

Problem #1

a.) $\frac{x}{2} - 5 = -12 - \frac{2x}{3}$

LCD = 6

$6(\frac{x}{2}) - 6(5) = 6(-12) - 6(\frac{2x}{3})$

$3x - 30 = -72 - 4x$

$3x + 4x = -72 + 30$

$7x = -42$

$x = -6$

b.) $6 - 4|x+3| = -2$

$-4|x+3| = -2 - 6$

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

$|x+3| = 2$

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

$x = -1$ or $x = -5$

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

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

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

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

$x = \frac{6 \pm \sqrt{-16}}{2}$

$x = \frac{6 \pm 4i}{2}$

$x = 3 \pm 2i$

d.) $x^4 - 7x^2 + 12 = 0$

$u = x^2$

$u^2 = x^4$

$u^2 - 7u + 12 = 0$

$(u-3)(u-4) = 0$

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

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

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

$x^2 = 3$ or $x = -2$ or $x = 2$

$x = \pm\sqrt{3}$

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

e.) $x^2 + 6x = 7$

$x^2 + 6x - 7 = 0$

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

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

$x = -7$ or $x = 1$

f.) $4x^2 + 8x + 3 = 0$

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

$2x+3 = 0$ or $2x+1 = 0$

$x = -3/2$ or $x = -1/2$

g.) $x^4 - 5x^2 + 4 = 0$

$u = x^2$

$u^2 = x^4$

$u^2 - 5u + 4 = 0$

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

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

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

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

$x = -2$ or $x = 2$ or $x = -1$ or $x = 1$

h.) $x^2 = -12x + 13$

$x^2 + 12x - 13 = 0$

$(x+13)(x-1) = 0$

$x+13 = 0$ or $x-1 = 0$

$x = -13$ or $x = 1$

i.) $2x^2 + 12x = -5$

$2x^2 + 12x + 5 = 0$

$x = \frac{-12 \pm \sqrt{(12)^2 - 4(2)(5)}}{2(2)}$

$x = \frac{-12 \pm \sqrt{144 - 40}}{4}$

$x = \frac{-12 \pm \sqrt{104}}{4}$

$x = \frac{-12 \pm 4\sqrt{6}}{4}$

$x = -3 \pm \sqrt{6}$

j.) $(x+3)(x+2) = 15$

$x^2 + 5x + 6 = 15$

$x^2 + 5x - 9 = 0$

$x = \frac{-5 \pm \sqrt{(5)^2 - 4(1)(-9)}}{2(1)}$

$x = \frac{-5 \pm \sqrt{25 + 36}}{2}$

$x = \frac{-5 \pm \sqrt{61}}{2}$

k.) $6y^2 + 2y + 1 = 0$

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

$y = \frac{-2 \pm \sqrt{4 - 24}}{12}$

$y = \frac{-2 \pm \sqrt{-20}}{12}$

$y = \frac{-2 \pm 2i\sqrt{5}}{12}$

$y = -\frac{1}{6} \pm \frac{1}{6}i\sqrt{5}$

Problem #1 continued

l.) $\sqrt{3x+1} = 6$
 $(\sqrt{3x+1})^2 = (6)^2$

$3x+1 = 36$

$3x = 35$

$x = 35/3$

check: $\sqrt{3(35/3)+1} = 6$
 $\sqrt{35+1} = 6$
 $\sqrt{36} = 6$
 $6 = 6 \checkmark$

o.) $\frac{x-2}{2x} + 1 = \frac{x+1}{x}$

LCD = $2x$

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

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

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

$3x-2 = 2x+2$

$x = 4$

p.) $\frac{x+2}{x+10} = \frac{x-3}{x+4}$

$(x+2)(x+4) = (x+10)(x-3)$

$x^2+6x+8 = x^2+7x-30$

$38 = x$

q.) $\frac{8}{x^2-9} + \frac{4}{x+3} = \frac{2}{x-3}$

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

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

$8 + 4(x-3) = 2(x+3)$

$8 + 4x - 12 = 2x + 6$

$4x - 4 = 2x + 6$

$4x - 2x = 6 + 4$

$2x = 10$

$x = 5$

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

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

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

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

$x+2 + x-2 = 4$

$2x = 4$

$x = 2$

↑
Gives zero in denominator

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

s.) $\frac{2x-1}{x^2+2x-8} + \frac{2}{x+4} = \frac{1}{x-2}$

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

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

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

$2x-1 + 2x-4 = x+4$

$4x-5 = x+4$

$4x-x = 4+5$

$3x = 9$

$x = 3$

m.) $\sqrt[5]{x+5} = 2$

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

$x+5 = 8$

$x = 3$

n.) $3 + \sqrt{x-6} = \sqrt{x+9}$

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

$9 + 6\sqrt{x-6} + x-6 = x+9$

$x+3+6\sqrt{x-6} = x+9$

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

$\sqrt{x-6} = 1$

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

$x-6 = 1$

$x = 7$

check:

$3 + \sqrt{7-6} = \sqrt{7+9}$

$3 + \sqrt{1} = \sqrt{16}$

$3 + 1 = 4$

$4 = 4 \checkmark$

Problem #2

a.) $f(x) = x^2 - 6x + 9$

vertex: $x = \frac{-(-6)}{2(1)} = 3$

$f(3) = 3^2 - 6(3) + 9$
 $= 9 - 18 + 9 = 0$

$(3, 0)$

axis of symmetry:

$x = 3$

x-intercepts:

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

$(x - 3)^2 = 0$

$x - 3 = 0$

$x = 3$

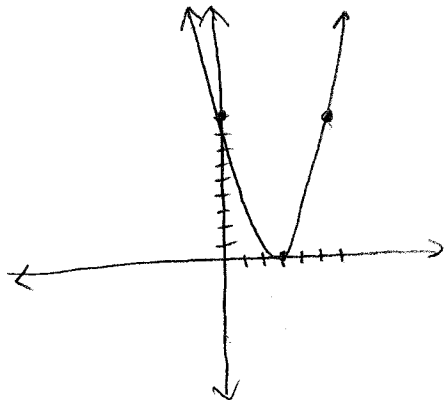
$(3, 0)$

y-intercept

$f(0) = 0^2 - 6(0) + 9$

$= 9$

$(0, 9)$



b.) $f(x) = 2x^2 - x + 2$

vertex: $x = \frac{-(-1)}{2(2)} = \frac{1}{4}$

$f(\frac{1}{4}) = 2(\frac{1}{4})^2 - \frac{1}{4} + 2$

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

$= \frac{1}{8} - \frac{1}{4} + 2$

$= \frac{1 - 2 + 16}{8}$

$= \frac{15}{8}$

$(\frac{1}{4}, \frac{15}{8})$

axis of symmetry:

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

x-intercepts:

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

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

$x = \frac{1 \pm \sqrt{1 - 16}}{4}$

$x = \frac{1 \pm \sqrt{-15}}{4}$

$x = \frac{1 \pm i\sqrt{15}}{4}$

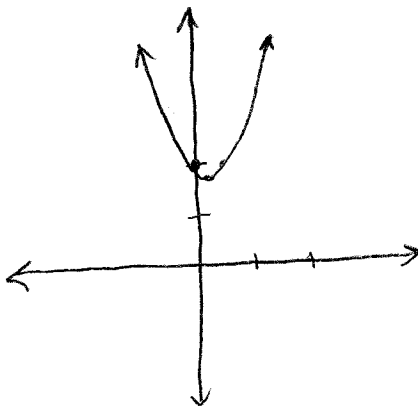
Not real

No x-intercepts

y-intercept

$f(0) = 2(0)^2 - 0 + 2 = 2$

$(0, 2)$



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

vertex: $x = \frac{-5}{2(2)} = -\frac{5}{4}$

$f(-\frac{5}{4}) = 2(-\frac{5}{4})^2 + 5(-\frac{5}{4}) + 3$

$= 2(\frac{25}{16}) - \frac{25}{4} + 3$

$= \frac{25}{8} - \frac{25}{4} + \frac{3}{1}$

$= \frac{25 - 50 + 24}{8} = -\frac{1}{8}$

$(-\frac{5}{4}, -\frac{1}{8})$

axis of symmetry:

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

x-intercepts:

$2x^2 + 5x + 3 = 0$

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

$2x + 3 = 0$ or $x + 1 = 0$

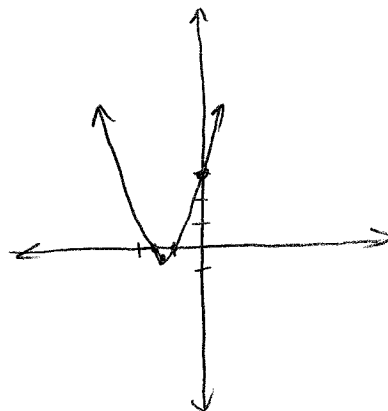
$x = -\frac{3}{2}$ $x = -1$

$(-\frac{3}{2}, 0)$ $(-1, 0)$

y-intercept:

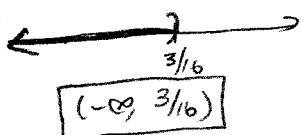
$f(0) = 2(0)^2 + 5(0) + 3 = 3$

$(0, 3)$



Problem #3

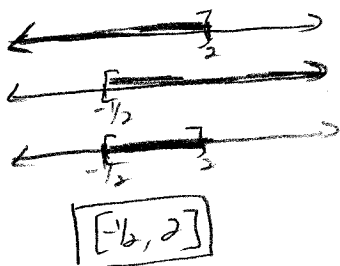
a) $\frac{1}{2} - x > \frac{x}{3} + \frac{1}{4}$
 $-x - \frac{x}{3} > \frac{1}{4} - \frac{1}{2}$
 $-\frac{4}{3}x > -\frac{1}{4}$
 $x < (-\frac{1}{4})(-\frac{3}{4})$
 $x < \frac{3}{16}$



b) $|3x - 7| \geq -5$
 Always true
 $(-\infty, \infty)$

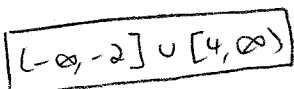
c) $|4x - 3| \leq 5$

$4x - 3 \leq 5$ and $4x - 3 \geq -5$
 $4x \leq 8$ and $4x \geq -2$
 $x \leq 2$ and $x \geq -\frac{1}{2}$

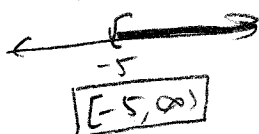


d) $\frac{x-4}{x+2} \leq 0$

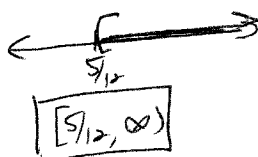
	-3	0	5
	-	+	-
x-4	-	-	+
x+2	-	+	+
	(+)	-	(+)



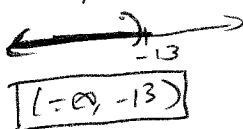
e) $5x + 1 \geq 3x - 9$
 $5x - 3x \geq -9 - 1$
 $2x \geq -10$
 $x \geq -5$



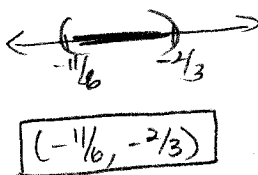
f) $4x - (6x + 1) \leq 8x + 2(x - 3)$
 $4x - 6x - 1 \leq 8x + 2x - 6$
 $-2x - 1 \leq 10x - 6$
 $-2x - 10x \leq -6 + 1$
 $-12x \leq -5$
 $x \geq \frac{5}{12}$



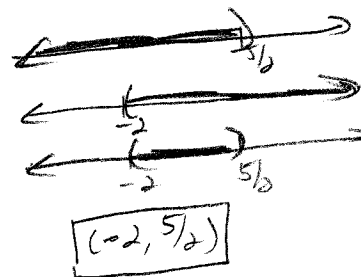
g) $2(x - 5) + 3x < 4(x - 6) + 11$
 $2x - 10 + 3x < 4x - 24 + 11$
 $5x - 10 < 4x - 13$
 $5x - 4x < -23 + 10$
 $x < -13$



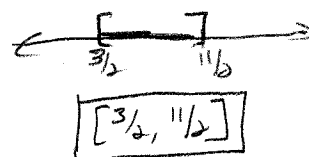
h) $5 < 1 - 6m < 12$
 $5 - 1 < 1 - 6m - 1 < 12 - 1$
 $4 < -6m < 11$
 $-\frac{4}{6} < \frac{-6m}{-6} < \frac{11}{-6}$
 $-\frac{2}{3} > m > -\frac{11}{6}$



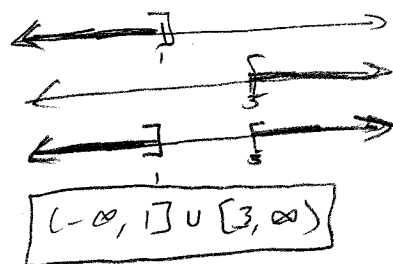
i) $6 - 5x > 1 - 3x$ and $4x - 3 > x - 9$
 $-5x + 3x > 1 - 6$ and $4x - x > -9 + 3$
 $-2x > -5$ and $3x > -6$
 $x < \frac{5}{2}$ and $x > -2$



j) $3 \leq 4x - 3 < 19$
 $3 + 3 \leq 4x - 3 + 3 < 19 + 3$
 $6 \leq \frac{4x}{4} \leq \frac{22}{4}$
 $\frac{3}{2} \leq x \leq \frac{11}{2}$

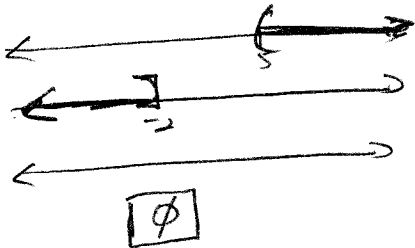


k) $3x + 2 \leq 5$ or $5x - 7 \geq 8$
 $3x \leq 3$ or $5x \geq 15$
 $x \leq 1$ or $x \geq 3$

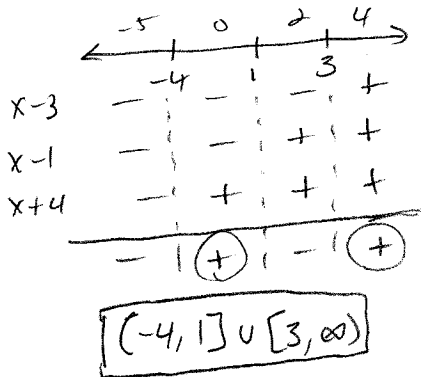


Problem #3 continued

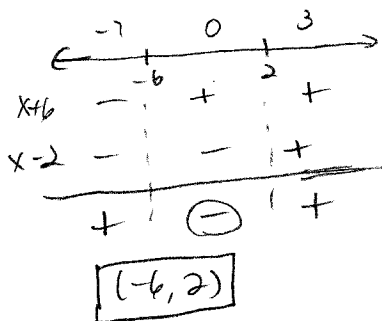
l.) $5(x-2) > 15$ and $\frac{x-6}{4} \leq -2$
 $5x-10 > 15$ and $x-6 \leq -8$
 $5x > 25$ and $x \leq -2$
 $x > 5$ and $x \leq -2$



m.) $\frac{x^2-4x+3}{x+4} \geq 0$
 $\frac{(x-3)(x-1)}{x+4} \geq 0$

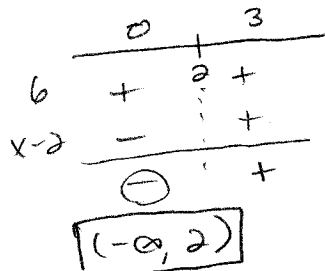


n.) $x^2+4x < 12$
 $x^2+4x-12 < 0$
 $(x+6)(x-2) < 0$

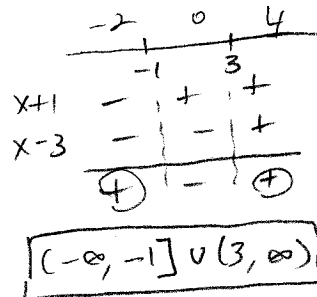


o.) $\frac{x+4}{x-2} \leq 1$

$\frac{x+4}{x-2} - 1 \leq 0$
 $\frac{x+4-x+2}{x-2} \leq 0$
 $\frac{6}{x-2} \leq 0$



p.) $\frac{x+1}{x-3} \geq 0$



Problem #4

a.) $(5-3i) - (-3+2i)$
 $5-3i+3-2i = \boxed{8-5i}$

b.) $(4-3i)(2+5i)$
 $8+20i-6i-15i^2$
 $8+14i-15(-1)$
 $8+14i+15 = \boxed{22+14i}$

c.) $\frac{2-i}{3+4i} \cdot \frac{3-4i}{3-4i}$
 $\frac{6-8i-3i+4i^2}{9-16i^2} = \frac{6-11i-4}{25}$
 $= \boxed{\frac{2}{25} - \frac{11}{25}i}$

d.) i^{3513}
 $i' = \boxed{i}$

Problem #5

a.) $y = 2x^2 + 5x - 3$
 $y = 2(x^2 + \frac{5}{2}x + \frac{25}{16}) - 3 - \frac{(25)}{16}(2)$
 $\frac{5}{2} \div 2 = \frac{5}{4}$
 $\frac{5}{2} \cdot \frac{1}{2} = (\frac{5}{4})^2$
 $y = 2(x + \frac{5}{4})^2 - 3 - \frac{25}{8}$
 $y = 2(x + \frac{5}{4})^2 - \frac{24}{8} - \frac{25}{8}$
 $y = 2(x + \frac{5}{4})^2 - \frac{49}{8}$

b.) vertex: $(-\frac{5}{4}, -\frac{49}{8})$

c.) axis of symmetry: $x = -\frac{5}{4}$

Problem #6

a.) $x-2y = 16 \rightarrow x = (6+2)y$
 $y+3 = 3x$
 $y+3 = 3(6+2y)$
 $y+3 = 48+6y$
 $3-48 = 6y-y$
 $-45 = 5y$
 $y = -9$
 $x-2(-9) = 16$
 $x+18 = 16$
 $x = -2$
 $\boxed{(-2, -9)}$

Problem #6 continued

b.) $-3(x-3y) = -6$
 $3x - 9y = 9$

$-3x + 9y = 18$
 $3x - 9y = 9$
 $0 = 27$

No solution

c.) $2(3x - 5y) = 11$
 $-3(2x - 6y) = 2$

$6x - 10y = 22$
 $-6x + 18y = -6$
 $8y = 16$
 $y = 2$

$3x - 5(2) = 11$
 $3x - 10 = 11$
 $3x = 21$
 $x = 7$

(7, 2)

d.) ① $3x + 2y - z = 4$
 ② $3x - 2y + z = 5$
 ③ $4x - 5y - z = -1$

① & ②
 $3x + 2y - z = 4$
 $3x - 2y + z = 5$
 $6x = 9$
 $x = 3/2$ ④

② & ③
 $3x - 2y + z = 5$
 $4x - 5y - z = -1$
 $7x - 7y = 4$ ⑤

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

④ & ⑤
 $7(\frac{3}{2}) - 7y = 4$
 $\frac{21}{2} - 7y = 4$
 $-7y = 4 - \frac{21}{2}$
 $-7y = -\frac{13}{2}$
 $y = \frac{13}{14}$

$3x - 2y + z = 5$
 $3(\frac{3}{2}) - 2(\frac{13}{14}) + z = 5$
 $\frac{9}{2} - \frac{13}{7} + z = 5$
 $z = 5 - \frac{9}{2} + \frac{13}{7}$
 $z = \frac{70 - 63 + 26}{14} = \frac{33}{14}$

Problem #7

a.) $\sqrt{18} - \sqrt{50} + \sqrt{12} - \sqrt{75}$
 $3\sqrt{2} - 5\sqrt{2} + 2\sqrt{3} - 5\sqrt{3}$
 $-2\sqrt{2} - 3\sqrt{3}$

b.) $\frac{5}{3-\sqrt{2}} \cdot \frac{3+\sqrt{2}}{3+\sqrt{2}}$
 $\frac{15+5\sqrt{2}}{9-2}$
 $\frac{15+5\sqrt{2}}{7}$

c.) $5\sqrt{12} + 16\sqrt{27}$
 $5 \cdot 2\sqrt{3} + 16 \cdot 3\sqrt{3}$
 $10\sqrt{3} + 48\sqrt{3}$
 $58\sqrt{3}$

d.) $\sqrt{9a} + 2\sqrt{45a^3}$
 $\sqrt{9a} + 2 \cdot 3a\sqrt{5a}$
 $\sqrt{9a} + 6a\sqrt{5a}$
 $(1+6a)\sqrt{5a}$

e.) $\sqrt{10} \cdot \sqrt{5}$
 $\sqrt{50} = \sqrt{5 \cdot 10}$

f.) $\sqrt{5a^7} \cdot \sqrt{5a^3}$
 $\sqrt{75a^{10}}$
 $5a^5\sqrt{3}$

g.) $\frac{\sqrt{40xy^3}}{\sqrt{8x}}$
 $\sqrt{\frac{40xy^3}{8x}}$
 $\sqrt{5y^3}$
 $y\sqrt{5y}$

h.) $\frac{4\sqrt{5}}{3\sqrt{2}} \cdot \frac{\sqrt{2}}{\sqrt{2}}$
 $\frac{4\sqrt{10}}{3 \cdot 2} = \frac{4\sqrt{10}}{6} = \frac{2\sqrt{10}}{3}$

i.) $\frac{3-\sqrt{2}}{5+\sqrt{6}} \cdot \frac{5-\sqrt{6}}{5-\sqrt{6}}$
 $\frac{15-3\sqrt{6}-5\sqrt{2}+\sqrt{12}}{25-6}$
 $\frac{15-3\sqrt{6}-5\sqrt{2}+2\sqrt{3}}{19}$

Problem #8

a.) $(\frac{1}{81} - \frac{1}{x^2}) \div (x-9)$
 $\frac{x^2-81}{81x^2} \div \frac{x-9}{1}$
 $\frac{(x+9)(x-9)}{81x^2} \cdot \frac{1}{x-9}$
 $\frac{x+9}{81x^2}$

b.) $\frac{a^2-9}{3a-6} \cdot \frac{a^2-4}{a^2-a-6}$
 $\frac{(a+3)(a-3)}{3(a-2)} \cdot \frac{(a+2)(a-2)}{(a-3)(a+3)}$
 $\frac{a+3}{3}$

c.) $(\frac{-2x^4y^{-4}}{3x^{-3}y^{-2}})^{-3} = (\frac{-2x^4x^3y^2}{3y^4})^{-3}$
 $= (\frac{-2x^7}{3y^4})^{-3} = (\frac{3y^4}{-2x^7})^3$
 $\frac{27y^{12}}{-8x^{21}}$

Problem #8 continued

d.) $\frac{x^2-16}{x^2-10x+25} \div \frac{3x-12}{x^2-3x-10}$

$\frac{x^2-16}{x^2-10x+25} \cdot \frac{x^2-3x-10}{3x-12}$

$\frac{(x+4)(x-4)}{(x-5)(x-5)} \cdot \frac{(x-5)(x+2)}{3(x-4)}$

$\frac{(x+4)(x+2)}{3(x-5)}$

e.) $\frac{4}{x+1} + \frac{x+2}{x^2-1} + \frac{3}{x-1}$

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

LCD = (x+1)(x-1)

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

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

$\frac{8x+1}{(x+1)(x-1)}$

f.) $\frac{4}{x^2-1} - \frac{3}{x+1}$
 $\frac{5}{x^2-1} - \frac{2}{x-1}$

$\frac{4}{x^2-1} - \frac{3}{x+1}$

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

LCD = (x+1)(x-1)

LCD = (x+1)(x-1)

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

$\frac{5-2(x+1)}{(x+1)(x-1)}$

$\frac{-3x+7}{(x+1)(x-1)}$

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

$\frac{-3x+7}{(x+1)(x-1)} \div \frac{-2x+3}{(x+1)(x-1)}$

$\frac{-3x+7}{(x+1)(x-1)} \cdot \frac{(x+1)(x-1)}{-2x+3} = \frac{-3x+7}{-2x+3}$

g.) $\frac{x^{-1}+y^{-1}}{\frac{x^2-y^2}{xy}}$

$\frac{\frac{1}{x} + \frac{1}{y}}{\frac{x^2-y^2}{xy}}$

$\frac{1}{x} + \frac{1}{y}$

LCD = xy

$\frac{y+x}{xy}$

$\frac{y+x}{xy} \div \frac{x^2-y^2}{xy}$

$\frac{y+x}{xy} \cdot \frac{xy}{(x+y)(x-y)}$

$\frac{1}{x-y}$

Problem #9

a.) $2w^3-2w^2+3w-3$

$(2w^3-2w^2)+(3w-3)$

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

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

b.) $15x^2-14x-8$

$(5x+2)(3x-4)$

c.) $-3x^3+27x$

$-3x(x^2-9)$

$-3x(x+3)(x-3)$

d.) $9x^2-12xy+4y^2$

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

e.) a^8-b^8

$(a^4+b^4)(a^4-b^4)$

$(a^4+b^4)(a^2+b^2)(a^2-b^2)$

$(a^4+b^4)(a^2+b^2)(a+b)(a-b)$

f.) $8m^3+m^6-20$

m^6+8m^3-20

$u=m^3$

u^2+m^6

$u^2+8u-20$

$(u+10)(u-2)$

$(m^3+10)(m^3-2)$

g.) $10x^2+19x+6$

$(5x+2)(2x+3)$

h.) $6x^2-7xy-5y^2$

$(3x-5y)(2x+y)$

i.) $(x-6)^2-y^2$

$(x-6+y)(x-6-y)$

j.) $64x^2-16y^2$

$16(4x^2-y^2)$

$16(2x+y)(2x-y)$

k.) $x^2-14x+49$

$(x-7)(x-7)$

l.) $9x^2+48xy+64y^2$

$(3x)^2 + 2(3x)(8y) + (8y)^2$

$(3x+8y)^2$

m.) $2x^3y-32xy$

$2xy(x^2-16)$

$2xy(x+4)(x-4)$

n.) $x^2-12x+36-y^2$

$(x-6)^2-y^2$

$(x-6+y)(x-6-y)$

Problem #10

a.) $(-9xy^2 - xy + 6x^2y) + (-5x^2y - xy + 4xy^2) + (12x^2y - 3xy^2 + 6xy)$

$$\boxed{-8xy^2 + 4xy + 13x^2y}$$

b.) $(4x-3)(2x+7)$
 $8x^2 + 28x - 6x - 21$

$$\boxed{8x^2 + 22x - 21}$$

c.) $(x^2 - 2x + 1)(x^2 + x + 2)$
 $x^4 + x^3 + 2x^2 - 2x^3 - 2x^2 - 4x + x^2 + x + 2$

$$\boxed{x^4 - x^3 + x^2 - 3x + 2}$$

d.) $(x^3 - 2x^2 + 2x - 5) \div (x+1)$

$$\begin{array}{r} x^3 - 3x + 5 \\ x+1 \overline{) x^3 - 2x^2 + 2x - 5} \\ \underline{-(x^3 + x^2)} \\ -3x^2 + 2x \\ \underline{-(3x^2 - 3x)} \\ 5x - 5 \\ \underline{-(5x + 5)} \\ -10 \end{array}$$

$$\boxed{x^2 - 3x + 5 + \frac{-10}{x+1}}$$

Problem #11

a.) $f(4) = 3(4)^2 + 2$
 $= 3(16) + 2 = 48 + 2 = \boxed{50}$

b.) $h(-4) = |3(-4) - 2|$
 $= |-12 - 2| = |-14| = \boxed{14}$

c.) $f(x+2) = 3(x+2)^2 + 2$
 $= 3(x^2 + 4x + 4) + 2$
 $= 3x^2 + 12x + 12 + 2$

$$\boxed{3x^2 + 12x + 14}$$

d.) $(g \circ h)(x) = g(h(x))$
 $= g(13x - 2)$

$$= \boxed{4|3x - 2| - 3}$$

e.) $g^{-1}(x)$:
 $g(x) = 4x - 3$
 $y = 4x - 3$
 $x = 4y - 3$
 $x + 3 = 4y$
 $y = \frac{x+3}{4}$

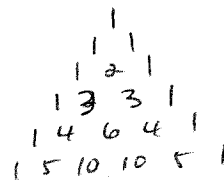
$$g^{-1}(x) = \frac{x+3}{4}$$

Problem #12

$a_{100} = \frac{3(100) + 2}{(100)^2 + 4} = \frac{302}{10004} = \frac{\boxed{151}}{5002}$

Problem #13

Pascal's Triangle:



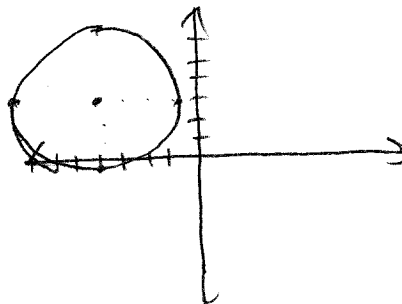
a.) $(x+y)^5 = x^5 + 5x^4y + 10x^3y^2 + 10x^2y^3 + 5xy^4 + y^5$

b.) $(2x-3y)^4 = (2x)^4 + 4(2x)^3(-3y) + 6(2x)^2(-3y)^2 + 4(2x)(-3y)^3 + (-3y)^4$

$$= \boxed{16x^4 - 96x^3y + 216x^2y^2 - 216xy^3 + 81y^4}$$

Problem #14

a.) $(x+4)^2 + (y-3)^2 = 10$
 center: $(-4, 3)$ radius = $\sqrt{10}$



Problem #14 continued

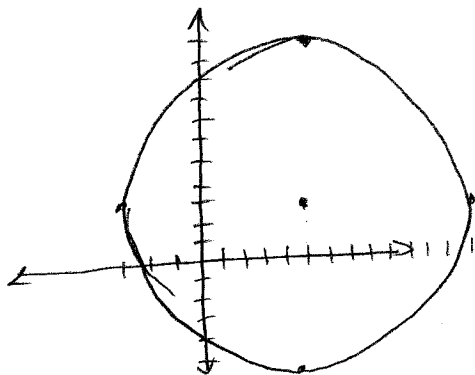
b.) $x^2 + y^2 - 10x - 6y - 30 = 0$

$x^2 - 10x + 25 + y^2 - 6y + 9 = 30 + 25 + 9$

$\frac{-10}{2} = (-5)^2 \quad \frac{-6}{2} = (-3)^2$

$(x-5)^2 + (y-3)^2 = 64$

center: (5, 3) radius = 8

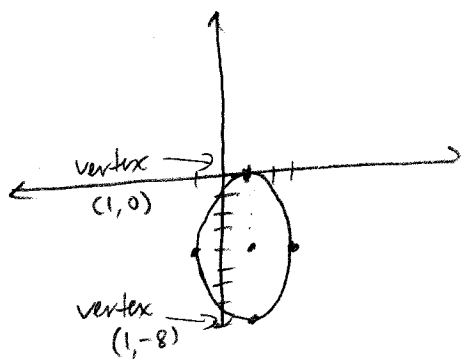


Problem #15

a.) $\frac{12(x-1)^2 + 3(y+4)^2}{48} = \frac{48}{48}$

$\frac{(x-1)^2}{4} + \frac{(y+4)^2}{16} = 1$

center: (1, -4)

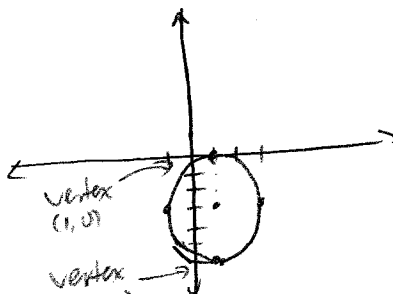


major axis parallel to y-axis

b.) $\frac{9(x-1)^2 + 4(y+3)^2}{36} = \frac{36}{36}$

$\frac{(x-1)^2}{4} + \frac{(y+3)^2}{9} = 1$

center: (1, -3)

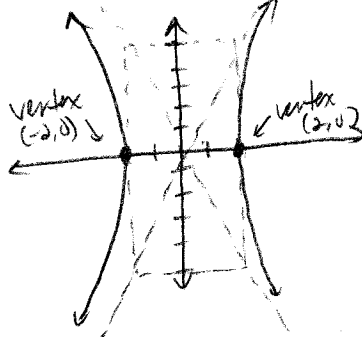


major axis parallel to y-axis

Problem #16

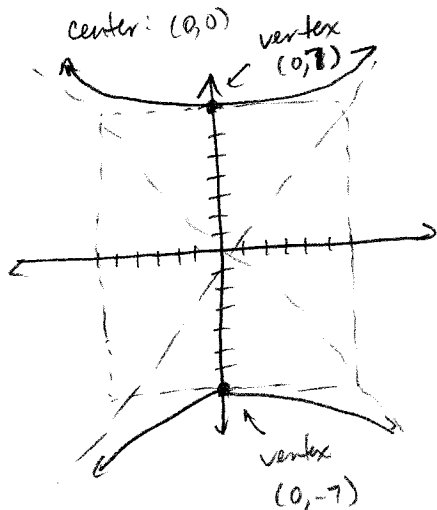
a.) $\frac{x^2}{4} - \frac{y^2}{25} = 1$

center: (0, 0)



b.) $\frac{y^2}{49} - \frac{x^2}{36} = 1$

center: (0, 0)



Problem #17

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

vertex (3, 1)

axis of symmetry $x = 3$

x-intercepts:

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

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

$(x-3)^2 = -1/2$

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

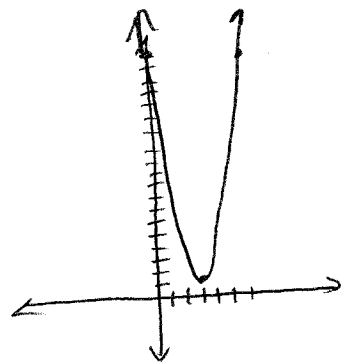
not real

No x-intercepts

y-intercept:

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

$= 2(9) + 1 = 19$



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

vertex (1, 4)

axis of symmetry $y = 4$

x-intercept

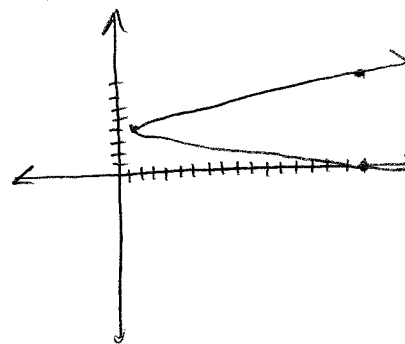
$x = (0-4)^2 + 1 = 16 + 1 = 17$

y-intercepts

$0 = (y-4)^2 + 1$

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

not real No y-intercepts



Problem #17 continued

c.) $x = y^2 - 6y + 8$

vertex:

$$y = \frac{-(-6)}{2(1)} = 3$$

$$x = (3)^2 - 6(3) + 8 = 9 - 18 + 8 = -1$$

$(-1, 3)$

axis of symmetry: $y = 3$

x-intercept:

$$x = 0^2 - 6(0) + 8 = 8$$

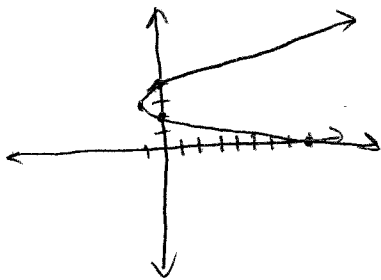
y-intercepts

$$y^2 - 6y + 8 = 0$$

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

$$y-4=0 \text{ or } y-2=0$$

$$y = 4 \text{ or } y = 2$$



Problem #18

a.) $y = x^2 + 1$

$$y = 4x + 1$$

$$x^2 + 1 = 4x + 1$$

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

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

$$x = 0 \text{ or } x - 4 = 0$$

$x = 4$

$x = 0$: $y = 4(0) + 1 = 1$

$(0, 1)$

$x = 4$: $y = 4(4) + 1 = 17$

$(4, 17)$

b.) $2x^2 + y^2 = 18$

$$xy = 4$$

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

$$2x^2 + \left(\frac{4}{x}\right)^2 = 18$$

$$2x^2 + \frac{16}{x^2} = 18$$

$$\text{LCD} = x^2$$

$$x^2(2x^2) + x^2\left(\frac{16}{x^2}\right) = x^2(18)$$

$$2x^4 + 16 = 18x^2$$

$$2x^4 - 18x^2 + 16 = 0$$

$$2(x^4 - 9x^2 + 8) = 0$$

$$u = x^2$$

$$u^2 = x^4$$

$$2(u^2 - 9u + 8) = 0$$

$$2(u-8)(u-1) = 0$$

$$2(x^2-8)(x^2-1) = 0$$

$$2(x^2-8)(x+1)(x-1) = 0$$

$$2=0 \text{ or } x^2-8=0 \text{ or } x+1=0 \text{ or } x-1=0$$

$x = \pm 2\sqrt{2}, x = -1, x = 1$

c.) $7x^2 - 3y^2 + 5 = 0$

$$3x^2 + 5y^2 = 12$$

$$5(-7x^2 - 3y^2 = -5)$$

$$3(3x^2 + 5y^2 = 12)$$

$$35x^2 - 15y^2 = -25$$

$$9x^2 + 15y^2 = 36$$

$$44x^2 = 11$$

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

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

$x = \frac{1}{2}$: $3\left(\frac{1}{2}\right)^2 + 5y^2 = 12$

$$\frac{3}{4} + 5y^2 = 12$$

$$5y^2 = 12 - \frac{3}{4}$$

$$5y^2 = \frac{45}{4}$$

$$y^2 = \frac{9}{4}$$

$$y = \pm \frac{3}{2}$$

$x = -\frac{1}{2}$: $3\left(-\frac{1}{2}\right)^2 + 5y^2 = 12$

$$\frac{3}{4} + 5y^2 = 12$$

$$5y^2 = 12 - \frac{3}{4}$$

$$5y^2 = \frac{45}{4}$$

$$y^2 = \frac{9}{4}$$

$$y = \pm \frac{3}{2}$$

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

Problem #19

a) $f(x) = 2^{x-1} + 4$

$$2^x$$

$$2^{x-1} + 4$$

$$(-1, \frac{1}{2})$$

$$(0, 4\frac{1}{2})$$

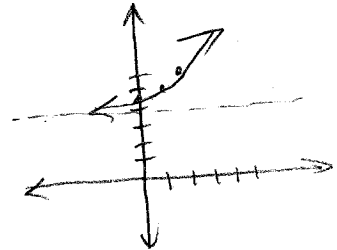
$$(0, 1)$$

$$(1, 5)$$

$$(1, 2)$$

$$(2, 6)$$

$$\begin{matrix} \uparrow & \uparrow \\ +1 & +4 \end{matrix}$$



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

$$2^x$$

$$\log_2 x$$

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

$$(-1, \frac{1}{2})$$

$$\left(\frac{1}{2}, -1\right)$$

$$\left(-2\frac{1}{2}, -5\right)$$

$$(0, 1)$$

$$(1, 0)$$

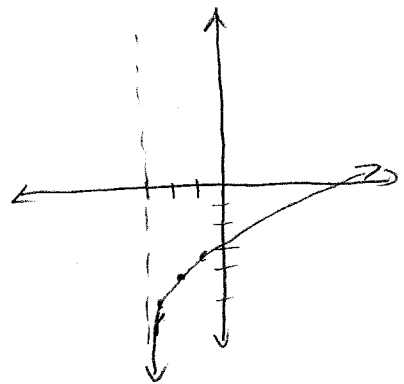
$$(-2, -4)$$

$$(1, 2)$$

$$(2, 1)$$

$$(-1, -3)$$

$$\begin{matrix} \uparrow & \uparrow \\ -3 & -4 \end{matrix}$$



Problem #20

a.) $\log_{25} 25 = 2$

b.) $\log_{25} \frac{1}{8} = -3$

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

d.) $\log_5 5 = 1$

e.) $\log_{10} 1 = 0$

f.) $\log_4 4^6 = 6$

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

h.) $\log_2 64 = 6$

i.) $\log_{49} 7 = \frac{1}{2}$

c.) $5^{2x+1} = 125$
 $5^{2x+1} = 5^3$
 $2x+1 = 3$
 $2x = 4$
 $x = 2$

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

e.) $3^x = 14$
 $\ln 3^x = \ln 14$
 $x \ln 3 = \ln 14$
 $x = \frac{\ln 14}{\ln 3}$

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

$\ln 3 - 2x \ln 3 = x \ln 4$
 $\ln 3 = x \ln 4 + 2x \ln 3$
 $\ln 3 = x(\ln 4 + 2 \ln 3)$
 $x = \frac{\ln 3}{\ln 4 + 2 \ln 3}$

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

h.) $9e^x = 99$
 $\frac{9e^x}{9} = \frac{99}{9}$
 $e^x = 11$
 $\ln e^x = \ln 11$
 $x = \ln 11$

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

j.) $\log_2(x^2) - \log_2(x-2) = 3$
 $\log_2 \frac{x^2}{x-2} = 3$
 $2^3 = \frac{x^2}{x-2}$
 $8(x-2) = x^2$
 $8x - 16 = x^2$
 $0 = x^2 - 8x + 16$
 $0 = (x-4)(x-4)$
 $x-4 = 0$
 $x = 4$ checks.

k.) $\log_2(x-3) + \log_2(x+4) = 3$
 $\log_2(x-3)(x+4) = 3$
 $2^3 = x^2 + x - 12$
 $0 = x^2 + x - 20$
 $0 = (x+5)(x-4)$
 $x+5 = 0$ or $x-4 = 0$
 $x = -5$ or $x = 4$
 Does not check checks

Problem #21

a.) $\log 52 \approx 1.716$

b.) $\ln 28 \approx 3.332$

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

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

Problem #22

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

b.) $3^{x^3} = 9^x$
 $3^{x^3} = (3^2)^x$
 $3^{x^3} = 3^{2x}$
 $x^3 = 2x$
 $x^3 - 2x = 0$
 $x(x^2 - 2) = 0$
 $x = 0$ or $x^2 - 2 = 0$
 $x^2 = 2$
 $x = \pm\sqrt{2}$

Problem #22 continued

l.) $x = \log_5 625$

$5^x = 625$

$5^x = 5^4$

$x = 4$

m.) $\log_8 x = -2$

$8^{-2} = x$

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

checks

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

$x^{1/3} = 4$

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

$x = 64$

checks

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

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

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

$64 = x - 3$

$x = 67$

checks

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

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

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

$500x = 3x - 5$

$497x = -5$

$x = -5/497$

Does not check

No solution

Problem #23

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

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

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

$\log \frac{x}{y^{3/2}}$

$\log x - \log y^{3/2}$

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

Problem #24

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

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

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

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

Problem #25

a.) $(-2, -6) (3, -4)$

$d = \sqrt{(-2 - 3)^2 + (-6 - (-4))^2}$

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

$= \sqrt{25 + 4} = \sqrt{29}$

b.) $(3\sqrt{3}, \sqrt{5}) (-\sqrt{3}, 4\sqrt{5})$

$d = \sqrt{(3\sqrt{3} - (-\sqrt{3}))^2 + (\sqrt{5} - 4\sqrt{5})^2}$

$= \sqrt{(4\sqrt{3})^2 + (-3\sqrt{5})^2}$

$= \sqrt{16(3) + 9(5)}$

$= \sqrt{48 + 45} = \sqrt{93}$

Problem #26

a.) $(10, 4) (2, 6)$

$(\frac{10+2}{2}, \frac{4+6}{2}) = (\frac{12}{2}, \frac{10}{2}) = (6, 5)$

b.) $(-2, -1) (-8, 6)$

$(\frac{-2+(-8)}{2}, \frac{-1+6}{2}) = (\frac{-10}{2}, \frac{5}{2}) = (-5, \frac{5}{2})$

Problem #27

a.) $(3, 4) (7, -2)$

$m = \frac{-2-4}{7-3} = \frac{-6}{4} = -\frac{3}{2}$

b.) $(-1, -4) (5, 3)$

$m = \frac{3-(-4)}{5-(-1)} = \frac{7}{6}$

c.) $(4, 7) (8, 7)$

$m = \frac{7-7}{8-4} = \frac{0}{4} = 0$

d.) $(2, 4) (2, 6)$

$m = \frac{6-4}{2-2} = \frac{2}{0} \rightarrow$ undefined

Problem #28

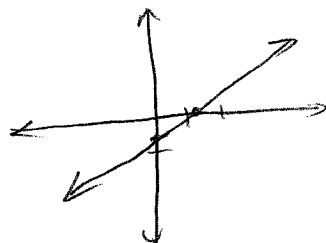
a.) $y = \frac{2}{3}x - \frac{3}{4}$

$m = \frac{2}{3}$ y-int: $(0, -3/4)$

x-int: $0 = \frac{2}{3}x - \frac{3}{4}$

$\frac{3}{4} = \frac{2}{3}x$

$x = \frac{3}{4}(\frac{3}{2}) = \frac{9}{8} (\frac{9}{8}, 0)$



Problem #28 continued

b.) $5x - 4y = 20$

x-intercept:

$$5x - 4(0) = 20$$

$$5x = 20$$

$$x = 4$$

(4, 0)

y-intercept

$$5(0) - 4y = 20$$

$$-4y = 20$$

$$y = -5$$

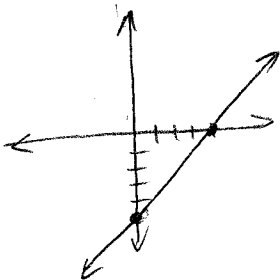
(0, -5)

slope:

$$\frac{-4y}{-4} = \frac{-5x + 20}{-4}$$

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

$$m = \frac{5}{4}$$



c.) $2x + y = 6$

x-intercept:

$$2x + 0 = 6$$

$$2x = 6 \quad (3, 0)$$

$$x = 3$$

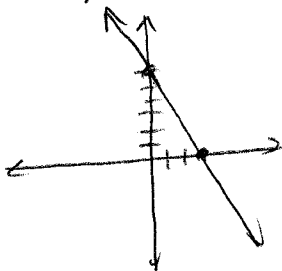
y-intercept:

$$2(0) + y = 6$$

$$y = 6 \quad (0, 6)$$

slope:

$$y = -2x + 6$$



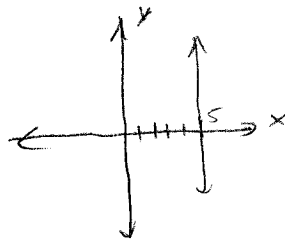
d.) $x = 5$

vertical line

no y-intercept

x-intercept (5, 0)

slope undefined



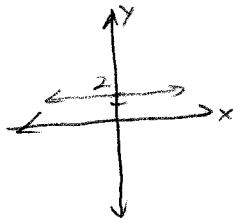
e.) $y = 2$

horizontal line

no x-intercept

y-intercept (0, 2)

slope = 0



Problem #29

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

$$-8x + 6y = 0$$

$$-4x + 3y = 4 \quad -8x + 6y = 0$$

$$3y = 4x + 4 \quad 6y = 8x$$

$$y = \left(\frac{4}{3}\right)x + \frac{4}{3} \quad y = \left(\frac{4}{3}\right)x$$

parallel

b.) $5x - 3y = -2$

$$3x - 5y = -8$$

$$5x - 3y = -2 \quad 3x - 5y = -8$$

$$-3y = -5x - 2 \quad -5y = -3x - 8$$

$$y = \left(\frac{5}{3}\right)x + \frac{2}{3} \quad y = \left(\frac{3}{5}\right)x + \frac{8}{5}$$

Neither parallel nor perpendicular

c.) $3x - 5y = -1$

$$5x + 3y = 2$$

$$3x - 5y = -1$$

$$5x + 3y = 2$$

$$-5y = -3x - 1$$

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

$$y = \left(\frac{3}{5}\right)x + \frac{1}{5}$$

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

perpendicular

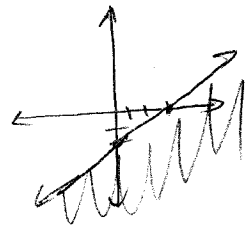
Problem #30

a.) $2x - 3y \geq 6$

$$\frac{-3y \geq -2x + 6}{-3} \quad \frac{-3y \geq -2x + 6}{-3}$$

$$y \leq \frac{2}{3}x - 2$$

Test (0, 0): $2(0) - 3(0) \geq 6$
 $0 \geq 6$ False

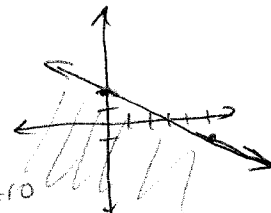


b.) $3x + 5y \leq 10$

$$5y \leq -3x + 10$$

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

Test (0, 0): $3(0) + 5(0) \leq 10$
 $0 \leq 10$ True

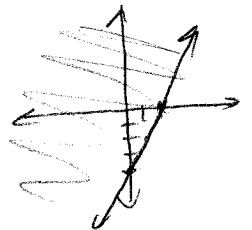


c.) $2x - y \leq 4$

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

$$y \geq 2x - 4$$

Test (0, 0): $2(0) - 0 \leq 4$
 $0 \leq 4$ True

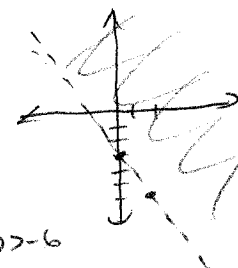


d.) $3x + 2y > -6$

$$2y > -3x - 6$$

$$y > -\frac{3}{2}x - 3$$

Test (0, 0): $3(0) + 2(0) > -6$
 $0 > -6$ True



Problem #31

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

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

c.) $h(-3) = -4(-3)^2 + 2(-3) + 8$
 $= -4(9) - 6 + 8$
 $= -36 - 6 + 8 = \boxed{-34}$

Problem #32

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

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

All real numbers except $5/2$

$\{x \mid x \in \mathbb{R}, x \neq 5/2\}$
 $(-\infty, 5/2) \cup (5/2, \infty)$

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

All real numbers
 $(-\infty, \infty)$

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

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

All real numbers except 5

$\{x \mid x \in \mathbb{R}, x \neq 5\}$

$(-\infty, 5) \cup (5, \infty)$

Problem #33

$l = 2w$ $P = 2l + 2w$
 $300 = 2(2w) + 2w$
 $300 = 4w + 2w$
 $300 = 6w$
 $w = 50$

$l = 2(50) = 100$

The width is 50 yards and
the length is 100 yards

Problem #34

$l = 2w - 6$ $P = 2l + 2w$
 $126 = 2(2w - 6) + 2w$
 $126 = 4w - 12 + 2w$
 $138 = 6w$
 $w = 23$

$l = 2(23) - 6$
 $= 46 - 6 = 40$

The length is 40 m and
the width is 23 m

Problem #35

rate x time = distance

upstream	$b - \frac{3}{2}$	t	4
downstream	$b + \frac{3}{2}$	t	10

$(b - \frac{3}{2})t = 4$ $(b + \frac{3}{2})t = 10$
 $t = \frac{4}{b - \frac{3}{2}}$ $t = \frac{10}{b + \frac{3}{2}}$

$\frac{4}{b - \frac{3}{2}} = \frac{10}{b + \frac{3}{2}}$

$4(b + \frac{3}{2}) = 10(b - \frac{3}{2})$
 $4b + 12 = 10b - 30$
 $12 + 30 = 10b - 4b$
 $42 = 6b$
 $b = 7$

The speed of the kayak
is 7 mph

Problem #36

rate x time = distance

upstream	$b - 6$	10	d
downstream	$b + 6$	4	d

$d = 10(b - 6)$ $d = 4(b + 6)$
 $10b - 60 = 4b + 24$
 $10b - 4b = 24 + 60$
 $6b = 84$
 $b = 14$

The speed of the canoe
is 14 km/hr

Problem #37

value x qty = amount

40%	x	0.4x
10%	y	0.1y
25%	10	2.5

$0.4x + 0.1y = 2.5$
 $x + y = 10$

$y = 10 - x$

$0.4x + 0.1(10 - x) = 2.5$
 $0.4x + 1 - 0.1x = 2.5$
 $0.3x = 1.5$
 $x = 5$

$y = 10 - 5 = 5$

5 lbs of the 40% mixture
and 5 lbs of the 10%
mixture are needed

Problem #38

Quarter Pounders = q
Whoppers = w

$2q + 3w = 2607$
 $-2(q + w = 1009)$

$2q + 3w = 2607$
 $-2q - 2w = 2018$

 $w = 589$

$q + 589 = 1009$
 $q = 1009 - 589$
 $q = 420$

One Quarter Pounder has
420 calories and one
Whopper has 589 calories

Problem #39

value	x qty	= amount
\$6	x	6x
\$8	y	8y
\$7.50	144	1080

$$6x + 8y = 1080$$

$$-6(x + y = 144)$$

$$6x + 8y = 1080$$

$$-6x - 6y = -864$$

$$2y = 216$$

$$y = 108$$

$$x + 108 = 144$$

$$x = 36$$

36 lbs of the \$6 mixture and 108 lbs of the \$8 mixture are needed

Problem #40

- ① $f + s + t = 16$
- ② $2f + 3s + 4t = 46$
- ③ $5f - s = 31$

① & ②

$$4(f + s + t = 16)$$

$$2f + 3s + 4t = 46$$

$$-4f - 4s - 4t = -64$$

$$2f + 3s + 4t = 46$$

④ $-2f - s = -18$

③ & ④

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

$$5f - s = 31$$

$$-1(-2f - s = -18)$$

$$-s = -4$$

$$s = 4$$

$$5f - s = 31$$

$$2f + s = 18$$

$$7 + 4 + t = 16$$

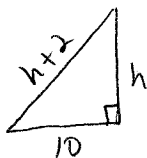
$$t = 5$$

$$7f = 49$$

$$f = 7$$

The numbers are 7, 4, 5

Problem #41



$$a^2 + b^2 = c^2$$

$$10^2 + h^2 = (h+2)^2$$

$$100 + h^2 = h^2 + 4h + 4$$

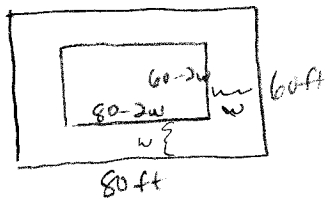
$$100 - 4 = 4h$$

$$96 = 4h$$

$$h = 24$$

The ladder reaches 24 ft up the wall

Problem #42



$$(60-2w)(80-2w) = 2400$$

$$4800 - 280w + 4w^2 = 2400$$

$$4w^2 - 280w + 2400 = 0$$

$$4(w^2 - 70w + 600) = 0$$

$$4(w-60)(w-10) = 0$$

$$w-60=0 \text{ or } w-10=0$$

$$w=60 \text{ or } w=10$$

\uparrow Not possible \uparrow possible

The width of the walkway is 10 ft

Problem #43

rate	x time	= distance
upstream $8-c$	t	9
downstream $8+c$	t	15

$$(8-c)t = 9$$

$$(8+c)t = 15$$

$$t = \frac{9}{8-c}$$

$$t = \frac{15}{8+c}$$

$$\frac{9}{8-c} = \frac{15}{8+c}$$

$$9(8+c) = 15(8-c)$$

$$72 + 9c = 120 - 15c$$

$$9c + 15c = 120 - 72$$

$$24c = 48$$

$$c = 2$$

The current is 2 mph

Problem #44

rate	x time	= job
$\frac{1}{3}$	t	$\frac{1}{3}t$
$\frac{1}{6}$	t	$\frac{1}{6}t$

$$\frac{1}{3}t + \frac{1}{6}t = 1$$

$$LCD = 6$$

$$6(\frac{1}{3}t) + 6(\frac{1}{6}t) = 6(1)$$

$$2t + t = 6$$

$$3t = 6$$

$$t = 2$$

It will take 2 hrs together

Problem #45

rate x time = job

Len	$\frac{1}{t+5}$	6	$\frac{6}{t+5}$
Bud	$\frac{1}{t}$	6	$\frac{6}{t}$

$$\frac{6}{t+5} + \frac{6}{t} = 1$$

$$LCD = t(t+5)$$

$$t(t+5)\left(\frac{6}{t+5}\right) + t(t+5)\left(\frac{6}{t}\right) = t(t+5)(1)$$

$$6t + 6(t+5) = t^2 + 5t$$

$$6t + 6t + 30 = t^2 + 5t$$

$$12t + 30 = t^2 + 5t$$

$$0 = t^2 - 7t - 30$$

$$0 = (t-10)(t+3)$$

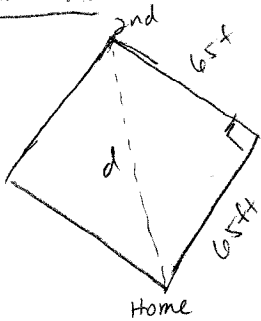
$$t-10=0 \text{ or } t+3=0$$

$$t=10 \text{ or } t=-3$$

↑
not possible

It will take Bud 10 hrs

Problem #46



$$a^2 + b^2 = c^2$$

$$65^2 + 65^2 = d^2$$

$$4225 + 4225 = d^2$$

$$8450 = d^2$$

$$d = \sqrt{8450}$$

$$d = 65\sqrt{2}$$

The distance is $65\sqrt{2}$ ft

Problem #47

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

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

$$A = \boxed{\$59.83}$$

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

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

$$A = \boxed{\$789.24}$$

c) $A = Pe^{rt}$

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

$$A = \boxed{\$156.83}$$

Problem #48

$$A = Pe^{rt}$$

$$t=0 \quad A = 10000$$

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

$$t=? \quad A = 25000$$

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

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

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

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

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

Problem #49

$$N = 1000e^{0.01t}$$

$$t=? \quad N = 1500$$

$$\frac{1500}{1000} = \frac{1000e^{0.01t}}{1000}$$

$$1.5 = e^{0.01t}$$

$$\ln 1.5 = \ln e^{0.01t}$$

$$\frac{\ln 1.5}{0.01} = \frac{0.01t}{0.01}$$

$$t = \boxed{40.5 \text{ hrs}}$$

$$t=? \quad N = 2000$$

$$\frac{2000}{1000} = \frac{1000e^{0.01t}}{1000}$$

$$2 = e^{0.01t}$$

$$\ln 2 = \ln e^{0.01t}$$

$$\frac{\ln 2}{0.01} = \frac{0.01t}{0.01}$$

$$t = \boxed{69.3 \text{ hrs}}$$

Problem #50

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

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

$$t = 1.5 \text{ yrs} \quad A = 20000$$

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

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

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

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

$$k = 0.462$$

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

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

$$A = \boxed{25193 \text{ people}}$$

Problem #51

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

$$A = 10 e^{kt}$$

Half-Life = 1690 yrs

$$t = 1690 \quad A = 5$$

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

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

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

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

$$k = -0.0004101$$

$$A = 10 e^{-0.0004101t}$$

t = 50:

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

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

Problem #52

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

Half-Life = 5600 yrs

$$\frac{1}{2} A_0 = \frac{A_0 e^{5600k}}{A_0}$$

$$\frac{1}{2} = e^{5600k}$$

$$\ln \frac{1}{2} = \ln e^{5600k}$$

$$\frac{\ln \frac{1}{2}}{5600} = \frac{5600k}{5600}$$

$$k = -0.000124$$

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

$$A = 0.3 A_0 \quad t = ?$$

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

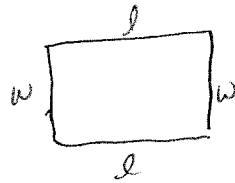
$$0.3 = e^{-0.000124t}$$

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

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

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

Problem #53



$$\frac{\partial l}{\partial t} + \frac{\partial w}{\partial t} = 56 \quad A = lw$$

$$2l = 56 - 2w \quad A = (28 - w)w$$

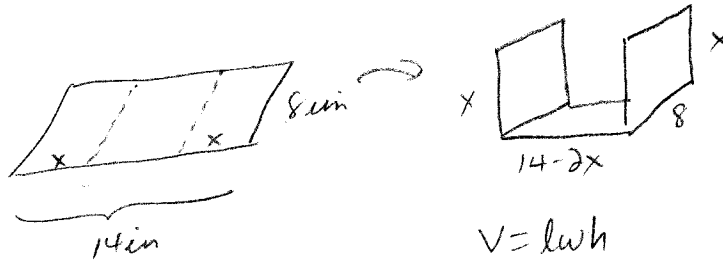
$$l = 28 - w \quad A = -w^2 + 28w$$

$$w = \frac{-28}{2(-1)} = 14$$

$$l = 28 - 14 = 14$$

The length is 14 ft and the width is 14 ft.
The maximum area is 196 ft²

Problem #54



$$V = lwh$$

$$V = (14 - 2x)8x$$

$$V = -16x^2 + 112x$$

$$x = \frac{-112}{2(-16)} = 3.5$$

The height is 3.5 in