CCSS Math Samples — Functions

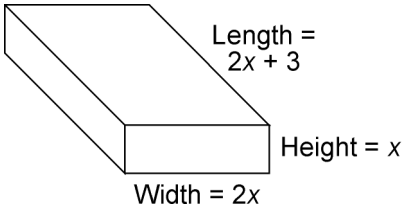
1. Express the following function in function notation:

$$\{(x, y) |\ 2(x-3)+3(1-y)=0\}$$

A. $f(x)=\frac{2}{3}x-1$ B. $2x-3y-3=0$

C. $f(x)=\frac{2}{3}x$ D. $f(x)=2x-1$

2. The dimensions of a rectangular container are shown in the figure.



Which of the following polynomial functions models the volume, (V), of the container in terms of x?

A. $V(x)=4x^3+3x$

B. $V(x)=4x^3-3x$

C. $V(x)=4x^3+6x^2$

D. $V(x)=4x^3-6x^2$

3. If $f(x)=3x-1$ and $g(x)=x^2-4x$, find $f(g(x))$.

A. $3x^2-12x-1$ B. $9x^2-18x+5$

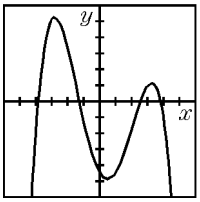
C. $3x^3-13x^2+4x$ D. $\dfrac{3x-1}{x^2-4x}$

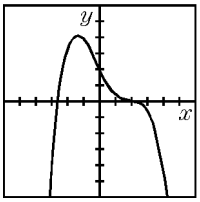
4. Given the relation $\left\{(x, y):\ y=3\sqrt{x^2-1}\right\}$:

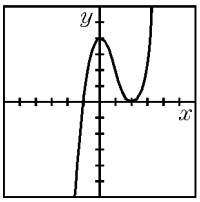
a) find the equations of the asymptotes in the form $y=mx+b$; and

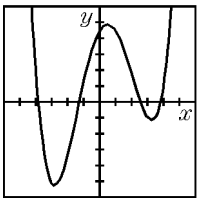
b) sketch the graph of the restricted relation. Plot and label a minimum of four points on the graph.

5. Which of the following graphs best illustrates the graph of $y=a(x-b)(x-c)(x-d)(x-e)$ where $a>0$ and $b\neq c\neq d\neq e$?

A. 

B. 

C. 

D. 

6. A scientist was carbon dating to determine how old something is. If 100 grams of a sample is remaining after 4 years and the decay formula is

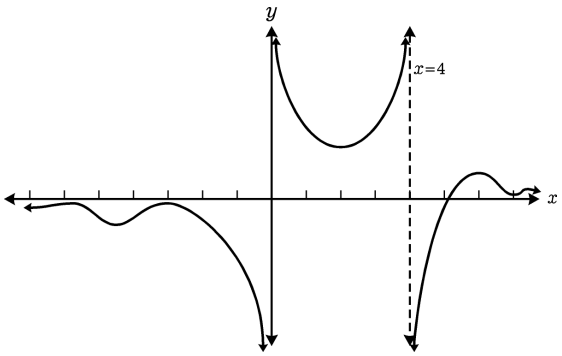
$$R=B\left(\tfrac{1}{2}\right)^{(1/t)}$$

where R is the amount remaining, B is the amount at the beginning and t is the time in years, how many grams was the original sample to the nearest tenth of a gram?

A. 123.1 grams B. 118.9 grams

C. 111.0 grams D. 107.2 grams

7. The graph of $h(x)$ is shown below.



a) The graph shows that $h(-4)$ is negative and $h(2)$ is positive. Could you use the Bisection Algorithm to find a zero? Why or why not?

b) The graph of the function has a zero near $x = 5$. What algorithm could you use to find this point? Explain your reasoning.

c) A minimum of $h(x)$ occurs between 0 and 4. Explain how you would use your graphing calculator to find this point.

8. A dietician graphs the effect of a nutrient on heart rate and discovers that it is $r = 2n^2$, where n is the amount of nutrient and r is the heart rate. If an enzyme is added to the nutrient, the graph changes to $r = 4n^2$. Describe how the graph of this new relationship is different from that of the original relationship.

A. The new graph is reflected about the horizontal axis (n-axis).

B. The new graph is horizontally translated to the left.

C. The new graph is vertically translated downward.

D. The new graph is narrower in its width.

9. The following are parabolic functions:

1. $f(x) = x^2 + 3$
2. $f(x) = 3x^2 - 1$
3. $f(x) = 2x^2 - 3$
4. $f(x) = x^2 + 5$

Which list places the parabolas in order from highest vertex to lowest vertex?

A. 4, 1, 2, 3 B. 2, 3, 4, 1

C. 3, 4, 1, 2 D. 4, 1, 3, 2

10. Sketch the graph of each function. Label the coordinates of all x- and y-intercepts.

a) $f(x) = \log_2 x$

b) $f(x) = -\log_2 x$

c) $f(x) = \log_2(-x)$

d) $f(x) = \log_2 |x|$

e) List all the functions from the above that have the property $f(x) = f(-x)$.

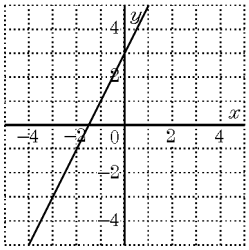
11. Use the properties of logarithms to expand the expression $\log \dfrac{3x}{2y^3}$.

A. $\dfrac{\log 3x}{\log 2y^3}$

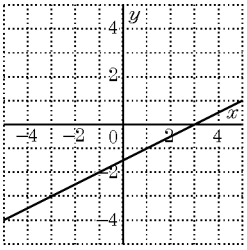
B. $\dfrac{3 \log x}{\log 2 + \log y^3}$

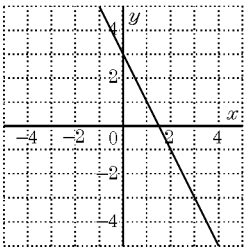
C. $\log 3 + \log x - \log 2 + 3 \log y$

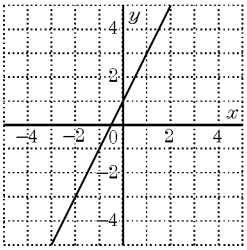
D. $\log 3 + \log x - \log 2 - 3 \log y$

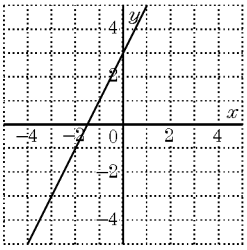
12. 

The graph of $f(x) = 2x + 3$ is shown above. Which graph represents $f^{-1}(x)$?

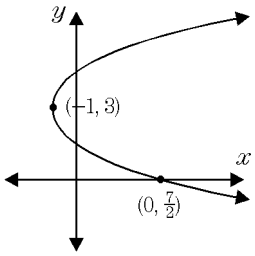
A. 

B. 

C. 

D. 

13. What is the equation of the inverse of the given parabola?



14. What is the recursive formula for the sequence 10, 6, 2, −2 . . . ?

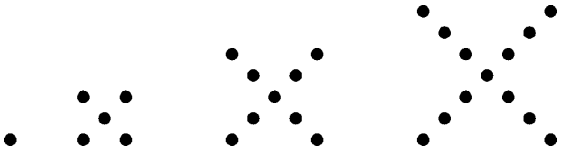
A. $a_1 = 10$, $a_n = 4a_{n-1}$

B. $a_1 = 10$, $a_n = -4a_{n-1}$

C. $a_1 = 10$, $a_n = a_{n-1} + 4$

D. $a_1 = 10$, $a_n = a_{n-1} - 4$

15. Assume that the pattern of dots below continues indefinitely, with more dots being added at each step.



Ginger wants to determine the number of dots in the 20th step, but she does not want to draw all 20 steps and then count the dots.

a) Explain how Ginger could find the number of dots in step 20 without actually drawing them.

b) What would be the number of dots in the 20th step? 100th step?

16. Which investment plan is better, and by how much?

    A) $900 earning 11% simple interest for a year and a half; or

    B) $900 earning 17% interest compounded semi-annually for one year.

17. The amount of money A after t years that a principal amount P will amount to if it is invested at rate r compounded n times a year is given by the relationship

$$A(t) = P\left(1 + \frac{r}{n}\right)^{nt}$$

    where r is expressed as a decimal.

    To 1 decimal place, how long with it take:

    a) $2500 to become $4500 if it is invested at 7% and is compounded quarterly?

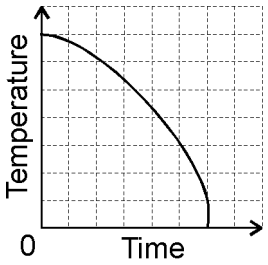
    b) $3600 to become $5200 if it is invested at 9% and is compounded semi-annually?

    c) a sum of money to double if it is invested at 12% and compounded annually?

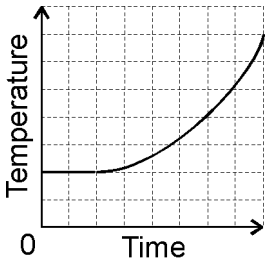
    d) a sum of money to double if it is invested at 12% and compounded semi-annually?

18. Tamara puts some fresh cod filets that she bought on sale at the grocery store in the freezer. Which graph best describes their temperature as a function of time?

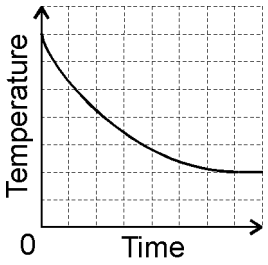
A.



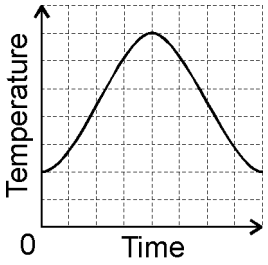
B.



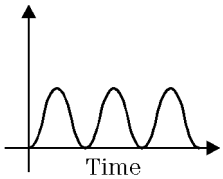
C.



D.



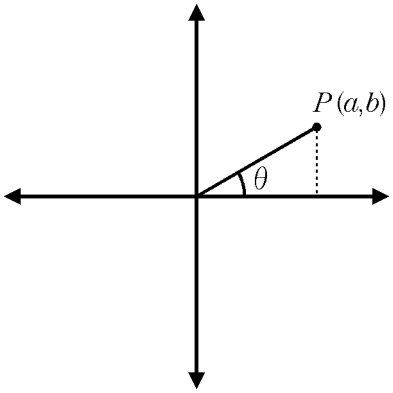
19. Make up a situation that the graph could represent.



20. Determine the exact value of $\cos\frac{11\pi}{6}$.

A. $\frac{\sqrt{3}}{2}$ B. $\frac{1}{2}$ C. $-\frac{1}{2}$ D. $\frac{\sqrt{2}}{2}$

21.



For the given diagram, point P is 1 unit away from the origin. If $\sin^2\theta = \frac{1}{2}$, find the coordinates of point P.

A. $(2\sqrt{2}, \sqrt{2})$ B. $(\frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2})$

C. $(\frac{1}{2}, \frac{1}{2})$ D. $(\frac{\sqrt{2}}{2}, \frac{1}{2})$

22. To 3 decimal places find:

a) $\sec 0.23^R$

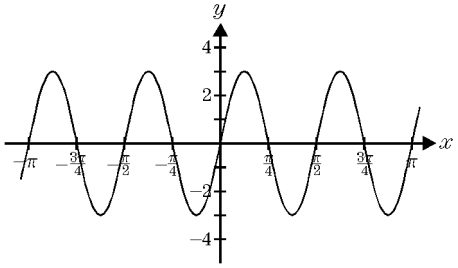
b) $\csc 2.34^R$

c) $\cot(-0.82)^R$

23. If $y = f(x)$ has a period of 12, then what is the period of $y = f(x - 6)$?

A. 2 B. 12 C. 72 D. 3

24. Given the graph for $f(x) = 3\sin 4x$, over which domain could $f^{-1}(x)$ be constructed?



A. $\left[-\frac{3\pi}{8}, -\frac{\pi}{8}\right]$ B. $\left(0, \frac{\pi}{4}\right)$

C. $\left[\frac{\pi}{4}, \frac{3\pi}{4}\right]$ D. $\left(\frac{3\pi}{8}, \frac{7\pi}{8}\right)$

25. A Ferris wheel has a radius of 30 m. Its center is 31 m above the ground. It rotates once every 40 s. Suppose you get on the bottom at $t = 0$. Write an equation that expresses your height as a function of elapsed time.

A. $h = 31\cos 2\pi\frac{(t-40)}{40} + 30$

B. $h = 30\cos 2\pi\frac{(t-20)}{40} + 1$

C. $h = 30\cos 2\pi\frac{(t-20)}{40} + 31$

D. $h = \cos 2\pi\frac{(t-20)}{40} + 30$

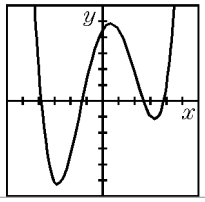
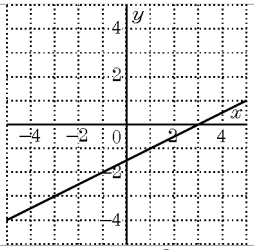
26. Simplify: $\frac{1}{1+\sin\theta} + \frac{1}{1-\sin\theta}$

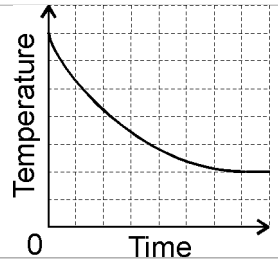
A. 0 B. $2\csc^2\theta$

C. $2\sec^2\theta$ D. $\sin\theta\cos\theta$

Problem-Attic Sample Document
all items from CCSS Math Database

Functions

Num	Scoring	Standard	Answer
1	A	F.IF.02	$f(x) = \frac{2}{3}x - 1$
2	C	F.IF.02	$V(x) = 4x^3 + 6x^2$
3	A	F.BF.01C	$3x^2 - 12x - 1$
4		F.IF.07B	$y = \pm 3x$; [graph]
5	D	F.IF.07C	
6	B	F.IF.08B	118.9 grams
7		F.BF.01A	Bisection will not reveal the zero between -4 and 2 because of the asymptote at $x = 0$. This asymptote would be approached as the zero. Bisection is best. x-values near $x = 5$ result in positive and negative y-values. Use zoom and trace to search for the minimum y-value between $x = 5$ and $x = 6$.
8	D	F.BF.03	The new graph is narrower in its width.
9	A	F.BF.03	4, 1, 2, 3
10		F.IF.07E	[graph]; [graph]; [graph]; [graph]; d
11	D	F.BF.05	$\log 3 + \log x - \log 2 - 3 \log y$
12	A	F.BF.04C	
13		F.BF.04C	$y = 4(x - 3)^2 - 1$ or equivalent
14	D	F.IF.03	$a_1 = 10$ $a_n = a_{n-1} - 4$
15		F.BF.02	$4n - 3$; 77
16		F.LE.03	Plan B by $11.00
17		F.LE.04	8.5 years; 4.2 years; 6.1 years; 5.9 years

18	C	F.LE.05	
19		F.LE.05	[answers vary]
20	A	F.TF.09	$\frac{\sqrt{3}}{2}$
21	B	F.TF.08	$(\frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2})$
22		F.TF.02	1.027; 1.392; −0.933
23	B	F.TF.04	12
24	A	F.TF.06	$\left[-\frac{3\pi}{8}, -\frac{\pi}{8}\right]$
25	C	F.TF.05	$h = 30\cos 2\pi\frac{(t-20)}{40} + 31$
26	C	F.TF.08	$2\sec^2\theta$