1.CO1	**Represent** -67 with -75 in 11 bits using 2's complement system. (You don't need to show the conversions)
2.CO1	Ronaldo's career earning is $(11101100100001101.11)_2$ dollars, while Messi's career earning is $(177761)_9$ dollars. Kylian Mbappe started his career five years ago and has been earning $(1124)_7$ dollars per match for the last five years, playing $(143)_5$ matches each year. If he continues to earn at the same rate—that is, $(1124)_7$ dollars per match and $(143)_5$ matches per year—how many additional years will Mbappe need to surpass the combined total earnings of Ronaldo and Messi? (Show the answer in decimal, show the conversions)
3.CO1	**Divide** $(1112311)_4$ by $(112)_4$ using base 4. Find the quotient and remainder. Note: You must show the necessary calculations. You don't need to show the conversions.

Solution

1. 67 = 1000011
+67 = 01000011
+67 in 11 bits = 00001000011
-67 in 11 bits = 11110111100+1 =
11110111101

75 = 1001011
+75 = 01001011
+75 in 11 bits = 00001001011
-75 in 11 bits = 11110110100+1 =
11110110101

2. Ronaldo = $(11101100100001101.11)_2$ = 121101.75 dollars
Messi = $(177761)_9$ = 110701 dollars
Combined = 121101.75 + 110701 = 231802.75 dollars

Mbappé per match = $(1124)_7$ = 410 dollars
Matches per year = $(143)_5$ = 48
Yearly = 410 × 48 = 19680 dollars
5 years = 19680 × 5 = 98400 dollars

Needed = 231802.75 − 98400 = 133402.75
Each year = 19680 → 133402.75 ÷ 19680 ≈ 6.78
Additional years = 7

3. 112] 1112311 [3330
1002
1103
1002
1011
1002
31
0
31

1.CO1	**Represent** -59 with -83 in 11 bits using 2's complement system. (You don't need to show the conversions)
2.CO1	Ronaldo's career earning is $(11101100100001101.11)_2$ dollars, while Messi's career earning is $(177761)_9$ dollars. Kylian Mbappe started his career five years ago and has been earning $(1124)_7$ dollars per match for the last five years, playing $(143)_5$ matches each year. If he continues to earn at the same rate—that is, $(1124)_7$ dollars per match and $(143)_5$ matches per year—how many additional years will Mbappe need to surpass the combined total earnings of Ronaldo and Messi? (Show the answer in decimal, show the conversions)
3.CO1	**Divide** $(1412356)_7$ by $(423)_7$ using base 7. Find the quotient and remainder. Note: You must show the necessary calculations. You don't need to show the conversions.

Solution

4. 59 = 111011
+59 = 0111011
+59 in 11 bits = 00000111011
-59 in 11 bits = 11111000100+1 =
11111000101

83 = 1010011
+83 = 01010011
+83 in 11 bits = 00001010011
-83 in 11 bits = 11110101100+1 =
11110101101

5. Ronaldo = $(11101100100001101.11)_2$ = 121101.75 dollars
Messi = $(177761)_9$ = 110701 dollars
Combined = 121101.75 + 110701 = 231802.75 dollars

Mbappé per match = $(1124)_7$ = 410 dollars
Matches per year = $(143)_5$ = 48
Yearly = 410 × 48 = 19680 dollars
5 years = 19680 × 5 = 98400 dollars

Needed = 231802.75 − 98400 = 133402.75
Each year = 19680 → 133402.75 ÷ 19680 ≈ 6.78
Additional years = 7

6. 423] 1412356 [2401
1146
2333
2325
55
0
556
423
133

1.CO1	**Represent** -53 and -89 in 11 bits using 2's complement system. (You don't need to show the conversions)
2.CO1	Magnus's career earning is $(11101100100001101.11)_2$ dollars, while Hikaru's career earning is $(177761)_9$ dollars. Fabiano Caruana started his career five years ago and has been earning $(1124)_7$ dollars per match for the last five years, playing $(143)_5$ matches each year. If he continues to earn at the same rate—that is, $(1124)_7$ dollars per match and $(143)_5$ matches per year—how many additional years will Caruana need to surpass the combined total earnings of Magnus and Hikaru? (Show the answer in decimal, show the conversions)
3.CO1	**Divide** $(1512341)_6$ by $(213)_6$ using base 6. Find the quotient and remainder. Note: You must show the necessary calculations. You don't need to show the conversions.

Solution

1. 53 = 110101
+53 = 0110101
+53 in 11 bits = 00000110101
-53 in 11 bits = 11111001010+1 =
11111001011

89 = 1011001
+89 = 01011001
+89 in 11 bits = 00001011001
-89 in 11 bits = 11110100110+1 =
11110100111

2. Magnus = $(11101100100001101.11)_2$ = 121101.75 dollars
Hikaru = $(177761)_9$ = 110701 dollars
Combined = 121101.75 + 110701 = 231802.75 dollars

Caruana per match = $(1124)_7$ = 410 dollars
Matches per year = $(143)_5$ = 48
Yearly = 410 × 48 = 19680 dollars
5 years = 19680 × 5 = 98400 dollars

Needed = 231802.75 − 98400 = 133402.75
Each year = 19680 → 133402.75 ÷ 19680 ≈ 6.78
Additional years = 7

3. 213] 1512341 [4554
1300
2123
1513
2104
1513
1511
1300
211

1.CO1	**Represent** -47 and -95 in 11 bits using 2's complement system. (You don't need to show the conversions)
2.CO1	Magnus's career earning is $(11101100100001101.11)_2$ dollars, while Hikaru's career earning is $(177761)_9$ dollars. Fabiano Caruana started his career five years ago and has been earning $(1124)_7$ dollars per match for the last five years, playing $(143)_5$ matches each year. If he continues to earn at the same rate—that is, $(1124)_7$ dollars per match and $(143)_5$ matches per year—how many additional years will Caruana need to surpass the combined total earnings of Magnus and Hikaru? (Show the answer in decimal, show the conversions)
3.CO1	**Divide** $(1762311)_9$ by $(413)_9$ using base 9. Find the quotient and remainder. Note: You must show the necessary calculations. You don't need to show the conversions.

Solution

1. 47 = 101111
+47 = 0101111
+47 in 11 bits = 00000101111
-47 in 11 bits = 11111010000 + 1 =
1 1 1 1 1 0 1 0 0 0 1

95 = 1011111
+95 = 01011111
+95 in 11 bits = 00001011111
-95 in 11 bits = 11110100000+1 =
1 1 1 1 0 1 0 0 0 0 1

2. Magnus = $(11101100100001101.11)_2$ = 121101.75 dollars
Hikaru = $(177761)_9$ = 110701 dollars
Combined = 121101.75 + 110701 = 231802.75 dollars

Caruana per match = $(1124)_7$ = 410 dollars
Matches per year = $(143)_5$ = 48
Yearly = 410 × 48 = 19680 dollars
5 years = 19680 × 5 = 98400 dollars

Needed = 231802.75 − 98400 = 133402.75
Each year = 19680 → 133402.75 ÷ 19680 ≈ 6.78
Additional years = 7

3. 413] 1762311 [4020

```
      1753
  ------------
       83
        0
  ------------
      831
      826
  ------------
       41
        0
  ------------
       41
```