

# Exponential Functions (6 questions on STAAR)

## Write Exponential Functions (A9C)

Write exponential functions in the form  $f(x) = a(b)^x$  (where  $b$  is a rational number) to describe problems arising from mathematical and real-world situations, including growth and decay

I can...

- Write an exponential function from a pure mathematical situation
- Write an exponential function from a real world situation

### Notes:

$$f(x) = a(b)^x$$

↑  
beginning

↙ how it changes  
b is smaller than 1  
exp. decay

↘ b is bigger than 1  
exp. growth

Exponential growth:  $1 + \%$  change

Exponential decay:  $1 - \%$  change

### Sample Questions

17 There are 1,024 players in a tennis tournament. In each round, half the players are eliminated. Which function can be used to find the number of players remaining in the tournament at the end of  $x$  rounds?

A  $f(x) = 1,024(1.50)^x$

**B**  $f(x) = 1,024(0.50)^x$

C  $f(x) = 1,024(1.05)^x$

D  $f(x) = 1,024(0.05)^x$

The table contains some points on the graph of an exponential function.

$x$	$q(x)$
0	0.0625
1	0.25
2	1
3	4

Based on the table, which function represents the same relationship?

A  $q(x) = (0.25)^x$

B  $q(x) = 256(0.25)^x$

**C**  $q(x) = 0.0625(4)^x$

D  $q(x) = 0.5(4)^x$

The cost of a new television is \$948. If the value of the television decreases by 4.5% every year, which function models the value of this television  $x$  years after it was purchased?

A  $t(x) = 948(0.955)^x$

$4.5\% = .045$

~~B  $t(x) = 0.955(948)^x$~~

$1 - .045 = .955$

~~C  $t(x) = 0.55(948)^x$~~

D  $t(x) = 948(0.55)^x$

33 In the year 1900, the total number of metric tons of copper produced in the world was 495,000. Each year since 1900, the total number of metric tons of copper produced has increased on average by about 3.25% over the amount produced the previous year.

*growth* → Which function models the total number of metric tons of copper produced in the year that is  $x$  years since 1900?

A  $c(x) = 495,000(1.0325)^x$

$3.25\%$

B  $c(x) = 495,000(0.9675)^x$

$.0325$

~~C  $c(x) = 495,000 \times 1.0325$~~

$1 + .0325 = 1.0325$

~~D  $c(x) = 495,000 \times 0.9675$~~

7 There were 417 cell phones sold at an electronics store in January. Since then, cell phone sales at this store have increased at a rate of 3.75% per month. At this rate of growth, which function can be used to determine the monthly cell phone sales  $m$  months after January?

A  $p(m) = 417(0.0375)^m$

*growth*

B  $p(m) = 417(1.0375)^m$

$3.75\%$

~~C  $p(m) = 417(0.9625)^m$~~

$.0375$

~~D  $p(m) = 417(0.0375)^m$~~

$1 + .0375 = 1.0375$

40 The table contains some points on the graph of an exponential function.

x	y
0	0.0625
1	0.25
2	1
3	4

← start

Based on the table, which function represents the same relationship?

F  $q(x) = (0.25)^x$

G  $q(x) = 256(0.25)^x$

**H**  $q(x) = 0.0625(4)^x$

J  $q(x) = 0.5(4)^x$

15 A particular type of cell doubles in number every hour. Which function can be used to find the number of cells present at the end of  $h$  hours if there are initially 4 of these cells?

A  $n = 4\left(\frac{1}{2}\right)^h$

**B**  $n = 4(2)^h$

C  $n = 4 + (2)^h$

D  $n = 4 + \left(\frac{1}{2}\right)^h$

35 The amount of fertilizer in a landscaping company's warehouse decreases at a rate of 3% per week. The amount of fertilizer in the warehouse was originally 78,000 cubic yards.

↓ decay

Which function models the amount of fertilizer in cubic yards left after  $w$  weeks?

↑  
start

A  $f(w) = 0.97(78,000)^w$

B  $f(w) = 1.03(78,000)^w$

**C**  $f(w) = 78,000(0.97)^w$

D  $f(w) = 78,000(1.03)^w$

3%

0.03

$1 - 0.03 = \underline{\underline{.97}}$

## Graph Exponential Functions (A9D)

**Graph exponential functions that model growth and decay and identify key features, including y-intercept and asymptote, in mathematical and real-world problems**

I can...

- Graph exponential growth and decay functions
- Identify features of exponential graphs - y-intercept and asymptote
- Graph exponential functions that model real world problems

**Notes:**

y-intercept -

$$y = a(b)^x$$

↑  
y-int → where line crosses y-axis

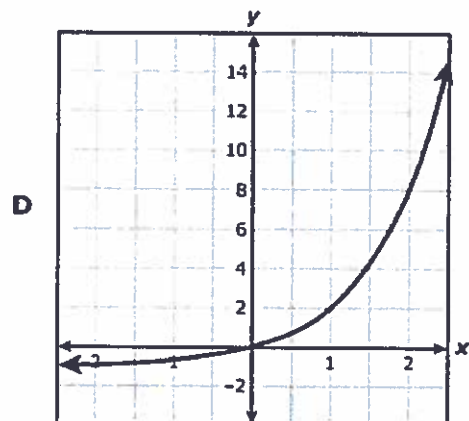
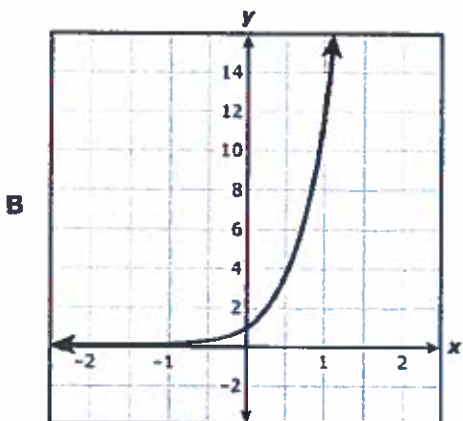
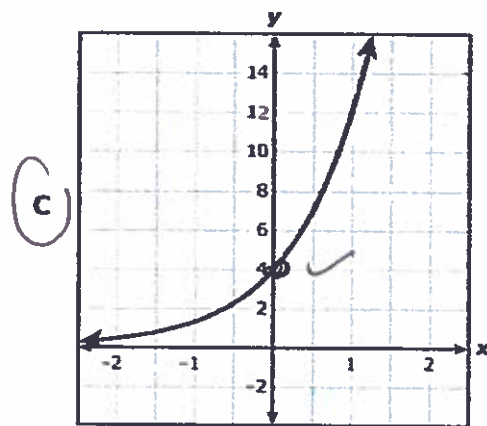
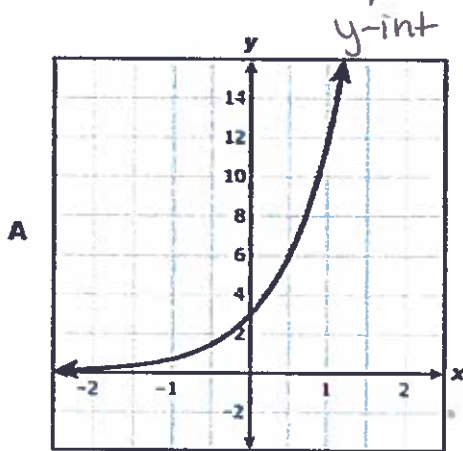
asymptote - line that graph gets close to but will never cross

always y=0 ← - - - - - →

### Sample Questions

Which graph represents  $y = 4(3)^x$ ?

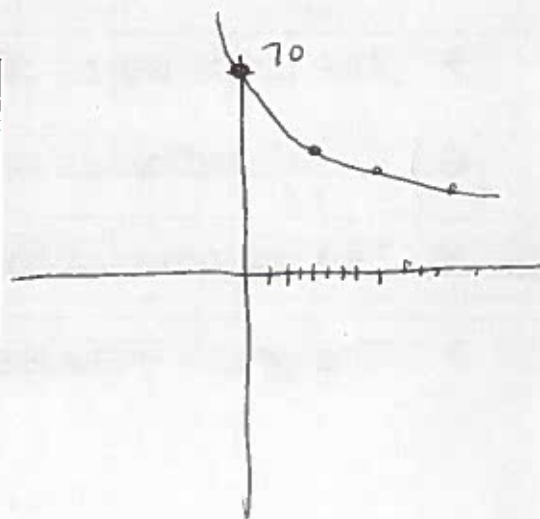
OR put into Graph





The table represents some points on the graph of the exponential function that models the radioactive decay of a sample of xenon-135.

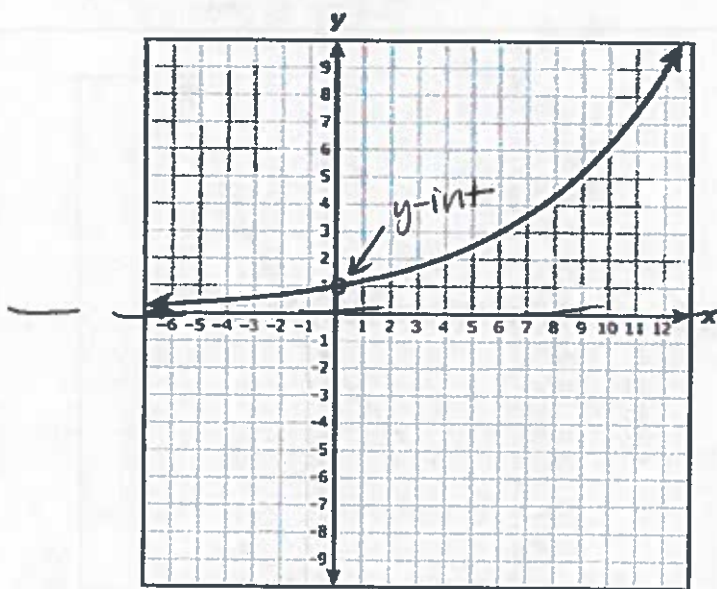
Time, $x$ (hours)	Mass, $y$ (grams)
0	70
4.6	49.5
9.2	35
13.8	24.7
18.4	17.5



Which statement about the graph of this function is true?

- A There is an asymptote at  $y = 70$ . ~~X~~
- B** The  $y$ -intercept is located at  $(0, 70)$ . ✓
- C There is an asymptote at  $x = 0$ . ~~X~~
- D The  $x$ -intercept is located at  $(70, 0)$ .

The graph of an exponential function is shown on the grid.



What appear to be the  $y$ -intercept and the equation of the asymptote of the graph?

- A  $y$ -intercept:  $\frac{1}{3}$  ~~X~~  
asymptote:  $y = 0$
- B**  $y$ -intercept: 1 ✓  
asymptote:  $y = 0$
- C  $y$ -intercept:  $\frac{1}{3}$  ~~X~~  
asymptote:  $x = 12$
- D  $y$ -intercept: 1 ✓  
asymptote:  $x = 12$

///

4 Which statement about the graph of  $y = 8(0.25)^x$  is true?

F The coordinates of the x-intercept are  $(0.25, 0)$ .

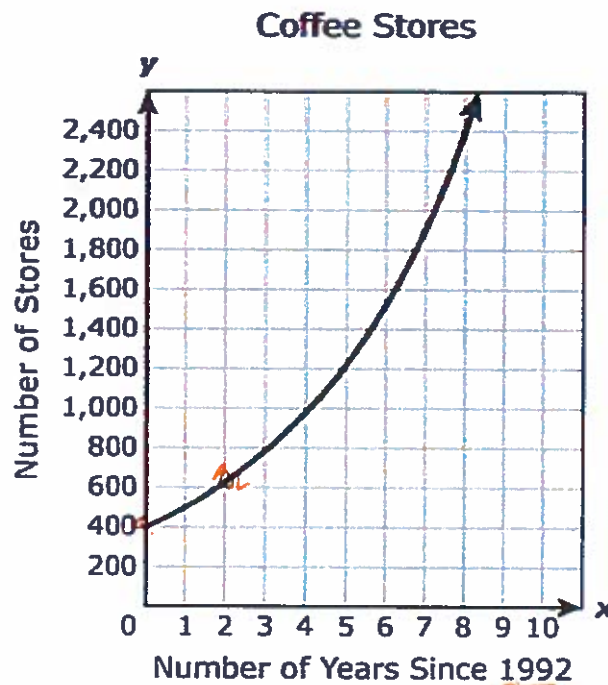
G The coordinates of the y-intercept are  $(0, 8)$ .

H The equation of the asymptote is  $x = 0$ .

J The graph includes the point  $(2, 1)$ .

or go to  
Graph  
→ look at  
Table

The number of stores opened by a coffee company can be modeled by the exponential function graphed on the grid, where  $x$  is the number of years since 1992.



Based on the graph, which statement does NOT appear to be true?

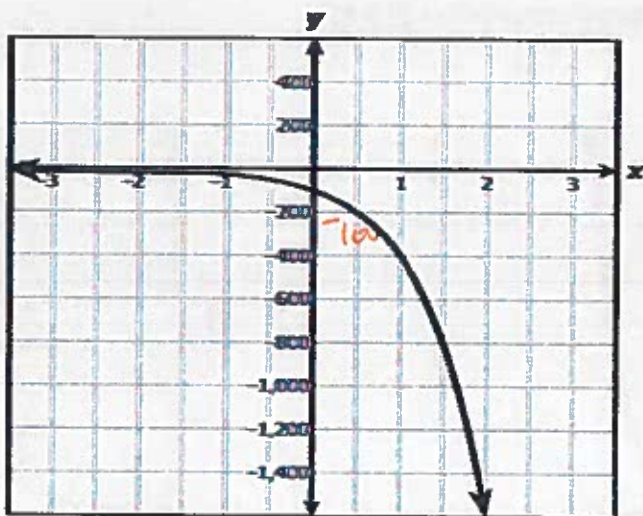
A The coffee company had opened 400 stores by the end of 1992.

B The coffee company opened 100 stores in one year.

C Every year the number of stores the coffee company opened increased by 25%.

D Since 1992 the coffee company has opened 250 stores each year.

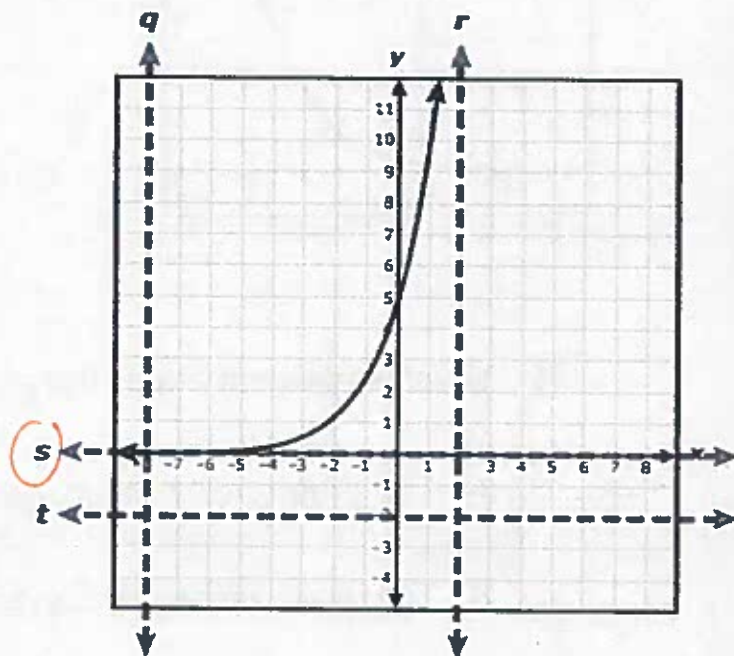
The graph of an exponential function is shown on the grid.



Which function is best represented by the graph?

- A  $f(x) = -100(4)^x$
- B  $f(x) = -200(2)^x$
- C  $f(x) = -50(4)^x$
- D  $f(x) = -400(2)^x$

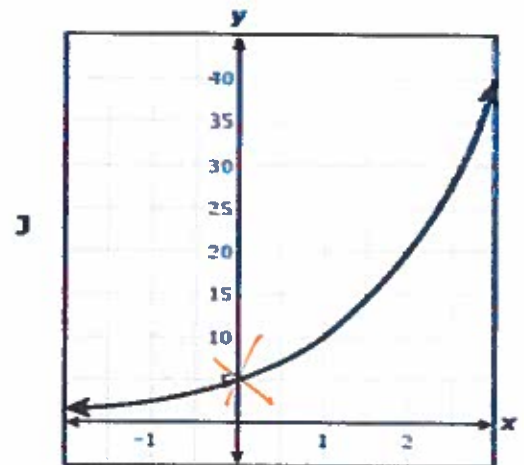
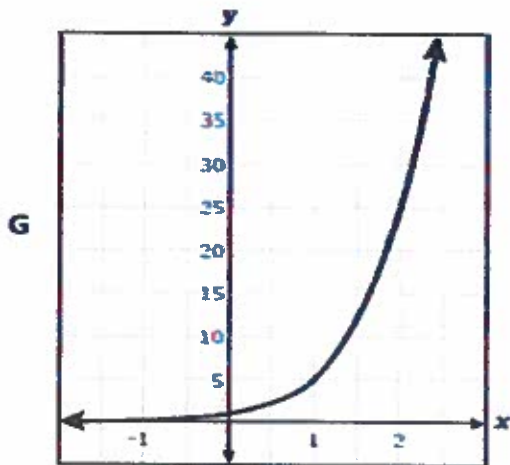
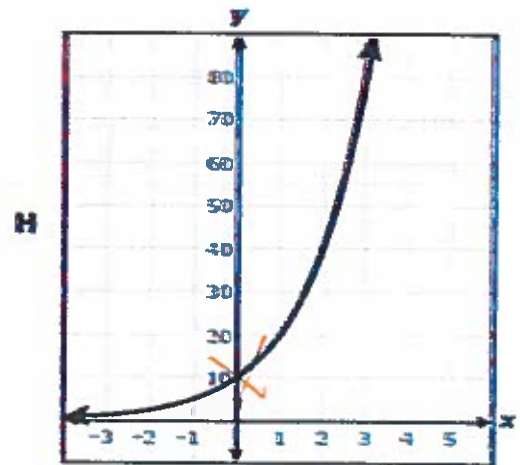
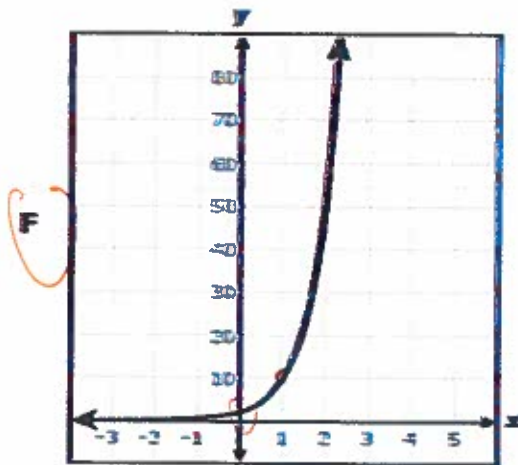
8 The graph of an exponential function is shown on the grid.



Which dashed line is an asymptote for the graph?

- F Line  $q$
- G Line  $r$
- H Line  $s$
- J Line  $t$

40 Which graph best represents  $f(x) = 2(5)^x$ ?



49 Which statement about the graph of  $y = \frac{1}{3}\left(\frac{2}{3}\right)^x$  is true?

- A The graph has a vertical asymptote.
- B The graph crosses the y-axis at  $(0, \frac{2}{9})$ .
- C The graph has an asymptote at  $y = \frac{1}{3}$ .
- D** The graph decreases from left to right.



## Domain and Range of Exponential Functions (A9A)

Determine the **domain/range of exponential functions** of the form  $f(x) = ab^x$  and represent the domain and range using inequalities

I can...

- Write domain and range of an exponential graph in inequality notation
- Write domain and range of an exponential graph given in a real world situation

### Notes:

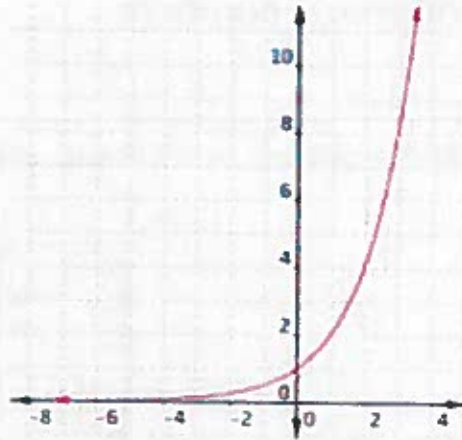
**x** Domain: left to right

**y** Range: bottom to top

\*If given a graph (no real world problem)

Domain: always  $-\infty < x < \infty$   
all real #s  $\mathbb{R}$

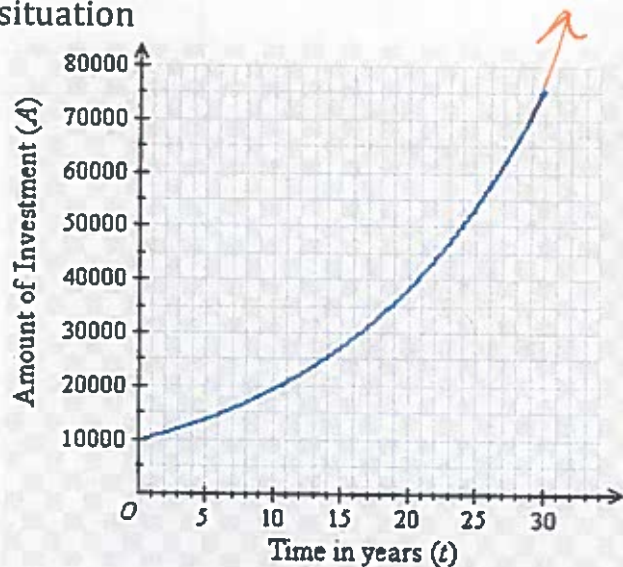
Range: always  $0 < y < \infty$



\*If given a graph that involves real world situation

Domain:  $0 < x < \infty$

Range:  $10,000 < y < \infty$



## Sample Questions

The table shows some points on the graph of exponential function  $g$ .

$x$	0	1	2	3	4
$g(x)$	1	3	9	27	81

What is the range of  $g$ ?

~~A  $x > 0$~~

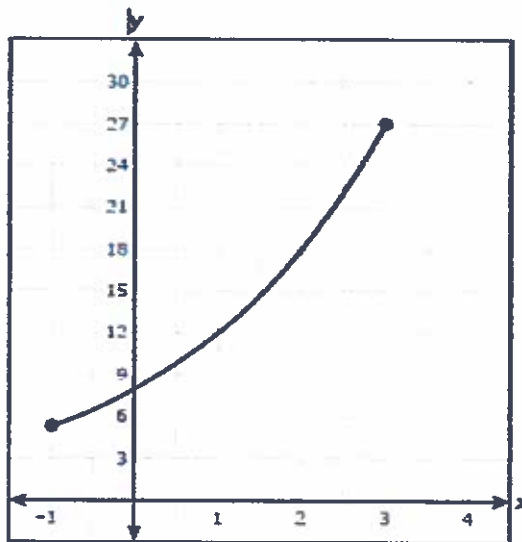
B All real numbers

C  $g(x) > 0$

D All whole numbers



23 What appears to be the domain of the part of the exponential function graphed on the grid?



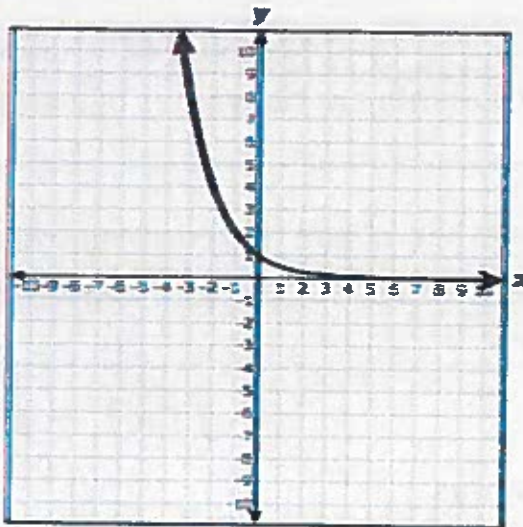
A  $-1 \leq x \leq 3$

B  $-1 \leq y \leq 3$

C  $5.3 \leq x \leq 27$

D  $5.3 \leq y \leq 27$

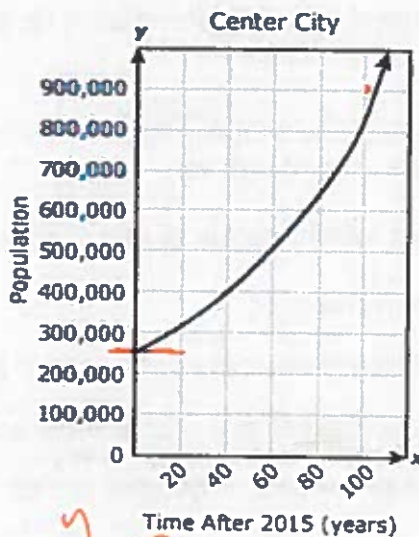
21 The graph of an exponential function is shown on the grid.



Based on the graph, which statement about the function is true?

- A The range is the set of all real numbers less than 0. ~~X~~
- B The domain is the set of all real numbers greater than -4. ~~X~~
- C The range is the set of all real numbers greater than 0. ✓
- D The domain is the set of all real numbers less than -4.

21 The population of Center City is modeled by exponential function  $f$ , where  $x$  is the number of years after the year 2015. The graph of  $f$  is shown on the grid.



Which inequality best represents the range of  $f$  in this situation?

- A  ~~$x \geq 0$~~
- B  $y \geq 250,000$
- C  ~~$0 \leq x \leq 110$~~
- D  $250,000 \leq y \leq 1,000,000$

*Handwritten note:* 250,000  $\leq y < \infty$

## Meaning of "a" and "b" (A9B)

Interpret the meaning of the values of a and b in exponential functions of the form

I can...

- Explain what "a" and "b" represent when given an equation, table, or situation

Notes:

$$f(x) = ab^x$$

*beginning*

*↖ bigger than 1 → growth*

*smaller than 1 → decay*

### Sample Questions

A stockbroker claimed that the value of a stock,  $v(t)$ , was expected to grow according to  $v(t) = 5,000(2)^t$ , where  $t$  is the time in years. Which of these is the best interpretation of what this function represents?

A Given an initial investment of \$10,000, the value of the stock is expected to increase by 2% every year.

**B** Given an initial investment of \$5,000, the value of the stock is expected to double every year.

C Given an initial investment of \$10,000, the value of the stock is expected to double every year.

D Given an initial investment of \$5,000, the value of the stock is expected to increase by 2% every year.

46 Scientists are studying a bacteria sample. The function  $f(x) = 245(1.12)^x$  gives the number of bacteria in the sample at the end of  $x$  days.

Which statement is the best interpretation of one of the values in this function?

F The initial number of bacteria is 12.

G The initial number of bacteria decreases at a rate of 88% each day.

**H** The number of bacteria increases at a rate of 12% each day.

J The number of bacteria at the end of one day is 245.

31 A student used  $f(x) = 5.00(1.012)^x$  to show how the balance in a savings account will increase over time. What does the 5.00 represent?

A The interest the savings account earned for the first year

B The annual interest rate of the savings account

C The number of years the savings account has earned interest

**D** The starting balance of the savings account