Final Exam Review — Math 101 —

#1. $\dfrac{x^2-4}{2x^2-2x-4} \cdot \dfrac{x^2-x-6}{2x^2-5x-3} = \dfrac{(x-2)(x+2)\cdot(x-3)(x+2)}{2(x+1)(x-2)\cdot(2x+1)(x-3)}$

$= \dfrac{(x+2)^2}{2(x+1)(2x+1)}$

SDWK

$2x^2-2x-4$
$=2(x^2-x-2)$
$=2(x+1)(x-2)$

#2. $\dfrac{x-1}{3x^2-5x-2} - \dfrac{x}{2x^2-x-6} = \dfrac{x-1}{(3x+1)(x-2)} - \dfrac{x}{(2x+3)(x-2)}$

$= \dfrac{(x-1)}{(3x+1)(x-2)} \cdot \left[\dfrac{(2x+3)}{(2x+3)}\right] + \dfrac{(-x)}{(2x+3)(x-2)}\left[\dfrac{(3x+1)}{(3x+1)}\right]$

$= \dfrac{2x^2+3x-2x-3}{(3x+1)(x-2)(2x+3)} + \dfrac{-3x^2-x}{(3x+1)(x-2)(2x+3)}$

$= \dfrac{2x^2+x-3-3x^2-x}{(3x+1)(x-2)(2x+3)}$

$= \dfrac{-x^2-3}{(3x+1)(x-2)(2x+3)}$

#3. $7\sqrt{64} = 7 \cdot 8$
$= 56$

SDWK
$64 = 8^2$

#4. $\sqrt[3]{-27} = \sqrt[3]{(-3)^3}$
$= -3$

SDWK
$-27 = (-3)(-3)(-3)$
$= (-3)^3$

#5. $\log_2 \frac{1}{16} = ?$

Let $y = \log_2\left(\frac{1}{16}\right)$

$2^y = \frac{1}{16}$

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

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

$y = -4$

So, $\log_2\left(\frac{1}{16}\right) = -4$.

Final Exam Review – Math 101 –

#6.

$$e^{\ln(32)} = ?$$

let $y = \ln(32)$

$y = \log_e(32)$

$e^y = 32$, So, $e^{\ln(32)} = 32$.

#7. $f(x) = \sqrt{5-3x}$

Solve; $5-3x \geq 0$

$3x+5-3x \geq 3x+0$

$5 \geq 3x$

$\frac{1}{3}(5) \geq \frac{1}{3} \cdot \frac{3x}{1}$

$\frac{5}{3} \geq x$

The domain of $f(x)$ is $\{x \mid \frac{5}{3} \geq x\} = (-\infty, \frac{5}{3}]$.

#8. $f(x) = 3^{x+1}$, No Restrictions for exponents

The domain of $f(x)$ is $\{x \mid \text{all real numbers}\} = (-\infty, \infty)$.

#9. $f(x) = \log_2(x-4)$

Solve $x-4>0$

$4+x-4 > 4+0$

$x > 4$

The domain of $f(x)$ is $\{x \mid x>4\} = (4, \infty)$.

#10. $f(x) = 2x-7$, No Restrictions for this "line."

The domain of $f(x)$ is $\{x \mid \text{all real numbers}\} = (-\infty, \infty)$.

Final Exam Review - Math 101 -

#11. $f(x) = x^2 + 2$, No restrictions for quadratic functions.

The domain of $f(x)$ is $\{x \mid \text{all real numbers}\} = (-\infty, \infty)$.

#12. $\dfrac{x^2-25}{x^2-2x-3}$, $x^2-2x-3 \neq 0$

$x^2-2x-3=0$

$(x-3)(x+1)=0$

Either

$x-3=0$, or $x+1=0$

$x=3$ $\quad$ $x=-1$

The excluded values are $x=3$ & $x=-1$. In other words $x \neq 3$ and $x \neq -1$ for this rational expression.

#13. $2 + \dfrac{9}{x^2} = \dfrac{9}{x}$

$\frac{x^2}{1}\left[\frac{2}{1} + \frac{9}{x^2}\right] = \frac{x^2}{1} \cdot \frac{9}{x}$

$2x^2 + 9 = 9x$

$-9x + 2x^2 + 9 = -9x + 9x$

$2x^2 - 9x + 9 = 0$

$(2x-3)(x-3) = 0$

$\begin{array}{|c} 9 \\ \hline 1,9 \\ 3,3 \end{array}$

Either

$2x-3=0$, or $x-3=0$

$3+2x-3=0+3$ $\quad$ $x=3$

$\frac{2x}{2}=\frac{3}{2}$

$x=\frac{3}{2}$

$\{\frac{3}{2}, 3\}$

Final Exam Review - Math 101 -

#14.

$$|4x-2|+5=13$$

$$-5+|4x-2|+5=-5+13$$

$$|4x-2|=8$$

Either

left	right
$-(4x-2)=8$, or	$+(4x-2)=8$
$-4x+2=8$	$4x-2=8$
$-4x+2-2=8-2$	$2+4x-2=2+8$
$-4x=6$	$4x=10$
$\frac{-4x}{-4}=\frac{6}{-4}$	$\frac{4x}{4}=\frac{10}{4}$
$x=\frac{-3}{2}$	$x=\frac{5}{2}$

$$\left\{-\frac{3}{2},\frac{5}{2}\right\}$$

#15.

$$\frac{-3}{x-4}-\frac{4}{x+2}=\frac{3}{x^2-2x-8}$$

SDWK

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

$$\frac{(x-4)(x+2)}{1}\left[\frac{-3}{x-4}-\frac{4}{x+2}\right]=\frac{(x-4)(x+2)}{1}\cdot\frac{3}{(x-4)(x+2)}$$

$$\left(\frac{-3}{x-4}\right)\frac{(x-4)(x+2)}{1}-\frac{4}{(x+2)}\cdot\frac{(x-4)(x+2)}{1}=3$$

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

$$-3x-6-4x+16=3$$

$$-7x+10=3$$

$$-7x+10-10=3-10$$

$$-7x=-7$$

$$\frac{-7x}{-7}=\frac{-7}{-7}$$

$$x=1$$

$$\{1\}$$

Final Exam Review - Math 101 -

#16.

$\sqrt{4-x} = x-2$

$(\sqrt{4-x})^2 = (x-2)^2$

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

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

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

$0 = x^2-3x$

$0 = x(x-3)$

Either

$x=0$, or $(x-3)=0$

$x=3$

$\{3\}$

check

$\sqrt{4-(0)} = (0)-2$

$\sqrt{4} = -2$

$2 = -2$

False.

$\sqrt{4-(3)} = (3)-2$

$\sqrt{1} = 1$

$1 = 1$

TRUE!

#17.

$\sqrt{4x+1} = 6$

$(\sqrt{4x+1})^2 = (6)^2$

$4x+1 = 36$

$-1+4x+1 = -1+36$

$4x = 35$

$\frac{4x}{4} = \frac{35}{4}$

$x = 35/4$

$\{35/4\}$

#18.

$\sqrt[3]{x+1} = 2$

$(\sqrt[3]{x+1})^3 = (2)^3$

$x+1 = 8$

$-1+x+1 = -1+8$

$x = 7$

$\{7\}$

Final Exam Review - Math 101 -

#19.

$$\sqrt[3]{6x-3}-3=0$$
$$3+\sqrt[3]{6x-3}-3=3+0$$
$$\sqrt[3]{6x-3}=3$$
$$\left[\sqrt[3]{6x-3}\right]^3=(3)^3$$
$$6x-3=27$$
$$3+6x-3=3+27$$
$$6x=30$$
$$\frac{1}{6}\cdot\frac{6x}{1}=\frac{1}{6}\cdot\frac{30}{1}$$
$$x=5$$
$$\{5\}$$

check:

$$\sqrt[3]{6(5)-3}-3=0$$
$$\sqrt[3]{30-3}-3=0$$
$$\sqrt[3]{27}-3=0$$
$$3-3=0$$
$$0=0$$

TRUE!

#21.

$$(x+1)^2-12=0$$
$$12+(x+1)^2-12=12+0$$
$$(x+1)^2=12$$

either

$x+1=+\sqrt{12}$, or $x+1=-\sqrt{12}$

$x+1=\sqrt{4}\sqrt{3}$	$x+1=-\sqrt{4}\sqrt{3}$
$x+1=2\sqrt{3}$	$x+1=-2\sqrt{3}$
$-1+x+1=-1+2\sqrt{3}$	$-1+x+1=-1+[-2\sqrt{3}]$
$x=-1+2\sqrt{3}$	$x=-1-2\sqrt{3}$

$$\{-1+2\sqrt{3},\ -1-2\sqrt{3}\}$$

check:

$$[(-1+2\sqrt{3})+1]^2-12=0$$
$$[2\sqrt{3}]^2-12=0$$
$$4\cdot3-12=0$$
$$12-12=0$$
$$0=0$$

TRUE!

$$[(-1-2\sqrt{3})+1]^2-12=0$$
$$[-2\sqrt{3}]^2-12=0$$
$$4\cdot3-12=0$$
$$12-12=0$$
$$0=0$$

TRUE!

#20. $\sqrt{2x-1} - 4 = -\sqrt{x-4}$

$[\sqrt{2x-1} - 4]^2 = [-\sqrt{x-4}]^2$

$[\sqrt{2x-1} - 4][\sqrt{2x-1} - 4] = x - 4$

$(2x-1) - 4\sqrt{2x-1} - 4\sqrt{2x-1} + 16 = x - 4$

$2x + 15 - 8\sqrt{2x-1} = x - 4$

$-2x - 15 + 2x + 15 - 8\sqrt{2x-1} = -2x - 15 + x - 4$

$-8\sqrt{2x-1} = -x - 19$

$-1\cdot[-8\sqrt{2x-1}] = -1(-x-19)$

$8\sqrt{2x-1} = x + 19$

$[8\sqrt{2x-1}]^2 = (x+19)^2$

$64\cdot(2x-1) = (x+19)(x+19)$

$128x - 64 = x^2 + 19x + 19x + 361$

$-128x + 64 + 128x - 64 = -128x + 64 + x^2 + 38x + 361$

$0 = x^2 - 90x + 425$

$0 = (x-5)(x-85)$

Either

$x - 5 = 0$, or $x - 85 = 0$

$x = 5$ $\quad$ $x = 85$

$\{5\}$

425
1, 425
5, 85 ✓
17, 25

Check

$\sqrt{2(5)-1} - 4 = -\sqrt{(5)-4}$

$\sqrt{10-1} - 4 = -\sqrt{1}$

$\sqrt{9} - 4 = -1$

$3 - 4 = -1$

$-1 = -1$

TRUE!

$\sqrt{2(85)-1} - 4 = -\sqrt{(85)-4}$

$\sqrt{170-1} - 4 = -\sqrt{81}$

$\sqrt{169} - 4 = -9$

$13 - 4 = -9$

$+9 = -9$

TRUE!

Final Exam Review -Math101-

#22.

$$(3x-2)^2+4=0$$
$$-4+(3x-2)^2+4=-4+0$$
$$(3x-2)^2=-4$$

$i=\sqrt{-1}$

Either

$3x-2=+\sqrt{-4}$, or $3x-2=-\sqrt{-4}$

$3x-2=\sqrt{4}\sqrt{-1}$	$3x-2=-\sqrt{4}\sqrt{-1}$
$3x-2=2i$	$3x-2=-2i$
$2+3x-2=2+2i$	$2+3x-2=2+(-2i)$
$3x=2+2i$	$3x=2-2i$
$\frac{3x}{3}=\frac{2+2i}{3}$	$\frac{3x}{3}=\frac{2-2i}{3}$
$x=\frac{2}{3}+\frac{2}{3}i$	$x=\frac{2}{3}-\frac{2}{3}i$

$$\left\{\frac{2}{3}+\frac{2i}{3},\ \frac{2}{3}-\frac{2i}{3}\right\}$$

#23.

$$2x^2-4x=3$$
$$-3+2x^2-4x=-3+3$$
$$2x^2-4x-3=0$$

$\begin{cases} a=2 \\ b=-4 \\ c=-3 \end{cases}$

$$x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$$
$$x=\frac{-(-4)\pm\sqrt{(-4)^2-4(2)(-3)}}{2(2)}$$
$$x=\frac{4\pm\sqrt{16+24}}{4}$$
$$x=\frac{4\pm\sqrt{40}}{4}$$
$$x=\frac{4\pm\sqrt{4}\sqrt{10}}{4}$$
$$x=\frac{4\pm2\sqrt{10}}{4}$$
$$x=\frac{\cancel{2}(2\pm\sqrt{10})}{\cancel{2}\cdot2}$$
$$x=\frac{2\pm\sqrt{10}}{2}$$

$$\left\{\frac{2+\sqrt{10}}{2},\ \frac{2-\sqrt{10}}{2}\right\}$$

Final Exam Review – Math 101 –

#24. $5x^2 - 3 = 14x$

$-14x + 5x^2 - 3 = -14x + 14x$

$5x^2 - 14x - 3 = 0$

$\begin{cases} a = 5 \\ b = -14 \\ c = -3 \end{cases}$ $\quad x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$x = \dfrac{-(-14) \pm \sqrt{(-14)^2 - 4(5)(-3)}}{2(5)}$

$x = \dfrac{14 \pm \sqrt{196 + 60}}{10}$

$x = \dfrac{14 \pm \sqrt{256}}{10}$

$x = \dfrac{14 \pm 16}{10}$

Either

$x = \dfrac{14 + 16}{10}$, or $x = \dfrac{14 - 16}{10}$

$x = \dfrac{30}{10}$ $\qquad x = -\dfrac{2}{10}$

$x = 3$ $\qquad x = -\dfrac{1}{5}$

$\{3, -\frac{1}{5}\}$

#25. $x^{2/3} - 5x^{1/3} = -6$

$6 + x^{2/3} - 5x^{1/3} = -6 + 6$

$x^{2/3} - 5x^{1/3} + 6 = 0$

$\boxed{\text{let } t = x^{1/3},\ t^2 = (x^{1/3})^2 = x^{2/3}}$

$t^2 - 5t + 6 = 0$

$(t - 2)(t - 3) = 0$

Either

$t - 2 = 0$ or $t - 3 = 0$

$\boxed{t = 2}$ $\qquad \boxed{t = 3}$

$x^{1/3} = 2$ $\qquad x^{1/3} = 3$

$(x^{1/3})^3 = (2)^3$ $\qquad (x^{1/3})^3 = (3)^3$

$x = 8$ $\qquad x = 27$

$\{8, 27\}$

check

$(8)^{2/3} - 5(8)^{1/3} = -6$

$(\sqrt[3]{8})^2 - 5(\sqrt[3]{8}) = -6$

$(2)^2 - 5(2) = -6$

$4 - 10 = -6$

$-6 = -6$, TRUE!

$(27)^{2/3} - 5(27)^{1/3} = -6$

$(\sqrt[3]{27})^2 - 5(\sqrt[3]{27}) = -6$

$(3)^2 - 5(3) = -6$

$9 - 15 = -6$

$-6 = -6$

TRUE!

Final Exam Review – Math 101 –

#26. $x^4 - 3x^2 = 4$

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

$x^4 - 3x^2 - 4 = 0$

$\boxed{\text{let } t = x^2, \quad t^2 = (x^2)^2 = x^4}$

$t^2 - 3t - 4 = 0$

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

Either

$t - 4 = 0$, or $t + 1 = 0$

$\boxed{t = 4}$ $\qquad$ $\boxed{t = -1}$

$x^2 = 4$ $\qquad$ $x^2 = -1$

Either $\qquad$ Either

$x = +\sqrt{4}$, or $x = -\sqrt{4}$ $\qquad$ $x = +\sqrt{-1}$, or $x = -\sqrt{-1}$

$x = 2, \quad x = -2$ $\qquad$ $x = i, \quad x = -i$

$\{2, -2, i, -i\}$

check

$(-i)^4 - 3(-i)^2 = 4$

$1 - 3(-1) = 4$

$1 + 3 = 4$

$4 = 4$ TRUE

$(-2)^4 - 3(-2)^2 = 4$

$16 - 3(4) = 4$

$16 - 12 = 4$

$4 = 4$ TRUE

$(i)^2 = -1$

$(i)^4 = (i)^2 \cdot (i)^2$

$= (-1)(-1)$

$= 1$

#27. $5^{2x-3} = 25$

$5^{2x-3} = 5^2$

$2x - 3 = 2$

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

$2x = 5$

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

$x = 5/2$

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

check:

$5^{2(\frac{5}{2}) - 3} = 25$

$5^{5-3} = 25$

$5^2 = 25$

$25 = 25$

TRUE!

Final Exam Review - Math 101 -

#28.

$$25^{2x-3} = 5$$
$$(5^2)^{2x-3} = 5$$
$$5^{2[2x-3]} = 5^1$$
$$5^{4x-6} = 5^1$$
$$4x-6 = 1$$
$$4x-6+6 = 6+1$$
$$4x = 7$$
$$\frac{4x}{4} = \frac{7}{4}$$
$$x = \frac{7}{4}$$
$$\left\{\frac{7}{4}\right\}$$

Check:

$$25^{2\left(\frac{7}{4}\right)-3} = 5$$
$$25^{\frac{7}{2}-3} = 5$$
$$25^{\frac{7}{2}-\frac{6}{2}} = 5$$
$$25^{1/2} = 5$$
$$\sqrt{25} = 5$$
$$5 = 5$$

TRUE!

#29

$$\log_2(x+1) = 4$$
$$2^4 = x+1$$
$$16 = x+1$$
$$-1+16 = -1+x+1$$
$$15 = x$$

OR

$$2^{\log_2(x+1)} = 2^4$$
$$x+1 = 16$$
$$-1+x+1 = -1+16$$
$$x = 15$$

$$\{15\}$$

Check

$$\log_2[(15)+1] = 4$$
$$\log_2(16) = 4$$
$$2^4 = 16$$
$$16 = 16$$

TRUE!

Final Exam Review — Math 101 —

#30.

$\log_2(x) + \log_2(x+2) = 3$

$\log_2[(x)(x+2)] = 3$

$\log_2[x^2+2x] = 3$

$2^3 = x^2+2x$

$8 = x^2+2x$

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

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

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

Either

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

$x=-4$ $\quad$ $x=2$

$\{2\}$

Check

$\log_2(2) + \log_2[(2)+2] = 3$

$1 + \log_2(4) = 3$

$1 + \log_2(2^2) = 3$

$1 + 2 = 3$

$3 = 3$

TRUE!

-4 is not allowed as a value in $\text{Log}_2(x)$

i.e. $\log_2(-4)$ is not defined as a Real Number

Final Exam Review – Math 101 –

#31

$2x^2 - 5x - 7 < 0$

$2x^2 - 5x - 7 = 0$ ← Find Boundary Points

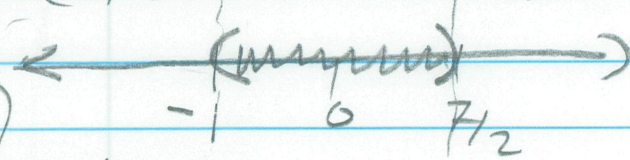
$(2x - 7)(x + 1) = 0$

Either

$2x - 7 = 0$, or $x + 1 = 0$

$7 + 2x - 7 = 7 + 0$	$-1 + x + 1 = 0 + (-1)$
$2x = 7$	$\underline{x = -1}$
$\frac{2x}{2} = \frac{7}{2}$	
$x = 7/2$	

Region A	Region B	Region C
$(-\infty, -1)$	$(-1, 7/2)$	$(\frac{7}{2}, \infty)$



Test $x = -2$	$x = 0$	$x = 4$
$2(-2)^2 - 5(-2) - 7 < 0$	$2(0)^2 - 5(0) - 7 < 0$	$2(4)^2 - 5(4) - 7 < 0$
$2 \cdot 4 + 10 - 7 < 0$	$0 - 0 - 7 < 0$	$2 \cdot 16 - 20 - 7 < 0$
$8 + 10 - 7 < 0$	$-7 < 0$	$32 - 27 < 0$
$18 - 7 < 0$	TRUE!	$5 < 0$
$11 < 0$		False!
FALSE!		

$(-1, \frac{7}{2}) = \{x \mid -1 < x < 7/2\}$ = Solution Set

Final Exam Review – Math 101 –

#32. $\dfrac{x-3}{x+7} \geq 0$

Region A $(-\infty,-7)$ | Region B $(-7,3)$ | Region C $(3,\infty)$

Solve for Boundary Points:

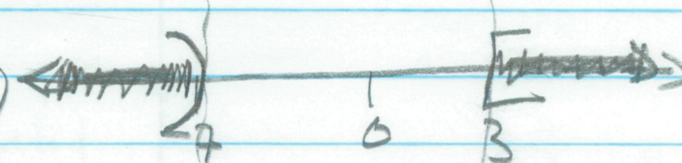
$x-3=0$

$x=3$

$x+7=0$

$x=-7$

Excluded value!



Test $x=-8$ | Test $x=0$ | Test $x=4$

$\dfrac{(-8)-3}{(-8)+7} \geq 0$

$\dfrac{-11}{-1} \geq 0$

$11 \geq 0$

TRUE!

$\dfrac{(0)-3}{(0)+7} \geq 0$

$\dfrac{-3}{7} \geq 0$

False!

$\dfrac{(4)-3}{(4)+7} \geq 0$

$\dfrac{1}{11} \geq 0$

TRUE!

Solution Set $= \{x \mid x < -7 \text{ or } x \geq 3\}$

$= (-\infty,-7) \cup [3,\infty)$

#33. $\sqrt{(3x-8)^2} = |3x-8|$

#34. $\sqrt[5]{(3x-8)^5} = 3x-8$

#35. $\sqrt[7]{x^2} \cdot \sqrt[6]{x} = x^{2/7} \cdot x^{1/6}$

$= x^{\frac{2}{7}+\frac{1}{6}}$

$= x^{\frac{2}{7}\cdot\frac{6}{6}+\frac{1}{6}\cdot\frac{7}{7}}$

$= x^{\frac{12}{49}+\frac{7}{49}}$

$= x^{\frac{19}{49}}$

$= \sqrt[49]{x^{19}}$

Final Exam Review - Math 101 -

#36.

$$\frac{\sqrt[5]{x}}{\sqrt[3]{x^2}} = \frac{x^{1/5}}{x^{2/3}}$$

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

$$= x^{\frac{1}{5}\cdot\frac{3}{3}-\frac{2}{3}\cdot\frac{5}{5}}$$

$$= x^{\frac{3}{15}-\frac{10}{15}}$$

$$= x^{-\frac{7}{15}}$$

$$= \frac{1}{x^{7/15}}$$

$$= \frac{1}{\sqrt[15]{x^7}}$$

#37.

$$\sqrt{50x^3y^4} = \sqrt{5^2x^2y^4}\cdot\sqrt{2x}$$

$$= 5xy^2\sqrt{2x}$$

SDWK

50
2 25
5 5

$50 = 2\cdot 5^2$

#38.

$$\sqrt[3]{16x^4y^5} = \sqrt[3]{2^3x^3y^3}\cdot\sqrt[3]{2xy^2}$$

$$= 2xy\sqrt[3]{2xy^2}$$

SDWK

16
4 4
2 2 2 2

$16 = 2^4$

#39.

$$\sqrt{12xy}\cdot\sqrt{3y} = \sqrt{36xy^2}$$

$$= \sqrt{6^2y^2}\cdot\sqrt{x}$$

$$= 6y\sqrt{x}$$

#40.

$$\sqrt[5]{8x^3y^4}\cdot\sqrt[5]{4x^3y^3} = \sqrt[5]{32x^6y^7}$$

$$= \sqrt[5]{2^5x^5y^5}\cdot\sqrt[5]{xy^2}$$

$$= 2xy\sqrt[5]{xy^2}$$

SDWK

32
4 8
2 2 2 4
2 2

$32 = 2^5$

#41.

$$\sqrt{3}\,(2x+\sqrt{6})$$

$$= \sqrt{3}\cdot 2x + \sqrt{3}\cdot\sqrt{6}$$

$$= 2x\sqrt{3} + \sqrt{18}$$

$$= 2x\sqrt{3} + \sqrt{9}\cdot\sqrt{2}$$

$$= 2x\sqrt{3} + 3\sqrt{2}$$

SDWK

18
2 9
3 3

$18 = 2\cdot 3^2$

$= 2\cdot 9$

Final Exam Review — Math 101 —

#42.

$$(5-\sqrt{3})(6+\sqrt{2})$$
$$= (5)\cdot(6) + (5)\cdot(\sqrt{2}) + (-\sqrt{3})(6) + (-\sqrt{3})(\sqrt{2})$$
$$= 30 + 5\sqrt{2} - 6\sqrt{3} - \sqrt{6}$$

#43.

$$\frac{5\sqrt{3x}}{\sqrt{y}} = \frac{5\sqrt{3x}}{\sqrt{y}} \cdot \frac{\sqrt{y}}{\sqrt{y}}$$
$$= \frac{5\sqrt{3xy}}{\sqrt{y^2}}$$
$$= \frac{5\sqrt{3xy}}{y}$$

#44.

$$\frac{2+\sqrt{x}}{3-\sqrt{x}} = \left(\frac{2+\sqrt{x}}{3-\sqrt{x}}\right)\left(\frac{3+\sqrt{x}}{3+\sqrt{x}}\right)$$
$$= \frac{(2)(3) + (2)(\sqrt{x}) + (\sqrt{x})(3) + (\sqrt{x})(\sqrt{x})}{3^2 - (\sqrt{x})^2}$$
$$= \frac{6 + 2\sqrt{x} + 3\sqrt{x} + x}{9 - x}$$
$$= \frac{6 + 5\sqrt{x} + x}{9-x}$$

#45.

$$\frac{4x}{\sqrt[5]{2x^2y^4}} = \frac{4x}{\sqrt[5]{2x^2y^4}} \cdot \frac{\sqrt[5]{2^4x^3y}}{\sqrt[5]{2^4x^3y}}$$
$$= \frac{4x\sqrt[5]{16x^3y}}{\sqrt[5]{2^5x^5y^5}} = \frac{4x\sqrt[5]{16x^3y}}{2xy}$$
$$= \frac{2\sqrt[5]{16x^3y}}{y}$$

Final Exam Review - Math 101

#46.

$\sqrt{-36} = \sqrt{36}\sqrt{-1}$

$= 6i$

#47. $3\sqrt{-25} = 3\sqrt{25}\sqrt{-1}$

$= 3 \cdot 5i$

$= 15i$

#48. $\sqrt{-9} \cdot \sqrt{-16} = \sqrt{9}\sqrt{-1} \cdot \sqrt{16}\sqrt{-1}$

$= 3i \cdot 4i$

$= 12i^2$

$= 12(-1)$

$= -12$

$i^2 = -1$

#49. $(3+i)^2 + (4-2i)$

$= (3+i)(3+i) + 4 - 2i$

$= 9 + 3i + 3i + i^2 + 4 - 2i$

$= 9 + 6i + (-1) + 4 - 2i$

$= 12 + 4i$

#50. $\dfrac{12+i}{2-3i} = \left(\dfrac{12+i}{2-3i}\right)\left(\dfrac{2+3i}{2+3i}\right)$

$= \dfrac{12 \cdot 2 + 36i + 2i + 3i^2}{(2)^2 - (3i)^2}$

$= \dfrac{24 + 38i + 3(-1)}{4 - 9(-1)}$

$= \dfrac{24 + 38i - 3}{4 + 9}$

$= \dfrac{21 + 38i}{13}$

Final Exam Review – Math 101 –

#51.

$$i^{29} = i^{28} \cdot i^{1}$$
$$= (i^{4})^{7} \cdot i$$
$$= 1^{7} \cdot i$$
$$= 1 \cdot i$$
$$= i$$

$i = \sqrt{-1}$ $\quad i^{3} = -i$

$i^{2} = -1$ $\quad i^{4} = 1$

#52. $i^{40} = (i^{4})^{10}$

$$= 1^{10}$$
$$= 1$$

#53. $\{\frac{1}{2}, 3\}$

$x = \frac{1}{2}$ or $x = 3$

$2 \cdot x = 2 \cdot \frac{1}{2}$

$2x = 1$

$-1 + 2x = -1 + 1$

$2x - 1 = 0$

$-3 + x = -3 + 3$

$x - 3 = 0$

$$(2x-1)(x-3) = 0$$
$$2x^2 - 6x - x + 3 = 0$$
$$2x^2 - 7x + 3 = 0 \checkmark$$

#54. $\{-4, 2\}$

$x = -4$, or $x = 2$

$x + 4 = -4 + 4$

$x + 4 = 0$

$-2 + x = -2 + 2$

$x - 2 = 0$

$$(x+4)(x-2) = 0$$
$$x^2 - 2x + 4x - 8 = 0$$
$$x^2 + 2x - 8 = 0 \checkmark$$

Final Exam Review — Math 101 —

#55. $\{2i, -2i\}$

$x = 2i$, or $x = -2i$

$-2i + x = -2i + 2i$ | $x + 2i = -2i + 2i$

$x - 2i = 0$ | $x + 2i = 0$

$(x - 2i)(x + 2i) = 0$

$x^2 + 2ix - 2ix - 4i^2 = 0$

$x^2 - 4(-1) = 0$

$x^2 + 4 = 0$ ✓

#56. $-2x^2 + 9x + 5 = 0$

$\begin{cases} a = -2 \\ b = 9 \\ c = 5 \end{cases}$

$D = b^2 - 4ac$

$D = (9)^2 - 4(-2)(5)$

$D = 81 + 8 \cdot 5$

$D = 81 + 40$

$D = 121 > 0$

Two Real Solutions.

#57. $5x^2 - 4x = -6$

$5x^2 - 4x + 6 = -6 + 6$

$5x^2 - 4x + 6 = 0$

$\begin{cases} a = 5 \\ b = -4 \\ c = 6 \end{cases}$

$D = (-4)^2 - 4(5)(6)$

$D = 16 - 20 \cdot 6$

$D = 16 - 120$

$D = -104 < 0$

Two Complex Solutions that are not Real (Conjugates)

20/34

Final Exam Review – Math 101 –

#58. $-9x^2 = 6x - 1$

$-9x^2 + 9x^2 = 9x^2 + 6x - 1$

$0 = 9x^2 + 6x - 1$

$\begin{cases} a = 9 \\ b = 6 \\ c = -1 \end{cases}$

$D = b^2 - 4ac$

$D = (6)^2 - 4(9)(-1)$

$D = 36 + 36$

$D = 72 > 0$

Two Real solutions.

#59. $f(x) = 4x^2 - x - 7$

$f(4) = 4(4)^2 - (4) - 7$

$f(4) = 4 \cdot 16 - 4 - 7$

$f(4) = 64 - 11$

$f(4) = 53$ ✓

#60.

$f(-2) = 4(-2)^2 - (-2) - 7$

$f(-2) = 4 \cdot 4 + 2 - 7$

$f(-2) = 16 - 5$

$f(-2) = 11$ ✓

#61. $f(\sqrt{2}) = 4(\sqrt{2})^2 - (\sqrt{2}) - 7$

$f(\sqrt{2}) = 4(2) - \sqrt{2} - 7$

$f(\sqrt{2}) = 8 - \sqrt{2} - 7$

$f(\sqrt{2}) = 1 - \sqrt{2}$ ✓

#62.

$f(2i) = 4(2i)^2 - (2i) - 7$

$f(2i) = 4 \cdot 4i^2 - 2i - 7$

$f(2i) = 16(-1) - 2i - 7$

$f(2i) = -16 - 2i - 7$

$f(2i) = -23 - 2i$ ✓

#63 $f(t+i) = 4(t+i)^2 - (t+i) - 7$

$f(t+i) = 4(t+i)(t+i) - t - i - 7$

$f(t+i) = 4[t^2 + ti + ti + i^2] - t - i - 7$

$f(t+i) = 4[t^2 + 2ti + (-1)] - t - i - 7$

$f(t+i) = 4t^2 + 8ti - 4 - t - i - 7$

$f(t+i) = 4t^2 + 8ti - t - i - 11$ ✓

#64. $f(x)=x^2-1$, $g(x)=2x-3$

$(f+g)(0)=f(0)+g(0)$
$=[(0)^2-1]+[2(0)-3]$
$=-1+(-3)$
$(f+g)(0)=-4$ ✓

#65.
$(fg)(x)=(x^2-1)(2x-3)$
$=2x^3-3x^2-2x+3$ ✓

#66. $f(3)+g(-1)=[(3)^2-1]+[2(-1)-3]$
$=(9-1)+(-2-3)$
$=8+(-5)$
$=3$ ✓

#67. $(f\circ g)(2)=f(g(2))$
$=[g(2)]^2-1$
$=[2(2)-3]^2-1$
$=[4-3]^2-1$
$=(1)^2-1$
$=1-1$
$=0$ ✓

#68. $(f\circ g)(x)=f(g(x))$
$=[g(x)]^2-1$
$=[2x-3]^2-1$
$=[2x-3][2x-3]-1$
$=4x^2-6x-6x+9-1$
$=4x^2-12x+8$ ✓

#69. If any vertical line intersects a graph in more than one point, the graph does not define y as a function of x.
Use the VLT to determine whether a given graph represents a function.

#70.
A function f has an inverse that is a function, f^{-1}, if there is no horizontal line that intersects the graph of the function f at more than one point.
Use HLT to determine whether a give graph has an inverse that is a function.

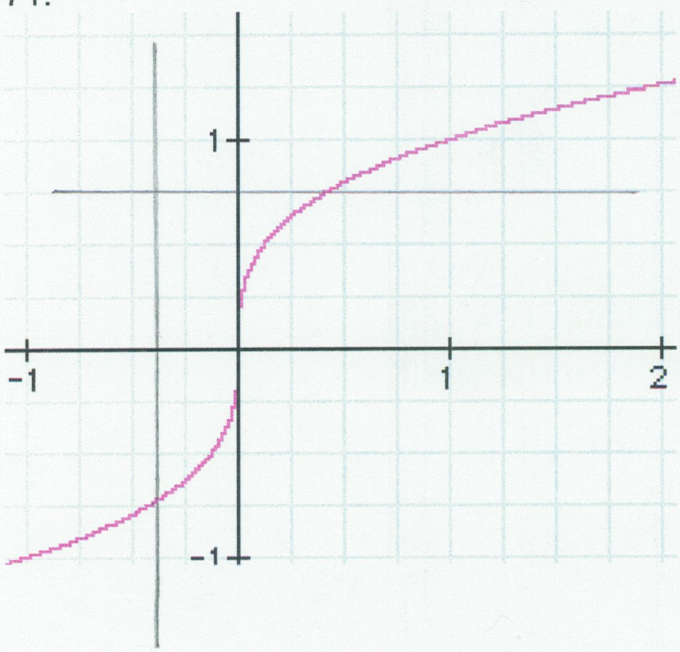
Problems #64-69: Given $f(x) = x^2 - 1$ and $g(x) = 2x - 3$, find each of the following.

64. $(f + g)(0)$
65. $(fg)(x)$
66. $f(3) + g(-1)$
67. $(f \circ g)(2)$
68. $(f \circ g)(x)$

69. State the Vertical Line Test. What is the Vertical Line Test used for?
70. State the Horizontal Line Test. What is the Horizontal Line Test used for?

Problems #71-73: For each graph, apply the appropriate test and determine if the graph represents a function and, if it does represent a function, whether the function has an inverse function.

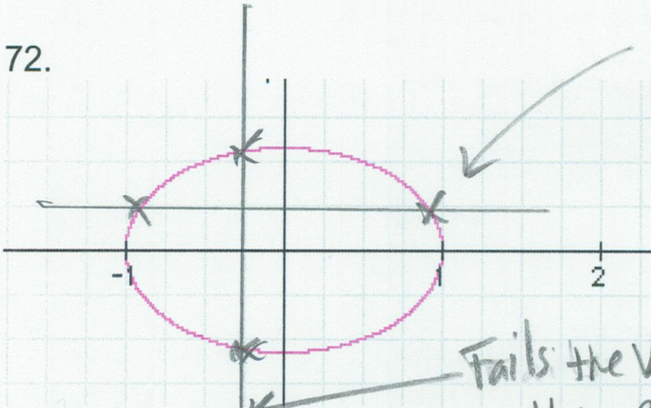
71.



Passes the Vertical Line Test, and the graph represents a function.

Passes the Horizontal Line Test, and the graph has an inverse that is a function.

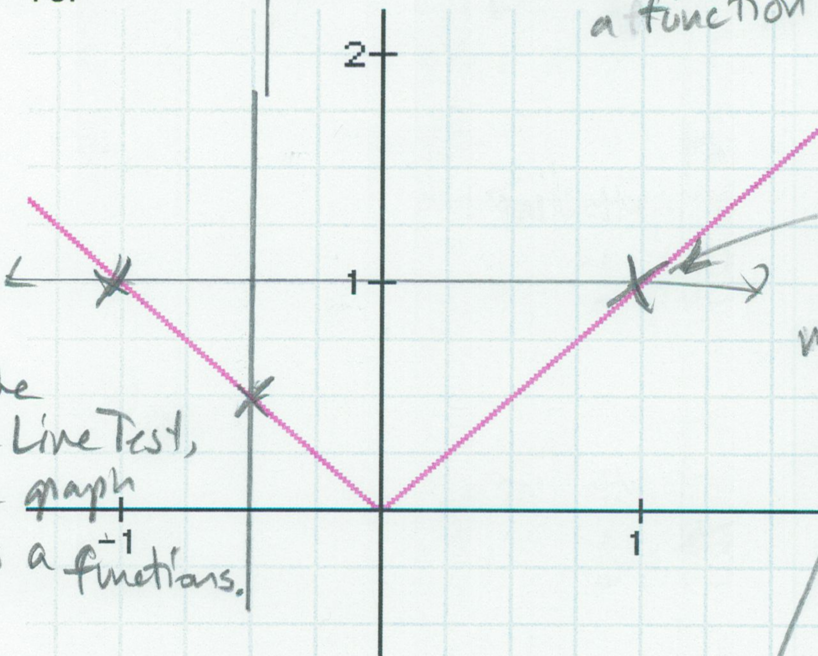
72.



Fails the Horizontal Line test, and the graph does not have an inverse that is a function

Fails the Vertical Line Test, and the graph does not represent a function.

73.



Passe the Vertical Line Test, and the graph represents a functions.

Fails the Horizontal Line Test, and the graph does not have an inverse that is a function.

~~check:~~

$f^{-1}(f(x)) = \frac{6(f(x))+7}{5}$

$= \frac{6\left[\frac{5x-7}{6}\right]+7}{5}$

$= \frac{5x-7+7}{5}$

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

$= x$ ✓

74. Given $f(x) = \frac{5x-7}{6}$, find the inverse function $f^{-1}(x)$.

let $y = \frac{5x-7}{6}$

"trade x & y"

$x = \frac{5y-7}{6}$

$6 \cdot x = 6 \cdot \left[\frac{5y-7}{6}\right]$

$6x = 5y-7$

$6x+7 = 5y-7+7$

$\frac{6x+7}{5} = \frac{5y}{5}$

$\frac{6x+7}{5} = y$

$f^{-1}(x) = \frac{6x+7}{5}$

check: $f(f^{-1}(x)) = \frac{5[f^{-1}(x)]-7}{6}$

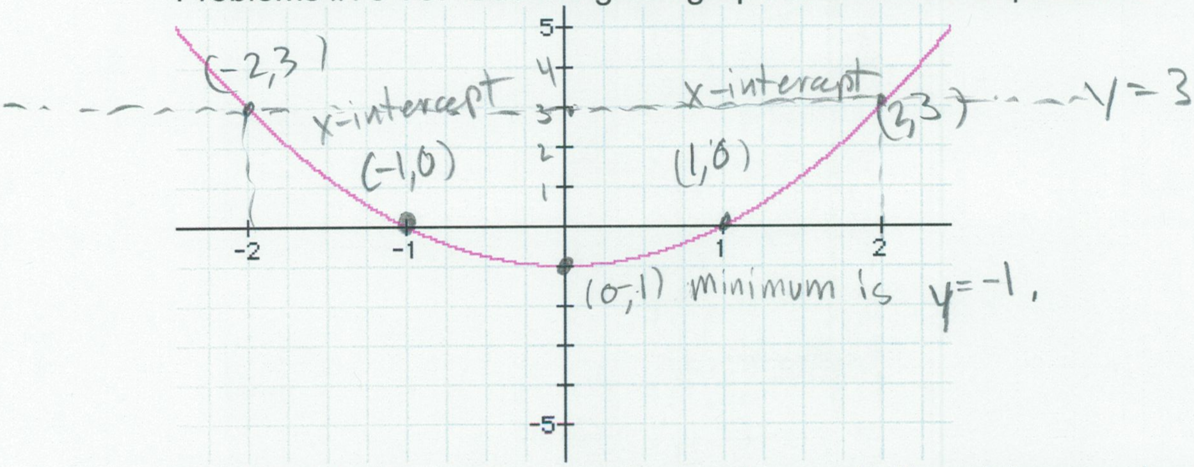
$= \frac{5\left(\frac{6x+7}{5}\right)-7}{6}$

$= \frac{6x+7-7}{6}$

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

$= x$ ✓

Problems #75-79: Use the given graph to answer the questions.



75. What is the smallest y-value on the graph (the minimum value for the function)? y=-1

76. What is the x-coordinate where the smallest y-value occurs? x=0

77. What are the x-intercepts? (Give your answer in ordered pair form). (-1,0) & (1,0)

78. If x = 0, what is y? y=-1

79. If f(x) = 3, what is x? x=2 or x=-2

Problems #80-89: Graph the given functions. Set up a table of coordinates. Find x-intercepts and y-intercepts, and any other important features of the graph. For a parabola, find the vertex. For an exponential function, find the horizontal asymptote.

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

81. $f(x) = -2(x+2)^2 - 1$

82. $f(x) = x^2 - 6x + 5$

83. $f(x) = -x^2 + 8x - 17$

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

85. $f(x) = 2^{x+3}$

86. $f(x) = 2^x - 1$

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

88. $f(x) = \log_{\frac{1}{3}} x$

89. $f(x) = \sqrt{x+3}$

25/34

Vertex $(h,k) = (1,3)$

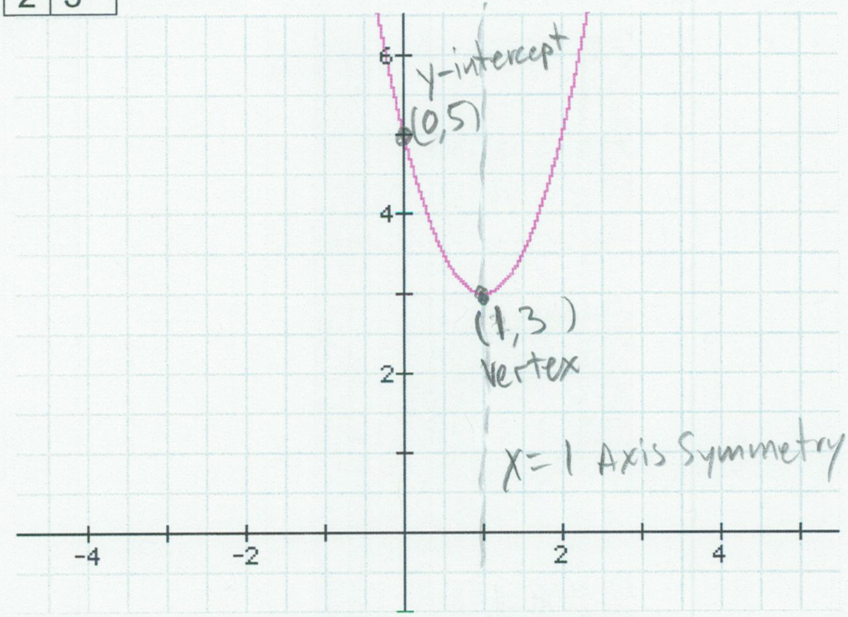
$a = 2 > 0$

80. V(1,3), a>o so parabola opens up

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

$f(x) = a(x-h)^2 + k$

x	y
0	5
1	3
2	5



81. V(−2,−1), a<0 so parabola opens downward

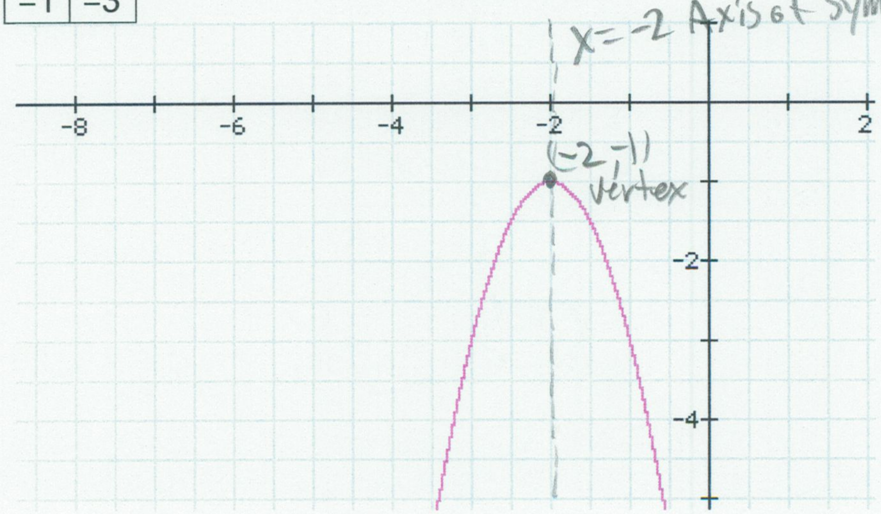
vertex $(h,k) = (-2,-1)$

$f(x) = -2(x+2)^2 - 1$

$f(x) = a(x-h)^2 + k$

x	y
−3	−3
−2	−1
−1	−3

$a = -2 < 0$



$f(x) = ax^2 + bx + c$

$f(x) = x^2 - 6x + 5$

$\begin{cases} a = 1 > 0 \\ b = -6 \\ c = 5 \end{cases}$

82. V(3,–4), a>0 so the parabola opens upward

Vertex $= \left(\frac{-b}{2a}, f\left(\frac{-b}{2a}\right)\right)$

$x = \frac{-(-6)}{2(1)}$

$x = \frac{6}{2}$

$x = 3$

$y = f(3)$

$y = (3)^2 - 6(3) + 5$

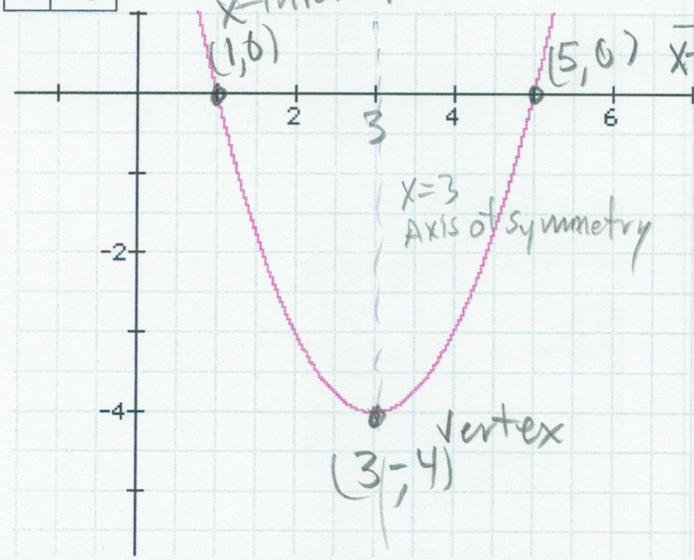
$y = 9 - 18 + 5$

$y = -9 + 5$

$y = -4$

$(3,-4)$ vertex

x	y
2	–3
3	–4
4	–3



$0 = x^2 - 6x + 5$

$0 = (x-5)(x-1)$

Either

$x - 5 = 0$, or $x - 1 = 0$

$x = 5$ $\quad x = 1$

$(5,0)$ & $(1,0)$

Vertex $= \left(\frac{-b}{2a}, f\left(\frac{-b}{2a}\right)\right)$

83. V(4,–1), a<0, so the parabola opens downward

$f(x) = -x^2 + 8x - 17$

$\left.\begin{matrix} a = -1 < 0 \\ b = 8 \\ c = -17 \end{matrix}\right\}$

$x = \frac{-b}{2a}$

$x = \frac{-(8)}{2(-1)}$

$x = \frac{-8}{-2}$

$x = 4$

$y = f(4)$

$y = -(4)^2 + 8(4) - 17$

$y = -16 + 32 - 17$

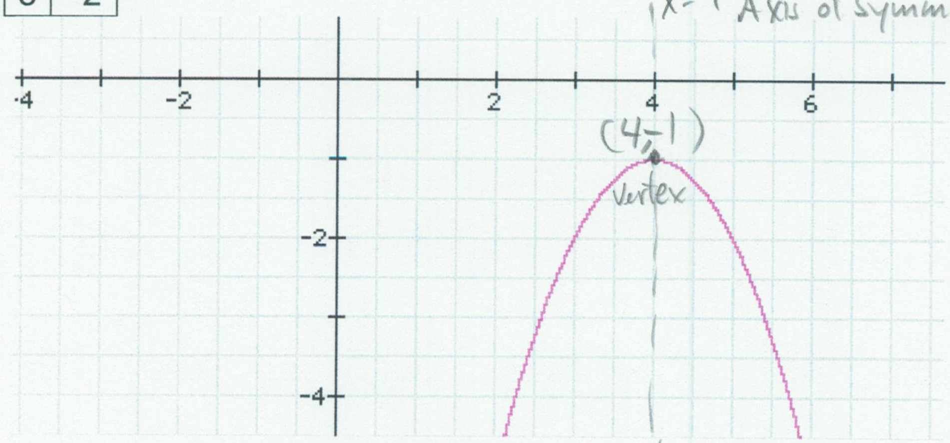
$y = 16 - 17$

$y = -1$

$x = 4$ Axis of Symmetry

$(4,-1)$ vertex

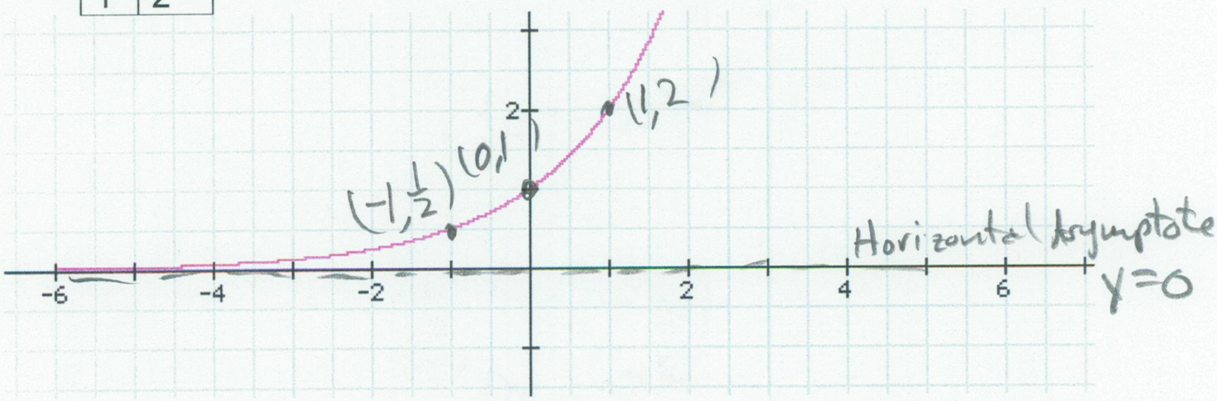
x	y
3	–2
4	–1
5	–2



84. exponential graph, horizontal asymptote is the negative x-axis

$f(x) = 2^x$

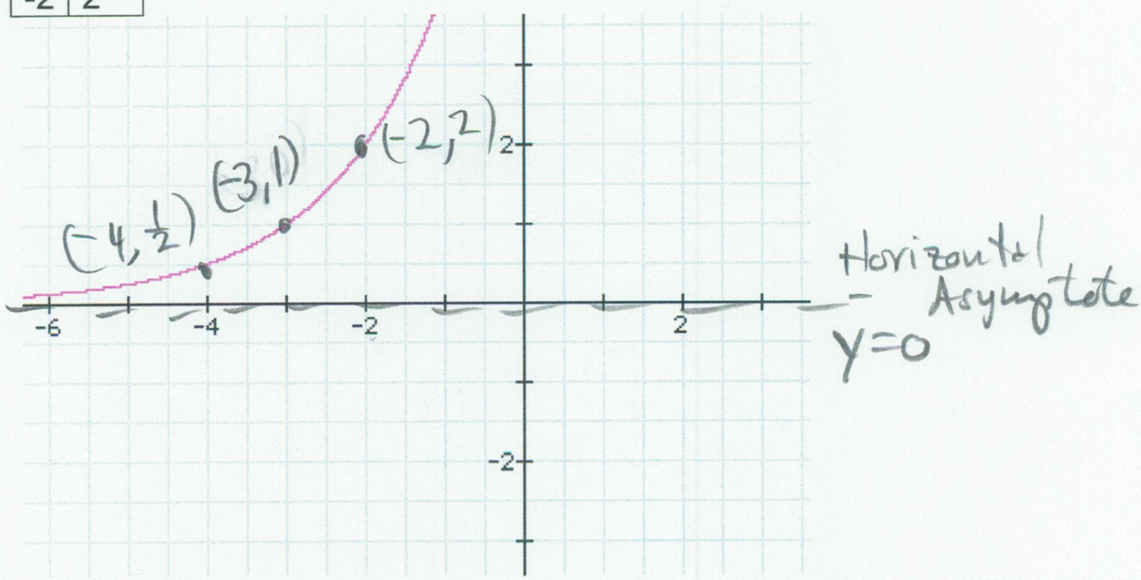
x	y
-1	0.5
0	1
1	2



85. exponential graph, shift $y = 2^x$ three units to the left, horizontal axymptote is the negative x-axis.

$f(x) = 2^{x+3}$

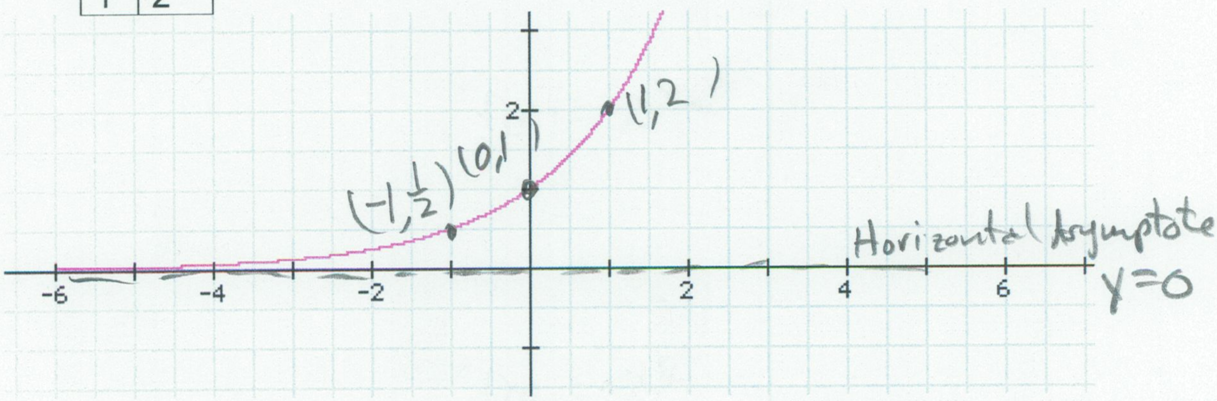
x	y
-4	0.5
-3	1
-2	2



84. exponential graph, horizontal asymptote is the negative x-axis

$f(x) = 2^x$

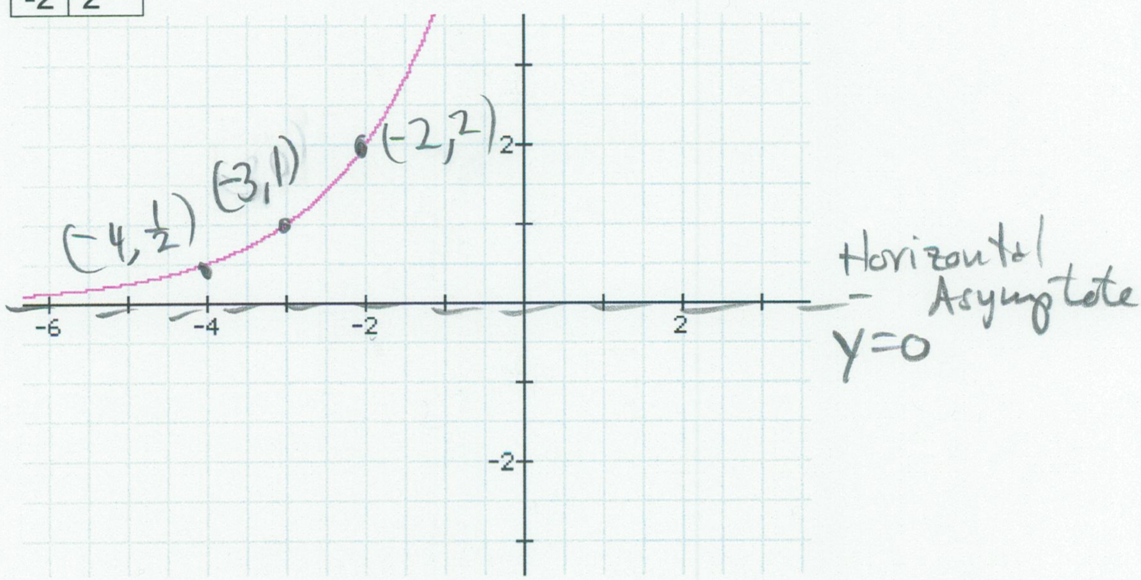
x	y
-1	0.5
0	1
1	2



85. exponential graph, shift $y = 2^x$ three units to the left, horizontal axymptote is the negative x-axis.

$f(x) = 2^{x+3}$

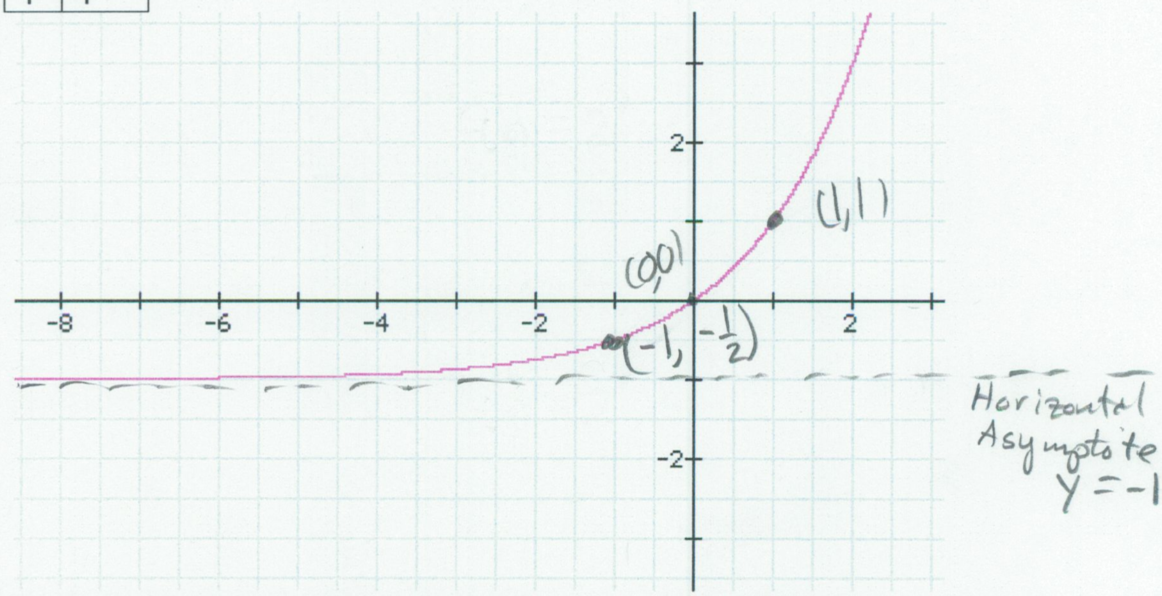
x	y
-4	0.5
-3	1
-2	2



86. exponential graph, shift $y = 2^x$ one unit down, horizontal asymptote moves down one unit also to the horizontal line y = -1.

$f(x) = 2^x - 1$

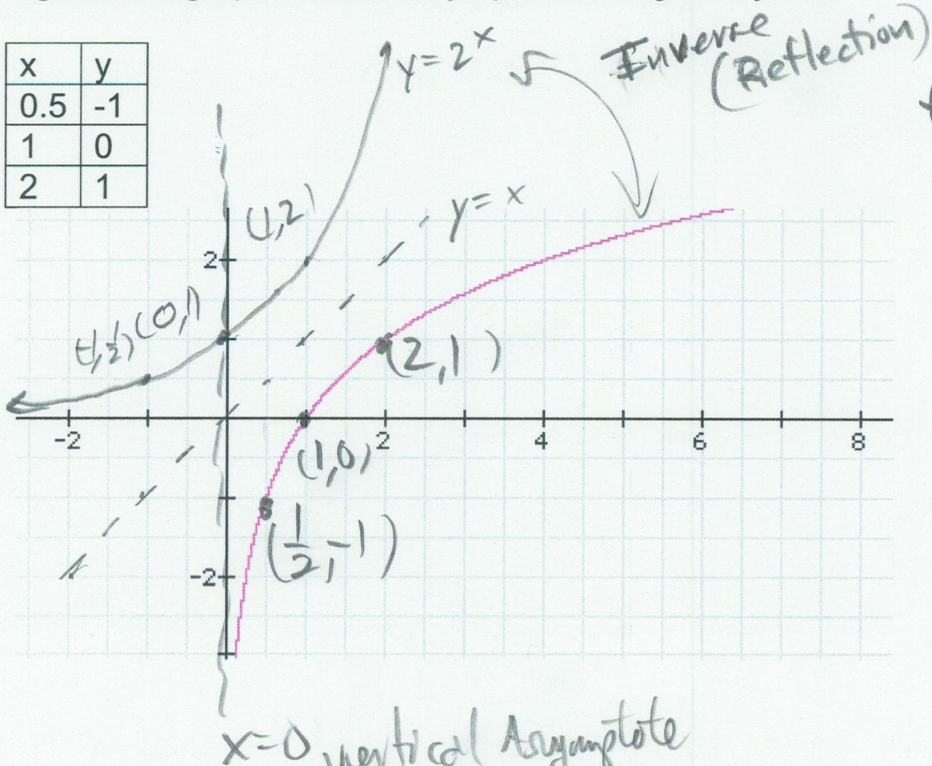
x	y
-1	-0.5
0	0
1	1



87. logarithmic graph, vertical asymptote is negative y-axis

x	y
0.5	-1
1	0
2	1

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



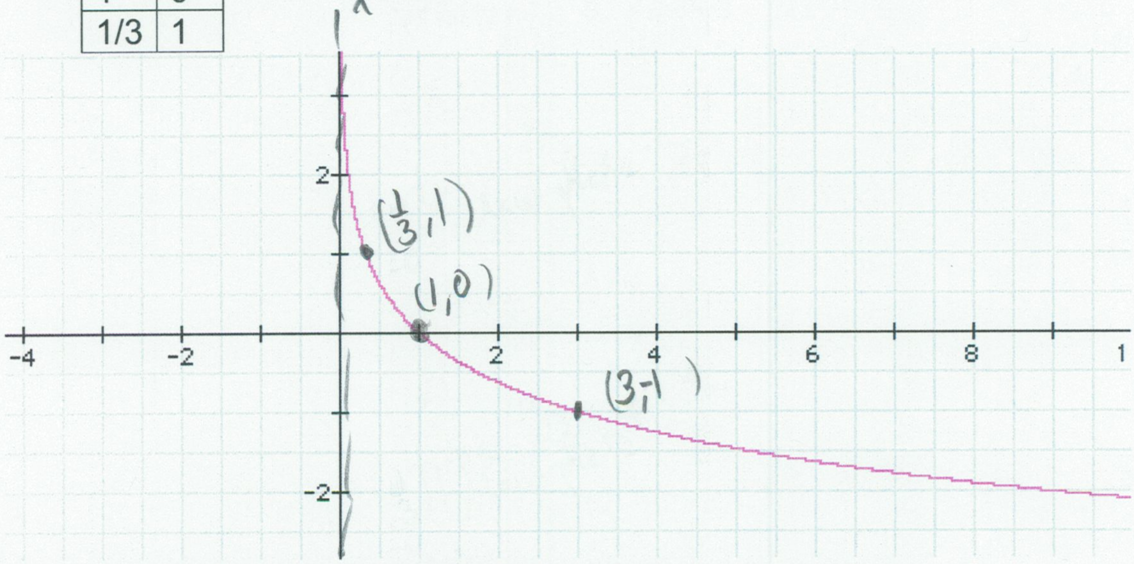
29/34

88. logarithmic graph, vertical asymptote is positive y-axis

x	y
3	-1
1	0
1/3	1

Vertical Asymptote $x=0$

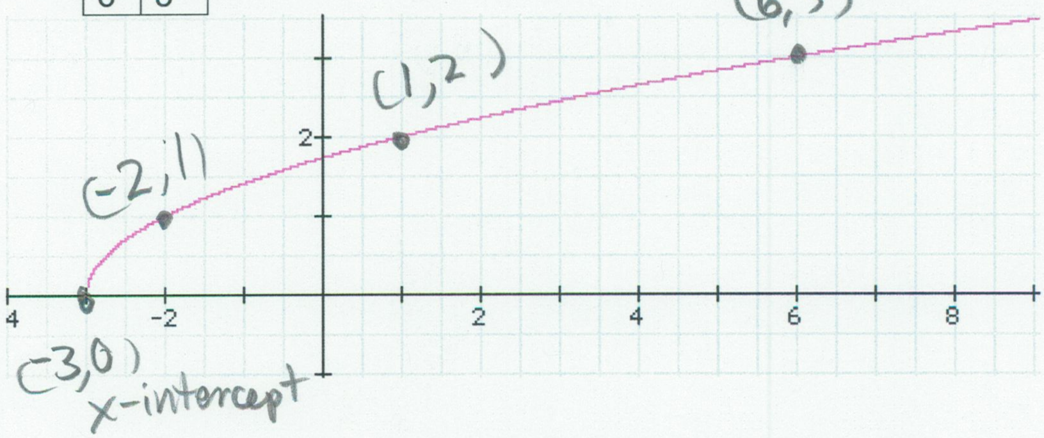
$f(x) = \log_{\frac{1}{3}}(x)$



89. graph of square root function, domain is x > -3.

$f(x) = \sqrt{x+3}$

x	y
-3	0
1	2
6	3



Final Exam Review - Math 101 -

30/34

#90.

$\sqrt{9+19} + \sqrt{25} = \sqrt{28} + 5$

$\approx 5.2915 + 5$

≈ 10.2915

≈ 10.292 ✓

#91 $15^{4/7} \approx 4.6995$

≈ 4.700

≈ 4.7 ✓

#92.

$\sqrt[5]{41} + \sqrt[4]{4}$

$= (41)^{\frac{1}{5}} + (4)^{1/4}$

$\approx 2.10163 + (2^2)^{1/4}$

$\approx 2.10163 + 2^{2/4}$

$\approx 2.10163 + 2^{1/2}$

$\approx 2.10163 + 1.41421$

≈ 3.51584

≈ 3.516 ✓

#93. $e^{1.34} \approx 3.81904$

≈ 3.819 ✓

#95. $\log(16.7) \approx 1.2227$

≈ 1.223 ✓

#94. $\ln(8.3) \approx 2.11626$

≈ 2.116 ✓

#96 $\log_2(5.78) = \dfrac{\ln(5.78)}{\ln(2)}$

$\approx \dfrac{1.7544037}{0.6931472}$

≈ 2.53107

≈ 2.531 ✓

#97. $0 = -0.2x^2 + 0.4x + 1$

$-10 \cdot 0 = -10\,[-0.2x^2 + 0.4 + 1]$

$0 = 2x^2 - 4x - 10$

$\begin{cases} a = 2 \\ b = -4 \\ c = -10 \end{cases}$

$x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$x = \dfrac{-(-4) \pm \sqrt{(-4)^2 - 4(2)(-10)}}{2(2)}$

$x = \dfrac{4 \pm \sqrt{16+80}}{4}$

$x = \dfrac{4 \pm \sqrt{96}}{4}$

$x = \dfrac{4 \pm \sqrt{16}\sqrt{6}}{4}$

$x = \dfrac{4 \pm 4\sqrt{6}}{4}$

$x = \dfrac{4}{4} \pm \dfrac{4\sqrt{6}}{4}$

$x = 1 \pm \sqrt{6}$

Either

$x = 1 + \sqrt{6}$, or $x = 1 - \sqrt{6}$

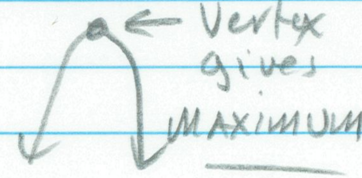
$x \approx 1 + 2.4495$	$x = 1 - 2.4495$
$x \approx 3.4495$	$x = -1.4495$
$x \approx 3.5$	$x = -1.5$

$\{3.5, -1.5\}$

Final Exam Review — Math 101 —

#98. $f(x) = -0.2x^2 + 0.4x + 1$

$\begin{cases} a = -0.2 \\ b = 0.4 \\ c = 1 \end{cases}$ $a = -0.2 < 0$, opens down



Vertex $= \left(\frac{-b}{2a}, f\left(\frac{-b}{2a}\right)\right)$

$x = -\frac{(0.4)}{2(-0.2)}$

$x = \frac{-0.4}{-0.4}$

$x = 1$

x-value at the maximum,

$y = f\left(\frac{-b}{2a}\right)$

$y = -0.2(1)^2 + 0.4(1) + 1$

$y = -0.2 \cdot 1 + 0.4 + 1$

$y = -0.2 + 1.4$

$y = 1.2$

MAXIMUM

#99. $f(t) = -16t^2 + 60t + 50$

at ground level $f(t) = 0$, Solve: $0 = -16t^2 + 60t + 50$

$-\frac{1}{2} \cdot 0 = -\frac{1}{2}[-16t^2 + 60t + 50]$

$0 = 8t^2 - 30t - 25$

$a = 8,\ b = -30,\ c = -25$

$t = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$t = \frac{-(-30) \pm \sqrt{(-30)^2 - 4(8)(-25)}}{2(8)}$

$t = \frac{30 \pm \sqrt{900 + 800}}{16}$

$t = \frac{30 \pm \sqrt{1700}}{16}$

$t = \frac{30 \pm \sqrt{100} \cdot \sqrt{17}}{16}$

$t = \frac{30 \pm 10\sqrt{17}}{16}$

Either

$t = \frac{30 + 10\sqrt{17}}{16}$ or $t = \frac{30 - 10\sqrt{17}}{16}$

$t \approx \frac{30 + 10 \cdot 4.123106}{16}$

$t \approx \frac{30 + 41.23106}{16}$

$t \approx \frac{71.23106}{16}$

$t \approx 4.45194$

$t \approx 4.5$

$t \approx \frac{30 - 10 \cdot 4.123106}{16}$

$t \approx \frac{30 - 41.23106}{16}$

$t \approx \frac{-11.23106}{16}$

$t \approx -0.70194$

Negative time??

ANS; The bullet hits the ground after approximately 4.5 seconds.

Final Exam Review – Math 101 –

#100. $f(t) = 10.1e^{0.005t}$ ← models population, t is time after 1992

Solve for t! $13 = 10.1e^{0.005t}$

$$13 = 10.1e^{0.005t}$$

$$\frac{13}{10.1} = \frac{10.1e^{0.005t}}{10.1}$$

$$1.287 \approx e^{0.005t}$$

$$\ln(1.287) \approx \ln(e^{0.005t})$$

$$\ln(1.287) \approx 0.005t$$

$$\frac{\ln(1.287)}{0.005} \approx \frac{0.005t}{0.005}$$

$$\frac{0.25231}{0.005} \approx t$$

$$50.462 \approx t$$

$$1992 + 50.462 \approx 2042.462$$

$$\approx \underline{2042}$$

ANS: In 2042, the population of Los Angeles should be about 13 million.

#101. $f(x) = 2.9\sqrt{x} + 20.1$ ← models height, x is age in months

Solve: $40.4 = 2.9\sqrt{x} + 20.1$

$$-20.1 + 40.4 = -20.1 + 2.9\sqrt{x} + 20.1$$

$$20.3 = 2.9\sqrt{x}$$

$$\frac{20.3}{2.9} = \frac{2.9\sqrt{x}}{2.9}$$

$$7 = \sqrt{x}$$

$$(7)^2 = (\sqrt{x})^2$$

$$49 = x$$

ANS: At age 49 months, the average height of boys is 40.4 inches.

Final Exam Review - Math 101 -

#102.

Trip	Distance	Rate	Time
Downstream	16 miles	30+x	$\frac{16}{30+x}$
Upstream	14 miles	30-x	$\frac{14}{30-x}$

$D = RT$

$\frac{D}{R} = T$

let x = rate of the water's current.

$$\frac{16}{30+x} = \frac{14}{30-x}$$ ← "SAME AMOUNT of time"

$$16\cdot(30-x) = 14(30+x)$$
$$480 - 16x = 420 + 14x$$
$$16x + 480 - 16x = 420 + 14x + 16x$$
$$480 = 420 + 30x$$
$$-420 + 480 = -420 + 420 + 30x$$
$$60 = 30x$$
$$\frac{60}{30} = \frac{30x}{30}$$
$$2 = x$$

ANS: The water's current is 2 miles per hour.

#104:

$$4^x = 7$$
$$\ln(4^x) = \ln(7)$$
$$x\cdot\ln(4) = \ln(7)$$
$$\frac{x\cdot\ln(4)}{\ln(4)} = \frac{\ln(7)}{\ln(4)}$$
$$x = \frac{\ln(7)}{\ln 4}$$

$$x \approx \frac{1.9459}{1.3863}$$
$$x \approx 1.40366$$
$$x \approx 1.404$$

$$\{1.404\}$$

Final Exam Review - Math 101 -

#103:

TRIP	Distance	Rate	Time
CAR A	60 miles	x	$\frac{60}{x}$
CAR B (faster)	90 miles	$x+10$	$\frac{90}{x+10}$

$D = RT$

$\frac{D}{R} = t$

let x = speed of car A (slower)

$$\frac{60}{x} = \frac{90}{x+10}$$ ← "SAME amount of time"

$$60 \cdot (x+10) = 90 \cdot x$$

$$60x + 600 = 90x$$

$$-60x + 60x + 600 = -60x + 90x$$

$$600 = 30x$$

$$\frac{600}{30} = \frac{30x}{30}$$

$$20 = x$$

ANS: CAR A has a speed of 20 miles per hour, and Car B (faster) has a speed of 30 miles per hour.

#105,

$$4^{2x-1} = 7$$

$$\ln(4^{2x-1}) = \ln 7$$

$$(2x-1) \cdot \ln(4) = \ln(7)$$

$$\frac{(2x-1) \cdot \ln(4)}{\ln(4)} = \frac{\ln(7)}{\ln(4)}$$

$$2x - 1 = \frac{\ln(7)}{\ln(4)}$$

$$1 + 2x - 1 = 1 + \frac{\ln(7)}{\ln(4)}$$

$$2x = 1 + \frac{\ln(7)}{\ln(4)}$$

$$\frac{1}{2} \cdot \frac{2x}{1} = \frac{1}{2}\left[1 + \frac{\ln(7)}{\ln(4)}\right]$$

$$x = \frac{1}{2} + \frac{\ln(7)}{2\ln(4)}$$

$$x \approx 0.5 + \frac{1.9459}{2 \cdot (1.3863)}$$

$$x \approx 0.5 + \frac{1.9459}{2.7726}$$

$$x \approx 0.5 + 0.70183$$

$$x \approx 1.20183$$

$$x \approx 1.202$$

$$\{1.202\}$$ ✓