Here's first our gates that is defined in the problem

```
X = matrix([[0,1],[1,0]])
S = matrix([[1,0,0,0], [0,0,1,0], [0,1,0,0], [0,0,0,1]])
TOF = matrix([[1, 0, 0, 0, 0, 0, 0, 0], [0, 1, 0, 0, 0, 0, 0, 0], [0, 0, 1, 0, 0, 0, 0, 0], [0, 0, 0, 1
```

Furthermore, here's all the identities we are going to use:

```
I2 = matrix.identity(2)
I4 = matrix.identity(4)
I8 = matrix.identity(8)
I16 = matrix.identity(16)
I32 = matrix.identity(32)
```

And now, we will create the components of our expression:

```
G1 = I8.tensor_product(TOF).tensor_product(I4)
G2 = TOF.tensor_product(I2).tensor_product(TOF).tensor_product(I2)
G3 = I4.tensor_product(X).tensor_product(I32)
G4 = I4.tensor_product(TOF).tensor_product(I8)
G5 = I2.tensor_product(TOF).tensor_product(I16)
G6 = I32.tensor_product(S).tensor_product(I2)
G7 = I16.tensor_product(S).tensor_product(S)
G8 = I4.tensor_product(S).tensor_product(I2).tensor_product(S).tensor_product(I2)
G9 = I2.tensor_product(S).tensor_product(I32)
G10 = S.tensor_product(S).tensor_product(X).tensor_product(I8)
G11 = I16.tensor_product(S).tensor_product(I4)
G12 = I8.tensor_product(S).tensor_product(I8)
```

1 | **Check matrix size**

In order to do this, we check the size of every single matrix (both rows and columns), and ensure they all agree to being 256.