	0	1	0	0	1	1	1	0	1	0		
8진수				6			5			4			.	0			1			2			3			5					

(e) $39E.8AD2_{16} = 1110011110.100010101101001_2 = 1636.42551_8$

16진수	3			9			14			8			10			13			2										
2진수	0	0	1	1	1	0	0	1	1	1	1	0	.	1	0	0	0	1	0	1	0	1	1	0	1	0	0	1	0
8진수	1			6			3			6			.	4			2			5			5			1			

(f) $B0A.19D3_{16} = 101100001010.0001100111010011_2 = 5412.063514_8$

16진수	11				0				10				.	1				9				13				3											
2진수	1	0	1	1	0	0	0	0	1	0	1	0	.	0	0	0	1	1	0	0	1	1	1	0	1	0	0	1	1	0	0						
8진수	5				4				1				.	0				6				3				5				1				4			

31.

(a) $369.12_{16} = 1110010110.0001001_2 = 1626.044_8$

(b) $BB.AC_{16} = 10111011.101011_2 = 273.53_8$

(c) $AE.FCD_{16} = 10101110.111111001101_2 = 256.7715_8$

(d) $FF13.ABCD_{16} = 1111111100010011.1010101111001101_2 = 177423.527464_8$

(e) $C04B.100F_{16} = 1100000001001011.0001000000001111_2 = 140113.040074_8$

(f) $FE13.ABCD_{16} = 1111111000010011.1010101111001101_2 = 177023.527464_8$

32.

	부호-절댓값	부호-1의 보수	부호-2의 보수
(a) 9_{10}	00001001	00001001	00001001
(b) -13_{10}	10001101	11110010	11110011
(c) -48_{10}	10110000	11001111	11010000
(d) 84_{10}	01010100	01010100	01010100
(e) -97_{10}	11100001	10011110	10011111
(f) -103_{10}	11100111	10011000	10011001
(g) -118_{10}	11110110	10001001	10001010
(h) 125_{10}	01111101	01111101	01111101

33.

(a)

부호-1의 보수 표현

$$\begin{array}{r}
 \begin{array}{cccccccc}
 & 0 & 0 & 1 & 1 & 1 & 0 & 1 & 0 \\
 + & 1 & 1 & 0 & 1 & 1 & 0 & 1 & 1 \\
 \hline
 1 & 0 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\
 + & \dots\dots\dots & 1 & & & & & & \\
 \hline
 0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 &
 \end{array}
 \end{array}$$

부호-2의 보수 표현

$$\begin{array}{r}
 \begin{array}{cccccccc}
 & 0 & 0 & 1 & 1 & 1 & 0 & 1 & 0 \\
 + & 1 & 1 & 0 & 1 & 1 & 1 & 0 & 0 \\
 \hline
 1 & 0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 \\
 \text{무시} & & & & & & & &
 \end{array}
 \end{array}$$

$$\therefore 00010110 = 16+4+2 = 22$$

(b)

부호-1의 보수 표현

$$\begin{array}{r}
 \begin{array}{cccccccc}
 & 1 & 1 & 1 & 1 & 0 & 1 & 1 & 1 \\
 + & 1 & 0 & 0 & 1 & 1 & 0 & 1 & 1 \\
 \hline
 1 & 1 & 0 & 0 & 1 & 0 & 0 & 1 & 0 \\
 + & \dots\dots\dots & 1 & & & & & & \\
 \hline
 1 & 0 & 0 & 1 & 0 & 0 & 1 & 1 &
 \end{array}
 \end{array}$$

부호-2의 보수 표현

$$\begin{array}{r}
 \begin{array}{cccccccc}
 & 1 & 1 & 1 & 1 & 1 & 0 & 0 & 0 \\
 + & 1 & 0 & 0 & 1 & 1 & 1 & 0 & 0 \\
 \hline
 1 & 1 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\
 \text{무시} & & & & & & & &
 \end{array}
 \end{array}$$

$$\therefore 10010011 = -127+(16+3) = -108$$

10010011의 1의 보수 : 11101100

$$=-(64+32+8+4) = -108$$

$$\therefore 10010100 = -128+(16+4) = -108$$

10010100의 2의 보수 : 11101100

$$=-(64+32+8+4) = -108$$

(c)

부호-1의 보수 표현 = 부호-2의 보수 표현

$$\begin{array}{r}
 \begin{array}{cccccccc}
 & 0 & 1 & 0 & 1 & 0 & 1 & 1 & 1 \\
 + & 0 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \\
 \hline
 0 & 1 & 1 & 0 & 0 & 1 & 0 & 0 &
 \end{array}
 \end{array}$$

$$\therefore 01100100 = 64+32+4 = 100$$

(d)

부호-1의 보수 표현

$$\therefore 10101001 = -86$$

10101001의 1의 보수 :

$$11010110 = -86$$

부호-2의 보수 표현

$$\therefore 10101010 = -86$$

10101010의 2의 보수 :

$$11010110 = -86$$

(e)

부호-1의 보수 표현

$$\therefore 11111110 = -1$$

11111110의 1의 보수 : 10000001 = -1

부호-2의 보수 표현

$$\therefore 11111111 = -1$$

11111111의 2의 보수 : 10000001 = -1

(f)

부호-1의 보수 표현

$$\therefore 10001111 = -112$$

10001111의 1의 보수 :

$$11110000 = -112$$

부호-2의 보수 표현

$$\therefore 10010000 = -112$$

10010000의 2의 보수 :

$$11110000 = -112$$

34.

(a) $42_{10} + 77_{10}$

부호-1의 보수 표현 = 부호-2의 보수 표현

$$\begin{array}{r}
 0 \ 0 \ 1 \ 0 \ 1 \ 0 \ 1 \ 0 \\
 + \ 0 \ 1 \ 0 \ 0 \ 1 \ 1 \ 0 \ 1 \\
 \hline
 0 \ 1 \ 1 \ 1 \ 0 \ 1 \ 1 \ 1
 \end{array}$$

$$\therefore 01110111 = 64+32+16+4+2+1 = 119$$

(b) $-42_{10} + 77_{10}$

부호-1의 보수 표현

$$\begin{array}{r}
 1 \ 1 \ 1 \ 0 \ 1 \ 0 \ 1 \ 0 \ 1 \\
 + \ 0 \ 1 \ 0 \ 0 \ 0 \ 1 \ 1 \ 0 \ 1 \\
 \hline
 1 \ 0 \ 0 \ 1 \ 0 \ 0 \ 0 \ 1 \ 0 \\
 + \ 1 \ 0 \ 0 \ 0 \ 0 \ 0 \ 1 \ 1 \\
 \hline
 0 \ 0 \ 1 \ 0 \ 0 \ 0 \ 1 \ 1
 \end{array}$$

$$\therefore 00100011 = 32 + 2 + 1 = 35$$

부호-2의 보수 표현

$$\begin{array}{r}
 1 \ 1 \ 0 \ 1 \ 0 \ 1 \ 1 \ 0 \\
 + \ 0 \ 1 \ 0 \ 0 \ 1 \ 1 \ 0 \ 1 \\
 \hline
 1 \ 0 \ 0 \ 1 \ 0 \ 0 \ 0 \ 1 \\
 \text{무시}
 \end{array}$$

(c) $42_{10} - 77_{10}$

부호-1의 보수 표현

$$\begin{array}{r} \begin{array}{cccccccc} & 0 & 0 & 1 & 0 & 1 & 0 & 1 & 0 \\ & & 1 & & & & & & \\ + & 1 & 0 & 1 & 1 & 0 & 0 & 1 & 0 \\ \hline & 1 & 1 & 0 & 1 & 1 & 1 & 0 & 0 \end{array} \end{array}$$

$$\therefore 11011100 = -127 + (64 + 16 + 8 + 4) = -35$$

11011100의 1의 보수 : 10100011

$$= -(32 + 2 + 1) = -35$$

부호-2의 보수 표현

$$\begin{array}{r} \begin{array}{cccccccc} & 0 & 0 & 1 & 0 & 1 & 0 & 1 & 0 \\ & & 1 & & & & 1 & & \\ + & 1 & 0 & 1 & 1 & 0 & 0 & 1 & 1 \\ \hline & 1 & 1 & 0 & 1 & 1 & 1 & 0 & 1 \end{array} \end{array}$$

$$\therefore 11011101 = -128 + (64 + 16 + 8 + 4 + 1) = -35$$

11011101의 2의 보수 : 10100011

$$= -(32 + 2 + 1) = -35$$

(d) $-42_{10} - 77_{10}$

부호-1의 보수 표현

$$\begin{array}{r} \begin{array}{cccccccc} & 1 & 1 & 0 & 1 & 0 & 1 & 0 & 1 \\ & & 1 & & & & & & \\ + & 1 & 0 & 1 & 1 & 0 & 0 & 1 & 0 \\ \hline & 1 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\ + & 1 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\ \hline & 1 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \end{array} \end{array}$$

$$\therefore 10001000 = -127 + 8 = -119$$

10001000의 1의 보수 : 11110111

$$= -(64 + 32 + 16 + 4 + 2 + 1) = -119$$

부호-2의 보수 표현

$$\begin{array}{r} \begin{array}{cccccccc} & 1 & 1 & 0 & 1 & 0 & 1 & 1 & 0 \\ & & 1 & & & & & & \\ + & 1 & 0 & 1 & 1 & 0 & 0 & 1 & 1 \\ \hline & 1 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\ \text{무시} & & & & & & & & \end{array} \end{array}$$

$$\therefore 10001001 = -128 + (8 + 1) = -119$$

10001001의 2의 보수 : 11110111

$$= -(64 + 32 + 16 + 4 + 2 + 1) = -119$$

35.

(a) $12_{10} + 51_{10}$

부호-1의 보수 표현 = 부호-2의 보수 표현

$$\therefore 00111111 = 63$$

(b) $-12_{10} + 51_{10}$

부호-1의 보수 표현 = 부호-2의 보수 표현

$$\therefore 00100111 = 39$$

(c) $12_{10} - 51_{10}$

부호-1의 보수 표현

$$\therefore 11011000 = -39$$

11011000의 1의 보수 :

$$10100111 = -39$$

부호-2의 보수 표현

$$\therefore 11011001 = -39$$

11011001의 2의 보수 :

$$10100111 = -39$$

(d) $-12_{10} - 51_{10}$

부호-1의 보수 표현

$$\therefore 11000000 = -63$$

11000000의 1의 보수 :

$$10111111 = -63$$

부호-2의 보수 표현

$$\therefore 11000001 = -63$$

11000001의 2의 보수 :

$$10111111 = -63$$

36.

(a) $101_{10} + 14_{10}$

부호-1의 보수 표현 = 부호-2의 보수 표현

$\therefore 01110011 = 115$

(b) $-101_{10} + 14_{10}$

부호-1의 보수 표현

부호-2의 보수 표현

$\therefore 10101000 = -87$

$\therefore 10101001 = -87$

10101000의 1의 보수 : 11010111 = -87

10101001의 2의 보수 : 11010111 = -87

(c) $101_{10} - 14_{10}$

부호-1의 보수 표현 = 부호-2의 보수 표현

$\therefore 01010111 = 87$

(d) $-101_{10} - 14_{10}$

부호-1의 보수 표현

부호-2의 보수 표현

$\therefore 10001100 = -115$

$\therefore 10001101 = -115$

10001100의 1의 보수 :

10001101의 2의 보수 :

11110011 = -115

11110011 = -115