1-2 Applied Calculus Solutions

Saturday, May 14, 2016 12:20 PM

Page 27

1.2 Exercises

Given each pair of functions, calculate $f(g(0))$ and $g(f(0))$.

1. $f(x) = 4x + 8$, $g(x) = 7 - x^2$

$f(g(x)) = f(7 - x^2) = 4(7 - x^2) + 8 = 28 - 4x^2 + 8 = 36 - 4x^2$
$\Rightarrow f(g(0)) = 36 - 4(0^2) = 36$

Or $f(g(0)) = f(7 - 0^2) = f(7) = 4(7) + 8 = 28 + 8 = 36$

$g(f(0)) = g(4(0) + 8) = g(8) = 7 - 8^2 = 7 - 64 = -57$

3. $f(x) = \sqrt{x + 4}$, $g(x) = 12 - x^3$

$f(g(0)) = f(12 - 0^3) = f(12) = \sqrt{12 + 4} = \sqrt{16} = 4$

$g(f(0)) = g(\sqrt{0 + 4}) = g(\sqrt{4}) = g(2) = 12 - 2^3 = 12 - 8 = 4$

Use the table of values to evaluate each expression

x	$f(x)$	$g(x)$
0	7	9
1	6	5
2	5	6
3	8	2
4	4	1
5	0	8
6	2	7
7	1	3
8	9	4
9	3	0

5. $f(g(8))$

$f(g(8)) = f(4) = 4$

7. $g(f(5))$

$g(f(5)) = g(0) = 9$

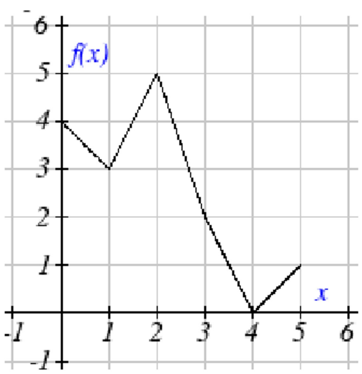
9. $f(f(4))$

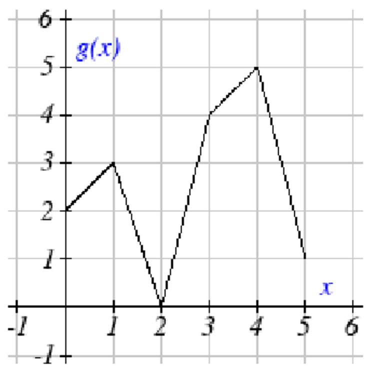
$f(f(4)) = f(4) = 4$

11. $g(g(2))$

$g(g(2)) = g(6) = 7$

Use the graphs to evaluate the expressions below.





13. $f(g(3))$

$f(g(3)) = f(4) = 0$

15. $g(f(1))$

$g(f(1)) = g(3) = 4$

17. $f(f(5))$

$f(f(5)) = f(1) = 3$

19. $g(g(2))$

$g(g(2)) = g(0) = 2$

For each pair of functions, find $f\left(g\left(x\right)\right)$ and $g\left(f\left(x\right)\right)$. Simplify your answers.

21. $f(x) = \dfrac{1}{x-6}$, $g(x) = \dfrac{7}{x} + 6$

$f(g(x)) = f\left(\frac{7}{x}+6\right) = \frac{1}{\left(\frac{7}{x}+6\right)-6} = \frac{1}{\frac{7}{x}} = \frac{x}{7}$

$g(f(x)) = g\left(\frac{1}{x-6}\right) = \frac{7}{\left(\frac{1}{x-6}\right)} + 6 = \frac{x-6}{7} + 6 = \frac{x-6+42}{7} = \frac{x+36}{7}$

23. $f(x) = x^2 + 1$, $g(x) = \sqrt{x+2}$

$f(g(x)) = f(\sqrt{x+2}) = (\sqrt{x+2})^2 + 1 = x + 2 + 1 = x + 3$

$g(f(x)) = g(x^2+1) = \sqrt{x^2+1+2} = \sqrt{x^2+3}$

25. $f(x) = |x|$, $g(x) = 5x + 1$

$f(g(x)) = f(5x+1) = |5x+1|$

$g(f(x)) = g(|x|) = 5|x| + 1$

27. If $f(x) = x^4 + 6$, $g(x) = x - 6$ and $h(x) = \sqrt{x}$, find $f(g(h(x)))$

$f\left(g(h(x))\right) = f\left(g(\sqrt{x})\right) = f(\sqrt{x}-6) = (\sqrt{x}-6)^4 + 6$

29. The function $D(p)$ gives the number of items that will be demanded when the price is p. The production cost, $C(x)$ is the cost of producing x items. To determine the cost of production when the price is \$6, you would do which of the following:

a. Evaluate $D(C(6))$ b. Evaluate $C(D(6))$

c. Solve $D(C(x))=6$ d. Solve $C(D(p))=6$

The cost of production is $C(x)$, where $x =$ the number of items produced.
We want to find C(x) when $p = 6$.

(a) can be eliminated, because it will result in the number of items demanded, not the cost.

(c) can be eliminated, because it sets the number of items demanded equal to 6, not the price.

(d) can be eliminated, because it sets the cost equal to 6, with p unknown, but we know that $p = 6$.
This leaves (b), but we should check that this answer makes sense.
By evaluating C, we will end up with a cost.
$D(6) =$ the number of items demanded when $p = 6$.
Thus, $D(6) =$ the number of items to be produced at this price.

Therefore, (b) satisfies all of the conditions.

Find functions $f(x)$ and $g(x)$ so the given function can be expressed as $h(x) = f(g(x))$.

31. $h(x) = (x+2)^2$

We can work from the inside out.
Let $g(x) = x + 2$.

Let $f(x) = x^2$.

33. $h(x) = \frac{3}{x-5}$

Let $g(x) = x - 5$.

Let $f(x) = \frac{3}{x}$.

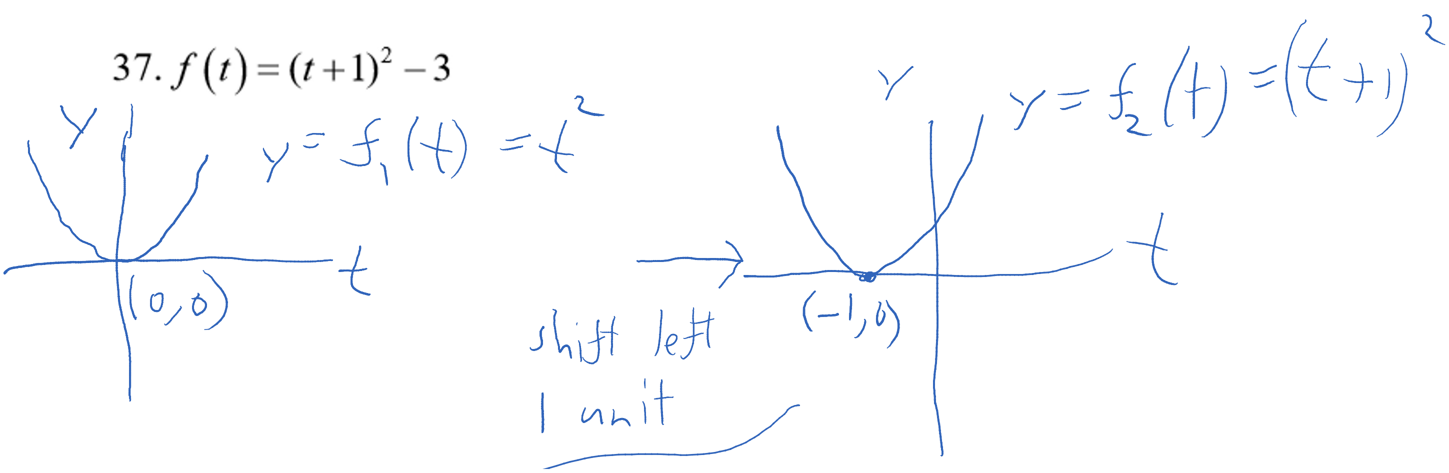
35. $h(x) = 3 + \sqrt{x-2}$

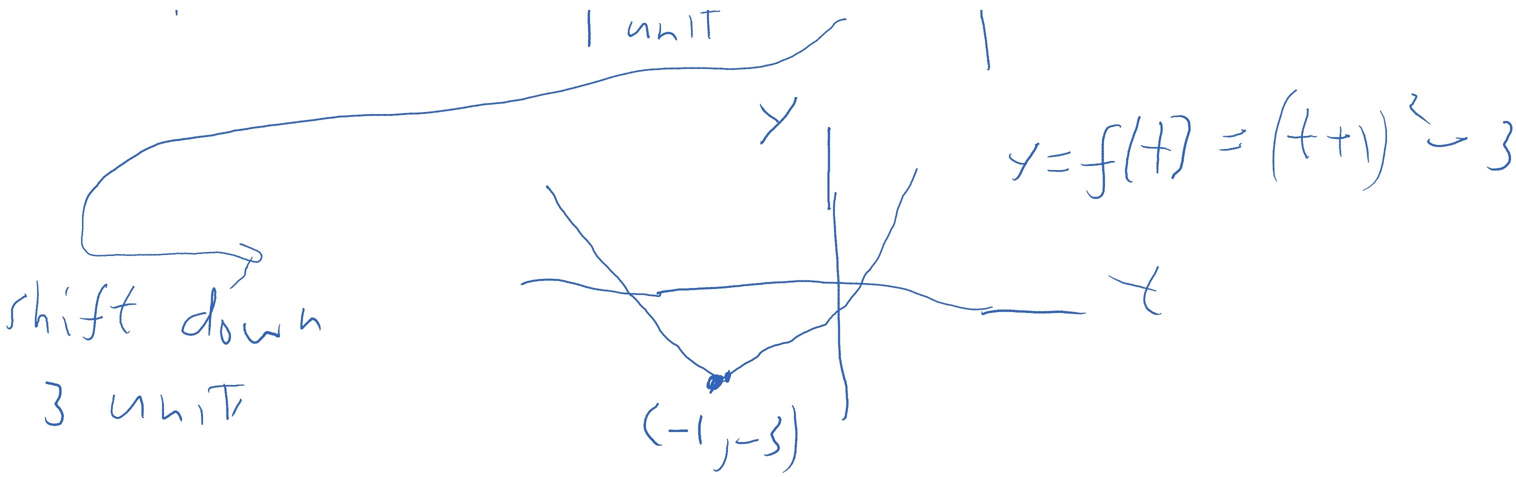
Let $g(x) = \sqrt{x-2}$.

Let $f(x) = 3 + \text{x}$.

Sketch a graph of each function as a transformation of a toolkit function.

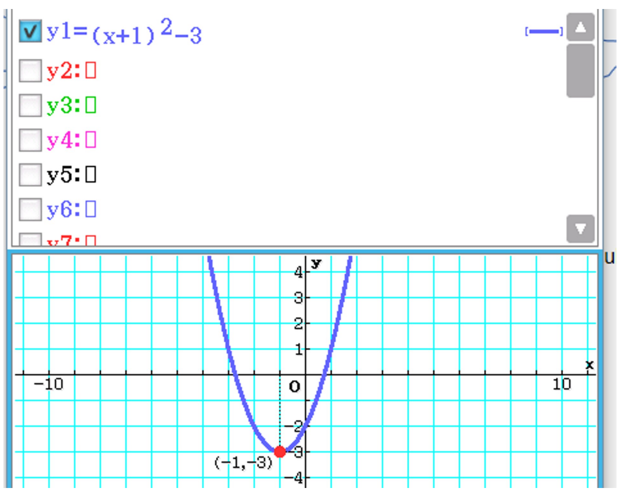
37. $f(t) = (t+1)^2 - 3$





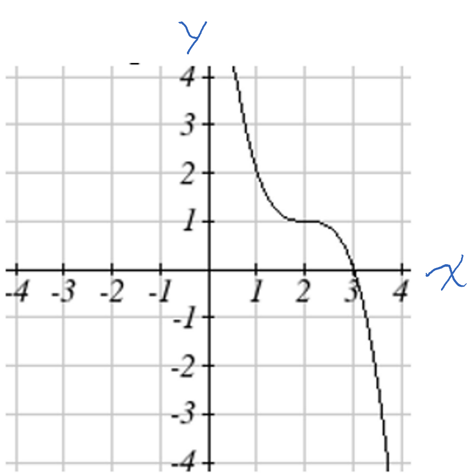
We can check our work, by graphing the original function in a calculator.

Casio ClassPad 400



Write an equation for each function graphed below.

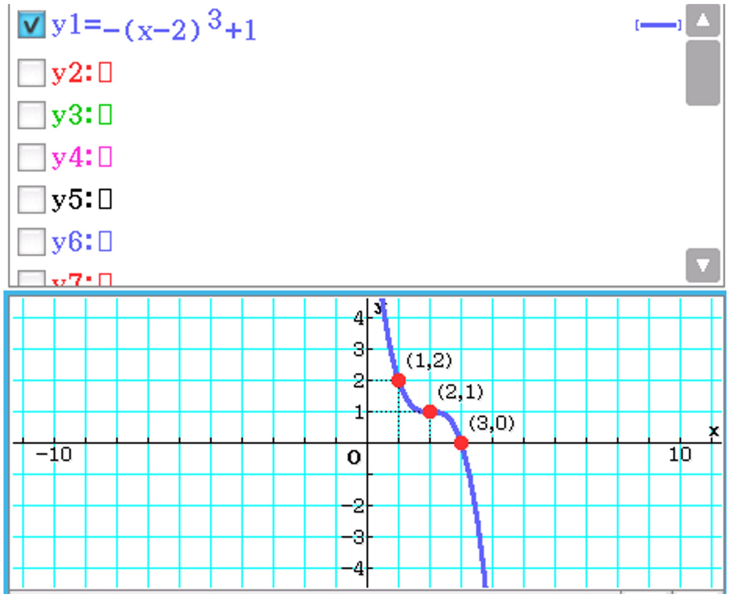
45.



This looks like the toolkit function $y = x^3$, but it is flipped upside down shifted right 2 units, and shifted up 1 unit.
Therefore the function is $f(x) = -(x - 2)^2 + 1$.

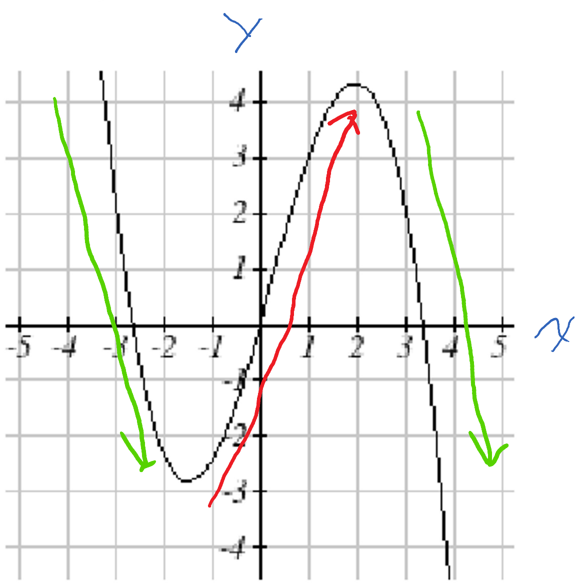
We can check our work by graphing the new function in a calculator.

Casio ClassPad 400



For each function graphed, estimate the intervals on which the function is increasing and decreasing.

51.



The function is increasing on the interval $\left(-\frac{3}{2}, 2\right)$

The function is decreasing on the intervals $\left(-\infty, \frac{-3}{2}\right)$ and $(2, \infty)$.

****

These solutions were created by Donald R. Goral from exercises in *Applied Calculus, Edition 1*
by Shana Calaway, Dale Hoffman, David Lippman

Copyright © 2014 Shana Calaway, Dale Hoffman, David Lippman
This text is licensed under a Creative Commons Attribution 3.0 United States License.