The Form $y = a \cdot b^x$

The exponential family is y = a · b^x. a is the starting value and y-intercept (b^0 = 1, so a · 1 = a). b is the growth factor, multiplied each step. Power first, then multiply by a.

1 THE VOCABULARY
Words we use

Family, member, parameter the form $y = a \cdot b^x$; each member picked out by a and b.

a, initial value the output when x = 0; the y-intercept, because $b^0 = 1$.

b, growth factor the number multiplied each step: the constant ratio.

Power first b^x before multiplying by a: $3 \cdot 2^4 = 48$.

Invisible 1 $y = 2^x$ has a = 1.

- Watch out for these.
- Multiplying a and b first: $3 \cdot 2^4$ is 48, not 6^4.
- Reading b as the starting value. a starts; b multiplies.
- Forgetting a = 1 when there is no number in front.
- Adding b each step. Multiply.

2 THE METHOD
From equation to table

1. **NAME THE FAMILY** $y = a \cdot b^x$: exponential.
2. **FIND a AND b** a is the number in front; b is the base.
3. **START AT a** x = 0 gives a, because $b^0 = 1$.
4. **MULTIPLY BY b EACH STEP** the ratio down the table is b.
5. **EVALUATE POWER FIRST** $f(4) = a \cdot b^4$: work out b^4, then multiply.

> **WHY A IS THE Y-INTERCEPT**
> b to the zero is 1, the do-nothing number. At x = 0 nothing has been multiplied yet, so $y = a \cdot 1 = a$. The curve crosses the y-axis at (0, a).

3 A MEMBER
$f(x) = 3 \cdot 2^x$

a = 3, b = 2	the number in front, and the base
$f(0) = 3 \cdot 2^0 = 3 \cdot 1 = 3$	the start, the y-intercept
f(1) = 6, f(2) = 12, f(3) = 24	multiply by 2 each step
$f(4) = 3 \cdot 2^4 = 3 \cdot 16 = 48$	power first, then times a
ratio down the table: 2	the growth factor

> **READ THE EQUATION FROM A TABLE**
> x: 0, 1, 2 with y: 6, 12, 24: a is the x = 0 output (6), b is the ratio (2). $y = 6 \cdot 2^x$.

> **SAY IT OUT LOUD**
> What family? What numbers? What do they do? a starts it, b multiplies it, and b to the zero is 1.