1–12. Perform the following binary multiplications:

(a) 1101×1011 **(b)** 0101×1010 **(c)** 100111×011011

```
a)     1101
     x 1011
     ------
       1101
      1101x
     0000xx
    1101xxx
   --------
   10001111
```

```
b)     0101
     x 1010
     ------
       0000
      0101x
     0000xx
    0101xxx
   --------
    0110010
```

```
c)       100111
       x 011011
       --------
         100111
        100111x
       000000xx
      100111xxx
     100111xxxx
    -----------
    10000011101
```

1–14. A limited number system uses base 12. There are at most four integer digits. The weights of the digits are 12^3, 12^2, 12, and 1. Special names are given to the weights as follows: 12 = 1 dozen, 12^2 = 1 gross, and 12^3 = 1 great gross.

(a) How many beverage cans are in 6 great gross + 8 gross + 7 dozen + 4?
(b) Find the representation in base 12 for 7569_{10} beverage cans.

a) $6 \times 1728 + 8 \times 144 + 7 \times 12 + 4 = \ldots$

b) $7569_{10} \rightarrow 7569 \% 1728$

(highest num that is multiple of 12
that goes into 7569 is 12^3 (1728)
$7569 \div 1728 = 4.308$
only take this)

$657 \rightarrow 657 \% 144$
(highest num that is multiple of 12
that goes into 657 is 12^2 (144)
$657 \div 144 = 4.5625$
only take this)

$81 \rightarrow 81 \% 12$
(highest num that is multiple of 12
that goes into 657 is 12^1 (12)
$81 \div 12 = 6.75$
only take this)

$9 \rightarrow 9 \% 1$
(highest num that is multiple of 12
that goes into 9 is 12^0 (1)
$9 \div 1 = 9.00$
only take this)

$\underline{4}\ \underline{4}\ \underline{6}\ \underline{9}_{12}$

1–16. *In each of the following cases, determine the radix r:

(a) $(BEE)_r = (2699)_{10}$ **(b)** $(365)_r = (194)_{10}$

a) $2699_{10} = (2 \cdot 10^3) + (6 \cdot 10^2) + (9 \cdot 10^0) = 2699$

$BEE_r = (11 \cdot r^2) + (14 \cdot r^1) + (14 \cdot r^0)$

$11r^2 + 14r + 14 = 2699$

$11r^2 + 14r - 2685 = 0$

$(11r + 179)(r - 15) = 0$

$r = 15, -\frac{179}{11}$ but $r > 0$ and integer so $r = 15$

b) $194_{10} = (1 \cdot 10^2) + (9 \cdot 10^1) + (4 \cdot 10^0) = 194$

$365_r = (3 \cdot r^2) + (6 \cdot r^1) + (5 \cdot r^0) + 3r^2 + 6r + 5$

$3r^2 + 6r + 5 = 194$

$3r^2 + 6r - 189 = 0$

$r^2 + 2r - 63 = 0$

$(r + 9)(r - 7) = 0$

$r = 9, 7$ but $r > 0$ so $r = 7$