

	[1]	[2]	[3]	[4]
IEEE 745 SP:	0x40C80000	0xbC4CCCCC	0x41233333	0xB12800000
Sign bit (0 or 1)	0	1	0	1
Sign (+/-):	+	-	+	-1
Exponent bits (8 bits)	10000001	01111000	10000010	01111011
real exponent factor (expressed in decimal, unbiased)	$2^2$	$2^{-7}$	$2^3$	$2^{-4}$
Significand bits (23-bit binary no hidden 1):	1001 0000 0000	10011001 1001	0100 0110 0110	0000 0000
Significand (expressed as a decimal number with a radix point.)	1.5625	1.59985	1.274902	1.0

1. 0x40C80000

0100 0000 1100 1000 0000 0000 0000 0000  
 ↓      ↓      ↓      ↓  
 sign bits, exponent bits      significand bits

$$129 - 127 = 2$$

3.

0100 0001 0010 0011 0011 0011 0011 00  
 ↓      ↓      ↓      ↓      ↓      ↓      ↓      ↓  
 0x 4 1 2 3 3 3 3 3

2. 0xbC4CCCCC

1011 1100 0100 1100 1100 1100 1100 1100  
 ↓      ↓      ↓      ↓      ↓      ↓      ↓      ↓  
 sign bits, exponent bits, significand bits

$$8 + 16 + 32 + 64 = 120$$

$$120 - 127 = -7$$

$$\text{Real exponent} = \boxed{2^{-7}}$$

$$\frac{1}{2} + \frac{1}{16} + \frac{1}{32} + \frac{1}{256} + \frac{1}{512} + \frac{1}{4096} = 0.59985$$

$$\text{Significand: } 1 + 0.59985 = \boxed{1.59985}$$

$$2 + 128 = 130$$

$$130 - 127 = 3$$

$$\frac{1}{4} + \frac{1}{64} + \frac{1}{128} + \frac{1}{1024} + \frac{1}{2048} = 0.274902$$

$$1 + 0.274902 = \boxed{1.274902}$$

$$-4 + 127 = 123$$

↓  
01111011

1011 1101 1000 0000 0000 0000 0000 00  
 ↓      ↓      ↓      ↓      ↓      ↓      ↓      ↓  
 B D 8 0 0 0 0 0

1. a)  $0x40866666$

0100 0000 1000 0110 0110 0110 0110  
exp                    significand

$1 + 128 - 127 = 2$        $\frac{1}{32} + \frac{1}{64} = 0.046875 \approx 0.0469$

$2^2$        $(1 + 0.0469) \cdot 2^2 = 4.1876 = 4.1876 \times 10^0$

b)  $0x66ff0000$

0110 0110 1111 1111 0000 0000 0000 0000

exp                  Significant

$$1 + 4 + 8 + 64 + 128 - 127 = 78 \quad \frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \frac{1}{16} + \frac{1}{32} + \frac{1}{64} + \frac{1}{128} \approx 0.9922$$

$$(1 + 0.9922) \cdot 2^{78} \approx \boxed{6.0211 \times 10^{23}}$$

2.a)	<u>-1600.6666</u>	<u>0.6666</u> - 2 = <u>1333</u>	Sign = 1
z		<u>0.3333</u> - 2 = <u>0.6666</u>	exp = 10
1600	0	11001000000.101010	significant = 1001000000101010
800	0		
400	0	1.1001000000101010	$\cdot 2^{10}$
200	0		
100	0	10+127 = 137	
50	0	137 in 8 bits binary is 10001001	
25	1	1100 0100 1100 1000 0001 0101 0101 0101	
12	0	↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓	
6	0	C 4 C 8 1 5 5 5	
3	1	0xC4C81555	

$$2b, -1.6 \times 10^{-19} = A0CE7380$$

$$\text{Power} = \log_2 (-1.6 \times 10^{-19}) \approx -62$$

$$\text{1+ fraction} = 1.6 \times 10^{-19} / 2^{-62} \approx 0.7379$$

$$\cancel{0.7379} = \cancel{0.7379}$$

~~$$-62 + 127 = 65$$~~

-62 + 127 = 65 65 in binary is 01000001

0.7379 in binary is 0.101110011100111

10100001101110011100111000100001  
A O C E 7 3 8 0

$$3) \text{ a) } 0x44800000 + 0x3f000000 = \boxed{0x44801000}$$

$$0x44800000 = \underline{0100} \underline{0100} \underline{1000} \underline{0000} \underline{0000} \underline{0000} \underline{0000},$$

$$1+8+128-127=1$$

$$1.0 \times 2^{10}$$

$$0x3f000000 = \underline{0011} \underline{1111} \underline{0000} \underline{0000} \underline{0000} \underline{0000} \underline{0000}$$

$$2^4+8+16+32+64-127=-1$$

$$1.0 \times 2^{-1}$$

$$0.0000000001 \times 2^{10}$$

$$+ \underline{1.0000000000} \times 2^{10}$$

$$\underline{1.0000000001} \times 2^{10}$$

$$10+127=137 \quad 137 \text{ in binary is } 10001001 \quad \text{Sign is 0}$$

$$0100 \quad 0100 \quad 1000 \quad 0000 \quad 0001 \quad 0000 \quad 0000 \quad 0000$$

$$\begin{array}{ccccccccc} 4 & 4 & 8 & 0 & 1 & 0 & 0 & 0 \end{array}$$

$$\boxed{0x44801000}$$

$$8) \quad 0x3C0bbbbbb + 0x3C111111$$

~~$$0x3C0bbbbbb = \underline{0011} \underline{1100} \underline{0000} \underline{1011} \underline{1011} \underline{1011} \underline{1011} \underline{1011}$$~~

~~$$8+16+32+64-127=-7$$~~

~~$$\frac{1}{16} + \frac{1}{64} + \frac{1}{128} + \frac{1}{256} + \frac{1}{512} + \frac{1}{1024} + \frac{1}{2048} + \frac{1}{4096} + \frac{1}{8192} \approx 0.0916$$~~

~~$$0x3C111111 = \underline{0011} \underline{1100} \underline{0001} \underline{0001} \underline{0001} \underline{0001} \underline{0001} \underline{0001}$$~~

~~$$8+16+32+64-127=-7$$~~

~~$$\frac{1}{8} + \frac{1}{128} + \frac{1}{2048} + \frac{1}{32768} \approx 0.133331$$~~



$$4. a) 0x3b6bbbb * 0xC2f0000 = \boxed{0xBEDCFFFF}$$

$$3b6bbbb = \underline{\underline{0011\ 1011\ 0110\ 1011\ 1011\ 1011\ 1011}}$$

$$2 + 4 + 16 + 32 + 64 - 127 = -9$$

$$C2f0000 = \underline{\underline{1100\ 0010\ 1110\ 0000\ 0000\ 0000\ 0000}}$$

$$1 + 4 + 128 - 127 = 6$$

$$\begin{array}{r} \cancel{0.0000000011010111011101110111011} \\ \cancel{111000} \quad \quad \quad 0 \\ \underline{1101011101110111011101110111011} \\ 1.111000 \quad \quad \quad \quad \quad \quad \quad \quad \quad 0 \\ \underline{1101011101110111011101110111011} \\ 11101011101110111011101110111011 \\ 11101011101110111011101110111011 \\ \underline{11101011101110111011101110111011} \\ 11.0111001111111111110101 \end{array}$$

$$= 1.10100011111111110101 \times 2^{-2}$$

$$-2 + 127 = 125$$

125 in binary is 0111101

101110101100111111111111

B E D C F F F F

b)  $0x44000000 \cdot 0x3b000000 = 0x3F800000$

010001000 ... 0

~~00111~~ 001101100 ... 0

$$8 + 128 - 127 = 9$$

$$2 + 4 + 16 + 32 + 64 - 127 = -9$$

$$1.0 \times 2^0$$

$$0 + 127 = 127 \quad 127 \text{ in binary is } 01111111$$

00111110000000000000000000000000

$\begin{array}{r} 1 \\ 3 \\ F \\ 8 \\ 0 \\ 0 \\ 0 \\ 0 \end{array}$

