PRE-CALCULUS 11 FINAL REVIEW KEY

CHAPTER 2 - RATIONAL EXPRESSIONS & EQUATIONS

1) $\frac{12}{x^2-4} = \frac{12}{(x+2)(x-2)}$ $x \neq \pm 2$ (A)

2) $\frac{20x^2-5y^2}{2x^2-15xy-8y^2} = \frac{5(4x^2-y^2)}{2x^2-16xy+xy-8y^2} = \frac{5(2x+y)(2x-y)}{(2x+y)(x-8y)}$ $\frac{5(2x-y)}{x-8y}$ $x \neq 8y$, $x \neq -\frac{y}{2}$ (D)

3) $\frac{-3x+12}{32-8x} = \frac{-3(x-4)}{-8(x-4)} = \frac{3}{8}$ (C)

4) $\frac{6x^9}{3x^3} \times \frac{x^8}{9x^6} = \frac{6x^{17}}{27x^9} = \frac{2x^8}{9}$ (A)

5) $\frac{4x^8y^5}{(2xy)^3} \div \frac{(x^8y^5)^3}{(2xy^8)^4} = \frac{4x^8y^5(16x^4y^{32})}{8x^3y^3(x^{24}y^{15})} = \frac{64x^{12}y^{37}}{8x^{27}y^{18}} = \frac{8y^{19}}{x^{15}}$ (B)

6) $\frac{x^2-5x-24}{x^2-11x+24} \div \frac{2x^2+7x+3}{x^2+x-12} = \frac{(x-8)(x+3)(x+4)(x-3)}{(x-8)(x-3)(2x+1)(x+3)} = \frac{x+4}{2x+1}$ (B)

7) $\frac{x+8}{x^2+9x+20} + \frac{x+5}{x^2+7x+12} = \frac{x+8}{(x+5)(x+4)} + \frac{x+5}{(x+4)(x+3)} = \frac{(x+8)(x+3)+(x+5)(x+5)}{(x+5)(x+4)(x+3)}$

$= \frac{x^2+11x+24+x^2+10x+25}{(x+5)(x+4)(x+3)} = \frac{2x^2+21x+49}{(x+5)(x+4)(x+3)}$ (D)

8) $\frac{x}{x+1} = \frac{4-x}{x^2-3x-4} + \frac{6}{x-4}$, $\frac{x}{x+1} = \frac{-(x-4)}{(x-4)(x+1)} + \frac{6}{x-4}$, $x(x-4) = -(x-4)+6(x+1)$

$x^2-4x = -x+4+6x+6$, $x^2-4x = 5x+10$, $x^2-9x-10=0$, $(x-10)(x+1)=0$

$x = 10, -1$ but $x \neq -1, 4$ so $x = 10$ (A)

9) a) $\frac{x^2-2x}{x+1} \times \frac{x^2-1}{x^2+x-6} = \frac{x(x-2)(x+1)(x-1)}{(x+1)(x+3)(x-2)} = \frac{x(x-1)}{x+3}$ $x \neq -3, -1, 2$

b) $\frac{4x-1}{x^2+7x+12} \div \frac{2x-1}{x^2+x-12} = \frac{4x-1}{(x+4)(x+3)} \div \frac{2x-1}{(x+4)(x-3)} = \frac{(4x-1)(x+4)(x-3)}{(x+4)(x+3)(2x-1)} = \frac{(4x-1)(x-3)}{(x+3)(2x-1)}$ $x \neq -4, \pm 3, \frac{1}{2}$

c) $\frac{x}{x^2-3x-4} - \frac{4}{x+1} = \frac{x}{(x-4)(x+1)} - \frac{4}{x+1}$ $\frac{x-4(x-4)}{(x-4)(x+1)} = \frac{x-4x+16}{(x-4)(x+1)} = \frac{-3x+16}{(x-4)(x+1)}$, $x \neq -1, 4$

d) $\frac{\frac{2}{x}-\frac{2}{3x}}{\frac{1}{x}-\frac{5}{6x}} = \frac{\frac{6-2}{3x}}{\frac{6-5}{6x}} = \frac{\frac{4}{3x}}{\frac{1}{6x}} = \frac{4(6x)}{1(3x)} = 8$, $x \neq 0$

e) $\frac{1+\frac{1}{x}}{1-\frac{1}{x^2}} = \frac{\frac{x+1}{x}}{\frac{x^2-1}{x^2}} = \frac{x^2(x+1)}{x(x+1)(x-1)} = \frac{x}{x-1}$ $x \neq 0, \pm 1$

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

$7x+3=-6x^2+6$, $6x^2+7x-3=0$, $6x^2+9x-2x-3=0$, $(2x+3)(3x-1)=0$

$3x(2x+3)-1(2x+3)$ $x=-\frac{3}{2},\frac{1}{3}$ $x\neq\pm1$

*check not shown

11) Let x = time together $\frac{x}{5}+\frac{x}{6}=1$, $6x+5x=30$, $11x=30$, $x=\frac{30}{11}=2\frac{8}{11}=$ 2 h 44 min

12) Let x = speed of jetski in still water

	d (km)	s (km/h)	time (h)	Equation
down	104	$x+9$	$\frac{104}{x+9}$	$\frac{104}{x+9}=\frac{74}{x-9}$
up	74	$x-9$	$\frac{74}{x-9}$	

$104(x-9)=74(x+9)$

$104x-936=74x+666$

$30x=1602$

$x=53.4$ km/h

The speed of the jet ski in still water is 53.4 km/h.

CHAPTER 5 - QUADRATIC EQUATIONS

13) (B)

14) $-8x^2+120x+432=0$ | $8(x^2-15x-54)=0$ | $x=-3,18$

$8x^2-120x-432=0$ | $8(x-18)(x+3)=0$

15) $-5x^2+55x=50$ | $5(x^2-11x+10)=0$ | $x=1,10$

$5x^2-55x+50=0$ | $5(x-10)(x-1)=0$

16) $A=LW$ | $72=5x^2+50x-4x-40$ | $5x^2-10x+56x-112=0$ | $(x-2)(5x+56)=0$

$72=(x+10)(5x-4)$ | $5x^2+46x-112=0$ | $5x(x-2)+56(x-2)=0$ | $x=-\frac{56}{5}$, 2 ↑ reject $x=2$ cm

17) $x^2+2x+42=0$ | $b=2$, $\frac{2}{2}=1$, $1^2=1$ | $(x+1)^2=-41$ | NO SOLUTIONS $\emptyset$

$x^2+2x=-42$ | $x^2+2x+1=-42+1$ | $\sqrt{(x+1)^2}=\sqrt{-41}$

18) $y=-\frac{1}{2}x^2-2x+\frac{7}{10}$ | $x^2+4x-\frac{7}{5}=0$ | $a=5, b=20, c=-7$ | $x=\frac{-20\pm\sqrt{540}}{10}$ | $x=-\frac{10\pm3\sqrt{15}}{5}$

$-\frac{1}{2}(x^2+4x-\frac{7}{5})=0$ | $5x^2+20x-7=0$ | $x=\frac{-20\pm\sqrt{20^2-4(5)(-7)}}{2(5)}$ | $x=\frac{-20\pm6\sqrt{15}}{10}$

19) $y=5x^2+20x-6$ | $5(x^2+4x)=6$ | $b=4$, $\frac{4}{2}=2$, $2^2=4$ | $(x+2)^2=\frac{26}{5}$ | $x=\frac{\pm\sqrt{130}}{5}-\frac{10}{5}$

$5x^2+20x=6$ | $x^2+4x=\frac{6}{5}$ | $x^2+4x+4=\frac{6}{5}+\frac{4}{1}$ | $x+2=\pm\sqrt{\frac{26}{5}}$ | $x=\frac{\pm\sqrt{130}-10}{5}$

20) a) $x^2+4x=21$
$x^2+4x-21=0$
$a=1, b=4, c=-21$

$x=\frac{-4\pm\sqrt{4^2-4(1)(-21)}}{2(1)}$

$x=\frac{-4\pm\sqrt{16+84}}{2}$

$x=\frac{-4\pm\sqrt{100}}{2}$

$x=\frac{-4\pm10}{2}$

$x=\frac{-4+10}{2}=\frac{6}{2}=3$

$x=\frac{-4-10}{2}=\frac{-14}{2}=-7$

$x=-7, 3$

b) $2x^2=5x-8$
$2x^2-5x+8=0$
$a=2, b=-5, c=8$

$x=\frac{-(-5)\pm\sqrt{(-5)^2-4(2)(8)}}{2(2)}$

$x=\frac{5\pm\sqrt{25-64}}{4}$

$x=\frac{5\pm\sqrt{-39}}{4}$

NO SOLUTIONS
$\varnothing$

c) $2x^2=5x+8$
$2x^2-5x-8=0$
$a=2, b=-5, c=-8$

$x=\frac{-(-5)\pm\sqrt{(-5)^2-4(2)(-8)}}{2(2)}$

$x=\frac{5\pm\sqrt{25+64}}{4}$

$x=\frac{5\pm\sqrt{89}}{4}$

21) $3x^2=8x-4$ a) factoring: $3x^2-8x+4=0$
$3x^2-6x-2x+4=0$

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

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

b) completing the square
$3x^2-8x=-4$

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

$b=-\frac{8}{3}, -\frac{8}{6}=-\frac{4}{3}, \frac{16}{9}$
$x^2-\frac{8}{3}x+\frac{16}{9}=-\frac{4}{3}+\frac{16}{9}$

$(x-\frac{4}{3})^2=-\frac{12}{9}+\frac{16}{9}$
$x-\frac{4}{3}=\pm\sqrt{\frac{4}{9}}$
$x=\frac{4}{3}\pm\frac{2}{3}$; $x=2, \frac{2}{3}$

c) quadratic formula
$3x^2-8x+4=0$
$a=3, b=-8, c=4$

$x=\frac{-(-8)\pm\sqrt{(-8)^2-4(3)(4)}}{2(3)}$

$x=\frac{8\pm\sqrt{64-48}}{6}$

$x=\frac{8\pm\sqrt{16}}{6}$

$x=\frac{8\pm4}{6}$

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

22) $y=3x^2-10x+6$
$3x^2-10x+6=0$

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

$x^2-\frac{10}{3}x=-2$
$b=-\frac{10}{3}, -\frac{10}{6}=-\frac{5}{3}, \frac{25}{9}$

$x^2-\frac{10}{3}x+\frac{25}{9}=-\frac{2}{1}+\frac{25}{9}$
$(x-\frac{5}{3})^2=\frac{7}{9}$

$x-\frac{5}{3}=\pm\sqrt{\frac{7}{9}}$
$x=\frac{5\pm\sqrt{7}}{3}$

23) a) $x^2+10x=24$
$x^2+10x-24=0$
$(x+12)(x-2)=0$
$x=-12, 2$

b) $2x^2=8x-6$
$2x^2-8x+6=0$
$2(x^2-4x+3)=0$
$2(x-3)(x-1)=0$
$x=1, 3$

c) $0=-x^2-15x-44$
$x^2+15x+44=0$
$(x+11)(x+4)=0$
$x=-11, -4$

d) $3x^2-21x=0$
$3x(x-7)=0$
$x=0, 7$

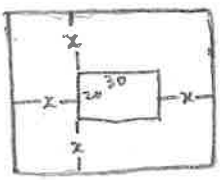
e) $6x^2+17x-3=0$
$6x^2+18x-x-3=0$
$6x(x+3)-1(x+3)=0$
$(x+3)(6x-1)=0$
$x=-3, \frac{1}{6}$

f) $8x^2+x=9$
$8x^2+x-9=0$
$8x^2-8x+9x-9=0$
$8x(x-1)+9(x-1)=0$
$(x-1)(8x+9)=0$
$x=-\frac{9}{8}, 1$

g) $x^2-9=0$
$(x+3)(x-3)=0$
$x=\pm3$

h) $4x^2+25=0$
$\varnothing$

24) $A_{photo}=(30)(20)=600\,cm^2$
$A_{total}=4(600)+600=3000\,cm^2$



$(30+2x)(20+2x)=3000$
$4x^2+60x+40x+600=3000$
$4x^2+100x-2400=0$
$4(x^2+25x-600)=0$
$4(x+40)(x-15)=0$
$x=-40, 15$, reject

$x=15$
length $=30+2x=30+2(15)=60cm$
width $=20+2x=20+2(15)=50cm$

$60cm \times 50cm$

25) $2l + 2w = 202$ | $2\left(\frac{2170}{w}\right) + 2w = 202$ | $2w^2 - 202w + 4340 = 0$ | $w = 70, 31$

$2170 = lw$ | $\frac{4340}{w} + 2w = 202$ | $2(w^2 - 101w + 2170) = 0$ | $l = \frac{2170}{70} = 31$ $l = \frac{2170}{31} = 70$

$l = \frac{2170}{w}$ | $4340 + 2w^2 = 202w$ | $w^2 - 101w + 2170 = 0$ | 70, 31 or 31, 70 } same thing

$(w-70)(w-31) = 0$

The dimensions are 70m × 31m

26) Let x = odd integer | $2x^2 + 4x - 1566 = 0$ | $(x+29)(x-27) = 0$

$x^2 + (x+2)^2 = 1570$ | $2(x^2 + 2x - 783) = 0$ | $x = -29, 27$

$x^2 + x^2 + 4x + 4 = 1570$ | $x^2 + 2x - 783 = 0$ | -29, -27 AND 27, 29

27)

	distance (km)	speed (km/h)	time (h)	Equation
W to B	1200	$x-5$	31	$\frac{1200}{x-5} = 31$
B to W	1200	x	$\frac{1200}{x}$	

Let x = avg speed from Billings to Winnipeg

$\frac{1200}{x-5} = 31$ | $31(x-5) = 1200$ | $31x = 1355$ | $x-5$

$x \neq 5$ | $31x - 155 = 1200$ | $x = 43.7$ km/h | $43.7 - 5$

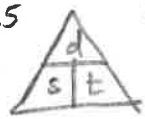
38.7 km/h

The average speed from Winnipeg to Billings was 38.7 km/h, and from Billings to Winnipeg was 43.7 km/h

28)

	d (km)	s (km/h)	time (h)	Eqn
up	12	$x-2$	$\frac{12}{x-2}$	$\frac{12}{x-2} + \frac{12}{x+2} = 2.5$
down	12	$x+2$	$\frac{12}{x+2}$	

Let x = speed of boat in still water



$\frac{12}{x-2} + \frac{12}{x+2} = 2.5$ | $12(x+2) + 12(x-2) = 2.5(x+2)(x-2)$ | $2.5x^2 - 24x - 10 = 0$ | $5x(x-10) + 2(x-10) = 0$

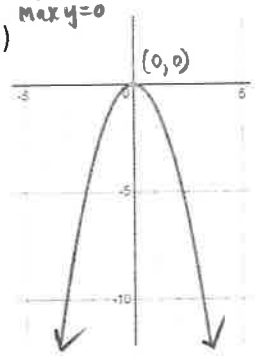
$12x + 24 + 12x - 24 = 2.5(x^2 - 4)$ | $5x^2 - 48x - 20 = 0$ | $(x-10)(5x+2) = 0$

$24x = 2.5x^2 - 10$ | $5x^2 - 50x + 2x - 20 = 0$ | $x = 10, -\frac{2}{5}$ ← reject

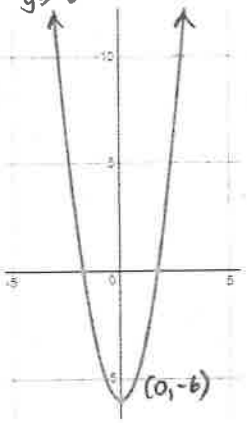
The speed of the boat in still water is 10 km/h

CH 3/4 - QUADRATIC FUNCTIONS

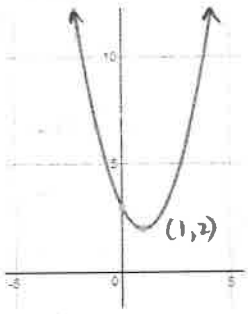
29)a) $x=0$, $x\in\mathbb{R}$, $y\le 0$, max $y=0$; x-int $=0$, y-int $=0$



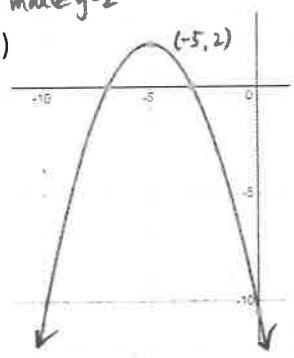
b) $x=0$, $x\in\mathbb{R}$, $y\ge -6$; min @ $y=-6$, y-int $=-6$, x-int $=\pm\sqrt{3}$



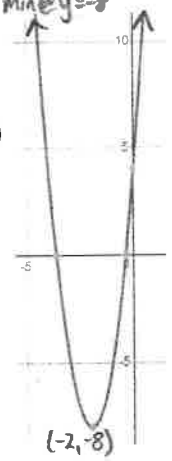
c) $x=1$, $x\in\mathbb{R}$, $y\ge 2$, min @ $y=2$; y-int $=3$, x-int none



d) $x=-5$, $x\in\mathbb{R}$, $y\le 2$, max @ $y=2$; y-int $=\frac{-21}{2}$, x-ints $=-3,-7$



e) $x=-2$, $x\in\mathbb{R}$, $y\ge -8$, min @ $y=-8$; y-int $=4$, x-ints $=\frac{-6\pm 2\sqrt{6}}{3}$



30)a) $y=a(x+1)^2+4$ through $(-2,2)$

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

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

$2=a+4$

$a=-2$

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

b) $y=a(x+2)^2+3$ through $(0,1)$

$1=a(0+2)^2+3$

$1=4a+3$

$4a=-2$

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

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

c) $(-3,4)$ & $(5,4)$ symmetrical so vertex $(1,k)$

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

* sub in a point $(5,4)$

$4=a(5-1)^2+k$

$4=16a+k$

$k=4-16a$

* sub in another point $(6,6)$

$y=a(x-1)^2+4-16a$

$6=a(6-1)^2+4-16a$

$6=25a+4-16a$

$2=9a$

$a=\frac{2}{9}$

$k=4-16a$

$4-16\left(\frac{2}{9}\right)$

$4-\frac{32}{9}$

$\frac{36}{9}-\frac{32}{9}$

$\frac{4}{9}$

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

31) a) $y=x^2-2x+3$

$b=-2,-1,1$

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

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

b) $y=-x^2+8x-12$

$y=-(x^2-8x)-12$

$b=-8,-4,16$

$y=-(x^2-8x+16-16)-12$

$y=-(x^2-8x+16)+16-12$

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

c) $y=-x^2+3x$

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

$b=-3,-\frac{3}{2},\frac{9}{4}$

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

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

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

d) $y=2x^2+8x+6$

$y=2(x^2+4x)+6$

$b=4,2,4$

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

$y=2(x^2+4x+4)-8+6$

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

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

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

$b=-6,-3,9$

$y=-\frac{1}{3}(x^2-6x+9-9)+4$

$y=-\frac{1}{3}(x^2-6x+9)+3+4$

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

32) ① $x - y = 10$
② $A = xy$
① $x = 10 + y$

$A = (10+y)y$
$A = y(y+10)$
$A = y^2 + 10y$

$b = 10, 5, 25$
$A = y^2 + 10y + 25 - 25$
$A = (y+5)^2 - 25$
Vertex $(-5, -25)$
y value ↑ min product ↑

$x - y = 10$
$x - (-5) = 10$
$x + 5 = 10$
$x = 5$
The two numbers are 5 and -5.

33) ① $x + y = 34$
② $M = x^2 + y^2$
① $x = 34 - y$

$M = (34-y)^2 + y^2$
$M = 1156 - 68y + y^2 + y^2$
$M = 2y^2 - 68y + 1156$

$M = 2(y^2 - 34y) + 1156$
$b = -34, -17, 289$
$M = 2(y^2 - 34y + 289 - 289) + 1156$
$M = 2(y^2 - 34y + 289) - 578 + 1156$

$M = 2(y-17)^2 + 578$
vertex $(17, 578)$
y value ↑ ↑ minimum
$x = 34 - y = 34 - 17$
$= 17$
The two numbers are 17 and 17.

34) $h(d) = -1.17d^2 + 3$

a) vertex $(0, 3)$
The max height is 3m.

(b) $0 = -1.17d^2 + 3$
$-3 = -1.17d^2$
$d^2 = 2.5641$
$d = \pm 1.601$
width $= 2(1.601) = 3.2$m

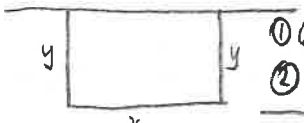
(c) $h(0.5) = -1.17(0.5)^2 + 3$
$h(0.5) = 2.7$m
The arch is 2.7m high.

35) Let x = number of $2 price increases
$R = (\text{price})(\#\text{people})$
$R = (36 + 2x)(300 - 10x)$
$R = -20x^2 + 240x + 10800$

$R = -20(x^2 - 12x) + 10800$
$b = -12, -6, 36$
$R = -20(x^2 - 12x + 36 - 36) + 10800$
$R = -20(x-6)^2 + 720 + 10800$
$R = -20(x-6)^2 + 11520$

vertex $(6, 11520)$
# of price inc. ↑ ↑ max rev
price inc $= 2x = 2(6) = 12$
A $12 price increase (tix $48) would maximize revenue.

36)



① $60 = x + 2y$
② $A = xy$
① $x = 60 - 2y$
② $A = xy$

$A = (60-2y)y$
$A = -2y^2 + 60y$

$A = -2(y^2 - 30y)$
$b = -30, -15, 225$
$A = -2(y^2 - 30y + 225 - 225)$
$A = -2(y-15)^2 + 450$

vertex $(15, 450)$
y dimension ↑ ↑ max area
① $60 = x + 2(15)$
$60 = x + 30$
$x = 30$m
The dimensions to maximize area are 30m x 15m.

CH 6/7 - SYSTEMS OF EQUATIONS + INEQUALITIES

37) ① $y = 9x-4$
② $y = x^2+7x-3$
$9x-4 = x^2+7x-3$

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

① $y=9x-4$
$y=9(1)-4$
$y=5$

$(1,5)$ (D)

38) ① $y = 4x+8$
② $y = -4x^2-5x+8$
$4x+8 = -4x^2-5x+8$

$4x^2+9x=0$
$x(4x+9)=0$
$x=0, -\frac{9}{4}$

① $y=4x+8$
$y=4(0)+8$
$y=8$
$(0,8)$

$y=4x+8$
$y=4(-\frac{9}{4})+8$
$y=-1$
$(-\frac{9}{4}, -1)$ (D)

39) ① $y = -2x^2-9x-4$
② $y = 2x^2-5x-4$
$-2x^2-9x-4 = 2x^2-5x-4$

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

② $y=2x^2-5x-4$
$y=2(0)^2-5(0)-4$
$y=-4$
$(0,-4)$

$y=2(-1)^2-5(-1)-4$
$y=2+5-4$
$y=3$
$(-1,3)$ (A)

40) ① $y = -2x^2-4x+5$
② $y = 2x^2+4x+5$
$-2x^2-4x+5 = 2x^2+4x+5$

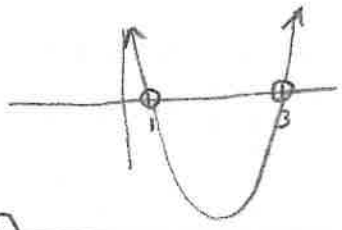
$4x^2+8x=0$
$4x(x+2)=0$
$x=0, -2$

② $y=2x^2+4x+5$
$y=2(0)^2+4(0)+5$
$(0,5)$

$y=2(-2)^2+4(-2)+5$
$y=8-8+5$
$y=5$
$(-2,5)$ (A)

41) $-2x^2+8x-6>0$
$2x^2-8x+6<0$

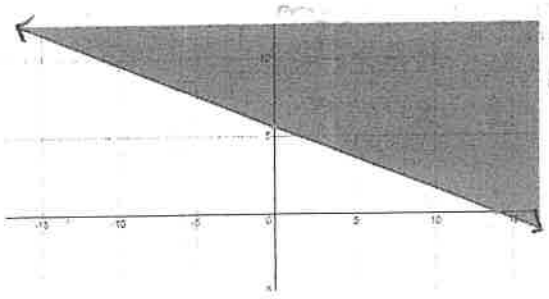
$2(x^2-4x+3)<0$
$2(x-3)(x-1)<0$
$x=3, 1$



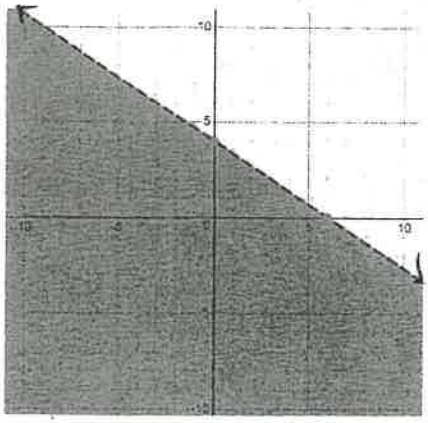
Where is the parabola BELOW the x axis?
$1<x<3$ (A)

42) Meet or exceed is $\geq$, so (C)

43)

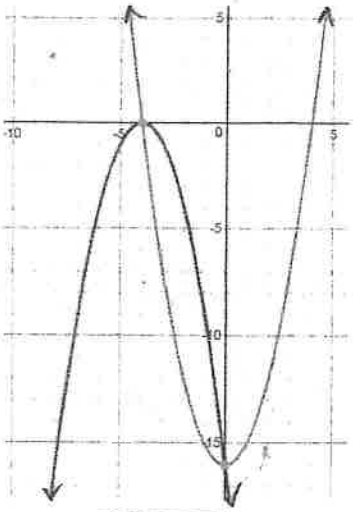


44)



45) (-4, 0) &

(0, -16)



46) ① $y = -3x^2 - 3x + 2$

② $y = -6x^2 + 4x + 7$

$-3x^2 - 3x + 2 = -6x^2 + 4x + 7$

$3x^2 - 7x - 5 = 0$

$x = \frac{7 \pm \sqrt{(-7)^2 - 4(3)(-5)}}{2(3)}$

$x = \frac{7 \pm \sqrt{109}}{6}$

$x = \frac{7 \pm 10.44}{6}$

$x = 2.91, -0.57$

Sub into ① or ②

(2.91, -32.07)

(-0.57, 2.73)

47) Test each point to see if it satisfies the inequality $y \geq 3x - 5$

(2, 2)	(-1, -9)	(1, -2)	(0, 0)
$2 \geq 3(2) - 5$	$-9 \geq 3(-1) - 5$	$-2 \geq 3(1) - 5$	$0 \geq 3(0) - 5$
$2 \geq 1$	$-9 \geq -8$	$-2 \geq -2$	$0 \geq -5$
✓	X	✓	✓

(2, 2), (1, -2), & (0, 0) are solutions

48) $2x^2 - 7x \geq -3$

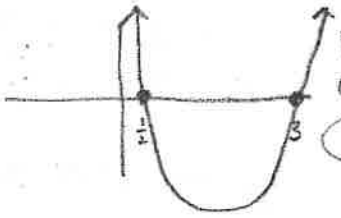
$2x^2 - 7x + 3 \geq 0$

$2x^2 - 6x - x + 3 \geq 0$

$2x(x-3) - 1(x-3) \geq 0$

$(x-3)(2x-1) \geq 0$

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



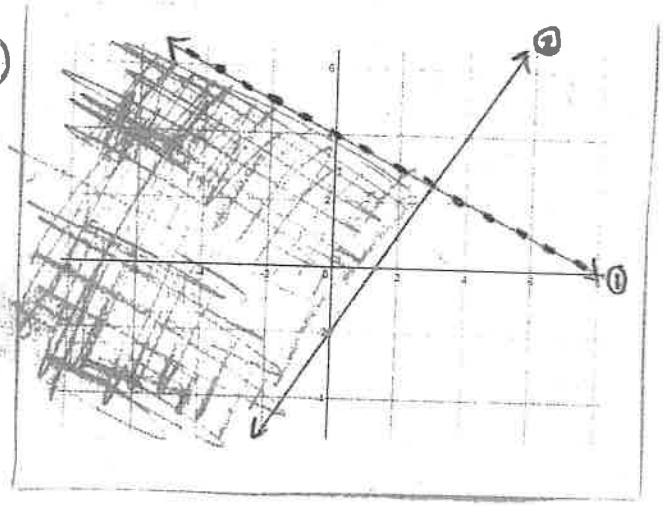
Where is the parabola above the x axis?

$x \leq \frac{1}{2}, x \geq 3$

49) ① $y = 4x^2 + 13$
② $y^2 + 7 = 4x^2$

$4x^2 + 13 + 7 = 4x^2$
$4x^2 + 20 = 4x^2$
$0 = 20$
NO SOLUTIONS $\emptyset$

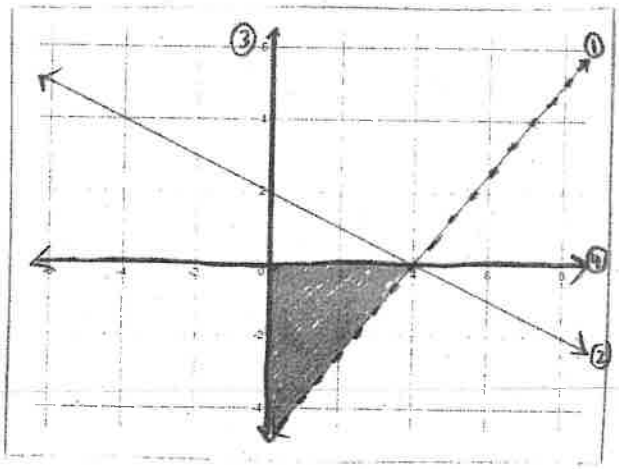
50)



① $x + 2y < 8$
$2y < -x + 8$
$y < -\frac{1}{2}x + 4$
below

② $-3x + 2y \geq -4$
$2y \geq 3x - 4$
$y \geq \frac{3}{2}x - 2$
above

51)



① $5x - 4y < 20$
$-4y < -5x + 20$
$y > \frac{5}{4}x - 5$
above

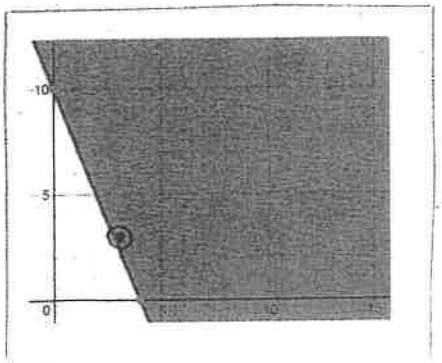
② $x + 2y \leq 4$
$2y \leq -x + 4$
$y \leq -\frac{1}{2}x + 2$
below

③ $x \geq 0$
right

④ $y \leq 0$
below

52) a) Let x = # of dresses sold
let y = # of blouses sold

① $125x + 50y \geq 500$
② $x \geq 0$
③ $y \geq 0$



c) (3,3)
3 dresses and 3 blouses
total $525

53) Let x = # of hours baking bagels
Let y = # of hours baking cupcakes

① $x+y \leq 10$

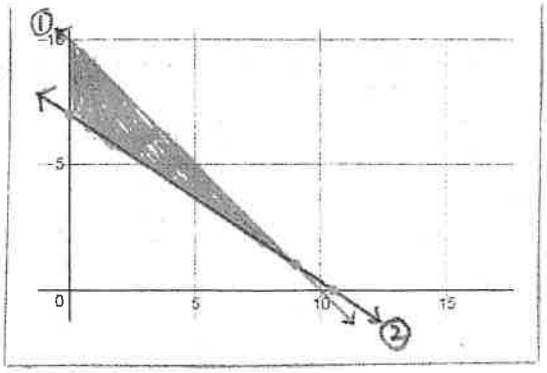
② $24x+36y \geq 252$

③ $x \geq 0$ right

④ $y \geq 0$ above

① $y \leq -x+10$ Below

② $y \geq -\frac{2}{3}x+7$ Above



Two possibilities:

(2,7): 2 hours baking bagels
7 hours baking cupc

(6,4): 6 hours baking bagels
4 hours baking cupcakes

CHAPTER 1 – RADICALS

54) $7\sqrt{7}-6\sqrt{12}-(4\sqrt{28}+4\sqrt{3})$

$7\sqrt{7}-12\sqrt{3}-8\sqrt{7}-4\sqrt{3}$

$-\sqrt{7}-16\sqrt{3}$ ©

55) $\sqrt[5]{64n^{10}m^{15}}$ | $2n^2m^3\sqrt[5]{2}$ (D)

$\sqrt[5]{2(32)n^{10}m^{15}}$

56) $-7\sqrt{6}(-6\sqrt{5}-2\sqrt{6})$ | $42\sqrt{30}+14(6)$

$42\sqrt{30}+14\sqrt{36}$ | $42\sqrt{30}+84$ ©

57) $\frac{2\sqrt{21}-3\sqrt{7}}{\sqrt{7}}+\frac{4\sqrt{3}-8}{\sqrt{4}}$ | $4\sqrt{3}-7$ ©

$2\sqrt{3}-3+2\sqrt{3}-4$

58) $\sqrt{4x}-5=6$ | $(\sqrt{4x})^2=11^2$ | $x=\frac{121}{4}$ $x\geq 0$

$\sqrt{4x}=11$ | $4x=121$ | ©

59) $\sqrt{x+3}=\sqrt{2x+8}$ | $x+3=2x+8$

$x \geq -3$, $x \geq -4$ | $-5=x$

$x \geq -3$ | extraneous

$\emptyset$ (A)

60) $-4-\sqrt{4-x}=6$

$4-x \geq 0$

$4 \geq x$ (C)

$x \leq 4$

61) $3\sqrt{5}, 2\sqrt{11}, 4\sqrt{3}, 5\sqrt{2}$
$\sqrt{45}, \sqrt{44}, \sqrt{48}, \sqrt{50}$ | $2\sqrt{11}, 3\sqrt{5}, 4\sqrt{3}, 5\sqrt{2}$

62) a) $5\sqrt{12} - 2\sqrt{27}$
$= 10\sqrt{3} - 6\sqrt{3}$
$= 4\sqrt{3}$

b) $\frac{24\sqrt{14}}{8\sqrt{2}}$
$= 3\sqrt{7}$

c) $\sqrt{2}(2\sqrt{2}+2) - 3(5\sqrt{2}+1)$
$= 2\sqrt{4} + 2\sqrt{2} - 15\sqrt{2} - 3$
$= 4 + 2\sqrt{2} - 15\sqrt{2} - 3$
$= 1 - 13\sqrt{2}$

63) a) $x^2 = 36$
$x = \pm\sqrt{36}$
$x = \pm 6$

b) $x^2 = -36$
$x = \pm\sqrt{-36}$
$\emptyset$

c) $x^3 = 27$
$x = \sqrt[3]{27}$
$x = 3$

d) $x^3 = -27$
$x = \sqrt[3]{-27}$
$x = -3$

e) $x^4 = 16$
$x = \pm\sqrt[4]{16}$
$x = \pm 2$

f) $x^4 = -16$
$x = \sqrt[4]{-16}$
$\emptyset$

64) a) $\sqrt{20x^3y^6}$
$2xy^3\sqrt{5x}$

b) $\sqrt{32x^2yz^9}$
$4xz^4\sqrt{2yz}$

c) $\sqrt{9x^8y^2z^3}$
$3x^4yz\sqrt{z}$

d) $\sqrt[3]{24x^2y^4z^6}$
$2yz^2\sqrt[3]{3x^2y}$

e) $\sqrt[4]{\frac{16x^6}{y^{12}z}}$
$\frac{2x}{y^3}\sqrt[4]{\frac{x^2}{z}}$

Rationalize:
$\frac{2x\sqrt[4]{x^2z^3}}{y^3z}$

65) a) $\sqrt{20x^3y^6}$
$2x|y^3|\sqrt{5x}$, $x \geq 0$

b) $\sqrt{32x^2yz^9}$
$4|x|z^4\sqrt{2yz}$ $y \geq 0, z \geq 0$

c) $\sqrt{9x^8y^2z^3}$
$3x^4|y|z\sqrt{z}$, $z \geq 0$

d) $\sqrt{\frac{18x^6}{y^2}}$
$= \frac{3|x^3|}{y}\sqrt{\frac{2}{y}}$, $y > 0$

e) $\sqrt[4]{32x^4y^8z^7}$
$2|x|y^2z\sqrt[4]{2z^3}$, $z \geq 0$

66) a) $3a^2b\sqrt[3]{2a^2b}$
$\sqrt[3]{54a^8b^4}$

b) $5x^5\sqrt{6y}$
$\sqrt{150x^{10}y}$

c) $\frac{3x^2}{y^3}\sqrt[4]{x^3}$
$\sqrt[4]{\frac{81x^{11}}{y^{12}}}$

67) a) $6\sqrt{5}(2\sqrt{4})$
$= 12\sqrt{20}$
$= 24\sqrt{5}$

(b) $3\sqrt{2}(8\sqrt{2} - 3\sqrt{6})$
$24\sqrt{4} - 9\sqrt{12}$
$48 - 18\sqrt{3}$

(c) $7\sqrt{2} - \sqrt{24} + \sqrt{18} - 5\sqrt{54}$
$7\sqrt{2} - 2\sqrt{6} + 3\sqrt{2} - 15\sqrt{6}$
$10\sqrt{2} - 17\sqrt{6}$

(d) $\frac{8\sqrt{18}}{2\sqrt{2}}$
$= 4\sqrt{9}$
$= 12$

(e) $\frac{-\sqrt{40}}{2\sqrt{5}}$
$= \frac{-\sqrt{8}}{2} = \frac{-2\sqrt{2}}{2}$
$= -\sqrt{2}$

68) $\left(\sqrt[3]{x}\right)\sqrt{x^5}$, $x \geq 0$
$(x^{\frac{1}{3}})(x^{\frac{5}{2}})$
$(x^{\frac{2}{6}})(x^{\frac{15}{6}})$
$x^{\frac{17}{6}}$
$\sqrt[6]{x^{17}}$
$\sqrt[6]{x^{12}x^5} = x^2\sqrt[6]{x^5}$

69) a) $\frac{2\sqrt{2}}{\sqrt{3}}\frac{(\sqrt{3})}{(\sqrt{3})}$
$\frac{2\sqrt{6}}{3}$

(b) $\frac{(4-\sqrt{5})}{3\sqrt{2}}\frac{(\sqrt{2})}{(\sqrt{2})}$
$\frac{4\sqrt{2}-\sqrt{10}}{6}$

(c) $\frac{6\sqrt{5}}{2\sqrt{10}} = \frac{3}{\sqrt{2}}\frac{(\sqrt{2})}{(\sqrt{2})}$
$= \frac{3\sqrt{2}}{2}$

(d) $\frac{-4\sqrt{2}}{3+\sqrt{3}}\frac{(3-\sqrt{3})}{(3-\sqrt{3})}$
$\frac{-12\sqrt{2}+4\sqrt{6}}{9+3\sqrt{3}-3\sqrt{3}-\sqrt{9}}$
$\frac{-12\sqrt{2}+4\sqrt{6}}{6}$
$-\frac{6\sqrt{2}+2\sqrt{6}}{3}$

(e) $\frac{-\sqrt{3}-1}{2-\sqrt{2}}\frac{(2+\sqrt{2})}{(2+\sqrt{2})}$
$\frac{-2\sqrt{3}-\sqrt{6}-2-\sqrt{2}}{4-2\sqrt{2}+2\sqrt{2}-2}$
$\frac{-2\sqrt{3}-\sqrt{6}-2-\sqrt{2}}{2}$

(f) $\frac{2\sqrt[3]{5}(\sqrt[3]{4})^2}{\sqrt[3]{4}(\sqrt[3]{4})^2}$
$= \frac{2\sqrt[3]{80}}{4}$
$\frac{4\sqrt[3]{10}}{4}$
$= \sqrt[3]{10}$

(g) $\frac{\sqrt{20}}{\sqrt[3]{16}} = \frac{2\sqrt{5}}{2\sqrt[3]{2}} = \frac{\sqrt{5}}{\sqrt[3]{2}}\frac{(\sqrt[3]{2})^2}{(\sqrt[3]{2})^2} = \frac{\sqrt{5}(\sqrt[3]{2})^2}{2} = \frac{\sqrt{5}(\sqrt[3]{4})}{2}$

70) $4 - \sqrt{4+x^2} = x$
$-\sqrt{4+x^2} = x - 4$
$\sqrt{4+x^2} = -(x-4)$
$\sqrt{4+x^2} = -x+4$
$\left(\sqrt{4+x^2}\right)^2 = (4-x)^2$
$4 + x^2 = 16 - 8x + x^2$
$8x - 12 = 0$
$x = \frac{12}{8} = \frac{3}{2}$

Check

LS	RS
$4-\sqrt{4+\left(\frac{3}{2}\right)^2}$	$\frac{3}{2}$
$4-\sqrt{4+\frac{9}{4}}$	
$4-\sqrt{\frac{25}{4}}$	
$4-\frac{5}{2} = \frac{3}{2}$	✓

71) $\sqrt{x+10} = x-2$, $x \geq -10$
$x+10 = (x-2)^2$
$x+10 = x^2 - 4x + 4$
$x^2 - 5x - 6 = 0$
$(x-6)(x+1) = 0$
$x = 6, -1$ ← ext
$x = 6$

Check:

$\sqrt{6+10}$	$6-2$	$\sqrt{-1+10}$	$-1-2$
$\sqrt{16}$	4	$\sqrt{9}$	-3
4	✓	3	✗

72) a) $s = 2\pi\sqrt{\frac{l}{32}}$ | $\left(\frac{s}{2\pi}\right)^2 = \left(\sqrt{\frac{l}{32}}\right)^2$ | $l = \frac{32s^2}{4\pi^2}$

$\frac{s}{2\pi} = \sqrt{\frac{l}{32}}$ | $\frac{s^2}{4\pi^2} = \frac{l}{32}$ | $l = \frac{8s^2}{\pi^2}$

b) $l = \frac{8(15)^2}{\pi^2} = 1.8 \text{ ft}$

73) a) $\sqrt{x} - 2 = 0$ $\boxed{x \geq 0}$

$\sqrt{x} = 2$

$x = 4$

b) $\sqrt{x-3} + 1 = 2$ $\boxed{x \geq 3}$

$\sqrt{x-3} = -4$

$\emptyset$

c) $\sqrt{4(x+3)} = 6$ $\boxed{x \geq -3}$

$4(x+3) = 36$

$x+3 = 9$

$x = 6$

d) $\sqrt{2-x} = \sqrt{x-2}$

$2-x \geq 0$ $\quad x-2 \geq 0$

$2 \geq x$ $\quad x \geq 2$

$x \leq 2$

so $\boxed{x=2}$ only

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

$2-x = x-2$

$4 = 2x$

$2 = x$

e) $\sqrt{\frac{x}{2}+8} = \sqrt{4x+1}$

$\frac{x}{2}+8 \geq 0$ $\quad 4x+1 \geq 0$

$\frac{x}{2} \geq -8$ $\quad 4x \geq -1$

$x \geq -16$ $\quad x \geq -\frac{1}{4}$

$\boxed{x \geq -\frac{1}{4}}$

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

$x+16 = 8x+2$

$14 = 7x$

$x = 2$

f) $\sqrt{4(x+1)} = \sqrt{2x+3}$

$4(x+1) \geq 0$ $\quad 2x+3 \geq 0$

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

$\boxed{x \geq -1}$

$4(x+1) = 2x+3$

$4x+4 = 2x+3$

$2x = -1$

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

g) $\sqrt{x-4} - x = -4$ $\boxed{x \geq 4}$

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

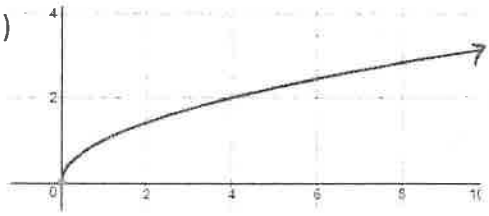
$x-4 = (x-4)^2$

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

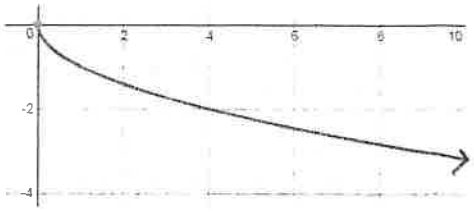
$x^2-9x+20 = 0$

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

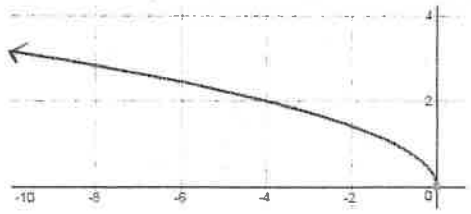
$x = 5, 4$

74a) 

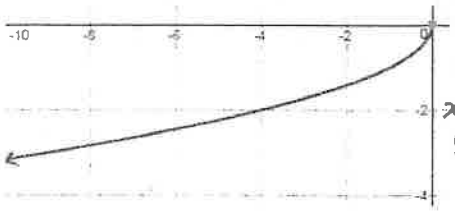
D: $x \geq 0$
R: $y \geq 0$
x-int = 0
y-int = 0

b) 

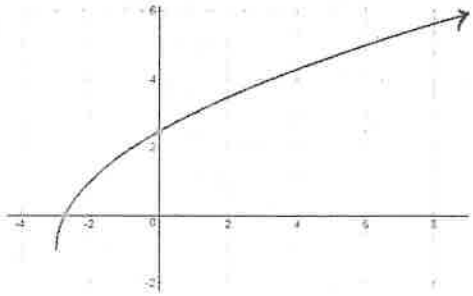
D: $x \geq$
R: $y \leq 0$
x-int = 0
y-int = 0

c) 

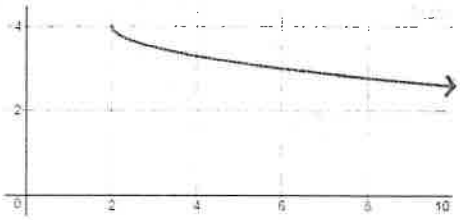
D: $x \leq 0$
R: $y \geq 0$
x-int = 0
y-int = 0

d) 

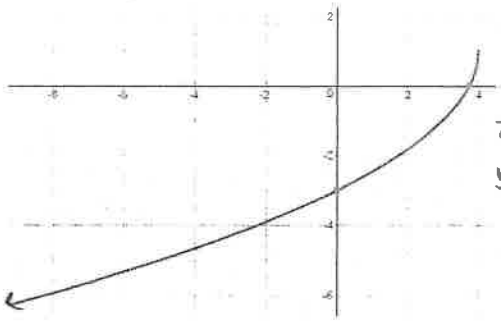
D: $x \leq 0$
R: $y \leq 0$
x-int = 0
y-int = 0

e) 

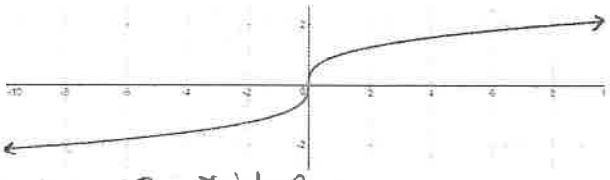
D: $x \geq -3$
R: $y \geq -1$
x-int = $-2\frac{3}{4}$
y-int = $2\sqrt{3} - 1$

f) 

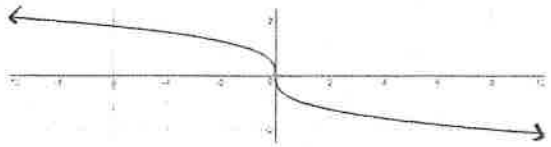
D: $x \geq 2$
R: $y \leq 4$
x-int = 66
y-int = $\emptyset$

g) 

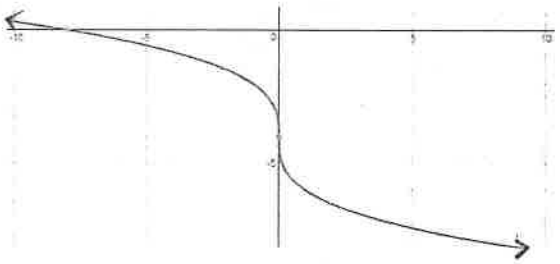
D: $x \leq 4$
R: $y \leq 1$
x-int = $3\frac{3}{4}$
y-int = -3

h) 

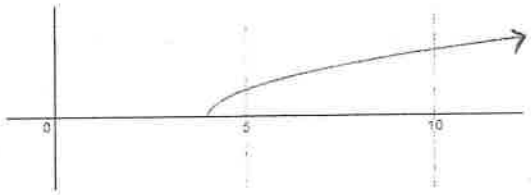
D: $x \in \mathbb{R}$ x-int = 0
R: $y \in \mathbb{R}$ y-int = 0

i) 

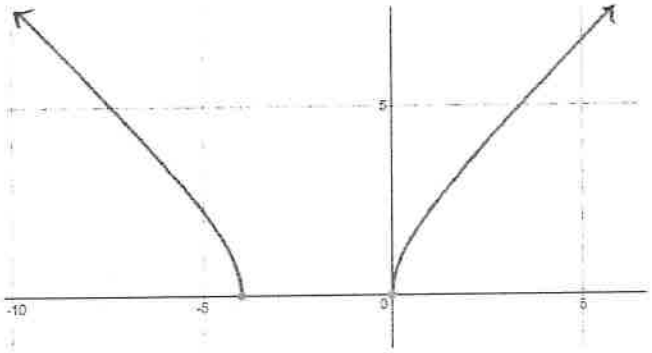
D: $x \in \mathbb{R}$ x-int = 0
R: $y \in \mathbb{R}$ y-int = 0

j) 

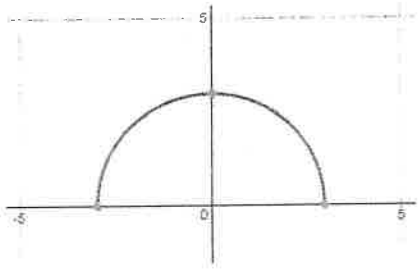
D: $x \in \mathbb{R}$ x-int = -8
R: $y \in \mathbb{R}$ y-int = -4

75a) 

D: $x \geq 4$
R: $y \geq 0$

75b) 

D: $x \leq -4,\ x \geq 0$
R: $y \geq 0$

75c) 

D: $-3 \leq x \leq 3$
R: $0 \leq y \leq 3$

76) a) $|6x+9|+2=8$

$|6x+9|=6$

$6x+9=6$ | $6x+9=-6$

$6x=-3$ | $6x=-15$

$x=-\frac{1}{2}$ | $x=\frac{-5}{2}$

Check

$\left\|6\left(-\frac{1}{2}\right)+9\right\|+2$	8
$\left\|6\left(-\frac{1}{2}\right)+9\right\|+2$	
$\|6\|+2$	
$6+2$	
8	✓

$\left\|6\left(\frac{-5}{2}\right)+9\right\|+2$	8
$\|-15+9\|+2$	
$\|-6\|+2$	
$6+2$	
8	✓

(b) $|4x+8|=-8x+3$

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

$12x=-5$ | $4x+8=8x-3$

$x=\frac{-5}{12}$ | $11=4x$

$x=\frac{11}{4}$ ← extraneous

Check

$\left\\|4\left(\frac{-5}{12}\right)+8\right\\|$	$-8\left(\frac{-5}{12}\right)+3$
$\left\\|\frac{-20}{12}+8\right\\|$	$\frac{40}{12}+3$
$\left\\|\frac{-5}{3}+\frac{24}{3}\right\\|$	$\frac{10}{3}+\frac{9}{3}$
$\left\\|\frac{19}{3}\right\\|$	$\frac{19}{3}$ ✓
$\frac{19}{3}$	

$\left\\|4\left(\frac{11}{4}\right)+8\right\\|$	$-8\left(\frac{11}{4}\right)+3$
$\|19\|$	$-22+3$
19	-19 ✗

(c) $\left|\frac{1}{2}x+1\right|=x+1$

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

$0=\frac{1}{2}x$ | $\frac{1}{2}x+1=-x-1$

$x=0$ | $\frac{3}{2}x=-2$

$x=-\frac{4}{3}$ ext

Check

$\left\\|\frac{1}{2}(0)+1\right\\|$	$0+1$
$\|1\|$	
1	✓

$\left\\|\frac{1}{2}\left(\frac{-4}{3}\right)+1\right\\|$	$-\frac{4}{3}+1$
$\left\\|\frac{-2}{3}+1\right\\|$	
$\left\\|\frac{1}{3}\right\\|$	
$\frac{1}{3}$	✗

(d) $|x+1|=x+1$

$x \geq -1$

e) $|4-x|+3=3$

$|4-x|=0$

$4-x=0$ | $4-x=-0$

$4=x$ | $4-x=0$

$x=4$ | $4=x$

Check

$\|4-4\|+3$	3
$\|0\|+3$	
$0+3$	
3	✓

(f) $-2|x+5|-3=5$

$-2|x+5|=8$

$|x+5|=-4$

$\emptyset$

(g) $|x^2-x-9|=3$

$x^2-x-9=3$ | $x^2-x-9=-3$

$x^2-x-12=0$ | $x^2-x-6=0$

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

$x=4,-3$ | $x=-2,3$

All checks work!

77) $5-3|\,|+2(-3-4)|$

$5-3|\,|+2(-7)|$

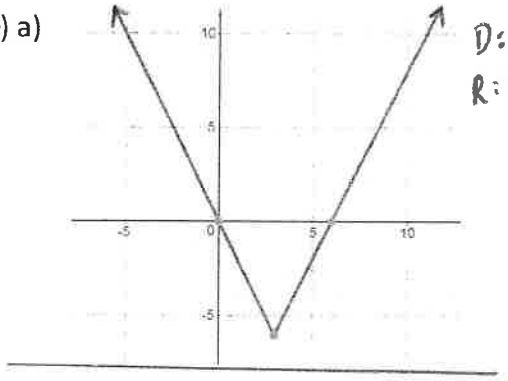
$5-3|\,|-14|$

$5-3|-13|$

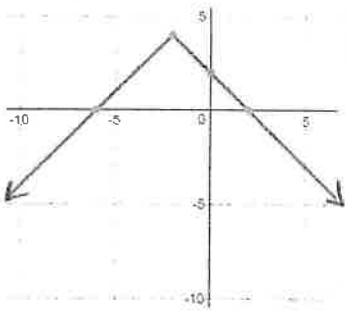
$5-3(13)$

$5-39$

-34

78) a) 

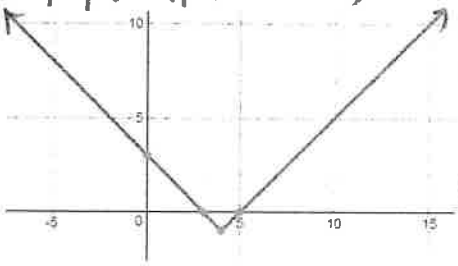
D: $x \in \mathbb{R}$
R: $y \geq -6$

b) 

D: $x \in \mathbb{R}$
R: $y \leq 4$

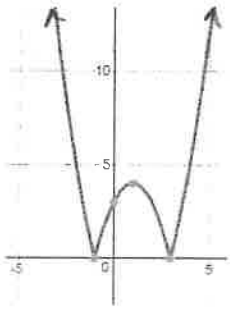
$$y = \begin{cases} x+6 & \text{when } x < -2 \\ -x+2 & \text{when } x \geq -2 \end{cases}$$

$y = |-(x-4)| - 1$ vertex $(4, -1)$

c) 

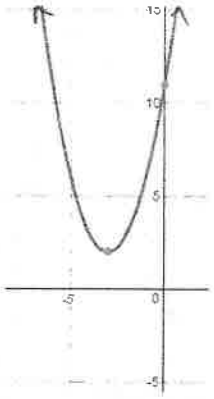
D: $x \in \mathbb{R}$
R: $y \geq -1$

$$y = \begin{cases} x-5 & \text{when } x \geq 4 \\ -x+3 & \text{when } x < 4 \end{cases}$$

d) 

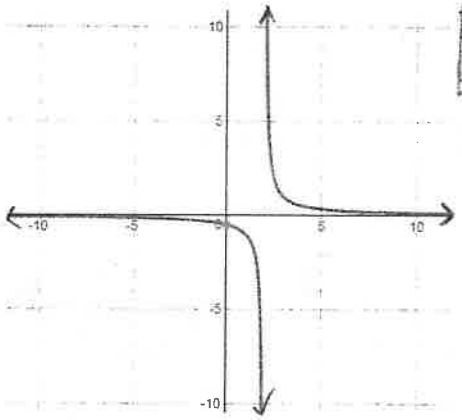
D: $x \in \mathbb{R}$
R: $y \geq 0$

$$y = \begin{cases} (x-1)^2 - 4 & \text{when } x \leq -1, x \geq 3 \\ -(x-1)^2 + 4 & \text{when } -1 < x < 3 \end{cases}$$

e) 

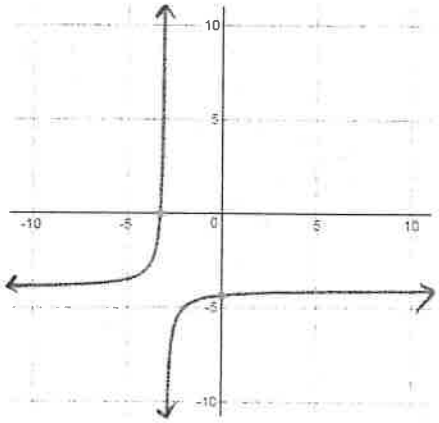
D: $x \in \mathbb{R}$
R: $y \geq 2$

(original parabola $y = -(x+3)^2 - 2$ is completely below x axis, so abs value $|y = -(x+3)^2 - 2|$ reflects through x axis.)

79) a) 

$x = 2$
$y = 0$

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

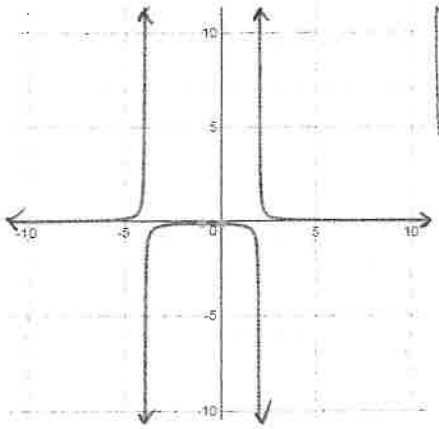
b) 

$x = -3$
$y = -4$

y-int $= -4\frac{1}{3}$

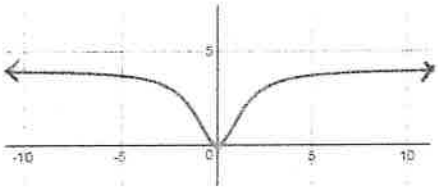
80 a) $x = -2$, $y = 3$ (b) $x = 0$ (c) $x = 4$, $x = 3$, $y = 0$ (d) $x = 0$, $y = 5$ (e) $x = 5$, $y = 0$ (f) $y = 0$

81) a)



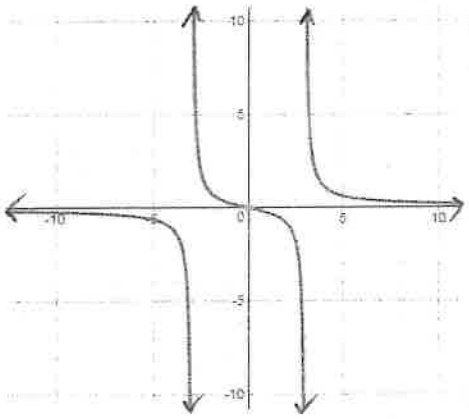
$x = -4$
$x = 2$
$y = 0$

b)



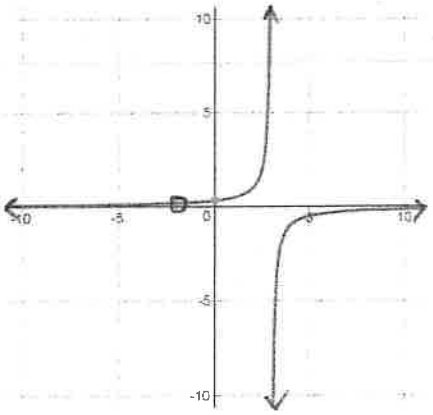
$y = 4$

c)



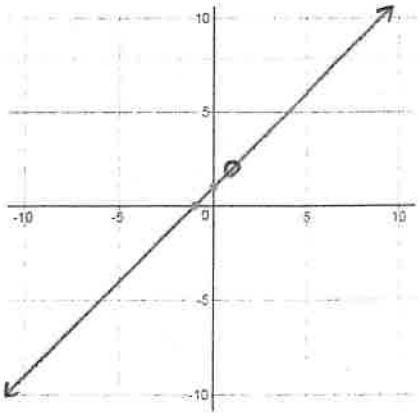
$x = 3$
$x = -3$
$y = 0$ (remember, a horizontal asymptote can be crossed.)

82) a)



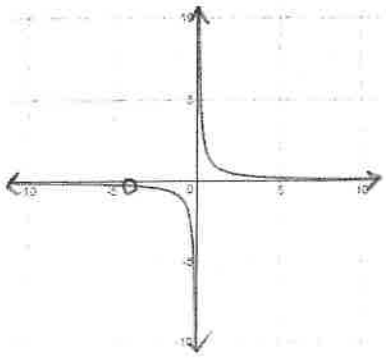
hole $(-2, \frac{1}{5})$

b)



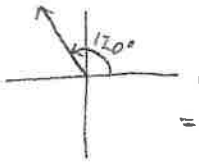
hole $(1, 2)$

c)



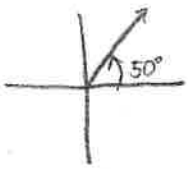
hole $(-4, -\frac{1}{4})$

CHAPTER 8 – TRIGONOMETRY

83) a) 

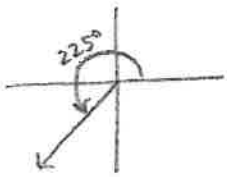
$\theta_R = 60°$

Coterminal
$= 480°, 840°, -240°$
etc

(b) 

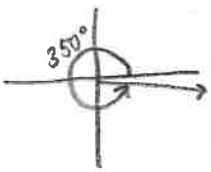
$\theta_R = 50°$

Coterminal
$= 410°, 770°, -310°$
etc

c) 

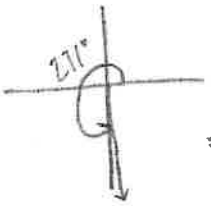
$\theta_R = 45°$

Coterminal
$= -135°, 585°, 945°$

(d) 

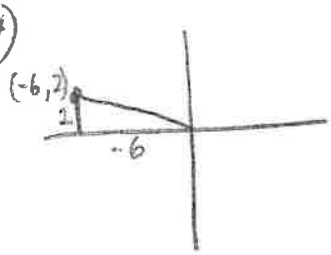
$\theta_R = 10°$

Coterminal
$= -10°, 710°, 1070°$

(e) 

$\theta_R = 89°$

Coterminal
$= -89°, 631°, 991°$

84) 

$x^2 + y^2 = r^2$

$(-6)^2 + 2^2 = r^2$

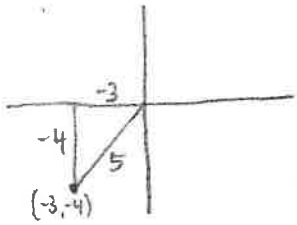
$r^2 = 40$

$r = \sqrt{40} = 2\sqrt{10}$

$\tan\theta = \frac{2}{-6} = \frac{-1}{3}$

$\sin\theta = \frac{2}{2\sqrt{10}} = \frac{1}{\sqrt{10}} = \frac{\sqrt{10}}{10}$

$\cos\theta = \frac{-6}{2\sqrt{10}} = \frac{-3}{\sqrt{10}} = \frac{-3\sqrt{10}}{10}$

85) 

$x^2 + y^2 = r^2$

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

$r^2 = 25$

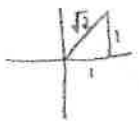
$r = 5$

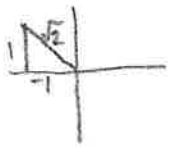
$\tan\theta = \frac{-4}{-3} = \frac{4}{3}$

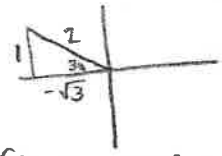
$\sin\theta = \frac{-4}{5}$

$\cos\theta = \frac{-3}{5}$

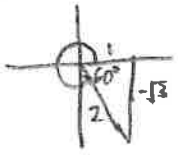
86a) $\sin 45° = \frac{1}{\sqrt{2}} = \frac{\sqrt{2}}{2}$ (b) $\cos 135° = \frac{-1}{\sqrt{2}} = \frac{-\sqrt{2}}{2}$ (c) $\tan 150° = \frac{-1}{\sqrt{3}} = \frac{-\sqrt{3}}{3}$

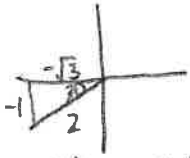


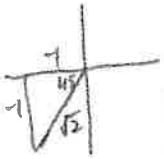




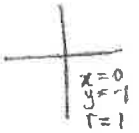
(d) $\sin 300° = \frac{-\sqrt{3}}{2}$ (e) $\cos 210° = \frac{-\sqrt{3}}{2}$ (f) $\tan 225° = \frac{-1}{-1} = 1$

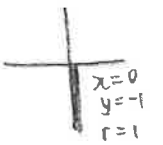




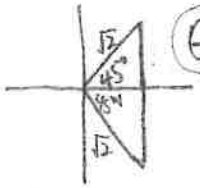


(g) $\cos 270° = \frac{x}{r} = \frac{0}{1} = 0$ (h) $\sin 90° = \frac{y}{r} = \frac{1}{1} = 1$ (i) $\tan 270° = \frac{y}{x} = \frac{-1}{0} = \text{undefined}$



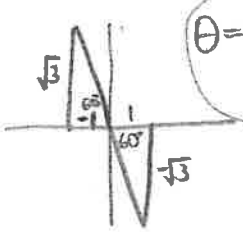


87) a) $\cos\theta = \frac{1}{\sqrt{2}}$



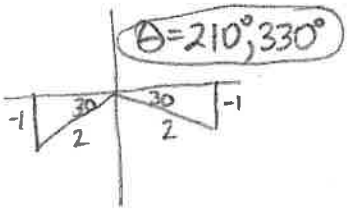
$\theta = 45°, 315°$

(b) $\tan\theta = -\sqrt{3}$



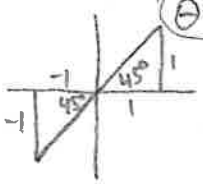
$\theta = 120°, 300°$

(c) $\sin\theta = -\frac{1}{2}$



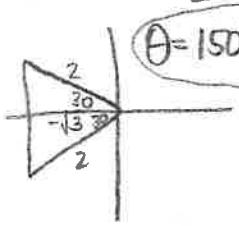
$\theta = 210°, 330°$

(d) $\tan\theta = 1$



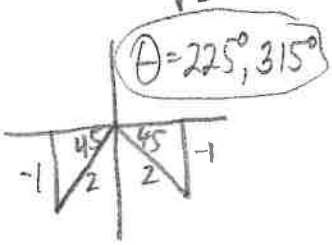
$\theta = 45°, 225°$

(e) $\cos\theta = -\frac{\sqrt{3}}{2}$



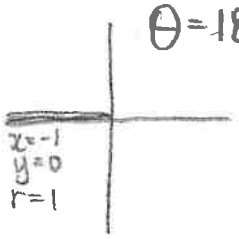
$\theta = 150°, 210°$

(f) $\sin\theta = -\frac{1}{\sqrt{2}}$



$\theta = 225°, 315°$

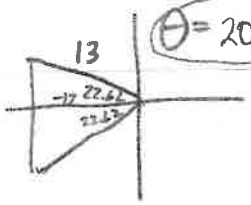
(g) $\cos\theta = -1$



$\theta = 180°$

88) a) $\cos\theta = -\frac{12}{13}$

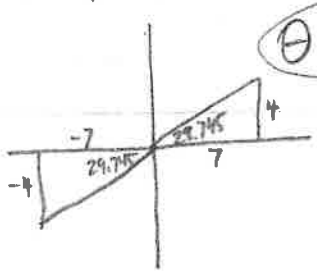
$\theta_R = \cos^{-1}\left(\frac{12}{13}\right) = 22.62°$



$\theta = 202.6°, 157.4°$

(b) $\tan\theta = \frac{4}{7}$

$\theta_R = \tan^{-1}\left(\frac{4}{7}\right) = 29.745°$



$\theta = 29.7°, 209.7°$

89) $\angle A = \_\_$ $a = \_\_$ cm
$\angle B = 50°$ $b = 7$ cm
$\angle C = \_\_$ $c = 9$ cm

use sine law to find $\angle C$

$\frac{\sin 50°}{7} = \frac{\sin C}{9}$

$\sin C = \frac{9\sin 50°}{7}$

$\angle C = 80.035$

$\angle C = 80.0°$

$\angle A$

$\angle A = 180 - 50 - 80.035$

$= 49.965$

$\angle A = 50.0°$

side a will be 7cm as $\angle A$ and $\angle b$ are equal

$a = 7.0$ cm

90) $\angle D =$ $d = 7cm$
$\angle E =$ $e = 9cm$
$\angle F =$ $f = 10cm$

Cos law

Find $\angle F$

$f^2 = d^2 + e^2 - 2de\cos F$

$10^2 = 7^2 + 9^2 - 2(7)(9)\cos F$

$100 = 49 + 81 - 126\cos F$

$100 = 130 - 126\cos F$

$-130 \quad -130$

$\frac{-30}{-126} = \frac{-126\cos F}{-126}$

$\cos F = 0.2381$

$\angle F = 76.226^\circ$

$\angle F = 76.2^\circ$

Sine law

$\angle E$:

$\frac{\sin 76.226^\circ}{10} = \frac{\sin E}{9}$

$\sin E = \frac{9\sin 76.226^\circ}{10}$

$\angle E = 60.94^\circ$

$\angle E = 60.9^\circ$

$\angle D = 180 - 76.226 - 60.94$

$\angle D = 42.8^\circ$

91) $\angle G =$ $g = 4cm$
$\angle H =$ $h = 6cm$
$\angle I = 85^\circ$ $i =$

Cos law

find side i

$i^2 = g^2 + h^2 - 2gh\cos I$

$i^2 = 4^2 + 6^2 - 2(4)(6)\cos 85^\circ$

$i^2 = 16 + 36 - 48\cos 85^\circ$

$i^2 = 47.8165$

$i = 6.915$

$i = 6.9cm$

Sine law

$\angle G$

$\frac{\sin G}{4} = \frac{\sin 85^\circ}{6.915}$

$\sin G = \frac{4\sin 85^\circ}{6.915}$

$\angle G = 35.19^\circ$

$\angle G = 35.2^\circ$

$\angle H = 180 - 85 - 35.2^\circ$

$\angle H = 59.8^\circ$