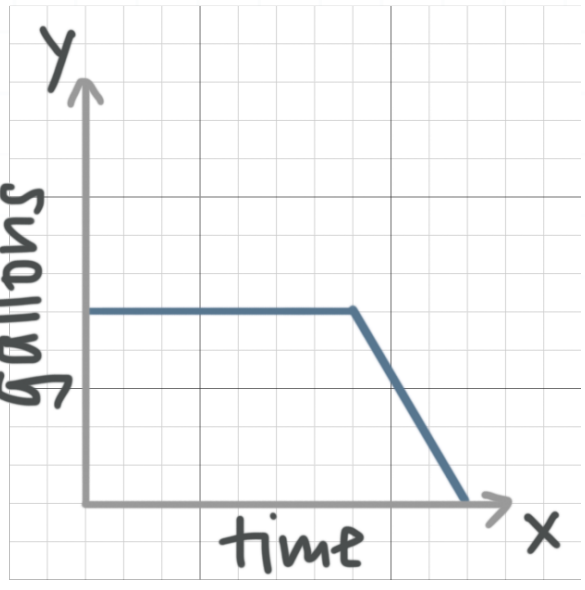
Topic: Sketching graphs from story problems

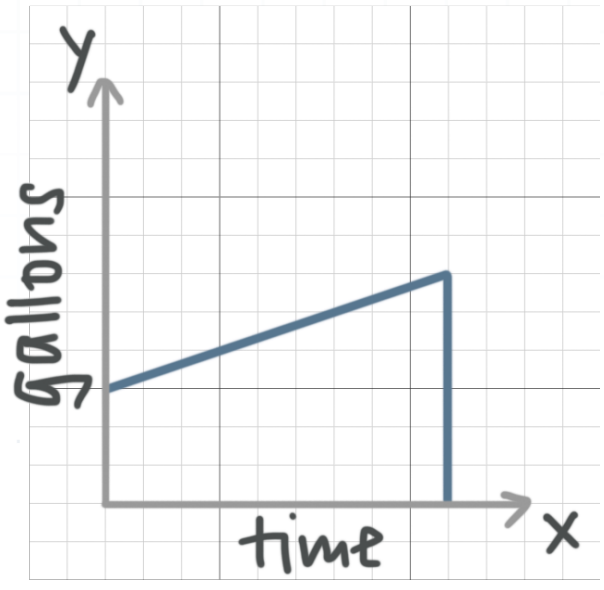
Question: A car with a full tank of gas starts on a long trip. The gas is being used up at a constant rate until a stone comes flying by and knocks a small hole in the bottom of the tank. The tank is now losing gas faster than before and eventually runs dry. Which graph best depicts the number of gallons of gas in the tank during this trip as a function of time?

Answer choices:

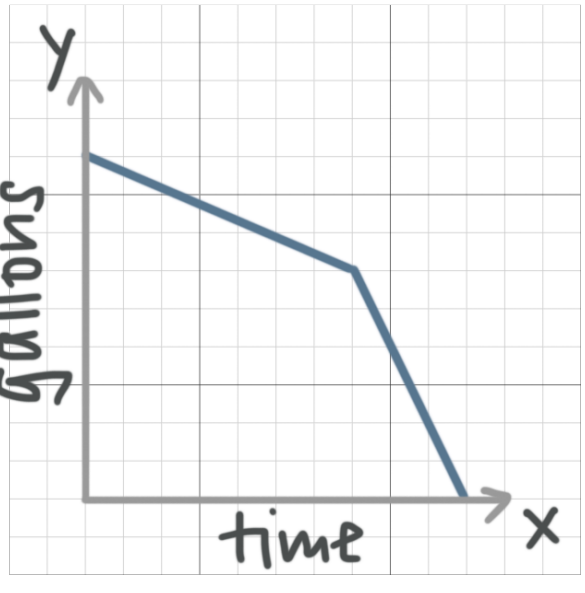
A



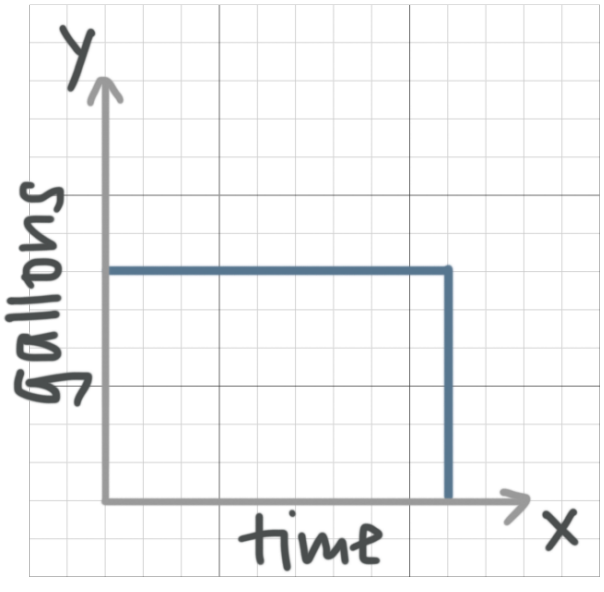
B



C



D



Solution: C

At first, the amount of gas in the tank is going down slowly, so the graph should have a mild negative slope.

After the stone knocks a hole in the tank, the amount of gas in the tank goes down faster, and the graph will show a steeper negative slope, eventually reaching 0 gallons.

The graph in answer choice C best fits this description.

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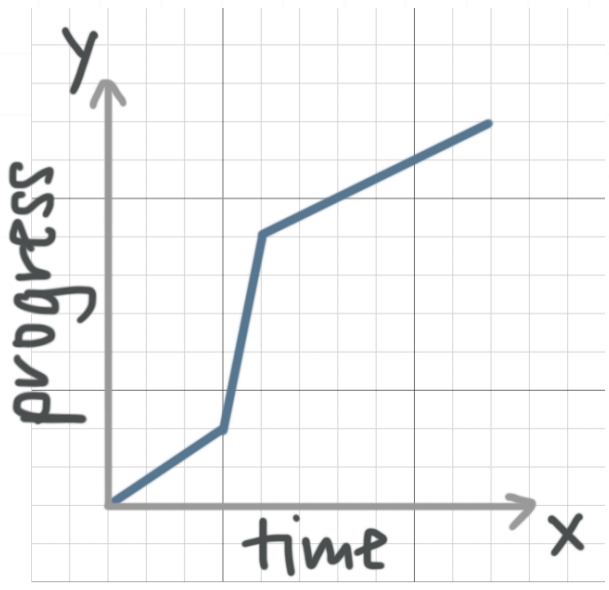
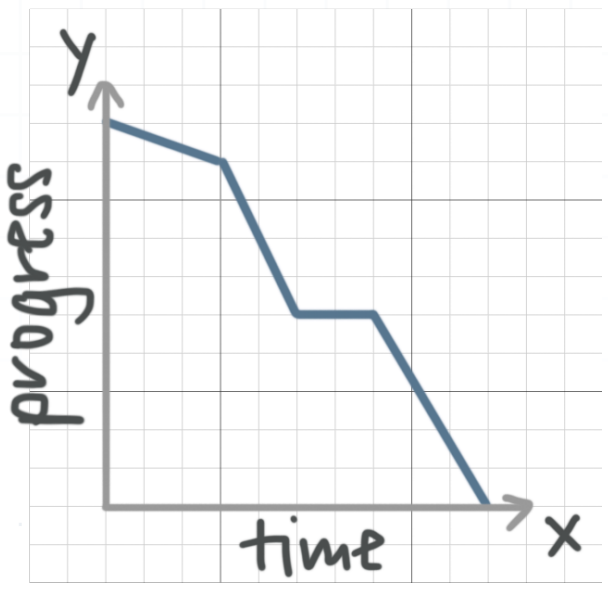
Question: A man starts to paint a large room. After an hour or so, he is joined by two other painters. An hour or so later, they all take a break for lunch. After lunch, they work for another couple of hours and finish the room. Which graph of painting progress vs. time best fits this description?

Answer choices:

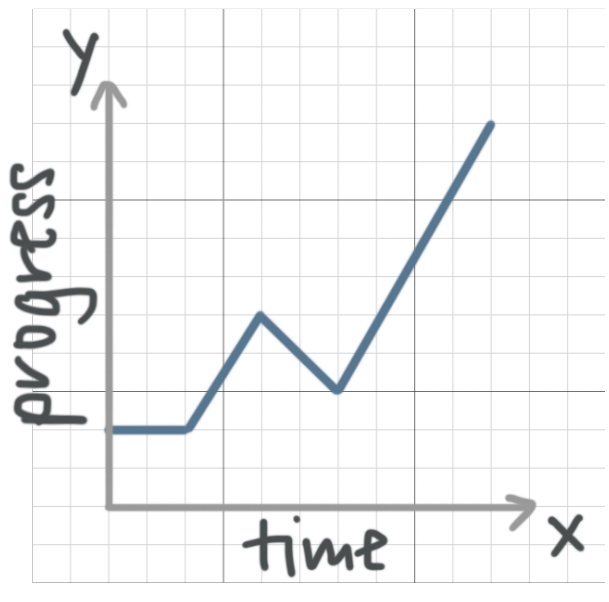
A



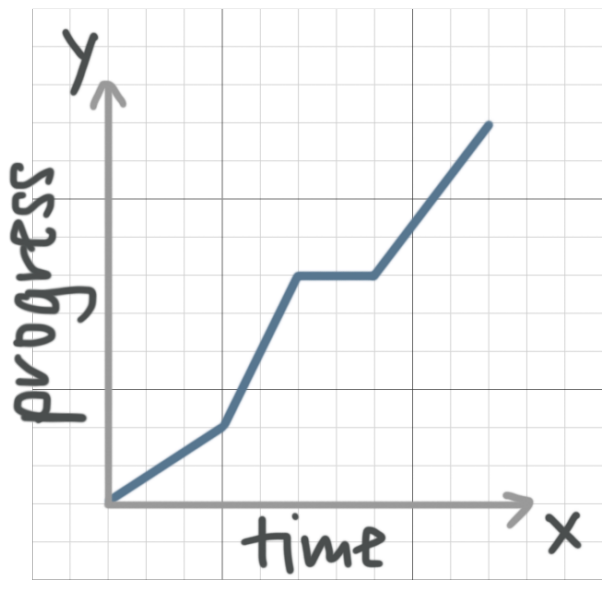
B



C



D



Solution: D

The graph must start at the None level. This immediately rules out answer choices B and C. Now consider the rate at which the painting is done in each part of the job.

1) One man working: The room is slowly getting painted, so the graph will have a positive slope. This would also rule out answer choices B and C.

2) Three men working: The room is getting painted faster now, so the graph will have a positive slope much steeper than in the first part. This would also rule out answer choice B.

3) Lunch time: The clock is ticking, but no painting is being done, so the graph will be horizontal here. This rules out answer choice A and would also rule out answer choice C.

4) Three men working again: The slope here should be the same as in the second part and will end at the Done level.

The graph in answer choice D satisfies all four criteria.

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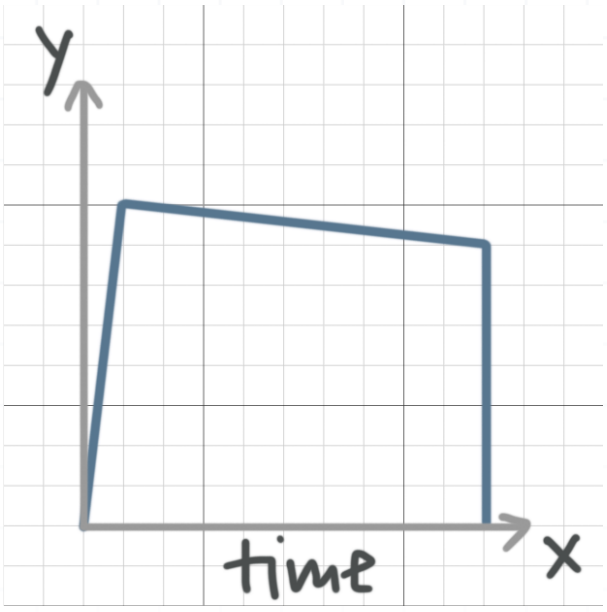
Question: Which of the following descriptions would best be represented by the graph?



Answer choices:

A The variable represented on the vertical axis is the depth of water in a bathtub. At time 0 the water is turned on and fills the tub at a normal rate. After the bathing is over, the tub suddenly cracks wide open and all the water runs out on the floor.

B The variable represented on the vertical axis is height above ground level. At time 0 a ball is dropped from a tall building, picking up speed all the way down. It bounces off the ground once and is caught after the bounce.

C The variable represented on the vertical axis is water temperature. There is an overnight rain. At time 0 (the next morning), the sun starts to warm a large puddle. After warming, it stays at a constant temperature until evening. Then it slowly cools back down.

D The variable represented on the vertical axis is the speed of an arrow. At time 0 the bow releases the arrow, causing it to go from stationary to a high speed very quickly. The arrow travels through the air for a time and then hits a tree and stops.

Solution: D

An important clue here is that the value of the variable represented on the vertical axis increases very suddenly (steep positive slope) at the at the start. This fact alone rules out answer choices A, B, and C. In answer choice A, water is flowing into the bathtub, but at a normal rate. In answer choice B, the ball is initially falling, so its height above ground level is initially decreasing (not increasing). In answer choice C, the temperature of the water in the puddle is initially increasing, but at a low rate.

That leaves only answer choice D. The almost-horizontal section of the graph in answer choice D represents the arrow speeding through the air at an almost constant speed, and the almost-vertical section at the end represents the arrow suddenly going to a speed of 0.