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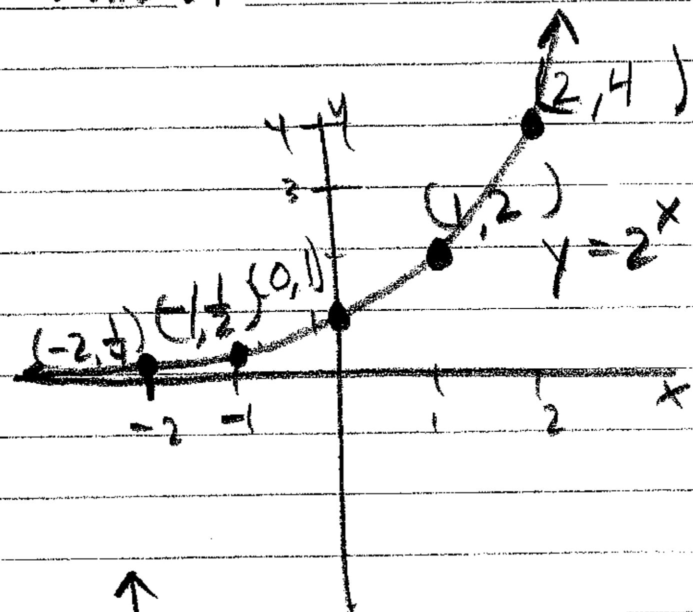
Chapter 12 Review — Math 64 —

#1

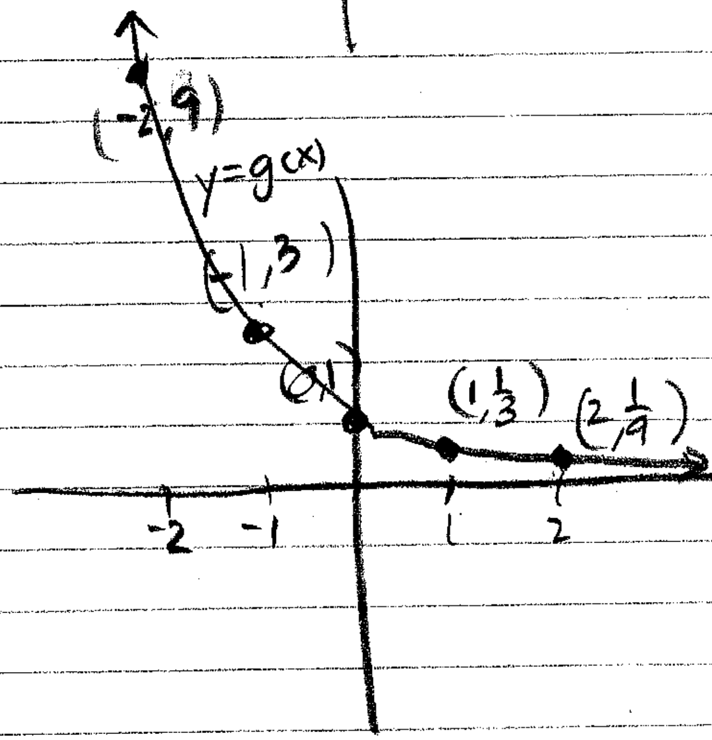
$f(x) = 2^x$

x	$y = 2^x$
0	$2^0 = 1$
1	$2^1 = 2$
-1	$2^{-1} = \frac{1}{2}$
2	$2^2 = 4$
-2	$2^{-2} = \frac{1}{4}$



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

x	$y = \left(\frac{1}{3}\right)^x$
0	$\left(\frac{1}{3}\right)^0 = 1$
1	$\left(\frac{1}{3}\right)^1 = \frac{1}{3}$
-1	$\left(\frac{1}{3}\right)^{-1} = 3$
2	$\left(\frac{1}{3}\right)^2 = \frac{1}{9}$
-2	$\left(\frac{1}{3}\right)^{-2} = 9$



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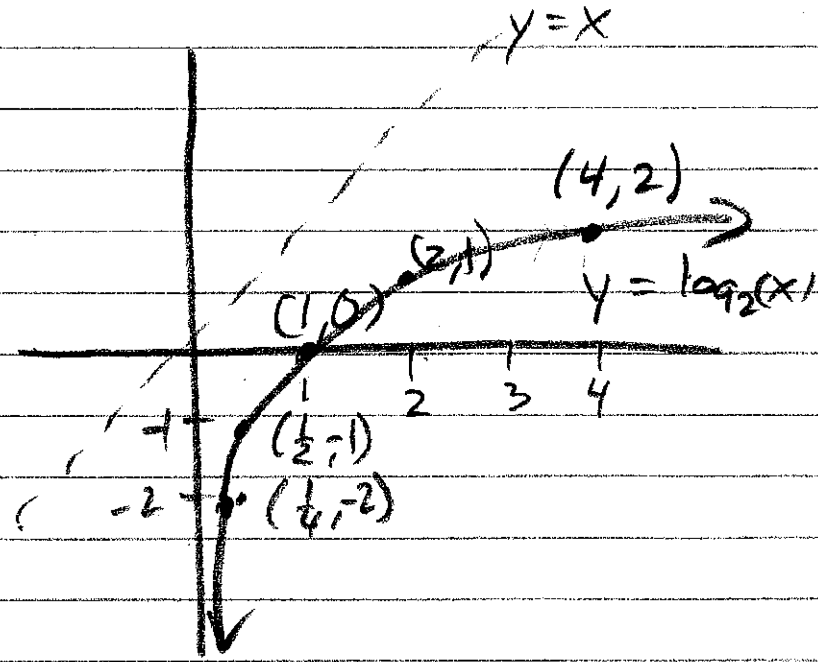
Chapter 12 Review — Math 64 —

#3

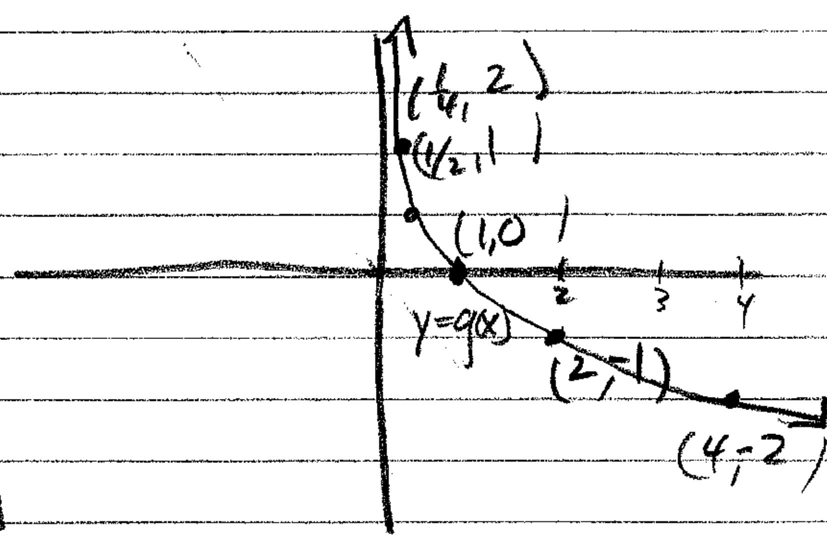
$f(x) = \log_2(x)$

x	$y = \log_2(x)$
1	$\log_2(1) = 0$
2	$\log_2(2) = 1$
$\frac{1}{2}$	$\log_2(\frac{1}{2}) = -1$
4	$\log_2(4) = 2$
$\frac{1}{4}$	$\log_2(\frac{1}{4}) = -2$



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

x	$y = \log_{\frac{1}{2}}(x)$
1	$\log_{\frac{1}{2}}(1) = 0$
$\frac{1}{2}$	$\log_{\frac{1}{2}}(\frac{1}{2}) = 1$
2	$\log_{\frac{1}{2}}(2) = -1$
$\frac{1}{4}$	$\log_{\frac{1}{2}}(\frac{1}{4}) = 2$
4	$\log_{\frac{1}{2}}(4) = -2$



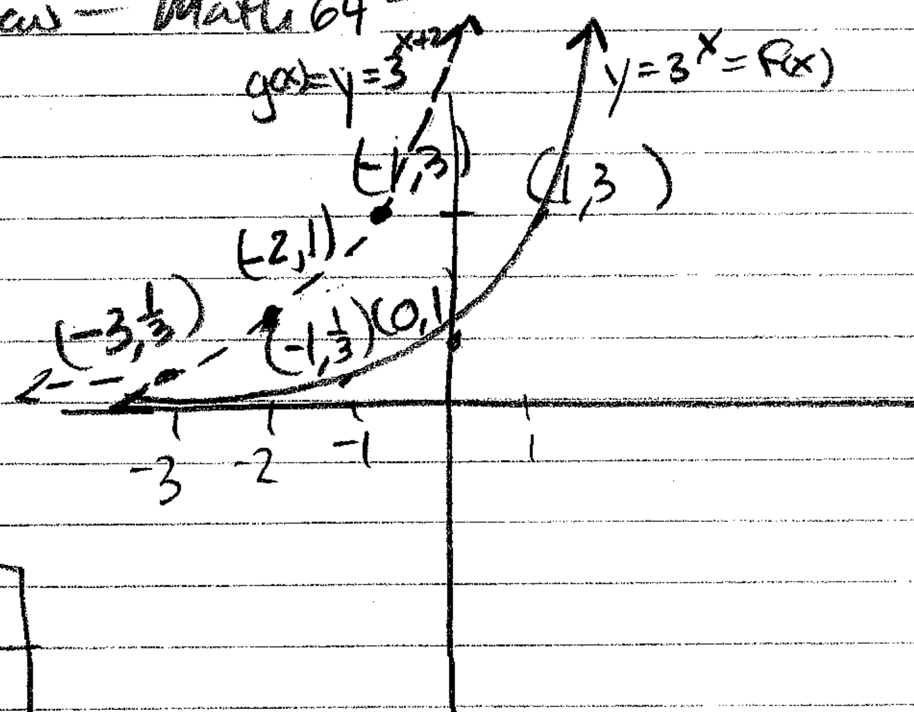
Chapter 12 Review — Math 64

#5

$f(x) = 3^x$

x	$y = 3^x$
0	$3^0 = 1$
1	$3^1 = 3$
-1	$3^{-1} = \frac{1}{3}$

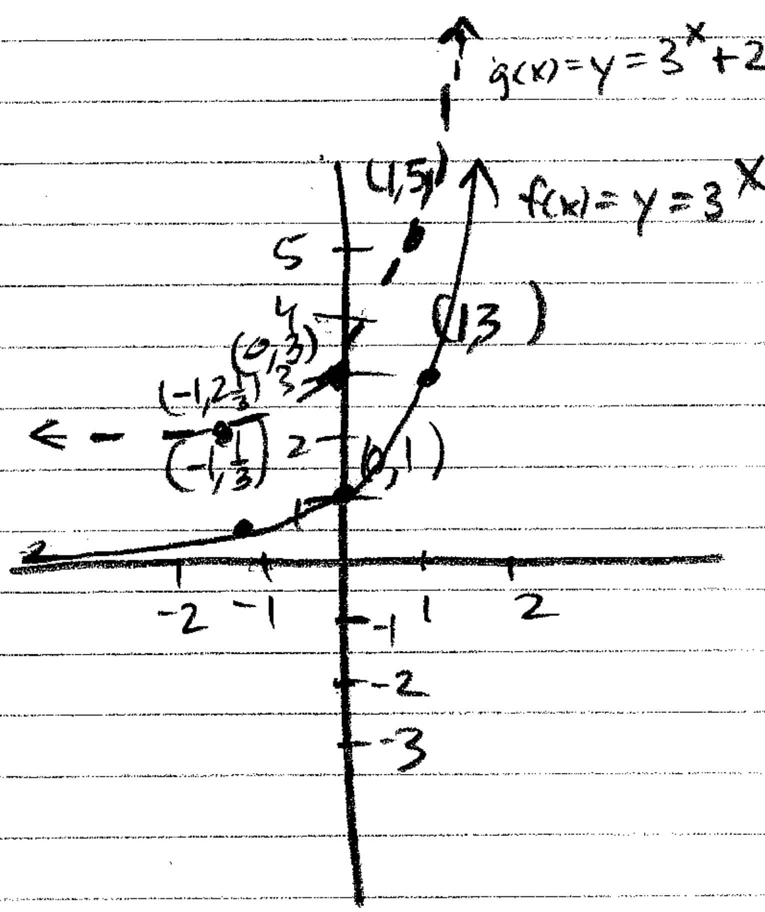
x	$y = 3^{x+2}$
-2	$3^{-2+2} = 3^0 = 1$
-1	$3^{-1+2} = 3^1 = 3$
-3	$3^{-3+2} = 3^{-1} = \frac{1}{3}$



#6 $f(x) = 3^x$

$g(x) = 3^x + 2$

x	$y = 3^x + 2$
0	$3^0 + 2 = 1 + 2 = 3$
1	$3^1 + 2 = 3 + 2 = 5$
-1	$3^{-1} + 2 = \frac{1}{3} + 2 = 2\frac{1}{3}$

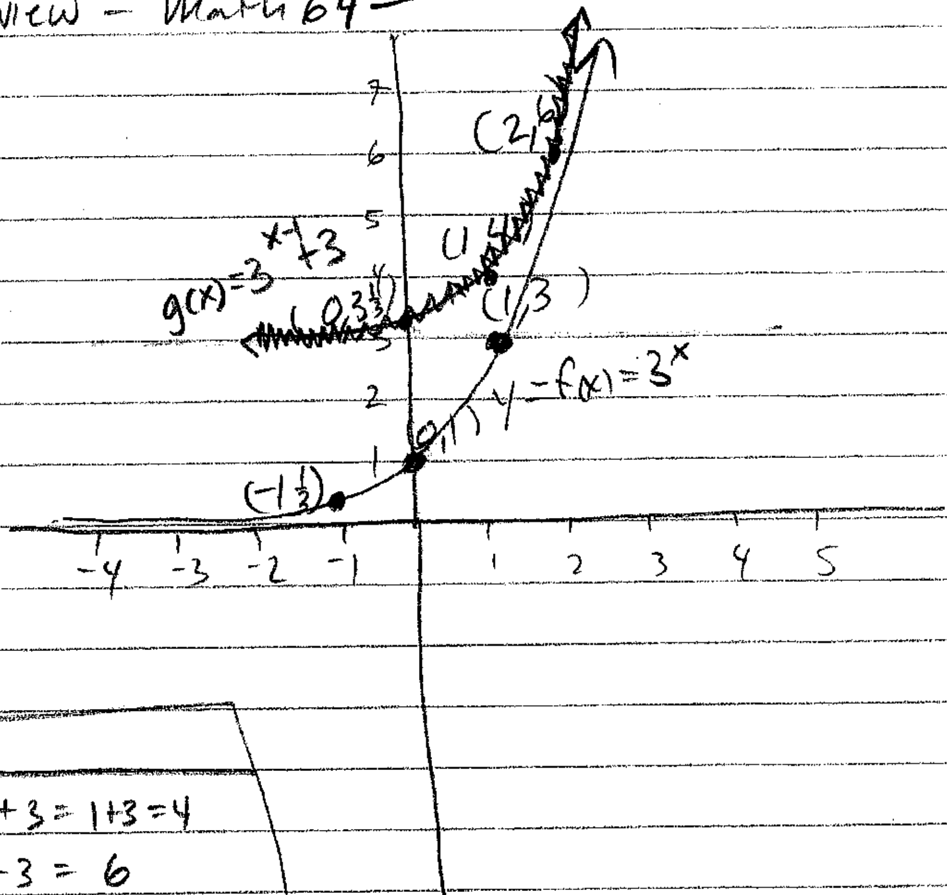


Chapter 12 Review – Math 64 –

#7

$f(x) = 3^x$

x	$y = 3^x$
0	$3^0 = 1$
1	$3^1 = 3$
-1	$3^{-1} = \frac{1}{3}$



$g(x) = 3^{x-1} + 3$

x	$y = 3^{x-1} + 3$
1	$3^{1-1} + 3 = 3^0 + 3 = 1 + 3 = 4$
2	$3^{2-1} + 3 = 3^1 + 3 = 6$
0	$3^{0-1} + 3 = 3^{-1} + 3 = \frac{1}{3} + 3 = 3\frac{1}{3}$

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

$$
\begin{aligned}
(f \circ g)(x) &= f(g(x)) \\
&= 7(g(x)) - 2 \\
&= 7(2x^2 + 1) - 2 \\
&= 14x^2 + 7 - 2 \\
(f \circ g)(x) &= 14x^2 + 5 \checkmark
\end{aligned}
$$

Chapter 12 Review — Math 64 —

#9.

$f(x) = 4x+9$, & $g(x) = \frac{x-9}{4}$

$f(g(x)) = 4[g(x)] + 9$
$= 4\left(\frac{x-9}{4}\right) + 9$
$= x - 9 + 9$
$f(g(x)) = x$

$g(f(x)) = \frac{(f(x))-9}{4}$
$g(f(x)) = \frac{(4x+9)-9}{4}$
$= \frac{4x}{4}$
$g(f(x)) = x$

Since $f(g(x)) = x$ and $g(f(x)) = x$, we know that $f(x)$ and $g(x)$ are inveres of each other.

#10. $f(x) = \sqrt[3]{x-4}$, & $g(x) = x^3 + 4$

$f(g(x)) = \sqrt[3]{(g(x))-4}$
$= \sqrt[3]{(x^3+4)-4}$
$= \sqrt[3]{x^3}$
$f(g(x)) = x$

$g(f(x)) = (f(x))^3 + 4$
$= (\sqrt[3]{x-4})^3 + 4$
$= x - 4 + 4$
$g(f(x)) = x$

Since $f(g(x)) = x$ and $g(f(x)) = x$, we know that $f(x)$ and $g(x)$ are inverses of each other.

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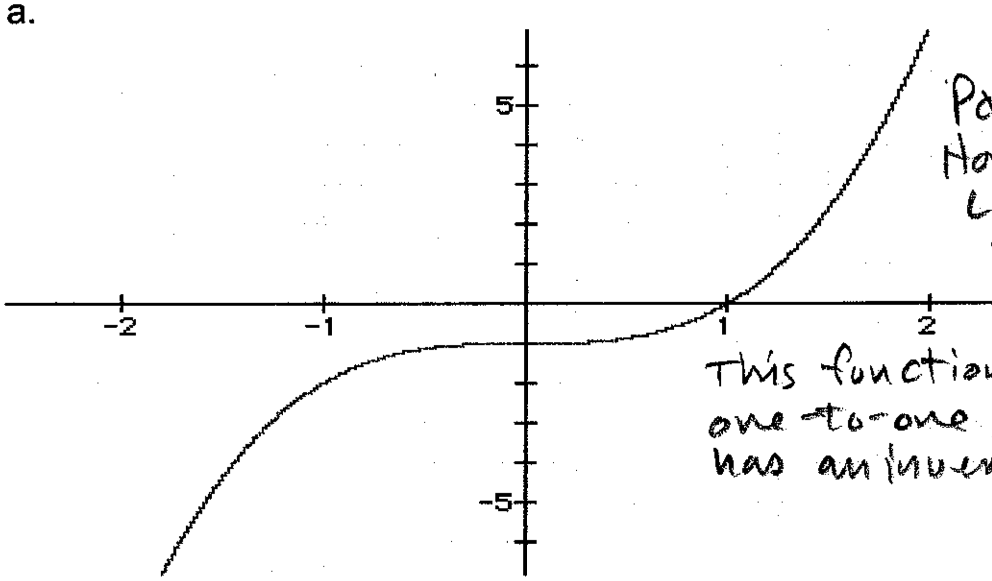
11. What test do you use to determine if a given graph represents a function that has an inverse function? State the test. Use the Horizontal Line test,

12. Determine whether each graph represents a function that has an inverse function. State your conclusion.

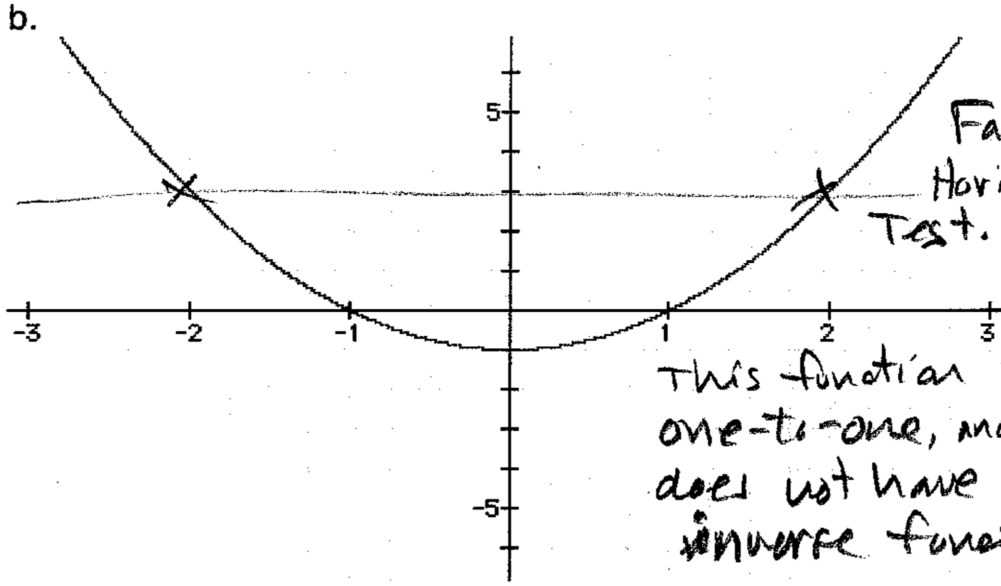
a.



Passes Horizontal Line Test

This function is one-to-one, and it has an inverse function.

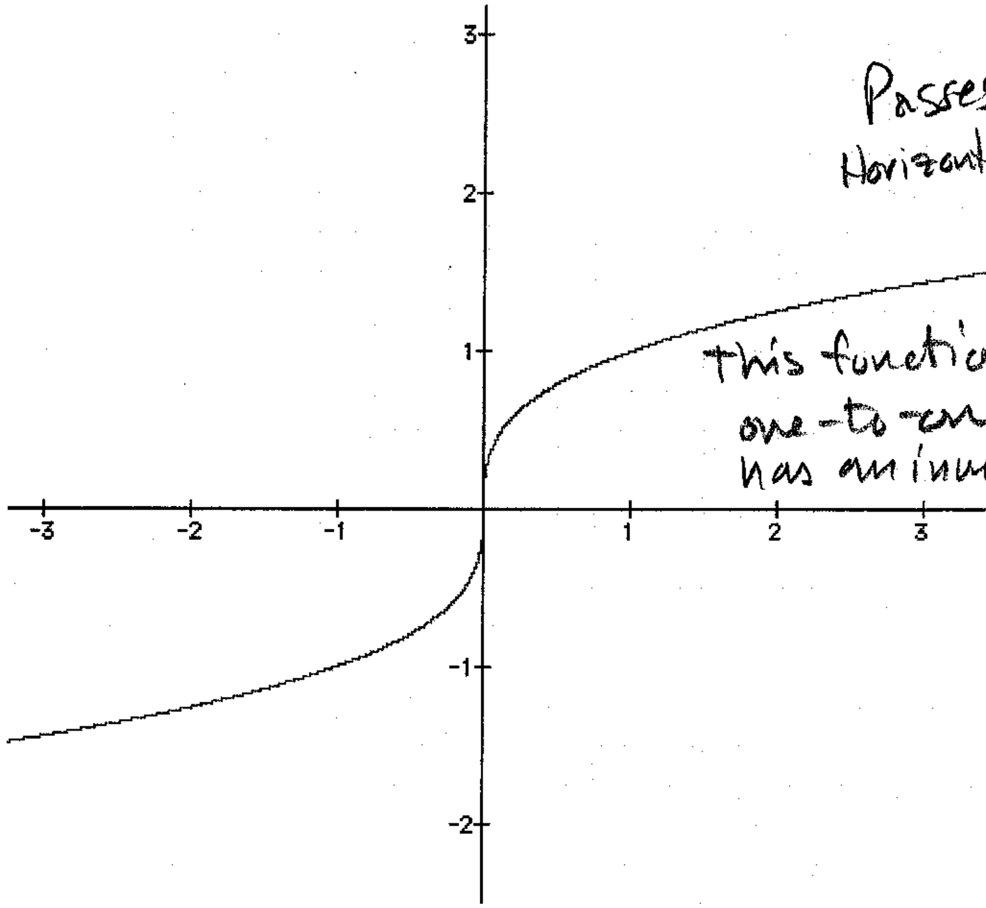
b.



Fails Horizontal Line Test.

This function is not one-to-one, and it does not have an inverse function.

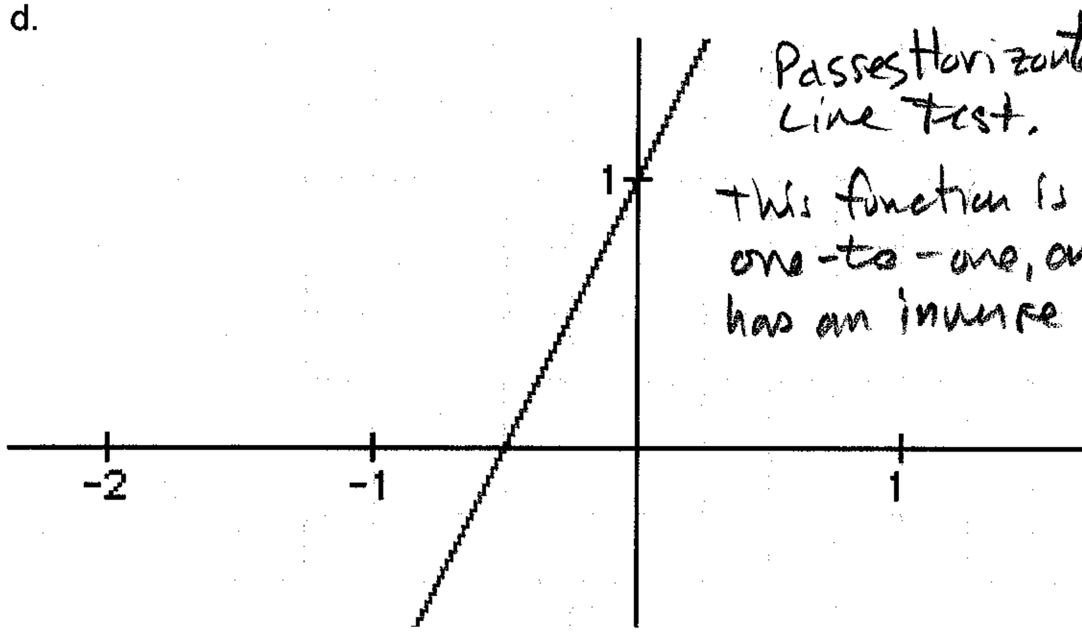
c.



Passes
Horizontal Line Test.

this function is
one-to-one, and it
has an inverse function.

d.



Passes Horizontal
Line Test.

this function is
one-to-one, and it
has an inverse function.

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Chapter 12 Review - Math 64. -

#13. $\log_5 1 = ?$

let $y = \log_5 1$ and $5^y = 1$

$5^y = 5^0$

$y = 0$

So, $\underline{\log_5(1) = 0}$.

#14. $6^{\log_6(5)} = ?$

let $y = \log_6(5)$ and $6^y = 5$

So, $6^{\log_6(5)} = 6^y$

and $\underline{6^{\log_6(5)} = 5}$.

#15. $\log_4\left(\frac{1}{16}\right) = ?$

let $y = \log_4\left(\frac{1}{16}\right)$ and $4^y = \frac{1}{16}$

$4^y = \frac{1}{4^2}$

$4^y = 4^{-2}$

$y = -2$

So, $\underline{\log_4\left(\frac{1}{16}\right) = -2}$.

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Chapter 12 Review - Math 64 -

#17. $\log_7 \sqrt{7} = ?$

let $y = \log_7 \sqrt{7}$ and $7^y = \sqrt{7}$

$7^y = 7^{1/2}$

$y = 1/2$

So, $\log_7 \sqrt{7} = \frac{1}{2}$.

#18. $\log(1{,}000) = \log_{10} 1{,}000 = ?$

let $y = \log_{10} 1{,}000$ and $10^y = 1{,}000$

$10^y = 10^3$

$y = 3$

So, $\log 1{,}000 = 3$.

#19 $\ln(e^6) = \log_e(e^6) = ?$

let $y = \log_e(e^6)$ and $e^y = e^6$

$y = 6$

So, $\ln(e^6) = 6$.

Chapter 12 Review - Math 64 -

#21.

$\log(10) = \log_{10} 10 = ?$

let $y = \log_{10} 10$ and $10^y = 10$

$10^y = 10^1$

$y = 1$

so, $\log(10) = 1$.

#20. $\ln(e) = \log_e(e) = ?$

let $y = \log_e(e)$ and $e^y = e$

$e^y = e^1$

$y = 1$

So $\ln(e) = 1$.

#24. $\ln(e^{11x+1}) = \log_e(e^{11x+1}) = ?$

let $y = \log_e(e^{11x+1})$ and $e^y = e^{11x+1}$

$y = 11x+1$

So, $\ln(e^{11x+1}) = 11x+1$.

#23. $e^{\ln(300)} = ?$

let $y = \ln(300)$

$y = \log_e(300)$ and $e^y = 300$

so, $e^{\ln(300)} = 300$.

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Chapter 12 Review – Math 64 –

#25. $10^{\log(8x)} = ?$

let $y = \log(8x)$
$y = \log_{10}(8x)$ and $10^y = 8x$

so, $10^{\log(8x)} = 8x$.

#26. $f(x) = \sqrt{2x-3}$

$2x - 3 \geq 0$

$3 + 2x - 3 \geq 3 + 0$

$2x \geq 3$

$\frac{1}{2} \cdot 2x \geq \frac{1}{2} \cdot 3$

$x \geq 3/2$

The domain of $f(x)$ is $\{x \mid x \geq \frac{3}{2}\} = [\frac{3}{2}, \infty)$

#27. $f(x) = 3^x$, x has no restrictions.

The domain of $f(x)$ is $\{x \mid$ All Real Numbers$\} = (-\infty, \infty)$

#28. $f(x) = (\frac{1}{3})^x$, x has no Restrictions.

The domain of $f(x)$ is $\{x \mid$ All Real Numbers$\} = (-\infty, \infty)$.

Chapter 12 Review - Math 64 -

#29.

$f(x) = \log_6(2x+4)$

$2x+4 > 0$

$-4+2x+4 > -4+0$

$2x > -4$

$\frac{1}{2}\cdot 2x > \frac{1}{2}\cdot\left(\frac{-4}{1}\right)$

$x > -2$

The domain of $f(x)$ is $\{x \mid x > -2\} = (-2, \infty)$.

#30. $f(x) = \log(6-2x)$

$6-2x > 0$

$2x+6-2x > 2x+0$

$6 > 2x$

$\frac{1}{2}\cdot\frac{6}{1} > \frac{1}{2}\cdot 2x$

$3 > x$

The domain of $f(x) = \{x \mid 3 > x\} = (-\infty, 3)$

#31. $f(x) = \ln[(x+1)^2]$

$(x+1)^2 > 0$

$(x+1)^2 = 0$

$x+1 = 0$

$-1+x+1 = -1+0$

$x = -1$

excluded

Region A $(-\infty, -1)$	Region B $(-1, \infty)$
$x=-2$	$x=2$
$[(-2+1)]^2 > 0$	$[(2)+1]^2 > 0$
$(-1)^2 > 0$	$(3)^2 > 0$
$1 > 0$	$9 > 0$
TRUE	TRUE!

The domain of $f(x) = \{x \mid x \neq -1\} = (-\infty, -1) \cup (-1, \infty)$.

Chapter 12 Review – Math 64 –

#32.

(i) $\log_b(XY) = \log_b(X) + \log_b(Y)$, Product Rule

(ii) $\log_b\left(\frac{X}{Y}\right) = \log_b(X) - \log_b(Y)$, Quotient Rule

(iii) $\log_b(X^r) = r \cdot \log_b(x)$, Power Rule

#33.

$$\log_2\left(\frac{32}{x}\right) = \log_2(32) - \log_2(x)$$
$$= \log_2(2^5) - \log_2(x)$$
$$= 5 \cdot \log_2(2) - \log_2(x)$$
$$= 5 \cdot 1 - \log_2(x)$$
$$= \underline{5 - \log_2(x)}$$

SDWK

32
4 8
2 2 2 4
2 2

$32 = 2^5$

#34

$$\ln\left(\frac{5}{e^2}\right) = \ln(5) - \ln(e^2)$$
$$= \ln(5) - 2 \cdot \ln(e)$$
$$= \ln(5) - 2 \cdot 1$$
$$= \underline{\ln(5) - 2}$$

Chapter 12 Review - Math 64 -

#35.

$$\log_5\left(\frac{25}{\sqrt{x+1}}\right) = \log_5(25) - \log_5\sqrt{x+1}$$

$$= \log_5(5^2) - \log_5\left[(x+1)^{1/2}\right]$$

$$= 2\cdot\log_5(5) - \tfrac{1}{2}\cdot\log_5(x+1)$$

$$= 2\cdot 1 - \tfrac{1}{2}\log_5(x+1)$$

$$= 2 - \tfrac{1}{2}\log_5(x+1)$$

#36. $$\log_b\left(\frac{x^2y}{z+1}\right) = \log_b(x^2y) - \log_b(z+1)$$

$$= \log_b(x^2) + \log_b(y) - \log_b(z+1)$$

$$= 2\cdot\log_b(x) + \log_b(y) - \log_b(z+1)$$

$$= 2\log_b(x) + \log_b(y) - \log_b(z+1)$$ ✓

#37.

$$\log_b\left[x(2x-1)^2\right] = \log_b(x) + \log_b\left[(2x-1)^2\right]$$

$$= \log_b(x) + 2\cdot\log_b(2x-1)$$

$$= \log_b(x) + 2\log_b(2x-1)$$ ✓

chapter 12 Review — Math 64 —

#38.

$3\log_b(x) + 2\log_b(y) = \log_b(x^3) + \log_b(y^2)$

$= \log_b(x^3 \cdot y^2)$

$= \log_b(x^3y^2)$

#39. $\frac{1}{5}\ln(x) + 2\ln(y) = \ln(x^{1/5}) + \ln(y^2)$

$= \ln(\sqrt[5]{x}) + \ln(y^2)$

$= \ln(y^2 \cdot \sqrt[5]{x})$

$= \ln(y^2\sqrt[5]{x})$ ✓

#40. $6\log_b(x+1) - 3\log_b(y) = \log_b[(x+1)^6] - \log_b(y^3)$

$= \log_b\left[\frac{(x+1)^6}{y^3}\right]$

#41. $3\log_2(x) + \frac{1}{2}\log_2(y+1) = \log_2(x^3) + \log_2[(y+1)^{1/2}]$

$= \log_2(x^3) + \log_2(\sqrt{y+1})$

$= \log_2(x^3\sqrt{y+1})$

#42. $4^x = 16$

$4^x = 4^2$

$x = 2$

$\{2\}$

side

16
4 4
$16 = 4^2$

check

$4^{(2)} = 16$
$16 = 16$
TRUE!

Chapter 12 Review — Math 64 —

#43

	SPWK	Check
$4^x = 32$	$4 = 2^2$	$4^{(5/2)} = 32$
$(2^2)^x = 2^5$	$32 = 2^5$	$(\sqrt{4})^5 = 32$
$2^{2x} = 2^5$	32 → 4, 8; 4 → 2, 2; 8 → 2, 4; 4 → 2, 2	$(2)^5 = 32$
$2x = 5$		$32 = 32$
$\frac{1}{2} \cdot 2x = \frac{1}{2} \cdot \frac{5}{1}$		TRUE!
$x = \frac{5}{2}$		

$\{\frac{5}{2}\}$

#44.

	check
$4^x = \frac{1}{4}$	$4^{(-1)} = \frac{1}{4}$
$4^x = 4^{-1}$	$\frac{1}{4} = \frac{1}{4}$
$x = -1$	
$\{-1\}$	TRUE!

#45.

	check	SPWK
$25^x = 5$	$25^{(\frac{1}{2})} = 5$	
$(5^2)^x = 5$	$\sqrt{25} = 5$	25 → 5, 5
$5^{2x} = 5^1$	$5 = 5$	
$2x = 1$	TRUE!	
$\frac{1}{2} \cdot 2x = \frac{1}{2} \cdot 1$		$25 = 5^2$
$x = \frac{1}{2}$		

$\{\frac{1}{2}\}$

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Chapter 12 Review — Math 64 —

#46

	Check	SDWK
$6^{2x+1} = 36$	$6^{[2(\frac{1}{2})+1]} = 36$	36
$6^{2x+1} = 6^2$	$6^{(1+1)} = 36$	$6 \quad 6$
$2x+1 = 2$	$6^2 = 36$	$36 = 6^2$
$-1+2x+1 = -1+2$	$36 = 36$	
$2x = 1$	TRUE!	
$\frac{1}{2} \cdot 2x = \frac{1}{2} \cdot 1$		
$x = \frac{1}{2}$		
$\{\frac{1}{2}\}$		

#47. $4^{2.1} \approx 18.37917368\ldots$

$4^{2.1} \approx 18.379$

#48. $3^{\sqrt{2}} \approx 3^{1.4142356237\ldots}$

$\approx 3^{1.414236}$

$\approx 4.72880458331\ldots$

$3^{\sqrt{2}} \approx 4.729$

#49. $e^{-1.25} \approx 0.28650479686\ldots$

$e^{-1.25} \approx 0.287$

#50. $\log_2(17) = \dfrac{\log(17)}{\log(2)}$

$\approx \dfrac{1.2304489}{0.30103}$

$\approx 4.08746\ldots$

$\log_2(17) \approx 4.087$ ✓

Chapter 12 Review – Math 64 –

#51

$$\log_{0.5}(2.1) = \frac{\log(2.1)}{\log(0.5)}$$
$$\approx \frac{0.322219}{-0.30103}$$
$$\approx -1.0703883$$
$$\approx -1.07$$

#52. $\log(5.1) \approx 0.70757017609 8\ldots$
$$\approx 0.708$$

#53. $\ln(4.8) \approx 1.56861591791\ldots$
$$\approx 1.569$$

#54. $5^x = 3$

$$\ln(5^x) = \ln(3)$$
$$x \cdot \ln(5) = \ln(3)$$
$$\frac{x \cdot \ln(5)}{\ln(5)} = \frac{\ln(3)}{\ln(5)}$$
$$x = \frac{\ln(3)}{\ln(5)}$$
$$x \approx \frac{1.098612}{1.609438}$$
$$x \approx 0.682605978$$
$$x \approx 0.683$$

Check

$$5^{0.683} \approx 3$$
$$3.0019 \approx 3$$

TRUE!

$$\{0.683\}$$

Chapter 12 Review – Math 64 –

#55.

$10^x = 8.7$

$\log(10^x) = \log(8.7)$

$x \cdot \log(10) = \log(8.7)$

$x \cdot 1 = \log(8.7)$

$x = \log(8.7)$

$x \approx 0.939519$

$x \approx 0.940$

$\{0.94\}$

check

$10^{0.94} \approx 8.7$

$8.70964 \approx 8.7$

$8.7 \approx 8.7$

TRUE!

#56.

$e^{2x} = 6.1$

$\ln(e^{2x}) = \ln(6.1)$

$2x \cdot \ln(e) = \ln(6.1)$

$2x = \ln(6.1)$

$\frac{2x}{2} = \frac{\ln(6.1)}{2}$

$x \approx \frac{1.80829}{2}$

$x \approx 0.904144$

$x \approx 0.904$

$\{0.904\}$

check

$e^{2(0.904)} \approx 6.1$

$e^{1.808} \approx 6.1$

$6.09824 \approx 6.1$

$6.1 \approx 6.1$

TRUE!

#57.

$20 - 2.1^x = 0$

$2.1^x + 20 - 2.1^x = 2.1^x + 0$

$20 = 2.1^x$

$\ln(20) = \ln(2.1^x)$

$\ln(20) = x \cdot \ln(2.1)$

$\frac{\ln(20)}{\ln(2.1)} = \frac{x \ln(2.1)}{\ln(2.1)}$

$\frac{\ln(20)}{\ln(2.1)} = x$

$x \approx \frac{2.99573}{0.741937}$

$x \approx 4.03771$

$x \approx 4.038$

$\{4.038\}$

check

$20 - 2.1^{(4.038)} \approx 0$

$20 - 20.0042 \approx 0$

$0.0042 \approx 0$

$0 \approx 0$

TRUE!

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Chapter 12 Review — Math 64 —

#58.

$10^{3x-1} = 3.7$

$\log(10^{3x-1}) = \log(3.7)$

$3x - 1 = \log(3.7)$

$1 + 3x - 1 = 1 + \log(3.7)$

$3x = 1 + \log(3.7)$

$\frac{3x}{3} = \frac{1 + \log(3.7)}{3}$

$x = \frac{1 + \log(3.7)}{3}$

$x \approx \frac{1 + 0.568202}{3}$

$x \approx \frac{1.568202}{3}$

$x \approx 0.522734$

$x \approx 0.523$

$\{0.523\}$

check

$10^{3(0.523)-1} \approx 3.7$

$10^{1.569-1} \approx 3.7$

$10^{0.569} \approx 3.7$

$3.70681 \approx 3.7$

$3.7 \approx 3.7$

TRUE!

#59

$4^{x+1} = 5^{x}$

$\ln(4^{x+1}) = \ln(5^{x})$

$(x+1) \cdot \ln(4) = x \cdot \ln(5)$

$x \cdot \ln(4) + 1 \cdot \ln(4) = x \ln(5)$

$-x\ln(4) + x\ln(4) + \ln(4) = x\ln(5) - x\ln(4)$

$\ln(4) = x \cdot [\ln(5) - \ln(4)]$

$\frac{\ln(4)}{\ln(5) - \ln(4)} = \frac{x \cdot [\ln(5) - \ln(4)]}{[\ln(5) - \ln 4]}$

$\frac{\ln(4)}{\ln(5) - \ln(4)} = x$

$\frac{1.38629}{1.60944 - 1.38629} \approx x$

$\frac{1.38629}{0.223145} \approx x$

$6.21251 \approx x$

$6.213 \approx x$

$\{6.213\}$

check

$4^{(6.213)+1} \approx 5^{6.213}$

$4^{7.213} \approx 5^{6.213}$

$22{,}012 \approx 22{,}014.1$

$22{,}000 \approx 22{,}000$

TRUE!

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Chapter 12 Review — Math 64 —

#60.

$\log_2(3x+1)=7$

$2^7=3x+1$

$128=3x+1$

$-1+128=-1+3x+1$

$127=3x$

$\frac{127}{3}=\frac{3x}{3}$

$\frac{127}{3}=x$

$42.3333\approx x$

$42.333\approx x$

$\{42.333\}$

Check

$\log_2[3(42.333)+1]\approx 7$

$\log_2(127.999)\approx 7$

$2^7\approx 127.999$

$128\approx 127.999$

$128\approx 128$

TRUE!

#61.

$\ln(x)=-3$

$e^{-3}=x$

$0.049787\approx x$

$0.050\approx x$

$0.05\approx x$

$\{0.05\}$

check

$\ln(0.05)\approx -3$

$-2.99573\approx -3$

$-3\approx -3$

TRUE!

#62. $\log_5(x)-\log_5(4x-1)=1$

$\log_5\left(\frac{x}{4x-1}\right)=1$

$5^1=\frac{x}{4x-1}$

$5=\frac{x}{4x-1}$

$5\cdot(4x-1)=(4x-1)\left(\frac{x}{4x-1}\right)$

$20x-5=x$

$-20x+20x-5=x+(-20x)$

$-5=-19x$

$\frac{-5}{-19}=\frac{-19x}{-19}$

$\frac{5}{19}=x$

$x\approx 0.26315789$

$x\approx 0.263$

$\{0.263\}$

Check #62

$\log_5(0.263)-\log_5[4(0.263)-1]\approx 1$

$\log_5(0.263)-\log_5[1.052-1]\approx 1$

$\log_5(0.263)-\log_5(0.52)\approx 1$

$\log_5\left(\frac{0.263}{0.52}\right)\approx 1$

$\log_5(5.05769)\approx 1$

$5^1\approx 5.05769$

$5\approx 5.05769$

$5\approx 5$

TRUE!

Chapter 12 Review – Math 64 –

#63.

$\log_4(x+2) - \log_4(x-1) = 1$

$\log_4\left(\frac{x+2}{x-1}\right) = 1$

$4^1 = \frac{x+2}{x-1}$

$4\cdot(x-1) = (x-1)\left(\frac{x+2}{x-1}\right)$

$4x-4 = x+2$

$-x+4x-4 = -x+x+2$

$3x-4 = 2$

$4+3x-4 = 4+2$

$3x = 6$

$\frac{1}{3}\cdot\frac{3x}{1} = \frac{1}{3}\cdot\frac{6}{1}$

$x = 2$

$\{2\}$

check

$\log_4[(2)+2] - \log_4[(2)-1] = 1$

$\log_4[4] - \log_4(1) = 1$

$1 - 0 = 1$

$1 = 1$

TRUE!

#64.

$6\ln(2x) = 30$

$\frac{6\ln(2x)}{6} = \frac{30}{6}$

$\ln(2x) = 5$

$\log_e(2x) = 5$

$e^5 = 2x$

$\frac{e^5}{2} = \frac{2x}{2}$

$\frac{e^5}{2} = x$

$x \approx \frac{148.413159}{2}$

$x \approx 74.2065795$

$x \approx 74.207$, $\{74.207\}$

check

$6\ln[2(74.207)] \approx 30$

$6\ln(148.414) \approx 30$

$6\cdot(5.00000566591) \approx 30$

$30.0000339954 \approx 30$

$30 \approx 30$

TRUE!

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Chapter 12 Review - Math 64 -

#65.

$\ln(\sqrt{x+4})=1$	check
$\log_e (x+4)^{\frac{1}{2}}=1$	$\ln\sqrt{(3.389)+4} \approx 1$
$e^1=(x+4)^{\frac{1}{2}}$	$\ln\sqrt{7.389} \approx 1$
$(e^1)^2=\left[(x+4)^{\frac{1}{2}}\right]^2$	$\ln(2.71827150962) \approx 1$
$e^2 = x+4$	$0.9999975 2337 \approx 1$
$-4+e^2=-4+x+4$	$1\approx 1$
$e^2-4=x$	TRUE!
$x\approx 7.389056-4$	
$x\approx 3.389056$	
$x\approx 3.389$	
$\{3.389\}$	

#66. $A=P\left(1+\frac{r}{n}\right)^{tn}$

$P=\$15000$

$t=30$ years

$r=5.5\%=0.055$

a. "quarterly" $\Rightarrow n=4$

$A=15{,}000\left[1+\frac{0.055}{4}\right]^{(30)(4)}$

$A=15{,}000[1+0.01375]^{120}$

$A=15{,}000[1.01375]^{120}$

$A\approx 15{,}000[5.1487768]$

$A\approx 77{,}231.652$

$A\approx \$77{,}231.65$

b. "Monthly" $\Rightarrow n=12$

$A=15{,}000\left[1+\frac{0.055}{12}\right]^{(30)(12)}$

$A\approx 15{,}000[1+0.004583]^{360}$

$A\approx 15{,}000[1.004583]^{360}$

$A\approx 15{,}000[5.18676823]$

$A\approx 77{,}801.523$

$A\approx \$77{,}801.52$

Chapter 12 Review – Math 64 –

#66. c. "continuously" $\Rightarrow A = Pe^{rt}$

$A = 15{,}000\, e^{(0.055)(30)}$

$A = 15{,}000\, e^{1.65}$

$A \approx 15{,}000(5.20697982718)$

$A \approx 78{,}104.697$

$A \approx \$78{,}104.70$

#68. $f(x) = x - 5$
$g(x) = 0.6x$
} The regular price of jeans is x dollars.

a. $f(x) = x - 5$, This function models a \$5 discount.

b. $g(x) = 0.60x$, This function models a 40% discount, which means that 60% of the regular price is being paid.

c. $(f \circ g)(x) = f(g(x))$
$= [g(x)] - 5$
$(f \circ g)(x) = 0.60x - 5$
} This composition function models a 40% discount and then a \$5 discount after that.

d. $(g \circ f)(x) = g(f(x))$
$= 0.60[f(x)]$
$= 0.60(x - 5)$
$= 0.60x - 3$
} This composition function models a \$5 discount which is followed by a 40% discount.

e. $0.60x - 5 \le 0.60x - 3$
$(f \circ g)(x) \le (g \circ f)(x)$
} This means that the better deal is $(f \circ g)(x)$.

Chapter 12 Review - Math 64 -

#68. (f)

$f(x) = x - 5$, let $y = x - 5$

$x = y - 5$

$f^{-1}(x) = x + 5$

$x + 5 = y - 5 + 5$

$x + 5 = y$

$x + 5 = f^{-1}(x)$

This function models a \$5 increase in the price.

#67. $S = C(1+r)^t$

C = value today
S = inflated value
t = years
r = annual inflation rate

$r = 0.08$
$t = 10$ years
$C = \$395{,}000$

$S = \$395{,}000\,[1 + (0.08)]^{(10)}$

$S = 395{,}000\,[1.08]^{10}$

$S \approx 395{,}000\,(2.158924997\,27)$

$S \approx \$852{,}775.374$

$S \approx \$852{,}775.37$

#69. $P(x) = 95 - 30\log_2(x)$

P(x) = percentage of students able to recall lecture facts,
x = days after lecture

a. $70 = 95 - 30\log_2(x)$

$-95 + 70 = -95 + 95 - 30\log_2(x)$

$-25 = -30\log_2(x)$

$\frac{-25}{-30} = \frac{-30}{-30}\log_2(x)$

$\frac{5}{6} = \log_2(x)$

$2^{5/6} = x$

$(\sqrt[6]{2})^5 = x$

$1.781797 \approx x$

$1.8 \approx x$

a: 70% of student recall facts after 1.8 days.

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Chapter 12 Review - Math 64 —

#69 $P(x) = 95 - 30\log_2(x)$

(b) $x = 7$ after one week.

$P(7) = 95 - 30\log_2(7)$

$P(7) = 95 - 30\left[\frac{\log 7}{\log 2}\right]$

$P(7) \approx 95 - 30 \cdot \left[\frac{0.845098}{0.30103}\right]$

$P(7) \approx 95 - 30 \cdot (2.80735)$

$P(7) \approx 95 - 84.2205$

$P(7) \approx 10.7795$

$P(7) \approx 11\%$

ANS: Approximately 11% of the student will recall the lecture features after one week.

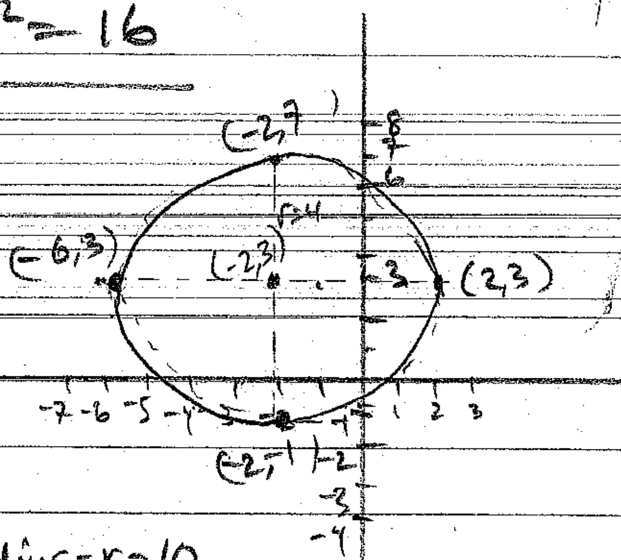
Chapter 13 Review – Math 64 – solutions

1. Center $= (-2,3)$, radius $= r = 4$
$= (h,k)$

$(x-h)^2 + (y-k)^2 = r^2$

$[x-(-2)]^2 + [y-(3)]^2 = (4)^2$

$\underline{(x+2)^2 + (y-3)^2 = 16}$

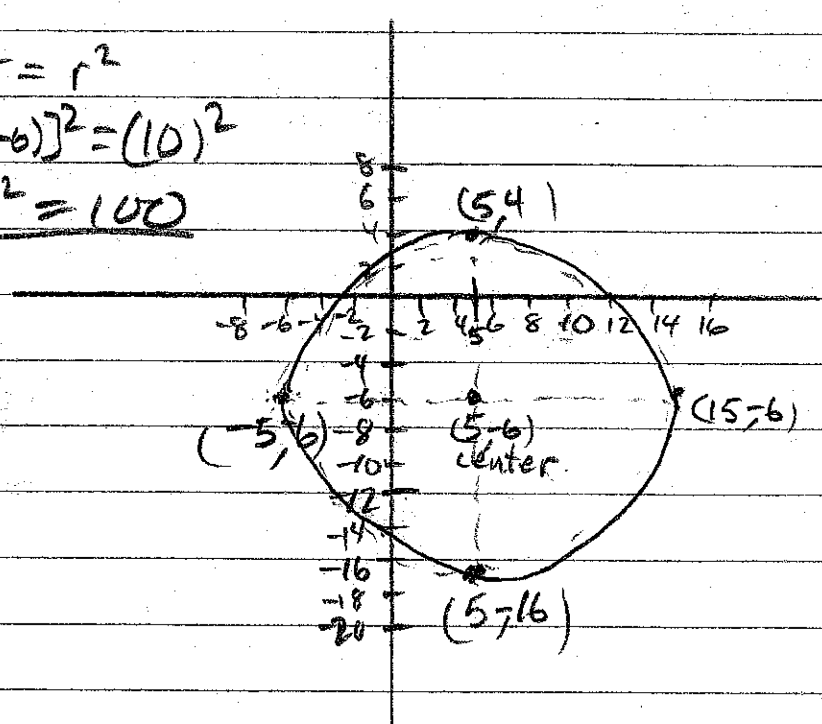


2. center $= (5,-6)$, radius $= r = 10$
$= (h,k)$

$(x-h)^2 + (y-k)^2 = r^2$

$[x-(5)]^2 + [y-(-6)]^2 = (10)^2$

$\underline{(x-5)^2 + (y+6)^2 = 100}$



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Chapter 13 Review — Math 64 —

#3. $(x+3)^2+(y-1)^2=4$

$(x-h)^2+(y-k)^2=r^2$

$h=-3$ Center $=(h,k)$

$k=1$ $=(-3,1)$

$r^2=4$ Radius $=2$

$r=2$

#4. $(x+4)^2+(y+5)^2=36$

$(x-h)^2+(y-k)^2=r^2$

$h=-4$ Center $=(h,k)$

$k=-5$ $=(-4,-5)$

$r^2=36$ Radius $=6$

$r=6$

#5. $x^2+y^2-6x+4y-23=0$

$(x^2-6x)+(y^2+4y)-23+23=0+23$

$(x^2-6x+\underline{9})+(y^2+4y+\underline{4})=23+\underline{9}+\underline{4}$

$[\frac{1}{2}(-6)]^2=(-3)^2=\underline{9}$, $[\frac{1}{2}(4)]^2=(2)^2=\underline{4}$

$(x-3)(x-3)+(y+2)(y+2)=36$

$\underline{(x-3)^2+(y+2)^2=36}$

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Chapter 13 Review – Math 64 –

#6. $x^2+y^2+8x-2y-8=0$

$(x^2+8x)+(y^2-2y)-8+8=0+8$

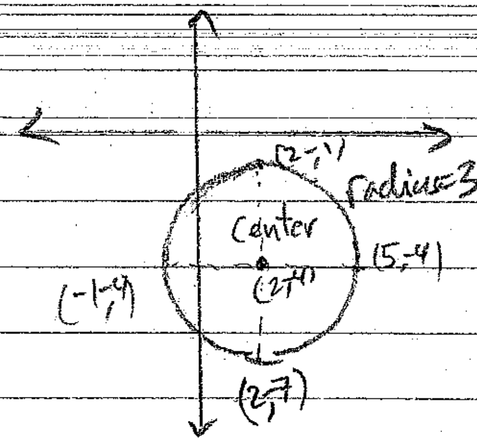
$(x^2+8x+\underline{16})+(y^2-2y+\underline{1})=8+\underline{16}+\underline{1}$

$[\frac{1}{2}(8)]^2=(4)^2=\underline{16}$, $[\frac{1}{2}(-2)]^2=(-1)^2=\underline{1}$

$(x+4)(x+4)+(y-1)(y-1)=25$

$\underline{(x+4)^2+(y-1)^2=25}$

#7.



center $=(h,k)$

$\underline{=(2,-4)}$

radius $=3$

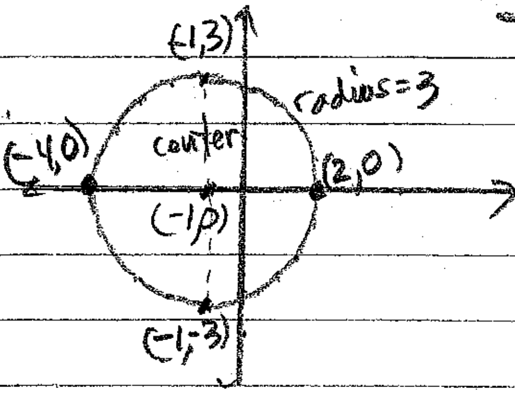
$\underline{r^2=9}$

$(x-h)^2+(y-k)^2=r^2$

$[x-(2)]^2+[y-(-4)]^2=(3)^2$

$\underline{(x-2)^2+(y+4)^2=9}$

#8.



center $=(h,k)$

$=(-1,0)$

radius $=3$

$r^2=9$

$(x-h)^2+(y-k)^2=r^2$

$[x-(-1)]^2+[y-(0)]^2=(3)^2$

$\underline{(x+1)^2+y^2=9}$

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Chapter 13 Review — Math 64 —

Solve by substitution!

#9.

$$\begin{cases} x^2 = y - 1 \\ 4x - y = -1 \end{cases}$$

Use $4x - y = -1$ for substitution. Solve $4x - y = -1$ for y.

$-4x + 4x - y = -1 - 4x$

$-y = -1 - 4x$

$-1 \cdot (-y) = -1 \cdot (-1 - 4x)$

$\underline{y = 1 + 4x}$

Use $y = 1 + 4x$ in $x^2 = y - 1$.

$x^2 = y - 1$

$x^2 = (1 + 4x) - 1$, Solve for x.

$x^2 = 4x$

$x^2 - 4x = 4x - 4x$

$x^2 - 4x = 0$

$x \cdot (x - 4) = 0$

Either

$\underline{x = 0}$, or $x - 4 = 0$

$\underline{x = 4}$

Find y!

Use $y = 1 + 4x$,

If $x = 0$,

$y = 1 + 4(0)$

$y = 1$

point of intersection is $(0, 1)$

If $x = 4$,

$y = 1 + 4(4)$

$y = 1 + 16$

$y = 17$

Point of intersection is $(4, 17)$

check: $(0, 1)$

$(0)^2 = (1) - 1$

$0 = 0$ ✓ TRUE

$4(0) - (1) = -1$

$-1 = -1$ ✓ TRUE

check: $(4, 17)$

$(4)^2 = (17) - 1$

$16 = 16$ ✓ TRUE

$4(4) - (17) = -1$

$16 - 17 = -1$

$-1 = -1$ ✓ TRUE

The solution set is $\underline{\{(0,1), (4,17)\}}$.

Chapter 13 Review — Math 64 —

#10. Solve by substitution:

$$\begin{cases} (x-1)^2+(y-1)^2=5 \\ x+2y=0 \end{cases}$$

Use $x+2y=0$ for substitution. Solve $x+2y=0$ for x.

$x+2y=0$

$-2y+x+2y=0-2y$

$\underline{x=-2y}$

Use $x=-2y$ in $(x-1)^2+(y-1)^2=5$.

$(x-1)^2+(y-1)^2=5$

$[(-2y)-1]^2+(y-1)^2=5$, Solve for y:

$(-2y-1)(-2y-1)+(y-1)(y-1)=5$

$4y^2+4y+1+y^2-2y+1=5$

$5y^2+2y+2=5$

$-5+5y^2+2y+2=5+5$

$5y^2+2y-3=0$ $\boxed{\frac{5}{1,5}}$ $\boxed{\frac{3}{1,3}}$

$(5y-3)(y+1)=0$

Either

$5y-3=0$, or $y+1=0$

$5y-3+3=0+3$ | $\underline{y=-1}$

$5y=3$

$\frac{5y}{5}=\frac{3}{5}$

$\underline{y=\frac{3}{5}}$

Find x:

Use $\underline{x=-2y}$.

If $y=\frac{3}{5}$,

$x=-2\left(\frac{3}{5}\right)$

$x=\frac{-6}{5}$

Point of intersection is $\left(\frac{-6}{5},\frac{3}{5}\right)$.

If $y=-1$

$x=-2(-1)$

$x=2$

Point of intersection is $(2,-1)$.

$4/10$

Chapter 13 Review – Math 64 –

more #10.

Check: $\left(\frac{-6}{5}, \frac{3}{5}\right)$

$$\left[\left(-\frac{6}{5}\right)-1\right]^2+\left[\left(\frac{3}{5}\right)-1\right]^2=5$$

$$\left[\frac{-6}{5}-\frac{5}{5}\right]^2+\left[\frac{3}{5}-\frac{5}{5}\right]^2=5$$

$$\left(\frac{-11}{5}\right)^2+\left(\frac{-2}{5}\right)^2=5$$

$$\frac{121}{25}+\frac{4}{25}=\frac{5}{1}\cdot\left(\frac{25}{25}\right)$$

$$\frac{125}{25}=\frac{125}{25}$$ ✓ TRUE

$$\left(-\frac{6}{5}\right)=-2\left(\frac{3}{5}\right)$$

$$\frac{-6}{5}=\frac{-2}{1}\left(\frac{3}{5}\right)$$

$$\frac{-6}{5}=\frac{-6}{5}$$ TRUE!

check: $(2,-1)$

$$[(2)-1]^2+[(-1)-1]^2=5$$

$$(1)^2+(-2)^2=5$$

$$1+4=5$$

$$5=5$$ ✓ TRUE

$$(2)=-2(-1)$$

$$2=2$$ ✓ TRUE

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Chapter 13 Review — Math 64 —

#11. Solve by addition/elimination: $\begin{cases} 2y = x^2-8 \\ x^2+y^2=16 \end{cases}$

Eliminate x's!

$$2y = x^2-8$$
$$-x^2+2y = -x^2+x^2-8$$
$$-x^2+2y = -8$$

$$\begin{array}{rl} & \cancel{-x^2} + 2y = -8 \\ + & \cancel{x^2} + y^2 = 16 \\ \hline \end{array}$$

$y^2+2y = 8$ ← Solve for y.

$y^2+2y-8 = 8-8$

$y^2+2y-8=0$

$(y-2)(y+4)=0$

$\boxed{\begin{array}{c} 8 \\ \hline 1,8 \\ 2\,4 \end{array}}$

Either

$y-2=0$, or $y+4=0$

$\underline{y=2}$ $\quad$ $\underline{y=-4}$

Find x!

Use $2y = x^2-8$

If $y=-4$

$2(-4)=x^2-8$

$-8 = x^2-8$

$-8+8 = x^2-8+8$

$0=x^2$

$0=x$

Point of intersection is

$(0,-4)$

If $y=2$

$2(2)=x^2-8$

$4=x^2-8$

$8+4 = x^2-8+8$

$12 = x^2$

Either

$x = -\sqrt{12}$, or $x = +\sqrt{12}$

$x = -\sqrt{4}\cdot\sqrt{3}$, or $x = \sqrt{4}\cdot\sqrt{3}$

$x = -2\sqrt{3}$, or $x = 2\sqrt{3}$

Points of intersection are

$(-2\sqrt{3}, 2)$ & $(2\sqrt{3}, 2)$

The solution set is

$\{(0,-4), (-2\sqrt{3},2), (2\sqrt{3},2)\}$.

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Chapter 13 Review — Math 64 —

More #11

check: $(0,-4)$

$2(-4) = (0)^2 - 8$	$(0)^2 + (-4)^2 = 16$
$-8 = -8$ ✓	$16 = 16$ ✓
TRUE	TRUE

check: $(-2\sqrt{3}, 2)$

		SDWK
$2(2) = (-2\sqrt{3})^2 - 8$	$(-2\sqrt{3})^2 + (2)^2 = 16$	$(-2\sqrt{3})^2$
$4 = 4 \cdot 3 - 8$	$4 \cdot 3 + 4 = 16$	$= (-2)^2 \cdot (\sqrt{3})^2$
$4 = 12 - 8$	$12 + 4 = 16$	$= 4 \cdot 3$
$4 = 4$ ✓	$16 = 16$ ✓	$= 12$ ✓
TRUE	TRUE	

check: $(2\sqrt{3}, 2)$

$2(2) = (2\sqrt{3})^2 - 8$	$(2\sqrt{3})^2 + (2)^2 = 16$
$4 = 4 \cdot 3 - 8$	$4 \cdot 3 + 4 = 16$
$4 = 12 - 8$	$12 + 4 = 16$
$4 = 4$ ✓	$16 = 16$ ✓
TRUE	TRUE

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Chapter 13 Review – Math 64 –

#12. Solve by addition/elimination. $\begin{cases} 3x^2+2y^2=35 \\ 4x^2+3y^2=48 \end{cases}$

Eliminate y's.

$-3\cdot(3x^2+2y^2)=-3\cdot 35$ | $2\cdot(4x^2+3y^2)=2\cdot 48$

$-9x^2-6y^2=-105$ | $8x^2+6y^2=96$

$$\begin{array}{rl} & -9x^2-6y^2=-105 \\ + & 8x^2+6y^2=96 \\ \hline & -x^2=-9 \end{array}$$

, Solve for x.

$-1\cdot(-x^2)=-1\cdot(-9)$

$x^2=9$

Either

$x=-\sqrt{9}$, or $x=+\sqrt{9}$

$x=-3$, or $x=3$

Find y:

Use $3x^2+2y^2=35$

If $x=-3$

$3(-3)^2+2y^2=35$

$3\cdot 9+2y^2=35$

$27+2y^2=35$

$27+2y^2-27=35-27$

$2y^2=8$

$\frac{2y^2}{2}=\frac{8}{2}$

$y^2=4$

Either

$y=-\sqrt{4}$, or $y=+\sqrt{4}$

$y=-2$, or $y=2$

If $x=3$

$3(3)^2+2y^2=35$

$3\cdot 9+2y^2=35$

$27+2y^2=35$

$27+2y^2-27=35-27$

$\frac{2y^2}{2}=\frac{8}{2}$

$y^2=4$

Either

$y=-\sqrt{4}$, or $y=+\sqrt{4}$

$y=-2$, or $y=2$

∴ Points of intersection are

$(3,-2)$ & $(3,2)$ & $(-3,-2)$ & $(-3,2)$.

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Chapter 13 Review — Math 64 —

Check: (3,-2)

$3(3)^2+2(-2)^2=35$	$4(3)^2+3(-2)^2=48$
$3\cdot 9+2\cdot 4=35$	$4\cdot 9+3\cdot 4=48$
$27+8=35$	$36+12=48$
$35=35$ ✓	$48=48$ ✓
TRUE	TRUE

The solution set is

$\{(3,-2),(3,2),(-3,-2),(-3,2)\}$.

Check: (3,2)

$3(3)^2+2(2)^2=35$	$4(3)^2+3(2)^2=48$
$3\cdot 9+2\cdot 4=35$	$4\cdot 9+3\cdot 4=48$
$27+8=35$	$36+12=48$
$35=35$ ✓	$48=48$ ✓
TRUE	TRUE

Check: (-3,-2)

$3(-3)^2+2(-2)^2=35$	$4(-3)^2+3(-2)^2=48$
$3\cdot 9+2\cdot 4=35$	$4\cdot 9+3\cdot 4=48$
$27+8=35$	$36+12=48$
$35=35$ ✓	$48=48$
TRUE	TRUE

Check: (-3,2)

$3(-3)^2+2(2)^2=35$	$4(-3)^2+3(2)^2=48$
$3\cdot 9+2\cdot 4=35$	$4\cdot 9+3\cdot 4=48$
$27+8=35$	$36+12=48$
$35=35$ ✓	$48=48$ ✓
TRUE	TRUE