

Problem 1

a.) $x - 2y = 16$
 $y + 3 = 3x$

$y = 3x - 3$

$x - 2(3x - 3) = 16$

$x - 6x + 6 = 16$

$-5x + 6 = 16$

$-5x = 10$

$x = -2$

$y + 3 = 3(-2)$

$y + 3 = -6$

$y = -9$

$(-2, -9)$

b.) $-3(x - 3y) = -6$

$3x - 9y = 9$

$-3x + 9y = 18$

$3x - 9y = 9$

$0 = 27$

No solution

c.) $3(2x + 6y) = 8$

$-2(3x + 9y) = 12$

$6x + 18y = 24$

$-6x - 18y = -24$

$0 = 0$

Infinite number of solutions

d.) $2(3x - 5y) = 11$

$-3(6x - 6y) = 2$

$6x - 10y = 22$

$-6x + 18y = -6$

$8y = 16$

$y = 2$

$3x - 5(2) = 11$

$3x - 10 = 11$

$3x = 21$

$x = 7$

$(7, 2)$

Problem 2

a.) $3x + 2y - z = 4$

$3x - 2y + z = 5$

$4x - 5y - z = -1$

④ & ⑤

$7x - 7y = 4$

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

$7(\frac{3}{2}) - 7y = 4$

$\frac{21}{2} - 7y = 4$

$-7y = 4 - \frac{21}{2}$

$-7y = -\frac{13}{2}$

$y = \frac{13}{14}$

$(\frac{3}{2}, \frac{13}{14}, \frac{33}{14})$

b.) $4x - y + 2z = 11$

$x + 2y - z = -1$

$2x + 2y - 3z = -1$

$\begin{bmatrix} 4 & -1 & 2 & 11 \\ 1 & 2 & -1 & -1 \\ 2 & 2 & -3 & -1 \end{bmatrix} \xrightarrow{R_1 \leftrightarrow R_2} \begin{bmatrix} 1 & 2 & -1 & -1 \\ 4 & -1 & 2 & 11 \\ 2 & 2 & -3 & -1 \end{bmatrix}$

$\xrightarrow{-4R_1 + R_2} \begin{bmatrix} 1 & 2 & -1 & -1 \\ 0 & -9 & 6 & 15 \\ 2 & 2 & -3 & -1 \end{bmatrix} \xrightarrow{-2R_1 + R_3} \begin{bmatrix} 1 & 2 & -1 & -1 \\ 0 & -9 & 6 & 15 \\ 0 & -2 & -1 & 1 \end{bmatrix}$

$\xrightarrow{R_2 \leftrightarrow R_3} \begin{bmatrix} 1 & 2 & -1 & -1 \\ 0 & -2 & -1 & 1 \\ 0 & -9 & 6 & 15 \end{bmatrix} \xrightarrow{-\frac{1}{2}R_2} \begin{bmatrix} 1 & 2 & -1 & -1 \\ 0 & 1 & \frac{1}{2} & -\frac{1}{2} \\ 0 & -9 & 6 & 15 \end{bmatrix} \begin{matrix} 0 & 9 & 9\frac{1}{2} & -9\frac{1}{2} \\ 0 & -9 & 6 & 15 \end{matrix}$

$\xrightarrow{9R_2 + R_3} \begin{bmatrix} 1 & 2 & -1 & -1 \\ 0 & 1 & \frac{1}{2} & -\frac{1}{2} \\ 0 & 0 & \frac{21}{2} & \frac{21}{2} \end{bmatrix} \xrightarrow{\frac{2}{21}R_3} \begin{bmatrix} 1 & 2 & -1 & -1 \\ 0 & 1 & \frac{1}{2} & -\frac{1}{2} \\ 0 & 0 & 1 & 1 \end{bmatrix}$

$x + 2y - z = -1$

$y + \frac{1}{2}z = -\frac{1}{2}$

$z = 1$

$(2, -1, 1)$

① & ② eliminate z

$3x + 2y - z = 4$

$3x - 2y + z = 5$

$6x = 9$

④ $x = \frac{3}{2}$

② & ③ eliminate z

$3x - 2y + z = 5$

$4x - 5y - z = -1$

⑤ $7x - 7y = 4$

$3(\frac{3}{2}) - 2(\frac{13}{14}) + z = 5$

$\frac{9}{2} - \frac{13}{7} + z = 5$

$z = 5 - \frac{9}{2} + \frac{13}{7}$

$z = \frac{70 - 63 + 26}{14} = \frac{33}{14}$

$y + \frac{1}{2}(1) = -\frac{1}{2}$

$y + \frac{1}{2} = -\frac{1}{2}$

$y = -\frac{1}{2} - \frac{1}{2} = -1$

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

$x - 2 - 1 = -1$

$x - 3 = -1$

$x = -1 + 3$

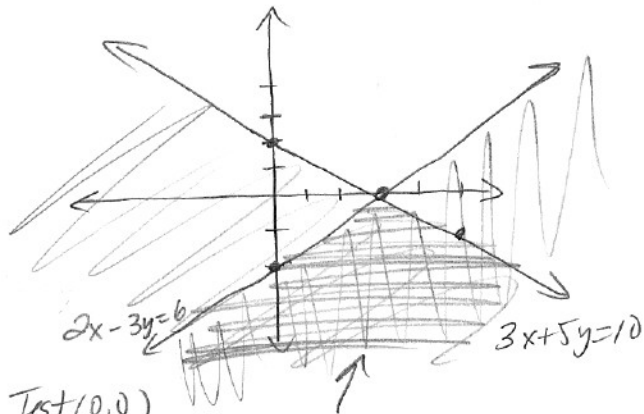
$x = 2$

MATH 130 FINAL EXAM REVIEW KEY

Problem 3

a.) $2x - 3y \geq 6$
 $3x + 5y \leq 10$

$2x - 3y \geq 6$ $3x + 5y \leq 10$
 $-3y \geq -2x + 6$ $5y \leq -3x + 10$
 $y \leq \frac{2}{3}x - 2$ $y \leq -\frac{3}{5}x + 2$



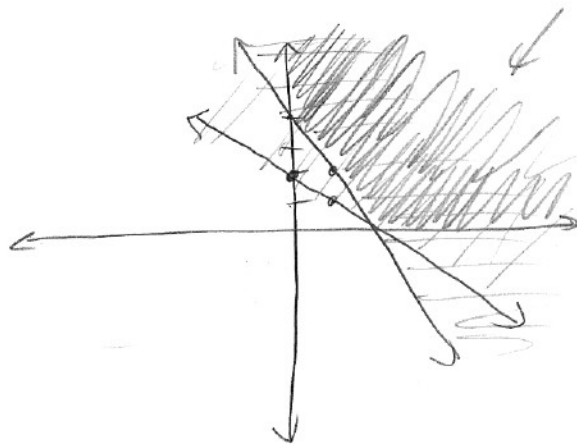
Test (10, 0)

$2(10) - 3(0) \geq 6$
 $20 \geq 6$
 F

$3(10) + 5(0) \leq 10$
 $30 \leq 10$
 T

b.) $x \geq 0$
 $y \geq 0$
 $x + y \geq 2$
 $2x + y \geq 4$

$x + y \geq 2$ $2x + y \geq 4$
 $y \geq -x + 2$ $y \geq -2x + 4$



Test (0, 0)

$0 + 0 \geq 2$
 $0 \geq 2$
 F

$2(0) + 0 \geq 4$
 $0 \geq 4$
 F

Problem 4

a.) $\{(-1)^{n+1}(2n+3)\}$

b.) $\left\{\frac{2^n}{n^2}\right\}$

$a_1 = (-1)^{1+1}(2(1)+3) = 5$

$a_1 = \frac{2^1}{1^2} = 2$

$a_2 = (-1)^{2+1}(2(2)+3) = -7$

$a_2 = \frac{2^2}{2^2} = 1$

$a_3 = (-1)^{3+1}(2(3)+3) = 9$

$a_3 = \frac{2^3}{3^2} = \frac{8}{9}$

$a_4 = (-1)^{4+1}(2(4)+3) = -11$

$a_4 = \frac{2^4}{4^2} = 1$

$a_5 = (-1)^{5+1}(2(5)+3) = 13$

$a_5 = \frac{2^5}{5^2} = \frac{32}{25}$

Problem 5

a.) $\sum_{k=1}^5 (k^2 + 12)$

$(1^2 + 12) + (2^2 + 12) + (3^2 + 12) + (4^2 + 12) + (5^2 + 12)$
 $= \boxed{115}$

b.) $\sum_{k=1}^9 (-2k + 8)$ arithmetic

$d = -2$ $a_1 = -2(1) + 8 = 6$

$S_9 = \frac{9}{2} [2(6) + (9-1)(-2)]$
 $= \frac{9}{2} [12 - 16] = \frac{9}{2} (-4) = \boxed{-18}$

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Problem 5 continued

c.) $\sum_{k=1}^7 \left(\frac{1}{3}\right)^k \leftarrow$ geometric

$a_1 = \frac{1}{3} \quad r = \left(\frac{1}{3}\right)' = \frac{1}{3}$

$S_7 = \frac{\frac{1}{3} \left(1 - \left(\frac{1}{3}\right)^7\right)}{1 - \frac{1}{3}}$

$= \frac{\frac{1}{3} \left(1 - \frac{1}{2187}\right)}{\frac{2}{3}}$

$= \frac{1}{3} \left(\frac{2186}{2187}\right) \frac{3}{2}$

$= \frac{1093}{2187}$

d.) $\sum_{k=1}^{40} (3k-9) \leftarrow$ arithmetic

$a_1 = -6 \quad d = 3$

$S_{40} = \frac{40}{2} [2(-6) + (40-1)3]$

$= 20 [-12 + 117]$

$= \boxed{2100}$

e.) $\sum_{k=1}^{10} 3(-2)^k$

$a_1 = 3(-2)' = -6 \quad r = -2$

$S_{10} = \frac{-6(1 - (-2)^{10})}{1 - (-2)}$

$= \frac{-6(1 - 1024)}{3}$

$= -2(-1023) = \boxed{2046}$

f.) $\sum_{k=1}^{\infty} 2\left(\frac{1}{2}\right)^{k-1}$

$r = \frac{1}{2} < 1 \quad a_1 = 2 \quad r = \frac{1}{2}$

$S_{\infty} = \frac{2}{1 - \frac{1}{2}} = \frac{2}{\frac{1}{2}} = \boxed{4}$

g.) $\sum_{k=1}^{\infty} 3\left(\frac{5}{4}\right)^{k-1}$

$r = \frac{5}{4} \neq 1$

No finite sum

Problem 6

a.) $a_7 = 31, a_{20} = 96$

$a_7 = a_1 + (7-1)d \quad a_{20} = a_1 + (20-1)d$

$31 = a_1 + 6d \quad a_6 = a_1 + 19d$

$-1(31 = a_1 + 6d) \quad 31 = a_1 + 6(5)$

$96 = a_1 + 19d \quad 31 = a_1 + 30$

$-31 = -a_1 - 6d \quad a_1 = 1$

$96 = a_1 + 19d$

$65 = 13d$

$d = 5$

$a_n = a_1 + (n-1)d$

$a_n = 1 + (n-1)5$

$= 1 + 5n - 5$

$a_n = 5n - 4$

b.) $a_{12} = 30, a_{22} = 50$

$a_{12} = a_1 + (12-1)d \quad a_{22} = a_1 + (22-1)d$

$30 = a_1 + 11d \quad 50 = a_1 + 21d$

$-1(30 = a_1 + 11d)$

$50 = a_1 + 21d$

$-30 = -a_1 - 11d$

$50 = a_1 + 21d$

$20 = 10d$

$d = 2$

$30 = a_1 + 11(2)$

$30 = a_1 + 22$

$a_1 = 8$

$a_n = a_1 + (n-1)d$

$a_n = 8 + (n-1)2$

$a_n = 8 + 2n - 2$

$a_n = 2n + 6$

MATH 130 FINAL EXAM REVIEW KEY

Problem 7

a.) $(x+2)^5$

$$x^5 + 5x^4(2) + 10x^3(2)^2 + 10x^2(2)^3 + 5x(2)^4 + (2)^5$$

$$\boxed{x^5 + 10x^4 + 40x^3 + 80x^2 + 80x + 32}$$

b.) $(x-3)^4$

$$x^4 + 4x^3(-3) + 6x^2(-3)^2 + 4x(-3)^3 + (-3)^4$$

$$\boxed{x^4 - 12x^3 + 54x^2 - 108x + 81}$$

c.) $(2x+3)^5$

$$(2x)^5 + 5(2x)^4(3) + 10(2x)^3(3)^2 + 10(2x)^2(3)^3 + 5(2x)(3)^4 + (3)^5$$

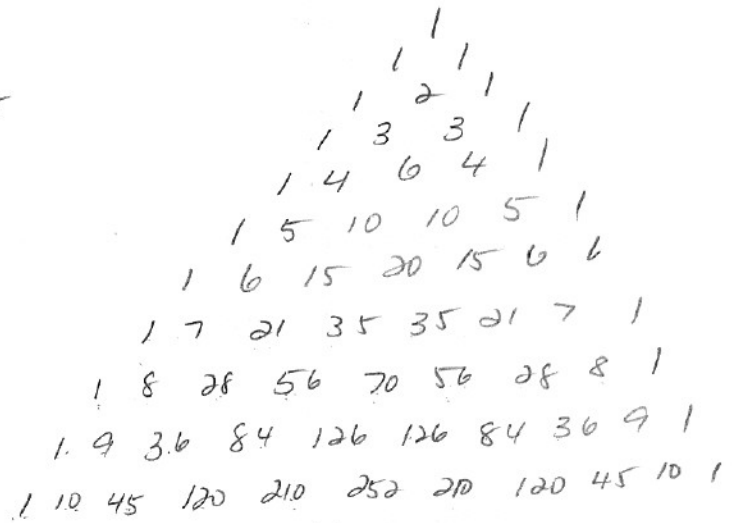
$$\boxed{32x^5 + 240x^4 + 720x^3 + 1080x^2 + 810x + 243}$$

d.) $(3x-4)^4$

$$(3x)^4 + 4(3x)^3(-4) + 6(3x)^2(-4)^2 + 4(3x)(-4)^3 + (-4)^4$$

$$\boxed{81x^4 - 432x^3 + 1296x^2 - 768x + 256}$$

Pascal's Triangle



Problem 8

a.) $6! = 720$

b.) $0! = 1$

c.) $\binom{5}{3} = 10$

d.) $\binom{7}{5} = 21$

Problem 9

a.) coefficient = 210 $\in \binom{10}{6}$

$$210x^6(3)^4 = \boxed{17010x^6}$$

b.) coefficient = 36 $\in \binom{9}{2}$

$$36x^2(-3)^7 = \boxed{-78732x^2}$$

c.) 3rd term = x^5 term

coefficient = 21 $\in \binom{7}{2}$

$$21x^5(-3)^2 = \boxed{189x^5}$$

d.) 6th term = x^3 term

coefficient = 56 $\in \binom{8}{5}$

$$56x^3(2)^5 = \boxed{1792x^3}$$

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Problem 10

a.) $f(2) = 3(2)^2 - 4(2) + 2$
 $= 12 - 8 + 2 = \boxed{6}$

b.) $g(1) = \frac{5}{1-4} = \boxed{-\frac{5}{3}}$

c.) $(f+g)(x) = \boxed{3x^2 - 4x + 2 + \frac{5}{x-4}}$

d.) $(f-h)(2) = f(2) - h(2)$
 $= (3(2)^2 - 4(2) + 2) - (-4(2)^2 + 2(2) + 8)$
 $= (12 - 8 + 2) - (-16 + 4 + 8)$
 $= 6 - (-4) = \boxed{10}$

e.) $(\frac{f}{h})(x) = \boxed{\frac{3x^2 - 4x + 2}{-4x^2 + 2x + 8}}$

f.) $f(x-3) = 3(x-3)^2 - 4(x-3) + 2$
 $= 3(x^2 - 6x + 9) - 4x + 12 + 2$
 $= 3x^2 - 18x + 27 - 4x + 14$
 $= \boxed{3x^2 - 22x + 41}$

g.) $(g \circ h)(x) = g(h(x)) = g(-4x^2 + 2x + 8)$
 $= \frac{5}{-4x^2 + 2x + 8 - 4} = \boxed{\frac{5}{-4x^2 + 2x + 4}}$

h.) $(h \circ f)(x) = h(f(x)) = h(3x^2 - 4x + 2)$
 $= -4(3x^2 - 4x + 2) + 2(3x^2 - 4x + 2) + 8$
 $= -12x^2 + 16x - 8 + 6x^2 - 8x + 4 + 8$
 $= \boxed{-6x^2 + 8x + 4}$

Problem 11

a.) $f(x) = \frac{3}{2x-5}$

$2x-5=0$
 $x=5/2$

Domain f: $x \neq 5/2$

b.) $f(x) = 2x + 1$

Domain f: All real numbers

c.) $f(x) = \frac{7x}{5-x}$

$5-x=0$
 $x=5$

Domain f: $x \neq 5$

Problem 12

a.) $\frac{x^2 - 4x + 3}{x+4} \geq 0$

$\frac{(x-3)(x-1)}{x+4} \geq 0$

	-5	-4	0	1	2	3	4
x-3	-		-		-		+
x-1	-		-		+		+
x+4	-		+		+		+
			+		-		+

$\boxed{(-4, 1] \cup [3, \infty)}$

b.) $x^2 + 4x < 12$

$x^2 + 4x - 12 < 0$

$(x+6)(x-2) < 0$

	-7	-6	0	2	3
x+6	-		+		+
x-2	-		-		+
			+		+
			-		+

$\boxed{(-6, 2)}$

MATH 130 FINAL EXAM REVIEW KEY

Problem 13

$$x^4 - 5x^3 + 3x^2 + 15x - 18 = 0$$

$$p: \pm 1, \pm 2, \pm 3, \pm 6, \pm 9, \pm 18$$

$$q: \pm 1$$

$$\frac{p}{q}: \pm 1, \pm 2, \pm 3, \pm 6, \pm 9, \pm 18$$

$$\begin{array}{r|rrrrr} 2 & 1 & -5 & 3 & 15 & -18 \\ & & 2 & -6 & -6 & 18 \\ \hline & 1 & -3 & -3 & 9 & 0 \end{array}$$

$$\begin{array}{r|rrrr} 3 & 1 & -3 & -3 & 9 \\ & & 3 & 0 & -9 \\ \hline & 1 & 0 & -3 & 0 \end{array}$$

$$x^2 - 3 = 0$$

$$x^2 = 3$$

$$x = \pm\sqrt{3}$$

$$\boxed{2, 3, \pm\sqrt{3}}$$

Problem 14

$$a.) f(x) = \frac{1}{3x+2}$$

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

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

$$x(3y+2) = 1$$

$$3xy + 2x = 1$$

$$3xy = 1 - 2x$$

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

$$\boxed{f^{-1}(x) = \frac{1-2x}{3x}}$$

$$b.) g(x) = x^3 - 3$$

$$y = x^3 - 3$$

$$x = y^3 - 3$$

$$x+3 = y^3$$

$$y = \sqrt[3]{x+3}$$

$$\boxed{g^{-1}(x) = \sqrt[3]{x+3}}$$

Problem 15

$$a.) \log_3 \frac{x^4 y^3}{z^2 w^3}$$

$$\boxed{4\log_3 x + 3\log_3 y - 2\log_3 z - 3\log_3 w}$$

$$b.) \log \sqrt{\frac{x^2}{y^3}}$$

$$\log \left(\frac{x^2}{y^3}\right)^{1/2}$$

$$\frac{1}{2} \log \left(\frac{x^2}{y^3}\right)$$

$$\frac{1}{2} [2\log x - 3\log y]$$

$$\boxed{\log x - \frac{3}{2} \log y}$$

Problem 16

$$a.) 2\log_3 x + 4\log_3 y - 6\log_3 z$$

$$\boxed{\log_3 \frac{x^2 y^4}{z^6}}$$

$$b.) 6\log_4 x - 2\log_4 y + 3\log_4 z$$

$$\boxed{\log_4 \frac{x^6 y^2}{z^3}}$$

Problem 17

$$a.) \log_5 25 = \boxed{2}$$

$$f.) \log_4 4^6 = \boxed{6}$$

$$b.) \log_2 \frac{1}{8} = \boxed{-3}$$

$$g.) 8^{\log_8 19} = \boxed{19}$$

$$c.) \log_7 \sqrt{7} = \boxed{\frac{1}{2}}$$

$$h.) \log_2 64 = \boxed{6}$$

$$d.) \log_5 5 = \boxed{1}$$

$$i.) \log_{16} 7 = \boxed{\frac{1}{2}}$$

$$e.) \log_6 1 = \boxed{0}$$

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Problem 18

a.) $\log_5 2 = \boxed{1.716}$

b.) $\ln 28 = \boxed{3.332}$

c.) $\log_5 12 = \frac{\ln 12}{\ln 5} = \boxed{1.544}$

d.) $\log_7 31 = \frac{\ln 31}{\ln 7} = \boxed{1.765}$

Problem 19

a.) $2^{2x+1} = 4$

$2^{2x+1} = 2^2$

$2x+1=2$

$2x=1$

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

d.) $4^x = \frac{1}{\sqrt{2}}$

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

$(2^2)^x = 2^{-1/2}$

$2^{2x} = 2^{-1/2}$

$2x = -1/2$

$\boxed{x = -1/4}$

b.) $3^{x^3} = 9^x$

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

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

$x^3 = 2x$

$x^3 - 2x = 0$

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

$x=0 \quad x^2 - 2 = 0$

$x = \pm\sqrt{2}$

$\boxed{x=0, \pm\sqrt{2}}$

e.) $3^x = 14$

$\ln 3^x = \ln 14$

$x \ln 3 = \ln 14$

$\boxed{x = \frac{\ln 14}{\ln 3}}$

f.) $3^{1-2x} = 4^x$

$\ln 3^{1-2x} = \ln 4^x$

$(1-2x) \ln 3 = x \ln 4$

$\ln 3 - 2x \ln 3 = x \ln 4$

$\ln 3 = x \ln 4 + 2x \ln 3$

$\ln 3 = x(\ln 4 + 2 \ln 3)$

$\boxed{x = \frac{\ln 3}{\ln 4 + 2 \ln 3}}$

c.) $5^{2x-1} = 125$

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

$2x-1=3$

$2x=4$

$\boxed{x=2}$

g.) $e^{5x} = 7$

$\ln e^{5x} = \ln 7$

$5x = \ln 7$

$\boxed{x = \frac{\ln 7}{5}}$

h.) $9e^x = 99$

$e^x = 11$

$\ln e^x = \ln 11$

$\boxed{x = \ln 11}$

i.) $e^{0.08x} = 4$

$\ln e^{0.08x} = \ln 4$

$0.08x = \ln 4$

$\boxed{x = \frac{\ln 4}{0.08}}$

j.) $\log_2(x^2) - \log_2(x-2) = 3$

$\log_2 \frac{x^2}{x-2} = 3$

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

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

$8x - 16 = x^2$

$0 = x^2 - 8x + 16$

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

$x-4=0$

$\boxed{x=4}$ ✓

k.) $\log_2(x-3) + \log_2(x+4) = 3$

$\log_2(x-3)(x+4) = 3$

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

$8 = x^2 + x - 12$

$0 = x^2 + x - 20$

$0 = (x+5)(x-4)$

$x+5=0$

$x-4=0$

$x = -5$

$\boxed{x=4}$ ✓

Does not check

l.) $x = \log_5 625$

$5^x = 625$

$5^x = 5^4$

$\boxed{x=4}$

m.) $\log_8 x = 2$

$8^2 = x$

$\boxed{x = \frac{1}{64}}$

Problem 19 continued

n.) $\log_x 4 = \frac{1}{3}$

$x^{1/3} = 4$

$(x^{1/3})^3 = 4^3$

$x = 64$ ✓

o.) $\log_4 (x^2 - 9) - \log_4 (x + 3) = 3$

$\log_4 \frac{x^2 - 9}{x + 3} = 3$

$4^3 = \frac{(x+3)(x-3)}{x+3}$

$64 = x - 3$

$x = 67$ ✓

p.) $\log (3x - 5) - \log 5x = 2$

$\log \frac{3x - 5}{5x} = 2$

$10^2 = \frac{3x - 5}{5x}$

$100 = \frac{3x - 5}{5x}$

$500x = 3x - 5$

$497x = -5$

$x = -5/497$

Does not check

$\boxed{\text{No solution}}$

Problem 20

a.) $m = -\frac{2}{3}; (1, -1)$

$y - (-1) = -\frac{2}{3}(x - 1)$

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

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

b.) $(-3, 4) (2, 5)$

$m = \frac{5 - 4}{2 - (-3)} = \frac{1}{5}$

$y - 4 = \frac{1}{5}(x - (-3))$

$y - 4 = \frac{1}{5}x + \frac{3}{5}$

$y = \frac{1}{5}x + \frac{3}{5} + 4$

$y = \frac{1}{5}x + \frac{23}{5}$

c.) $m = -2 (0, -2)$

since $(0, -2)$ is the y-int

$b = -2$

$y = -2x - 2$

d.) m undefined $(2, 4)$

m undefined \Rightarrow vertical line

$x = 2$

Problem 21

a.) $2x^2 - 5x - 3 = 0$

$(2x + 1)(x - 3) = 0$

$2x + 1 = 0 \quad x - 3 = 0$

$x = -\frac{1}{2} \quad x = 3$

b.) $x(x + 4) = 12$

$x^2 + 4x = 12$

$x^2 + 4x - 12 = 0$

$(x + 6)(x - 2) = 0$

$x + 6 = 0 \quad x - 2 = 0$

$x = -6 \quad x = 2$

c.) $(2x + 3)^2 = 9$

$\sqrt{(2x + 3)^2} = \sqrt{9}$

$2x + 3 = \pm 3$

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

$2x = 0 \quad 2x = -6$

$x = 0 \quad x = -3$

d.) $x^2 - 6x = 13$

$x^2 - 6x - 13 = 0$

$x = \frac{-(-6) \pm \sqrt{(-6)^2 - 4(1)(-13)}}{2(1)}$

$x = \frac{6 \pm \sqrt{36 + 52}}{2}$

$= \frac{6 \pm \sqrt{88}}{2} = \frac{6}{2} \pm \frac{\sqrt{88}}{2}$

$x = 3 \pm \frac{\sqrt{87}}{2}$

MATH 130 FINAL EXAM REVIEW KEY

Problem 1 continued

e.) $x^2 + \frac{2}{3}x - \frac{1}{3} = 0$

$3x^2 + 2x - 1 = 0$

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

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

$x = \frac{1}{3}$ $x = -1$

f.) $x^2 + 4x + 2 = 0$

$x = \frac{-4 \pm \sqrt{(4)^2 - 4(1)(2)}}{2(1)}$

$x = \frac{-4 \pm \sqrt{16-8}}{2}$

$x = \frac{-4 \pm \sqrt{8}}{2}$

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

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

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

g.) $4x^2 + x + 1 = 0$

$x = \frac{-1 \pm \sqrt{(1)^2 - 4(4)(1)}}{2(4)}$

$= \frac{-1 \pm \sqrt{-15}}{8}$

No real solution

h.) $3x = 1 - \frac{1}{x}$

$3x^2 = x - 1$

$3x^2 - x + 1 = 0$

$x = \frac{-(-1) \pm \sqrt{(-1)^2 - 4(3)(1)}}{2(3)}$

$x = \frac{1 \pm \sqrt{-11}}{6}$

No real solution

Problem 2

a.) $\sqrt{5t+3} = 2$

$(\sqrt{5t+3})^2 = (2)^2$

$5t+3 = 4$

$5t = 1$

$t = \frac{1}{5}$

check

$\sqrt{5(\frac{1}{5})+3} = 2$

$\sqrt{1+3} = 2$

$\sqrt{4} = 2$

$2 = 2 \checkmark$

b.) $x = 2\sqrt{x-1}$

$(x)^2 = (2\sqrt{x-1})^2$

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

$x^2 = 4x - 4$

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

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

$x-2 = 0$

$x = 2$

check

$2 = 2\sqrt{2-1}$

$2 = 2\sqrt{1}$

$2 = 2 \checkmark$

c.) $2 + \sqrt{12-2x} = x$

$\sqrt{12-2x} = x-2$

$(\sqrt{12-2x})^2 = (x-2)^2$

$12-2x = x^2-4x+4$

$0 = x^2-4x+4+2x-12$

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

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

$x-4 = 0$

$x = 4$

$x+2 = 0$

$x = -2$

check $x = 4$

$2 + \sqrt{12-2(4)} = 4$

$2 + \sqrt{12-8} = 4$

$2 + \sqrt{4} = 4$

$2 + 2 = 4 \checkmark$

check $x = 2$

$2 + \sqrt{12-2(2)} = 2$

$2 + \sqrt{12-4} = 2$

$2 + \sqrt{8} = 2 \quad \times$

Problem 2 continued

d.) $\sqrt{3x+7} + \sqrt{x+2} = 1$

$\sqrt{3x+7} = 1 - \sqrt{x+2}$

$(\sqrt{3x+7})^2 = (1 - \sqrt{x+2})^2$

$3x+7 = 1 - 2\sqrt{x+2} + x+2$

$3x+7 = x+3 - 2\sqrt{x+2}$

$3x+7 - x - 3 = -2\sqrt{x+2}$

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

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

$4x^2 + 16x + 16 = 4(x+2)$

$4x^2 + 16x + 16 = 4x + 8$

$4x^2 + 16x + 16 - 4x - 8 = 0$

$4x^2 + 12x + 8 = 0$

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

$4(x+2)(x+1) = 0$

$x+2=0 \quad x+1=0$

$x = -2 \quad x = -1$

check $x = -2$

$\sqrt{3(-2)+7} + \sqrt{-2+2} = 1$

$\sqrt{1} + \sqrt{0} = 1$

$1+0 = 1 \checkmark$

check $x = -1$

$\sqrt{3(-1)+7} + \sqrt{-1+2} = 1$

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

$2+1 = 1 \times$

e.) $x^4 - 10x^2 + 25 = 0$

let $u = x^2$

$u^2 - 10u + 25 = 0$

$(u-5)(u-5) = 0$

$u-5 = 0$

$u = 5$

$x^2 = 5$

$x = \pm\sqrt{5}$

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

let $u = x+1$

$2u^2 - 5u = 3$

$2u^2 - 5u - 3 = 0$

$(2u+1)(u-3) = 0$

$2u+1=0 \quad u-3=0$

$u = -1/2 \quad u = 3$

$x+1 = -1/2 \quad x+1 = 3$

$x = -3/2 \quad x = 2$

g.) $t^{1/2} - 2t^{1/4} + 1 = 0$

let $u = t^{1/4}$

$u^2 - 2u + 1 = 0$

$(u-1)(u-1) = 0$

$u-1 = 0$

$u = 1$

$t^{1/4} = 1$

$(t^{1/4})^4 = (1)^4$

$t = 1$

check

$(1)^{1/2} - 2(1)^{1/4} + 1 = 0$

$1 - 2 + 1 = 0$

$0 = 0 \checkmark$

Problem 3

a.) $f(x) = \frac{3x-2}{x^2-4x+3}$

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

x-int: $\frac{3x-2}{(x-3)(x-1)} = 0$

$(2/3, 0) \quad 3x-2=0$
 $x = 2/3$

y-int: $y = \frac{3(0)-2}{(0-3)(0-1)} = \frac{-2}{3}$

$(0, -2/3)$

vertical asymptote(s):

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

$x = 3, x = 1$

horizontal asymptote

deg num = 1

deg den = 2

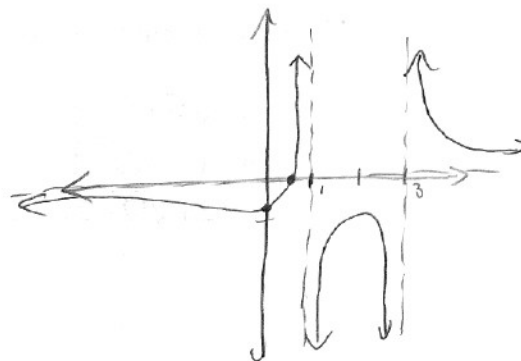
$y = 0$ (x-axis)

Table of Values

	$2/3$	1	3
$3x-2$	-	+	+
$x-3$	-	-	+
$x-1$	-	-	+
	-	+	+

below above below above

Graph:



Problem 23 continued

b) $f(x) = \frac{3x-4}{x-3}$

x-int
 $\frac{3x-4}{x-3} = 0$
 $3x-4=0 \quad (4/3, 0)$
 $x = 4/3$

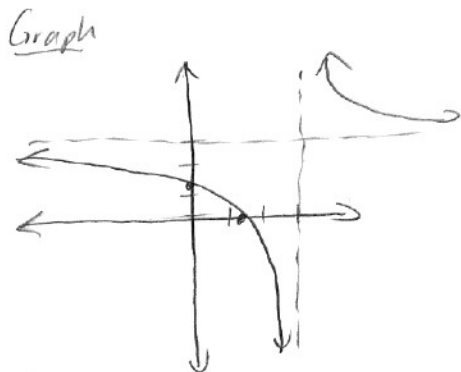
y-int
 $y = \frac{3(0)-4}{0-3} = \frac{4}{3} \quad (0, 4/3)$

vertical asymptote:
 $x-3=0$
 $x=3$

horizontal asymptote
 $\text{deg num} = 1$
 $\text{deg den} = 1$
 $y = \frac{3}{1} \Rightarrow y = 3$

Table of Values

	$4/3$	3	
$3x-4$	-	+	+
$x-3$	-	-	+
	+	-	+
	above	below	above



Problem 24

a.) $f(x) = (x-2)(x+3)(x-3)$

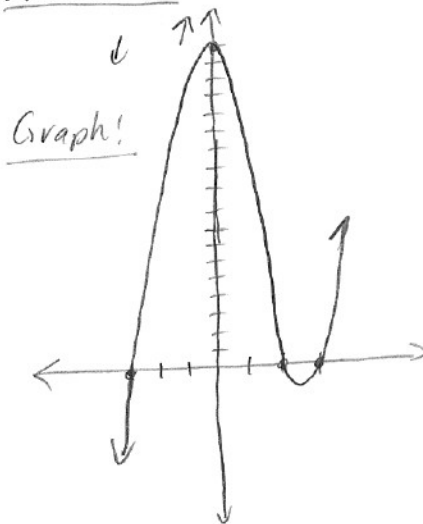
x-int:
 $(x-2)(x+3)(x-3) = 0$
 $x = 2, -3, 3$
 $(2, 0) \quad (-3, 0) \quad (3, 0)$

y-int
 $y = (0-2)(0+3)(0-3)$
 $y = 18 \quad (0, 18)$

Table of Signs

	-3	2	3	
$x-2$	-	-	+	+
$x+3$	-	+	+	+
$x-3$	-	-	-	+
	-	+	-	+
	below	above	below	above

End Behavior



b.) $f(x) = (x+3)(x-3)(x-1)(x+1)$

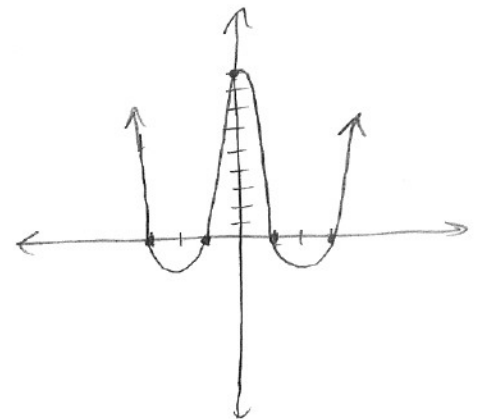
x-int:
 $(x+3)(x-3)(x-1)(x+1) = 0$
 $x = -3, 3, 1, -1$
 $(-3, 0) \quad (3, 0) \quad (1, 0) \quad (-1, 0)$

y-int
 $y = (0+3)(0-3)(0-1)(0+1)$
 $y = 9 \quad (0, 9)$

Table of Signs

	-3	-1	1	3	
$x+3$	-	+	+	+	+
$x-3$	-	-	-	-	+
$x-1$	-	-	-	+	+
$x+1$	-	-	+	+	+
	+	-	+	-	+
	above	below	above	below	above

Graph



Problem 24 continued

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

x-int

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

$x-1=0 \quad (x+3)^2=0 \quad (x-2)^3=0$

$x=1 \quad x=-3 \quad x=2$
 $(1,0) \quad (-3,0) \quad (2,0)$

y-int

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

$= (-1)(9)(-8) = 72$
 $(0,72)$

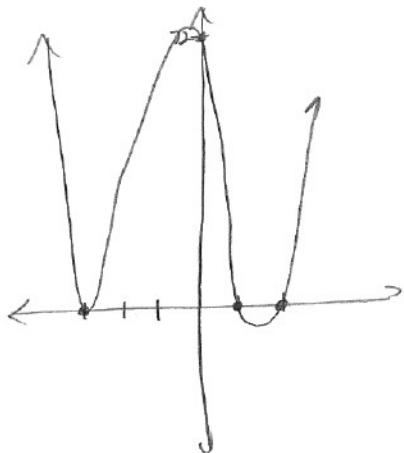
Table of Signs

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

End Behavior

↑ ↑

Graph!



Problem 25

a.) $A = P(1 + \frac{r}{n})^{nt}$

$A = 50(1 + \frac{0.06}{12})^{12(3)}$

$A = \boxed{\$59.83}$

b.) $A = P(1 + \frac{r}{n})^{nt}$

$A = 700(1 + \frac{0.06}{365})^{365(2)}$

$A = \boxed{\$789.24}$

c.) $A = Pe^{rt}$

$A = 100e^{0.12(3.75)}$

$A = \boxed{\$156.83}$

Problem 26

$A = Pe^{rt}$

$\frac{25000}{10000} = \frac{10000e^{0.06t}}{10000}$

$2.5 = e^{0.06t}$

$\ln 2.5 = \ln e^{0.06t}$

$\ln 2.5 = 0.06t$

$t = \frac{\ln 2.5}{0.06}$

$t = \boxed{15.3 \text{ years}}$

Problem 27



$P = 2l + 2w$

$400 = 2l + 2w$

$2l = 400 - 2w$

$l = 200 - w$

$A = lw$

$A = (200 - w)w$

$A = -w^2 + 200w$

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

$w = \frac{-200}{2(-1)} = 100 \text{ yds}$

$l = 200 - 100 = 100 \text{ yds}$

Dimensions:

$\boxed{\text{length} = 100 \text{ yds}}$
 $\boxed{\text{width} = 100 \text{ yds}}$

Area:

$\boxed{10,000 \text{ yds}^2}$

Problem 28



$$l + 2w = 4000$$

$$l = 4000 - 2w$$

$$A = lw$$

$$A = (4000 - 2w)w$$

$$A = -2w^2 + 4000w$$

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

$$W = \frac{-4000}{2(-2)} = 1000 \text{ m}$$

$$l = 4000 - 2(1000) = 2000 \text{ m}$$

$$A = (1000 \text{ m})(2000 \text{ m})$$

$$\text{Area} = 2,000,000 \text{ m}^2$$

$$\text{width} = 1000 \text{ m}$$

$$\text{length} = 2000 \text{ m}$$

Problem 29

$$A = A_0 e^{kt}$$

$$5 = 10 e^{1690k}$$

$$\frac{1}{2} = e^{1690k}$$

$$\ln \frac{1}{2} = 1690k$$

$$k = \frac{\ln \frac{1}{2}}{1690} = -0.0004101$$

$$A = 10 e^{-0.0004101(50)}$$

$$A = \boxed{9.8 \text{ g}}$$

Problem 30

$$A = A_0 e^{kt}$$

$$\frac{1}{2} A_0 = A_0 e^{5000k}$$

$$\frac{1}{2} = e^{5000k}$$

$$\ln \frac{1}{2} = 5000k$$

$$k = \frac{\ln \frac{1}{2}}{5000} = -0.000124$$

$$A = A_0 e^{-0.000124t}$$

$$0.3 A_0 = A_0 e^{-0.000124t}$$

$$0.3 = e^{-0.000124t}$$

$$\ln 0.3 = -0.000124t$$

$$t = \frac{\ln 0.3}{-0.000124}$$

$$t = \boxed{9709 \text{ yrs}}$$

Problem 31

$$A = A_0 e^{kt}$$

$$A = 10000 e^{kt}$$

$$20000 = 10000 e^{1.5k}$$

$$2 = e^{1.5k}$$

$$\ln 2 = 1.5k$$

$$k = \frac{\ln 2}{1.5} = 0.462$$

$$A = 10000 e^{0.462t}$$

$$A = 10000 e^{0.462(2)}$$

$$A = \boxed{25198 \text{ people}}$$

Problem 32

$$C = 0 \quad F = 32$$

$$C = 100 \quad F = 212$$

$$m = \frac{212 - 32}{100 - 0} = \frac{180}{100} = \frac{9}{5}$$

$$F - F_1 = m(C - C_1)$$

$$F - 32 = \frac{9}{5}(C - 0)$$

$$\boxed{F = \frac{9}{5}C + 32}$$

$$70 = \frac{9}{5}C + 32$$

$$70 - 32 = \frac{9}{5}C$$

$$38 = \frac{9}{5}C$$

$$C = 38 \cdot \frac{5}{9}$$

$$C = \boxed{21.1^\circ \text{C}}$$

Problem 33

value	qty	amount
5070	x	0.5x
2070	80	16
4070	y	0.4y

$$0.5x + 16 = 0.4y$$

$$x + 80 = y$$

$$5x + 160 = 4y$$

$$-5(x + 80 = y)$$

$$5x + 160 = 4y$$

$$-5x - 400 = -4y$$

$$-240 = -y$$

$$y = 240$$

$$x + 80 = 240$$

$$x = 160$$

160 gallons
of 5070

MATH 130 FINAL EXAM REVIEW KEY

Problem 34

value	qty	amount
12%	x	0.12x
20%	y	0.2y
14%	10	1.4

$$100(0.12x + 0.2y = 1.4)$$

$$x + y = 10$$

$$12x + 20y = 140$$

$$-12(x + y = 10)$$

$$12x + 20y = 140$$

$$-12x - 12y = -120$$

$$8y = 20$$

$$y = 2.5$$

$$x + 2.5 = 10$$

$$x = 7.5$$

7.5 gallons of 12% and
2.5 gallons of 20%

Problem 36

value	qty	amount
25%	x	0.25x
10%	y	0.1y
19%	20	3.8

$$100(0.25x + 0.1y = 3.8)$$

$$x + y = 20$$

$$25x + 10y = 380$$

$$-10(x + y = 20)$$

$$25x + 10y = 380$$

$$-10x - 10y = -200$$

$$15x = 180$$

$$x = 12$$

$$12 + y = 20$$

$$y = 8$$

12 lb of the 25% and
8 lb of the 10%

Problem 38

$$x + y + z = 16$$

$$2x + 3y + 4z = 46$$

$$5x - y = 31$$

$$-4(x + y + z = 16)$$

$$2x + 3y + 4z = 46$$

$$-4x - 4y - 4z = -64$$

$$2x + 3y + 4z = 46$$

$$-2x - y = -18$$

$$-1(-2x - y = -18)$$

$$5x - y = 31$$

$$2x + y = 18$$

$$5x - y = 31$$

$$7x = 49$$

$$x = 7$$

$$5(7) - y = 31$$

$$35 - y = 31$$

$$-y = -4$$

$$y = 4$$

$$7 + 4 + z = 16$$

$$11 + z = 16$$

$$z = 5$$

Problem 39

$$3x + y + 2z = 5$$

$$x + 3z - 3y = 2$$

$$2x + 3y - z = 1$$

① & ② elim x

$$3x + y + 2z = 5$$

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

$$3x + y + 2z = 5$$

$$-3x + 9y - 9z = -6$$

$$10y - 7z = -1$$

$$-1(10y - 7z = -1)$$

$$9y - 7z = -3$$

$$-10y + 7z = 1$$

$$9y - 7z = -3$$

$$-y = -2$$

$$y = 2$$

② & ③ elim x

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

$$2x + 3y - z = 1$$

$$-2x + 6y - 6z = -4$$

$$2x + 3y - z = 1$$

$$9y - 7z = 3$$

$$9(2) - 7z = 3$$

$$18 - 7z = 3$$

$$-7z = -15$$

$$z = 3$$

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

$$x - 6 + 9 = 2$$

$$x + 3 = 2$$

$$x = -1$$

Problem 35

value	qty	amount
0.05	n	0.05n
0.10	n+2	0.10(n+2)
		1.70

$$0.05n + 0.10(n+2) = 1.70$$

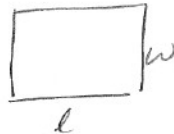
$$0.05n + 0.1n + 0.2 = 1.7$$

$$0.15n = 1.5$$

$$n = 10$$

10 nickels

Problem 37



$$2l + 2w = 360$$

$$20l + 2(8w) = 3280$$

$$-8(2l + 2w = 360)$$

$$20l + 16w = 3280$$

$$-16l - 16w = -2880$$

$$20l + 16w = 3280$$

$$4l = 400$$

$$l = 100$$

$$2(100) + 2w = 360$$

$$200 + 2w = 360$$

$$2w = 160$$

$$w = 80$$

length = 100 ft
width = 80 ft