

## UNIT #11 – A FINAL LOOK AT FUNCTIONS AND MODELING REVIEW QUESTIONS

### Part I Questions

1. If a quadratic function,  $f(x)$ , has a turning point at  $(4, -5)$ , and  $g(x) = f(x-3) + 2$ , then where does  $g(x)$  have a turning point?

(1)  $(1, -3)$                       (3)  $(1, -7)$

(2)  $(7, -3)$                       (4)  $(7, -7)$

2. If  $f(x) = x + 10$  and  $g(x) = f(2x)$  then  $g(-3) =$

(1) 7                                  (3) -30

(2) 2                                  (4) 4

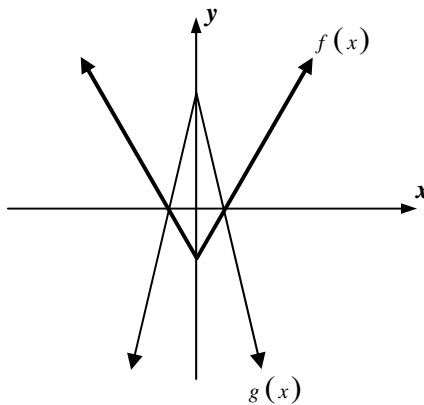
3. The graph of the function  $f(x)$  is shown below in bold. Which of the following would give a possible formula for the function  $g(x)$ ?

(1)  $g(x) = 3f(x)$

(2)  $g(x) = \frac{1}{2}f(x)$

(3)  $g(x) = -f(x)$

(4)  $g(x) = -2f(x)$



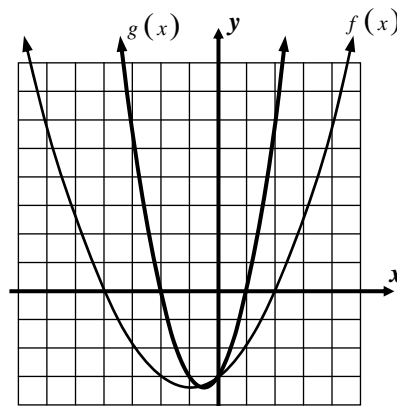
4. Given the two quadratic functions,  $f(x)$  and  $g(x)$ , shown below, which of the following equations shows the correct relationship between the two functions?

(1)  $g(x) = f(2x)$

(2)  $g(x) = 2f(x)$

(3)  $g(x) = f\left(\frac{1}{2}x\right)$

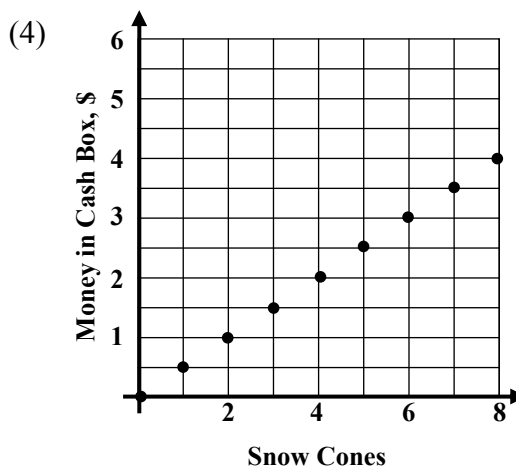
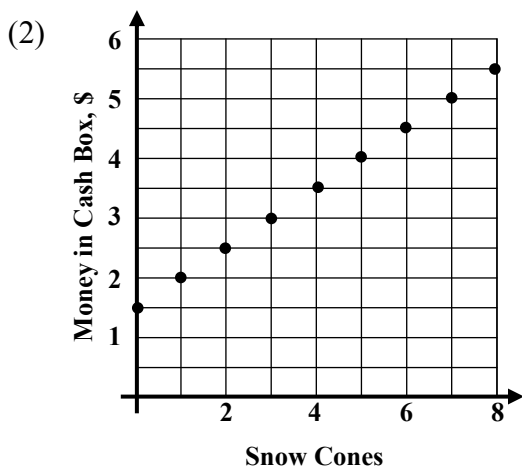
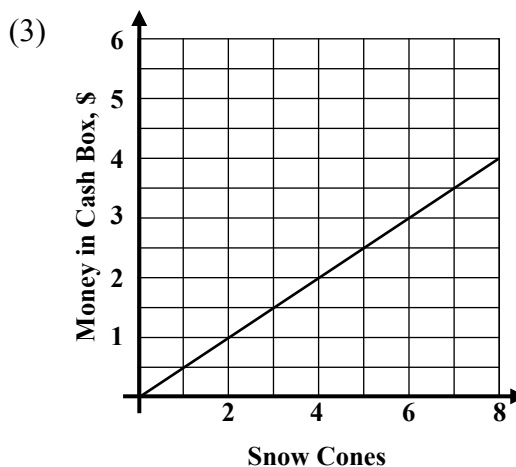
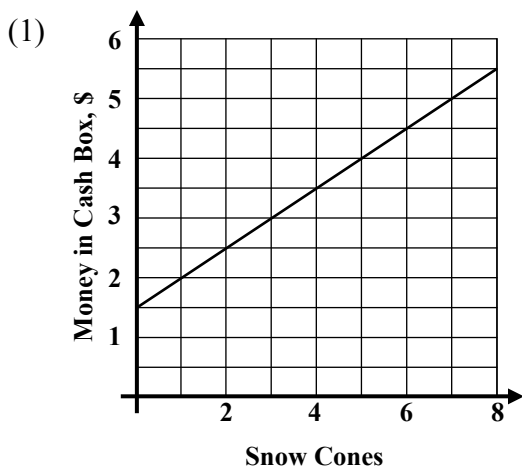
(4)  $g(x) = \frac{1}{2}f(x)$



5. Which of the following scenarios describes a discrete function?

- (1) The distance an object falls as a function of the time it has been falling.
- (2) The height of a mountain as a function of the location along a road.
- (3) The wait time for a park ride as a function of the number of people standing in line.
- (4) The volume of water in a pool as a function of the time it has been draining.

6. Franco starts with \$1.50 in his cash box and sells snow cones for 50 cents each. Which of the following graphs shows the amount of money in his box as a function of the number of snow cones he's sold?



7. A linear function models the depth of snowfall, in inches, as a function of the number of hours,  $h$ , since it started snowing. The equation is  $d = 0.25h + 2.25$ . We can interpret the equation as telling us

- (1) the snow fell at a rate of 0.25 inches per hour and started at a depth of 2.25 inches.
- (2) the snow fell at a rate of 2.25 inches per hour and started at a depth of 0.25 inches.
- (3) the snow fell at a rate of 1 inch each 0.25 hours and started at a depth of 2.25 inches.
- (4) the snow fell at a rate of 1 inch each 2.25 hours and started at a depth of 0.25 inches.

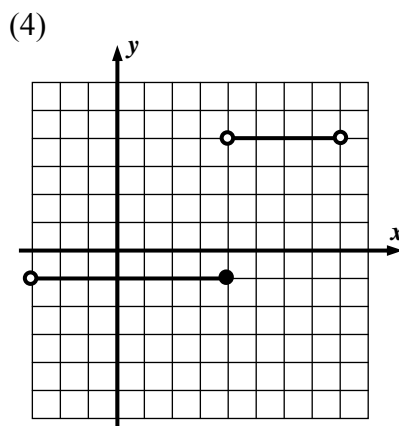
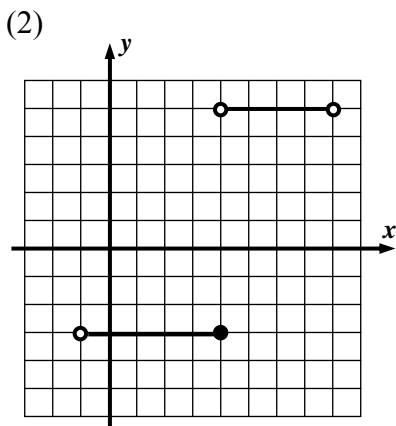
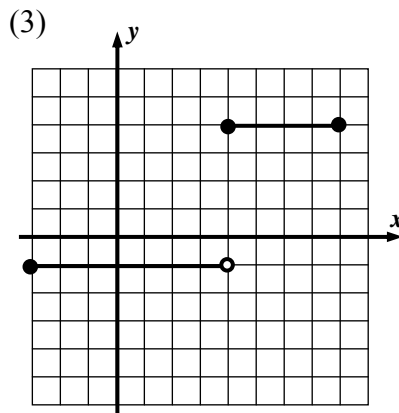
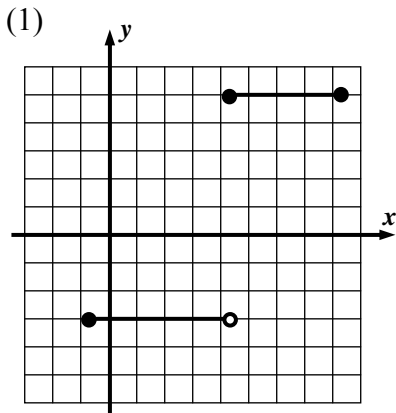


8. An exponential function has values shown in the table below, rounded to the nearest hundredth. If the equation for this exponential function was written in the form  $y = a(b)^x$ , then which of the following is closest to the value of  $b$ .

$x$	2	3	4	5	6
$y$	4.16	2.37	1.35	0.77	0.44

- (1) 0.73  
 (2) 1.38  
 (3) 1.76  
 (4) 0.57

9. Which of the following is the graph of the function  $f(x) = \begin{cases} -3 & -1 \leq x < 4 \\ 5 & 4 \leq x \leq 8 \end{cases}$ ?



10. Given the function  $f(x) = \begin{cases} 3x+1 & x < 2 \\ -6x+10 & x \geq 2 \end{cases}$ , what is its average rate of change over the interval  $1 \leq x \leq 5$ ?

- (1) -7  
 (2) -6  
 (3) 3  
 (4) 5



11. A ball was dropped from the top of a 50 foot tall building. Its height above the ground is given by the equation  $h = 50 - 16.1t^2$ , where  $t$  is the time it has been dropping in seconds.. Which of the following gives the time it takes for the ball to reach the ground?

- (1) 1.34 seconds                      (3) 1.89 seconds  
 (2) 1.76 seconds                      (4) 2.09 seconds

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12. A dart arcs through the air such that its height in feet above the ground can be modeled by the equation  $y = -0.1(x - 4)^2 + 7.5$ , where  $x$  represents its horizontal distance along the ground. What is the maximum height the dart reaches on its path?

- (1) 7.5                                      (3) 8.6  
 (2) 5.9                                      (4) 4

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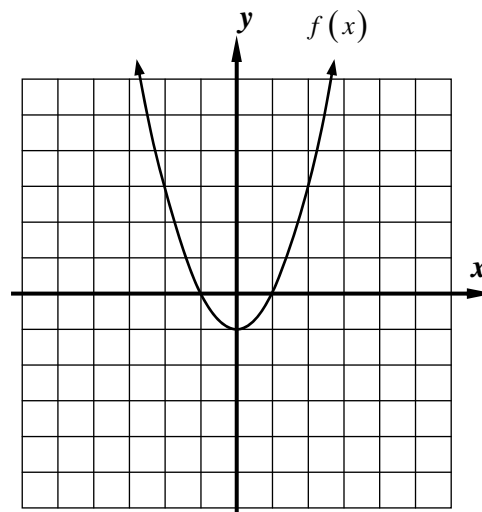
13. The precision of any model is

- (1) as good as its most precise input.  
 (2) as good as its least precise input.  
 (3) as good as the average precision of its inputs.  
 (4) independent of the precision of its inputs.

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**Free Response Questions**

14. Given the function  $f(x)$  shown graphed below. If  $g(x) = -2f(x)$  then sketch a graph of  $g(x)$  on the grid below.



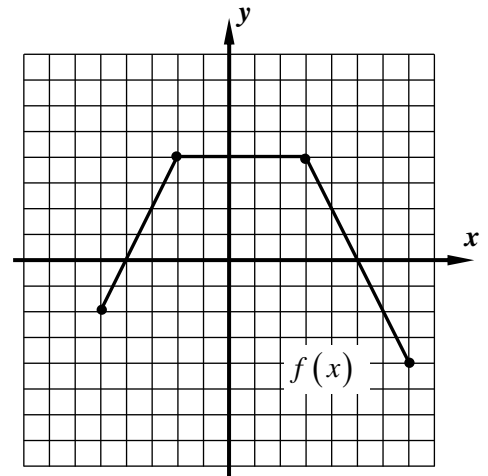
State the coordinates of the vertex of  $g(x)$ .



15. The function  $f(x)$  is shown below. The function  $g$  is defined by  $g(x) = f(2x)$ .

(a) Evaluate  $g(3)$ . Show how you came up with your answers.

(b) What are the zeroes of  $g(x)$ ? Explain how you arrived at your values.



16. A text plan charges a base price of \$10.00 per month and an additional \$0.05 per text. If  $y$  represents the cost of the text plan and  $x$  represents the number of texts sent then:

(a) Write a model for the cost,  $y$ , as a function of the number of texts,  $x$ .

(b) If the charge for a month of the texting was \$13.90, then determine algebraically how many texts were sent.

(c) Explain why this is an example of a discrete function.

17. Wildlife biologists model the population of wolves in a preserve using the equation  $w = 135(1.18)^t$ , where  $w$  is the number of wolves and  $t$  is the number of years since they were introduced into the preserve. Give interpretations of both the 135 and the 1.18 parameters in the exponential models.



18. The number of likes generated by a social media add are being tracked by an advertising firm. The total likes is shown in the table below as a function of the number of days since the add was first posted.

Days Since Posting, $x$	1	3	7	10	15
Number of likes, $y$	18	59	143	218	638

- (a) Create linear and exponential equations of best fit. Round all parameters to the nearest hundredth. Also state the correlation coefficients for both models.

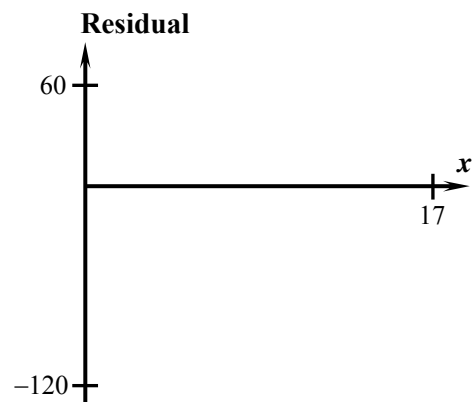
Linear:  $y = ax + b$

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

- (b) Explain why the exponential model should predict the number of likes better than the linear model?

- (c) For the exponential model, create a sketch of the residuals produced by this model.

- (d) Does the pattern of the residuals indicate that the exponential model is appropriate? Explain?



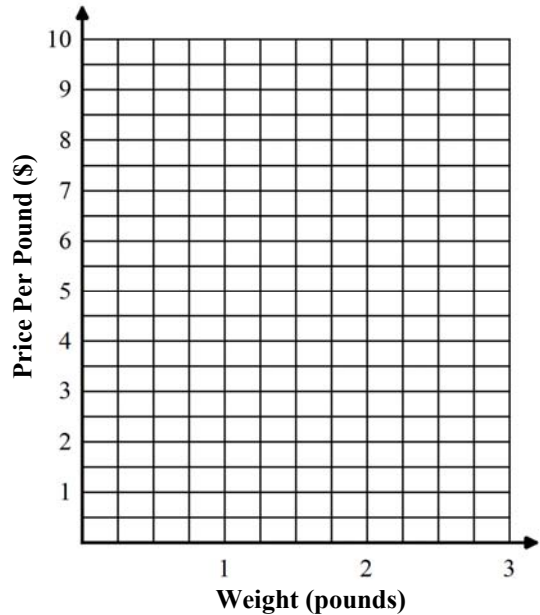
- (e) After 3 weeks, the add had generated 3,027 likes. Would the exponential model from (a) under predict or over predict the number of likes? By how many?



19. The per pound price of lobster varies with the weight of the lobster. Generally, the greater the weight of the lobster, the more you pay per pound for it. Cook's Lobster House has a lobster pricing structure given below:

$$p(w) = \begin{cases} \$6.00 & 0 \leq w < 1 \\ \$7.50 & 1 \leq w < 1\frac{1}{2} \\ \$8.25 & 1\frac{1}{2} \leq w < 2 \\ \$9.50 & w \geq 2 \end{cases}$$

where  $w$  is the weight of the lobster, in pounds, and  $p$  is the price per pound for the lobster.



(a) Graph this function on the axes provided.

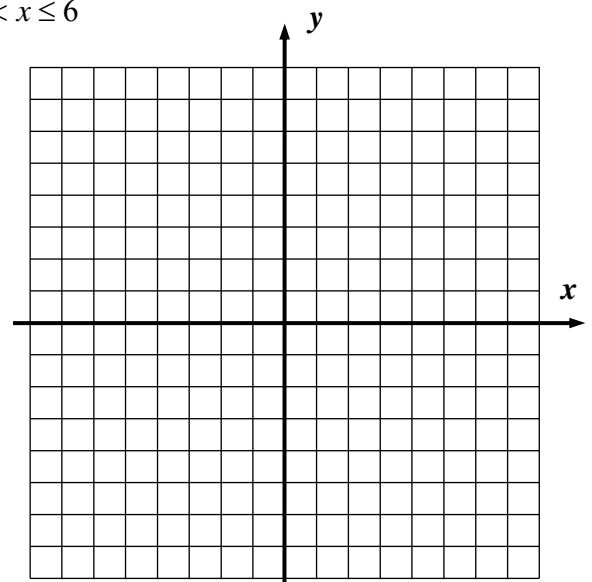
(b) Marty ordered a lobster that weighed in at  $1\frac{3}{4}$  pounds. How much did he pay for his lobster? Show the work that leads to your answer.

20. On the graph below, sketch the function  $f(x) = \begin{cases} \frac{3}{2}x + 6 & -6 \leq x \leq 0 \\ -x + 3 & 0 < x \leq 6 \end{cases}$

(a) Graph  $f(x)$  on the grid.

(b) State the range of  $f(x)$ .

(c) What are the zeroes of this function?



21. Seeds will germinate (sprout up from the ground) only when the soil is in a certain range of temperatures. The percent of corn seeds that germinate can be modeled by the equation

$$P = -0.15(T - 70)^2 + 93.75$$

where  $P$  is the percent of the seeds that will germinate and  $T$  is the temperature in degrees Fahrenheit.

- (a) How can we tell that this quadratic function has a maximum value? What is the maximum percent and at what temperature will it occur?

- (b) Algebraically determine the two temperatures at which zero percent of the seed will germinate.

22. A rectangular piece of metal had its dimensions measured as 10.2 centimeters and 4.3 centimeters, rounded to the nearest tenth of a centimeter. The metal weighs 4.2 grams per square centimeter, where this unit weight has been also rounded to the nearest tenth.

- (a) Determine the area of the rectangular piece of metal. Explain why it is proper for it to be rounded to the nearest tenth of a square centimeter.

- (b) What is the weight, in grams, of the piece of metal? Determine its proper rounding.

