Reading the Graph

y-intercept (0, a). Domain all reals. Range y > 0. Asymptote y = 0, never touched. End behavior: far right and far left. b decides increasing or decreasing. Match in two looks: direction from b, crossing from a.

1 THE VOCABULARY
Words we use

y-intercept (0, a), because $b^0 = 1$.
Domain all real numbers: any x works.
Range y greater than 0 (a positive): never 0, never negative.
Asymptote a line the graph approaches without touching: y = 0.
End behavior what y does as x goes to infinity, and to negative infinity.
Increasing, decreasing b above 1 climbs; b between 0 and 1 falls.

- Watch out for these.
- Saying the curve touches or crosses the x-axis. It only gets closer.
- Giving the range as all reals. Outputs stay positive.
- Mixing up which end goes to 0: growth goes to 0 on the left, decay on the right.
- Plugging in points to match instead of reading b then a.

2 THE METHOD
Read the graph

1. CROSSING (0, a). Read a.
2. DIRECTION b above 1 increasing; between 0 and 1 decreasing.
3. ASYMPTOTE y = 0. The curve flattens toward it (left for growth, right for decay).
4. END BEHAVIOR plain first: huge, or close to 0. Then: as x goes to infinity, y goes to ...
5. DOMAIN AND RANGE all reals; y greater than 0.

> WHY IT NEVER REACHES 0
> Positive a times positive factors of b is positive. Walking toward the asymptote divides by b each step: smaller and smaller, never 0.

3 A GROWTH CURVE
$y = 2 \cdot 3^x$

y-intercept (0, 2)	a = 2
increasing	b = 3 is more than 1
asymptote y = 0	flattens toward it on the left
as x goes to infinity, y goes to infinity	far right: huge
as x goes to negative infinity, y goes to 0	far left: close to 0
domain all reals; range y greater than 0	

> MATCH IN TWO LOOKS
> $y = 3 \cdot 0.8^x$: falls (b = 0.8), crosses at 3. Cross out every climber, then every survivor not crossing at 3.

> SAY IT OUT LOUD
> Crosses at a, never touches the x-axis, b decides the direction. Direction first, crossing second.