

$$2^{11} = (2^5)^2 \cdot 2$$

$$= ((2^2)^2 \cdot 2)^2 \cdot 2$$

$$= (((2^1)^2 \cdot 2)^2 \cdot 2)^2 \cdot 2$$

$$2^{13} = (2^6)^2 \cdot 2$$

$$= ((2^3)^2)^2 \cdot 2$$

$$= (((2^1)^2 \cdot 2)^2)^2 \cdot 2 \quad \underline{13 = 101_2}$$

$$(2)^{2 \cdot 3} \cdot 2^{2 \cdot 2} \cdot 2$$

$$2^{21} \Rightarrow 21 = \overset{4}{1} \overset{3}{0} \overset{2}{1} \overset{1}{0} \overset{0}{1}_2$$

$$= (2^4)^1 \cdot (2^2)^3 \cdot (2^1)^0$$

$$\text{num} = 10101_2.$$

for each iteration { ← keep running while num > 0.

if (last bit is 1) {

output = output · x;

}

x = x · x; ← double x.

}

```
function pow(x, n) {
```

```
  let q = n;
```

$17 = 10001_2$

```
  let output = 1;
```

```
  let p = x;
```

```
  while( q ) {
```

```
    output = q & 1 === 1 ? output * x : output;
```

```
    p = p * p;
```

```
    q = q >> 1;
```

```
  }
```

```
  return output;
```

```
}
```