

Mathematics I Resources for EOC Remediation

F.BF – Building Functions:

HSF-BF.A.1

HSF-BF.A.2

HSF-BF.B.3

The information in this document is intended to demonstrate the depth and rigor of the Nevada Academic Content Standards. The items are **not** to be interpreted as indicative of items on the EOC exam. These are a collection of standard-based items for students and **only** include those standards selected for the Math I EOC examination.

BF Building Functions Cluster

HSF-BF.A.1 Write a function that describes a relationship between two quantities.*

HSF-BF.A.1.a Determine an explicit expression, a recursive process, or steps for calculation from a context.

1. If a function is defined recursively by $f(0) = 2$ and $f(n + 1) = f(n) + \frac{3}{2}$ for $n \geq 0$, find $f(2)$.

Answer: 5

2. The first 4 figures in a pattern are shown below.



Part 1: What is the number of dots in Figure 6?

Part 2: Write a function to represent the pattern.

Answer: **Part 1:** 21, **Part 2:** $f(1) = 1, f(n) = f(n - 1) + 4, n \geq 2$ or $f(n) = 4n - 3$

3. The McCoy family has joined a yoga studio that has an initial membership fee of \$225. There is a monthly cost that is p percent of the initial membership fee.

Part 1: Write a function that describes the total amount of money the McCoy family would spend after y years as members of the yoga studio.

Part 2: How much would the McCoy's save if, after 5 years as members, the monthly cost was 25% of the initial fee instead of 28% of the initial fee?

Answer: **Part 1:** $f(y) = 225 + 12(225p)y = 225 + 2700py$, or $f(y) = 225 + 12y(225p)$,
Part 2: \$405

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4. The explicit function rule below describes a sequence of numbers: $f(n) = 17 - 4n$ for $n \geq 1$. Which of the following shows a recursive function rule that describes the sequence of numbers?
- A. $f(1) = 21; f(n) = f(n-1) - 4$
B. $f(1) = 21; f(n) = f(n-1) + 4$
C. $f(1) = 17; f(n) = f(n-1) - 4$
D. $f(1) = 17; f(n) = f(n-1) + 4$

Answer: C

5. Which of these shows the correct recursive function and the correct explicit function for the table of values?

1	2	3	4
-23	-30	-37	-44

- A. Recursive: $f(n) = -7n - 16$, for $n \geq 1$
Explicit: $f(n) = f(n-1) - 7$; $f(1) = -23$
- B. Recursive: $f(n) = f(n-1) - 44$; $f(1) = -23$
Explicit: $f(n) = -7n - 16$, for $n \geq 1$
- C. Recursive: $f(n) = f(n-1) - 7$; $f(1) = -23$
Explicit: $f(n) = -7n - 16$, for $n \geq 1$
- D. Recursive: $f(n) = f(n-1) - 7$; $f(1) = -23$
Explicit: $f(n) = -7n - 24$, for $n \geq 1$

Answer: C

6. The FEMA medical disease team arrived in the city of Las Vegas 26 months after the deadly plague, when the current population was down to 118,400. They learned that the population was 420,700 six months after the plague started. The same number of people died every month as a result of the plague.

Part 1: Determine the initial population of Las Vegas.

Part 2: How many people will still be alive in Las Vegas after seven more months? Nine more months?

Answer: Part 1: (6, 420,700), (26, 118,400); rate of change = -15,115;

$420,700 + 6(15,115) = 511,390$ - The initial population of Las Vegas was 511,390.

Part 2: $118,400 - 7(15,115) = 12,595$. After 7 more months the population will be 12,595. $118,400 - 9(15,115) = -17,635$. After 9 more months, the population will be negative, so no more people will exist in Las Vegas.

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7. A family went on a vacation in a motorhome. They traveled 225 miles on the first day. Every day after this, they planned to drive 150 miles a day so they could spend time sightseeing.
- What is $f(1)$?
 - What is the common difference?
 - Write an explicit function rule for the situation.
 - After traveling for two weeks, how many miles did the family travel.

Answer: A. $f(1) = 225$, B. The common difference is 150,
C. $f(n) = 225 + (n - 1)150$ or $f(n) = 75 + 150n$, for $n \geq 1$, D. 2175 miles

8. A sequence of numbers can be described using the recursive function rule below.

$$f(1) = 4, f(n) = (-2)f(n - 1)$$

Write the explicit function rule of this sequence and include its domain.

Answer: $f(n) = 4(-2)^{n-1}, n \geq 1$

9. Jose is beginning a 16-week training program to prepare for a sprint triathlon. He begins the first week by swimming 10 laps daily. Each week Jose increase his daily swim by 2 laps.

Part 1: Write an explicit function that represents the number of laps Jose swims per day each week.

Part 2: The sprint triathlon swim is equivalent to 42 laps in Jose's training pool. Will Jose meet the sprint triathlon swim distance by the end of his training program? Explain your reasoning mathematically.

Answer: Part 1: $f(n) = 10 + 2(n - 1), f(n) \geq 1$, **Part 2:** No, $f(16) = 40$ laps, not 42 laps.

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10. Consider this function given in recursive form:

- $f(1) = -2$
- $f(n) = 2 \cdot f(n - 1); n \geq 2$

Select the equivalent explicit function for $n \geq 1$.

- A. $f(n) = -2(n)$
- B. $f(n) = -1(2)^n$
- C. $f(n) = -2(n-1)$
- D. $f(n) = -1(2)^{n-1}$

Answer: B

11. A bamboo plant is 3 inches tall when Karl buys the plant. The plant grows 2 inches each week. Which function(s) shown below can be used to determine the height, $f(n)$, of the bamboo plant in n weeks?

- I. $f(n) = 2n + 3$
- II. $f(n) = 2n + 3(n-1)$
- III. $f(n) = f(n-1) + 2$ where $f(0) = 3$

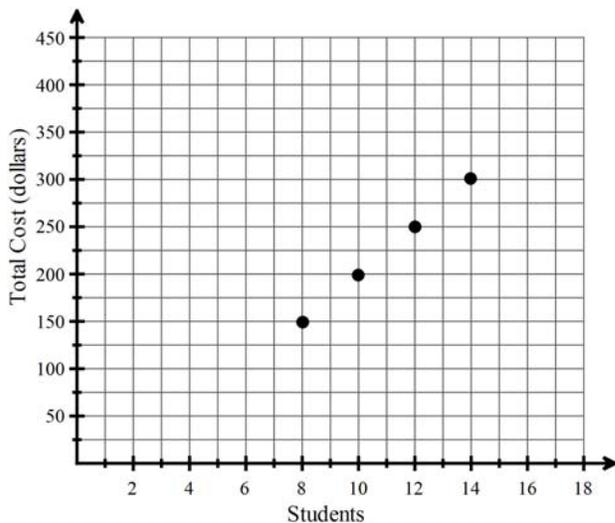
- A. I only
- B. II only
- C. III only
- D. I and II
- E. I and III
- F. II and III
- G. I, II, and III

Answer: E

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HSF-BF.A.2 Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.*

1. The graph below shows how the cost of a field trip varies depending on the number of students who attend.



Write the recursive rule to model the total cost of the field trip.

Answer: $a_1 = 25; a_n = a_{n-1} + 25, \text{ for } n \geq 1$

2. A plumber charges a one-time fee of \$40 plus an additional \$59 per hour worked. Write the recursive rule that models the total cost for the plumber's services in dollars, for n , number of hours.

Answer: $f(1) = 99, f(n) = f(n-1) + 59, n \geq 2$

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3. **Part 1:** Given the following table, select the row that creates a geometric sequence.

x	1	2	3	4
$f(x)$	-45	-38	-31	-24
$g(x)$	236	132	66	33
$h(x)$	$\frac{1}{2}$	$\frac{5}{4}$	$\frac{4}{2}$	$\frac{11}{4}$

Part 2: Based on the sequence selected in PART 1, write the explicit form of the geometric sequence and find the next term.

Answer: **Part 1:** $g(x)$, **Part 2:** $g(n) = 236 \cdot \frac{1}{2}^{(n-1)}$

4. Given the sequence defined by the formula: $a(1) = \frac{1}{3}$; $a(n) = 3 \cdot a(n - 1)$

Part 1: Identify the type of formula.

- A. Arithmetic – Recursive formula
- B. Arithmetic – Explicit formula
- C. Geometric – Recursive formula
- D. Geometric – Explicit formula

Part 2: If you identified the formula as recursive, then write the explicit formula. If you identified the formula as explicit, then write the recursive formula.

Answer: **Part 1:** C, **Part 2:** $a(n) = (\frac{1}{3})(3)^{n-1}$

5. **Part 1:** Given two terms in a geometric sequence find the explicit formula and the recursive formula. $a_6 = 486$ and $a_1 = 2$

Part 2: Explain how the sequence is increasing or decreasing and what type of real-world application could this have.

Answer: **Part 1:** Explicit: $a_n = 2 \bullet 3^{n-1}$, Recursive: $a_n = a_{n-1} \bullet 3$, $a_1 = 2$

Part 2: The sequence is increasing threefold from term to term. The real-world examples will vary. One example could be a start-up stock that increases by a factor of three for the first 6 days of its release.

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6. **Part 1:** Determine which of the following correctly represents a geometric sequence.

- A. -1, 1, 3, 5, ... B. -4, 0, 4, 8...
- C. 0, 1, 2, 3... D. 8, 4, 2, 1...

Part 2: Based on the sequence selected in Part A, find the fifth term, the eighth term, and the n th term of the geometric sequence.

Answer: Part 1: D, **Part 2:** $\frac{1}{2}$, $\frac{1}{16}$, $a_n = 8\left(\frac{1}{2}\right)^{n-1}$

7. As part of your New Year's resolution, you start a holiday savings account with a deposit of \$10. You increase each monthly deposit by \$5 until the end of the year.

- A. Write a recursive and explicit formula for the sequence of **deposits**.
- B. Write the amount in the account after each deposit.
- C. How much money will you have saved by the end of the year?

Answer:

A. Recursive formula: $f(n) = f(n - 1) + 5$, $f(1) = 10$

Explicit formula: $f(n) = 5n + 5$, for $n \geq 1$

B.

MONTH	DEPOSIT	BALANCE
January	\$10	\$10
February	\$15	\$25
March	\$20	\$45
April	\$25	\$70
May	\$30	\$100
June	\$35	\$135
July	\$40	\$175
August	\$45	\$220
September	\$50	\$270
October	\$55	\$325
November	\$60	\$385
December	\$65	\$450

C. You will save \$450 by the end of the year.

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8. Amy's Halloween candy collection amount is a function of how many streets she can cover on a Spooky Halloween night. The first block she covers is only one house – her own house – and her mother starts her off with some candy, giving her 10 pieces of candy. Amy then heads to the next block and collects the same amount of candy on each street, roughly 55 pieces of candy.

Part 1: Write a recursive rule to represent Amy's Halloween candy collection.

Part 2: Make a table to find Amy's amount of candy after 6 blocks.

Answer: Part 1: $f(1) = 10, f(n) = f(n-1) + 55$

Part 2:

Number of Blocks	Amount of candy
1	10
2	65
3	120
4	175
5	230
6	285

9. Quagga mussels are appearing in Toxic Lake. At first count, there were 10 quagga mussels. At the second count, there were 30 mussels. At third count, there were 50 mussels, and at 4th count, there were 70 quagga mussels.
- Make a data table showing this relationship.
 - Write a recursive formula for this relationship.
 - Write an explicit formula for this relationship.
 - How many mussels would be expected on the 45th count?
 - How many mussels would be expected for a_0 ? Interpret this value in context.

Answer: A.

n	1	2	3	4	45
a_n	10	30	50	70	?

- B. $a_n = a_{n-1} + 20$
 $a_1 = 10$
- C. $a_n = 10 + 20(n-1)$
- D. $a_n = 10 + 20(n-1)$
 $a_{45} = 10 + 20(45-1)$
 $a_{45} = 890$
- E. $a_0 = -10$ This means that there were not any quagga mussels.

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10. The Ford Dealership has their cars on display in rows. The first row has seven cars in it and each subsequent row has 3 more cars than the previous row. How many cars are in the seventh row? How many total cars are in the lot if there are only 7 rows? Find the explicit formula to represent this scenario.

Answer: 25 cars; 112 cars; the explicit formula is $a_n = 7 + (n-1)3$ or $a_n = 3n + 4$

11. $h(x)$ is an exponential function with an initial value of -4 and a common ratio of $\frac{1}{6}$. Write the explicit and recursive rule for $h(x)$ and find the first five terms of the sequence.

Answer: Explicit rule: $a_n = -4\left(\frac{1}{6}\right)^{n-1}$ Recursive rule: $a_1 = -4, a_n = \left(\frac{1}{6}\right)a_{n-1}$

First five terms: $-4, -\frac{4}{6}, -\frac{1}{9}, -\frac{1}{54}, -\frac{1}{324}$

12. The formula below can be used to model which scenario?

$$a_1 = 3000$$

$$a_n = 0.80a_{n-1}$$

- A. The first row of a stadium has 3000 seats, and each row thereafter has 80 more seats than the row in front of it.
- B. A bank account starts with a deposit of \$3000, and each year it grows by 80%.
- C. The last row of a stadium has 3000 seats, and each row before it has 80 fewer seats than the row behind it.
- D. The initial value of a specialty toy is \$3000, and its value each of the following years is 20% less.

Answer: D

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13. Jordyn has been offered two different jobs as a slot machine repair technician. Caesars Palace’s offer starts at \$50,000 with 4% annual increases for the next 8 years. The Mirage has offered a starting salary of \$45,000 with a 7% annual increase for the next 8 years.
- Write the recursive and explicit forms for each job offer.
 - Build a table to reflect the annual income for the first eight years of each job offer.
 - At the end of eight years, which offer results in the highest annual salary?
 - Find the total income for all eight years for each job offer.
 - Which job should Jordyn accept. Justify your answer?

Answer:

- A. Caesars Palace - recursive: $a_n = a_{n-1} \cdot r^1; n \geq 2; a_1 = \$50,000$
 explicit: $a_n = 50,000 \cdot r^{n-1}$
- Mirage - recursive: $a_n = a_{n-1} \cdot r; n \geq 2; a_1 = \$45,000$
 explicit: $a_n = 45,000 \cdot r^{n-1}$

B.

year (n)	Caesars Palace	Mirage
1	50000.00	45000.00
2	52000.00	48105.00
3	54080.00	51424.25
4	56243.20	54972.52
5	58492.93	58765.62
6	60832.65	62820.45
7	63265.95	67155.06
8	65796.59	71788.76
Total	460711.31	460031.65

- The job at the Mirage will result in the highest annual salary.
- The total income after eight years at Caesars Palace will be \$460,711.31 and the total for the Mirage will be \$460,031.65.
- Answers may vary... *Sample Answer: She should accept the job offer at the Mirage since she will earn a higher annual salary and will have a better bargaining tool if she seeks a job elsewhere after the eight-year period.*

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14. The Sofa Queen Warehouse has their couches on display in rows. The first row has 5 couches in it and each subsequent row has 2 more couches than the previous row. How many couches are in the 6th row? How many couches are in the lot if there are only 6 rows? Write the explicit formula for the description as well as the linear function.

Answer: 15 sofas; 60 sofas; explicit formula: $a_n = 5 + (n-1)2$, for $n \geq 1$; function: $y = 2x + 5$

15. A new strain of demonic mutant bacteria is taking over Nevada. When first identified, there were 500 bacteria. After an hour, there were 1000 bacteria, then the next hour, there were 2000 bacteria, then 4000 bacteria. It only takes contact with four of the bacteria to kill a person.

- A. Is the sequence arithmetic or geometric? Justify your answer.
- B. Make a data table showing the sequence.
- C. Write an explicit formula for the sequence.
- D. Write a recursive formula for the sequence.
- E. What does a_0 represent? What is the value of a_0 ?

Answer:

- A. The sequence is geometric. The bacteria are doubling each hour. If you divide two consecutive terms, the quotient is always 2.

n	1	2	3	4	?
a_n	500	1000	2000	4000	?

B.

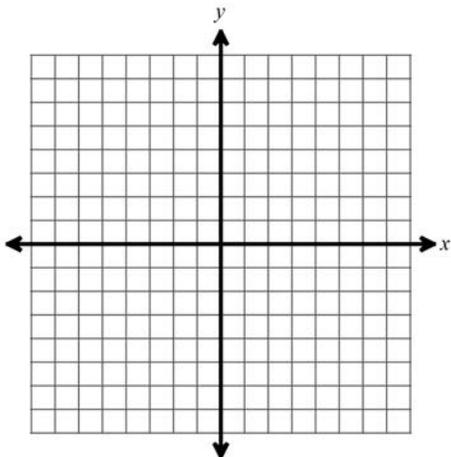
- C. $a_n = 500(2)^{n-1}$
 $f(n) = 500(2)^{n-1}$
- D. $a_1 = 500$
 $f(n) = f_{n-1}(2)$

- E. a_0 is 225. This represents the initial amount of bacteria present an hour before discovery.
-

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HSF-BF.B.3 Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k f(x)$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.

1. **Part 1:** Given the graph of the line represented by the equation $f(x) = -2x + b$, describe how the graph of the new line changes if b is increased by 4 units.
Part 2: Show your reasoning by graphing two different lines on the graph provided, one having a b -value that is 4 more than the other.



Answer: Part 1: The y -intercept of the new graph would be translated up 4 units.
Part 2: Answers will vary.

2. Given the functions below:
- $f(x) = a(x + 2) + 1$, where $a > 0$
 - $g(x) = a(x + 1) + 1$, where $a < 0$

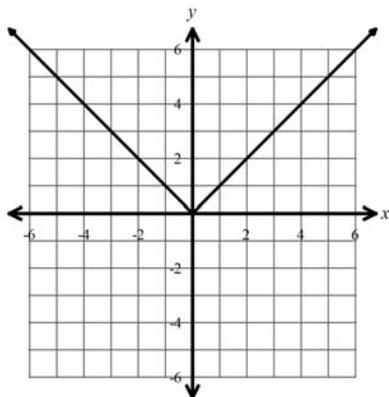
The statement: The slope of $f(x)$ is steeper than the slope of $g(x)$ is

- A. sometimes true.
- B. always true.
- C. never true.

Answer: A

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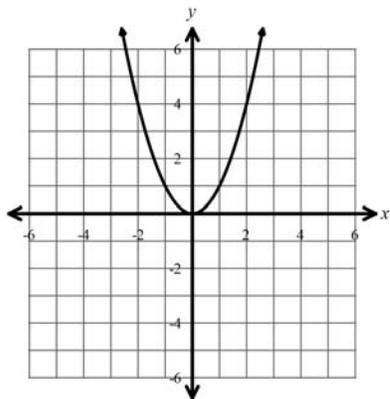
3. The graph of $g(x) = |x|$ is shown below.



Describe the transformation(s) required to graph $h(x) = \frac{1}{2}|x - 5| + 7$.

Answer: $g(x)$ must be transformed by a vertical compression by a factor of $\frac{1}{2}$, a vertical translation 7 units up, and a horizontal translation 5 units to the right.

4. The graph of $f(x) = x^2$ is shown below.



Describe the transformation(s) required to graph $g(x) = \frac{1}{4}(x + 3)^2 - 2$.

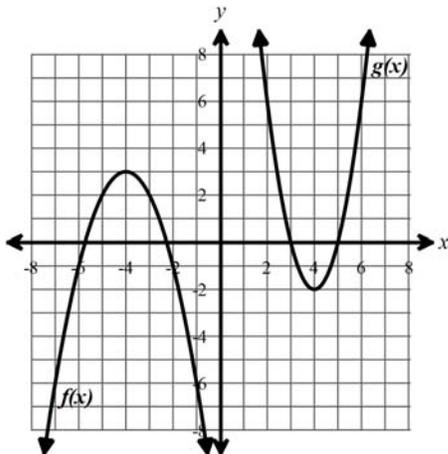
Answer: $f(x)$ must be transformed by a vertical compression by a factor of $\frac{1}{4}$, a vertical translation 2 units down, and a horizontal translation 3 units to the left.

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5. How does the graph of $f(x) = \frac{1}{2}(x + 1)^2 - 3$ compare to the graph of $g(x) = x^2$?
- A. The graph of $f(x)$ is vertically compressed compared to the graph of $g(x)$, and its vertex is translated to the right 1 unit and down 3 units.
 - B. The graph of $f(x)$ is vertically stretched compared to the graph of $g(x)$, and its vertex is translated to the left 1 unit and down 3 units.
 - C. The graph of $f(x)$ is vertically stretched compared to the graph of $g(x)$, and its vertex is translated to the right 1 unit and down 3 units.
 - D. The graph of $f(x)$ is vertically compressed compared to the graph of $g(x)$, and its vertex is translated to the left 1 unit and down 3 units.

Answer: D

6. Two functions, $f(x)$ and $g(x)$, are graphed below.



Part 1: Describe the transformation(s) required to map $f(x)$ onto $g(x)$.

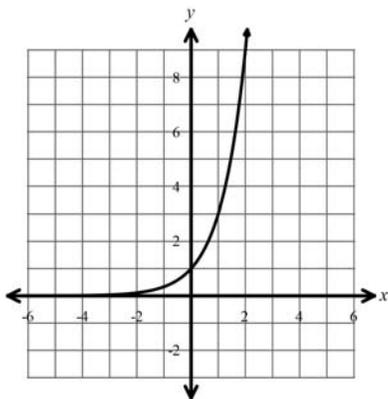
Part 2: What is the equation of $g(x)$?

Answer: Part 1: To map $f(x)$ onto $g(x)$ you have to translate the function to the right 8 units, reflect about the x -axis, vertically stretch by a factor of 2, and vertically translate it down 5 units.

Part 2: $g(x) = 2(x - 4)^2 - 2$

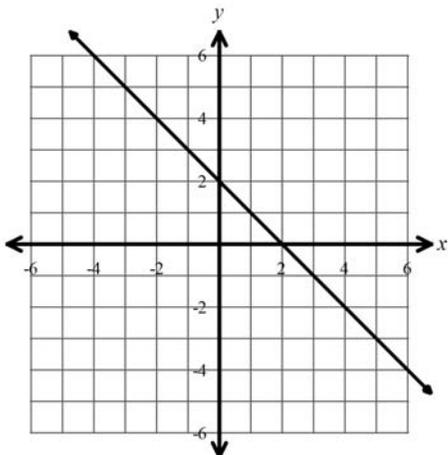
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7. Given the graph of $f(x)$ below, write a function $g(x)$ that reflects $f(x)$ across the y -axis.



Answer: $g(x) = \left(\frac{1}{3}\right)^x$

8. Given the graph of $f(x)$ below:



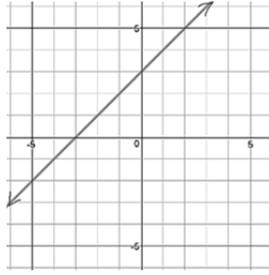
Part 1: The slope of $g(x)$ is not as steep as the slope of $f(x)$, but does have the same y -intercept. Write a possible equation for $g(x)$ and justify your answer.

Part 2: Given the function $g(x)$ from Part A, write the function $h(x)$ such that the slope is the same as $g(x)$ but has a vertical translation of -3 .

Answer: Part 1: Answers will vary, however, the slope should be $-1 < m < 1$ and the y -intercept must be 2. **Part 2:** Answers will vary, however, the slope should be the same as chosen for Part A, and the y -intercept must be -1 .

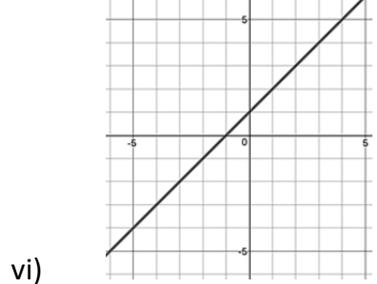
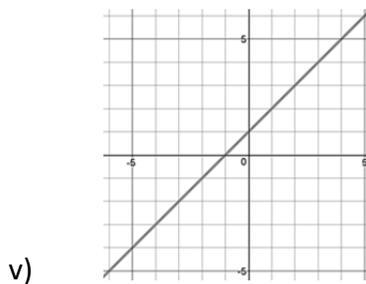
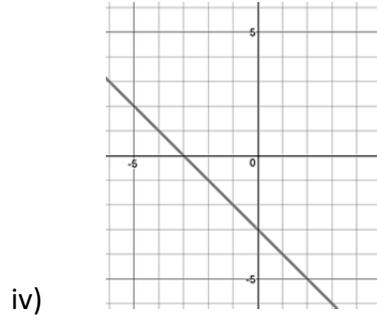
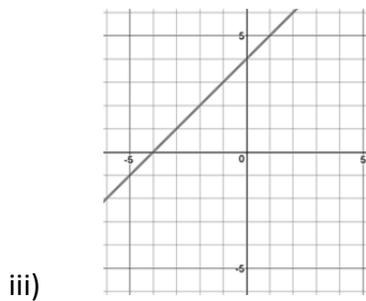
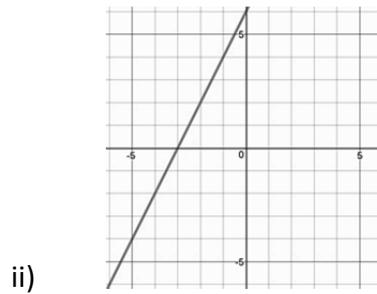
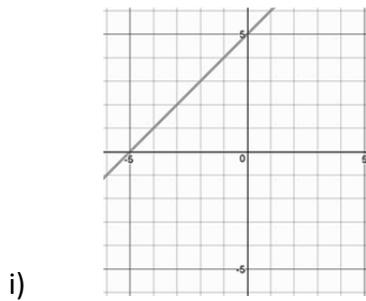
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9. Use the following graph of $f(x)$:



Match the graphs with each transformation below.

- A. $f(x) + 1$
- B. $f(x + 2)$
- C. $2f(x)$
- D. $f(x - 3) + 1$



Answer: A. iii, B. i, C. ii, D. vi