1. $\sqrt{275}$

$\sqrt{25(11)}$

$5\sqrt{11}$

2. $\sqrt[3]{320}$

$\sqrt[3]{64(5)}$

$4\sqrt[3]{5}$

3. $5x^3\sqrt{4x}$

$\sqrt{25x^6 \cdot 4x}$

$\sqrt{100x^7}$

4. $8\sqrt{28} - 3\sqrt{200} - 6\sqrt{63} + 2\sqrt{98}$

$8\sqrt{4(7)} - 3\sqrt{100(2)} - 6\sqrt{9(7)} + 2\sqrt{49(2)}$

$16\sqrt{7} - 30\sqrt{2} - 18\sqrt{7} + 14\sqrt{2}$

$-2\sqrt{7} - 16\sqrt{2}$

5. $3\sqrt{6x+42}$

Domain

$6x + 42 \geq 0$

$6x \geq -42$

$x \geq -7$

6. $7\sqrt{2-11x}$

Domain $2 - 11x \geq 0$

$-11x \geq -2$

$x \leq 2/11$

7. $(7\sqrt{20})(3\sqrt{75})$

$(14\sqrt{5})(15\sqrt{3})$

$210\sqrt{15}$

8. $\frac{2}{8}\sqrt{72} + \frac{6}{10}\sqrt{50}$

$\frac{2}{8}\sqrt{36(2)} + \frac{6}{10}\sqrt{25(2)}$

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

$= 7\sqrt{2}$

9. $(9\sqrt{5}-6\sqrt{3})(4\sqrt{5}+2\sqrt{3})$

$36\sqrt{25}+18\sqrt{15}-24\sqrt{15}-12\sqrt{9}$

$180-6\sqrt{15}-36$

$144-6\sqrt{15}$

10. $\frac{5\sqrt{15}}{6\sqrt{3}}$ OR $\frac{5\sqrt{15}}{6\sqrt{3}}\times\frac{\sqrt{3}}{\sqrt{3}}$

$=\frac{5}{6}\sqrt{5}$

$\frac{5\sqrt{45}}{6\sqrt{9}}=\frac{5\sqrt{9(5)}}{18}$

$\frac{15\sqrt{5}}{18}$

11. $\frac{5+4\sqrt{2}}{12-3\sqrt{2}}\times\frac{12+3\sqrt{2}}{12+3\sqrt{2}}$

$\frac{60+15\sqrt{2}+48\sqrt{2}+12\sqrt{4}}{144+36\sqrt{2}-36\sqrt{2}-9\sqrt{4}}$

$\frac{60+63\sqrt{2}+24}{144-18}$

$\frac{84+63\sqrt{2}}{126}$ ÷ by 21

$\frac{4+3\sqrt{2}}{6}$

12. $4\sqrt{3x+6}-15=9$

$(4\sqrt{3x+6})^2=(24)^2$

$16(3x+6)=576$

$48x+96=576$

$48x=480$

$x=10$

13. $(\sqrt{2x-4}+3)^2=\sqrt{5x-1}^2$

$(\sqrt{2x-4}+3)(\sqrt{2x-4}+3)=5x-1$

$2x-4+6\sqrt{2x-4}+9=5x-1$

$2x+5+6\sqrt{2x-4}=5x-1$

$6\sqrt{2x-4}=3x-6$

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

$36(2x-4)=9x^2-36x+36$

$72x-144=9x^2-36x+36$

$0=9x^2-108x+180$

$0=9(x^2-12x+20)$

$0=9(x-10)(x-2)$

$x=10, \quad x=2$

No extraneous roots

14. $S=20\sqrt{T+273}$

$340=20\sqrt{T+273}$

$\frac{340}{20}=\sqrt{T+273}$

$(17)^2=\sqrt{T+273}^2$

$289=T+273$

$16°C=T$

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

$2x-4+3\sqrt{2x-4}+3\sqrt{2x-4}+9$

$2x+5+6\sqrt{2x-4}$

Quadratic Expressions / Equations

1. (a) $x^2 - 16x + 48$
$(x-12)(x-4)$

(b) $5x^5 - 45x^3$
$5x^3(x^2-9)$
$5x^3(x-3)(x+3)$

(c) $5x^2 - 31x + 30$
$5x^2 - 25x - 6x + 30$
$5x(x-5) - 6(x-5)$
$(x-5)(5x-6)$

(d) $9x^2 - 121$
$(3x-11)(3x+11)$

2 (a) $6x^2 + 7x - 20 = 0$ factor or QF
$x = \frac{4}{3}, -\frac{5}{2}$

(b) $9x^2 = 4 - 6x$
$9x^2 + 6x - 4 = 0$
$x = 0.412, -1.079$ approx

exact
$\frac{-6 \pm \sqrt{180}}{18}$
$\frac{-6 \pm \sqrt{36(5)}}{18}$
$\frac{-6 \pm 6\sqrt{5}}{18}$
$\frac{-1 \pm \sqrt{5}}{3}$

(c) $2x(x-4) = x^2 + 9x - 70$
$2x^2 - 8x = x^2 + 9x - 70$
$x^2 - 17x + 70 = 0$
$(x-7)(x-10) = 0$
$x = 7, 10$

4. (a) $y = 6x^2 - 60x + 163$

$y = 6(x^2 - 10x) + 163$

$y = 6(x^2 - 10x + 25 - 25) + 163$

$y = 6(x^2 - 10x + 25) - 150 + 163$

$y = 6(x-5)^2 + 13$

vertex $(5, 13)$

axis: $x = 5$

range: $y \geq 13$

(b) $y = -7x^2 - 84x - 257$

$y = -7(x^2 + 12x) - 257$

$y = -7(x^2 + 12x + 36 - 36) - 257$

$y = -7(x^2 + 12x + 36) + 252 - 257$

$y = -7(x+6)^2 - 5$

vertex $(-6, -5)$

axis $x = -6$

range $y \leq -5$

(c). $y = x^2 - 30x + 200$

$y = x^2 - 30x + 225 - 225 + 200$

$y = (x^2 - 30x + 225) - 225 + 200$

$y = (x-15)^2 - 25$

vertex $(15, -25)$

axis $x = 15$

range $y \geq -25$

(d) $y = -2x^2 + 10x + 7$

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

$y = -2(x^2 - 5x + 6.25 - 6.25) + 7$

$y = -2(x^2 - 5x + 6.25) + 12.5 + 7$

$y = -2(x - 2.5)^2 + 19.5$

vertex $(2.5, 19.5)$

axis $x = 2.5$ range $y \leq 19.5$

(e) $y = \frac{1}{3}x^2 - 8x + 49$

$y = \frac{1}{3}(x^2 - 24x) + 49$

$y = \frac{1}{3}(x^2 - 24x + 144 - 144) + 49$

$y = \frac{1}{3}(x^2 - 24x + 144) - 48 + 49$

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

vertex $(12, 1)$

axis $x = 12$ range $y \geq 1$

(f). $y = -0.2x^2 - x + 3$

$y = -0.2(x^2 + 5x) + 3$

$y = -0.2(x^2 + 5x + 6.25 - 6.25) + 3$

$y = -0.2(x^2 + 5x + 6.25) + 1.25 + 3$

$y = -0.2(x + 2.5)^2 + 4.25$

vertex $(-2.5, 4.25)$

axis: $x = -2.5$

range $y \leq 4.25$

5. $C = -0.0002t^2 + 0.08t + 10$

$C = -0.0002(t^2 - 400t + 40000 - 40000) + 10$

$C = -0.0002(t^2 - 400t + 40000) + 8 + 10$

$C = -0.0002(t-200)^2 + 18$

a) max conc: 18 ug/L

(b) $C = -0.0002(120)^2 + 0.08(120) + 10$

$= 16.72$ ug/L

(c). $15 = -0.0002t^2 + 0.08t + 10$

$0 = -0.0002t^2 + 0.08t - 5$

$\frac{-0.08 \pm \sqrt{0.0024}}{-0.0004}$ → 77.5 min, 322.5 min

6. $h = -4.9t^2 + 78.4t + 24.6$

(a) 24.6m

(b). $h = -4.9(t^2 - 16t) + 24.6$

$h = -4.9(t^2 - 16t + 64 - 64) + 24.6$

$h = -4.9(t^2 - 16t + 64) + 313.6 + 24.6$

$h = -4.9(t-8)^2 + 338.2$

max $h = 338.2$m

(c) $h = -4.9(7)^2 + 78.4(7) + 24.6$

$= 333.3$m

(d). 220m: $220 = -4.9t^2 + 78.4t + 24.6$

$0 = -4.9t^2 + 78.4t - 195.4$

$\frac{-78.4 \pm \sqrt{2316.72}}{-9.8}$ → 3.09 sec, 12.91 sec

7. vertex $(-12, 14)$

$p+ (-4, -2)$

$y = a(x+12)^2 + 14$

$-2 = a(-4+12)^2 + 14$

$-2 - 14 = a(8)^2$

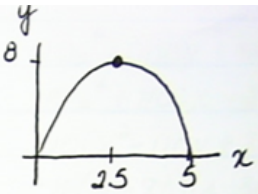
$-16 = 64a$

$\frac{-16}{64} = a$

$-\frac{1}{4} = a$

$y = -\frac{1}{4}(x+12)^2 + 14$

8.



vertex $(2.5, 8)$

$p+ (0, 0)$

$y = a(x-2.5)^2 + 8$

$0 = a(0-2.5)^2 + 8$

$0 - 8 = a(-2.5)^2$

$-8 = 6.25a$

$\frac{-8}{6.25} = a$

$y = \frac{-8}{6.25}(x-2.5)^2 + 8$

$y = -\frac{32}{25}(x-2.5)^2 + 8$

8. (b) at $x = 1.6$m

$y = \frac{-8}{6.25}(1.6-2.5)^2 + 8$

$y = \frac{-8}{6.25}(0.9)^2 + 8$

$y = 6.9632$m

$6.9632 - 1.72$

$= 5.2432$m

9. $P = (\$60)(700 \text{ seats})$

New Cost $\$60 + 2x$

New # Seats $700 - 5x$

(a) $P = (60+2x)(700-5x)$

$P = 42000 - 300x + 1400x - 10x^2$

$P = -10x^2 + 1100x + 42000$

(b) $P = -10(x^2 - 110x) + 42000$

$P = -10(x^2 - 110x + 3025 - 3025) + 42000$

$P = -10(x^2 - 110x + 3025) + 30250 + 42000$

$P = -10(x-55)^2 + 72250$

$x = 55$ Price $60 + 2x$

$60 + 2(55)$

170

9. (c) Seats: $700 - 5x$

$700 - 5(55)$

425 seats

275 empty

(d) $-10x^2 + 1100x + 42000 \geq 66000$

$-10x^2 + 1100x - 24000 \geq 0$

$-10(x^2 - 110x + 2400) \geq 0$

$-10(x-80)(x-30) \geq 0$

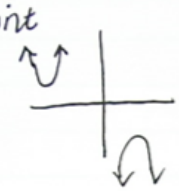
$x = 80 \quad ; \quad x = 30$

	$-10(x-80)(x-30)$
$(-\infty, 30]$	$-$
$[30, 80]$	$+$
$[80, \infty)$	$-$

$[30, 80]$

$x = 30$ Price: $60 + 2x$ $\$120$ to $x = 80$ $P = 60 + 2x$ $\$220$

10. $D < 0$ means no x-int



11. a. $y = x^2 - 12x + 50$

$D = b^2 - 4ac$

$= -56$

no real roots

No x-intercepts

11. (b) $y = x^2 + 18x + 36$

$D = 180$

2 Real Roots

2 x-intercepts

(c) $y = x^2 - 4x + 11$

$D = -28$

No Real Roots

No x-intercepts

(d) $y = 9x^2 - 30x + 25$

$b^2 - 4ac$

$30^2 - 4(9)(25)$

0

$\therefore$ 1 Real Root

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

$0 = (3x-5)(3x-5)$

(e) $y = x^2 - 64$

$b^2 - 4ac$

$0^2 - 4(1)(-64)$

256

2 Real Roots

$y = (x-8)(x+8)$

Systems of Equations

1) $5x-y=10$ $\quad x^2+x-2y=0$

$5x-10=y$ $\quad x^2+x=2y$

$\frac{x^2+x}{2}=y$

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

$10x-20=x^2+x$

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

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

$x=4$ $\quad y=5x-10=10$ $\quad (4,10)$

$x=5$ $\quad y=5x-10=15$ $\quad (5,15)$

2. $3x+y=-9$ $\quad 4x^2-x+y=-9$

$y=-3x-9$ $\quad y=-4x^2+x-9$

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

$4x^2-4x=0$

$4x(x-1)=0$

$x=0,1$

$x=0$ $\quad y=-3(0)-9=-9$

$x=1$ $\quad y=-3(1)-9=-12$

$(0,-9)$ $\quad (1,-12)$

3. $3x^2-x-y-2=0$; $6x^2+4x-y=4$

$3x^2-x-2=y$ $\quad 6x^2+4x-4=y$

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

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

$0=3x^2+6x-x-2$

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

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

$x=-2, +1/3$

$(-2,12)$ $\quad (1/3,-2)$

4. $6x^2-x-y=-1$; $4x^2-4x-y=-6$

$6x^2-x+1=y$ $\quad 4x^2-4x+6=y$

$6x^2-x+1=4x^2-4x+6$

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

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

$x(2x+5)-1(2x+5)=0$

$(2x+5)(x-1)=0$

$x=-5/2, 1$

$(-2.5,41)$ $\quad (1,6)$

6. start: $h = -4.9t^2 + 700$

after parachute opens $h = -5t + 650$

$-4.9t^2 + 700 = -5t + 650$

$0 = 4.9t^2 + 5t - 50$

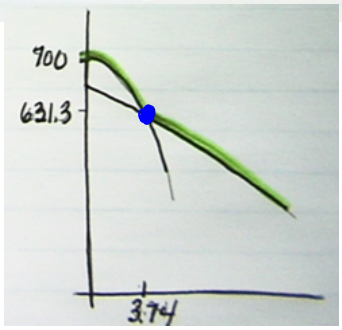
$\frac{-5 \pm \sqrt{1005}}{9.8}$ → $-2.72 = t$ inadmissible (time cannot be -)

→ $3.74 = t$ sec

at $t = 3.74$ sec

$h = -5t + 650$

$h = 631.3$



7. $y + 27 = -5x^2 + 40x$ $\quad y + 8x^2 = 40x$

$y = -5x^2 + 40x - 27$ $\quad y = -8x^2 + 40x$

x= time (sec)
y=height (m)

$-5x^2 + 40x - 27 = -8x^2 + 40x$

$3x^2 - 27 = 0$

$3(x^2 - 9) = 0$

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

$x = 3, \; x = -3$

inadmissible time not -

at 3sec the balls are at the same height

$h = -8x^2 + 40x$

$= -8(3)^2 + 40(3)$

$= 48$ m above ground

after 3 sec both balls are 48m in the air

$h = -5x^2 + 40x - 27$

$-5(3)^2 + 40(3) - 27$

$-45 + 120 - 27$

48 m

8.

$d^2 - 2d + 3h = 9$ $\quad 5d^2 - 10d + h = 0$

h = height above floor (m)

d = horizontal distance of ball from centre of the hoop

$3h = -d^2 + 2d + 9$ $\quad h = -5d^2 + 10d$

$h = \frac{-d^2}{3} + \frac{2}{3}d + \frac{9}{3}$

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

$-d^2 + 2d + 9 = -15d^2 + 30d$

$14d^2 - 28d + 9 = 0$

$\frac{28 \pm \sqrt{280}}{28}$ → $1.6 = d$, $0.4 = d$

$d = 1.6 \quad h = -5(1.6)^2 + 10(1.6)$
$= 3.2$

$d = 0.4 \quad h = -5(0.4)^2 + 10(0.4)$
$= 3.2$

at a height of 3.2m above the ground, Ben contacts Luke's Ball when it is 0.4m (or 1.6m) from the centre of the net (

Rational Expressions/Equations

1.(a) $\frac{9}{2m} \div \frac{3}{m} \times \frac{m}{3} \quad m \neq 0$

$= \frac{9}{2m} \times \frac{m}{3} \times \frac{m}{3}$

$= \frac{9m^2}{18m}$

$= \frac{m}{2}$

(b) $\frac{x^2-3x+2}{x^2-4} \times \frac{x+3}{x^2+3x} \div \frac{1}{x+2}$

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

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

(c). $\frac{a-3}{a-4} \div \frac{30}{a+3} \times \frac{5a-20}{a^2-9} \quad a \neq 4, -3, 3$

$\frac{a-3}{a-4} \times \frac{a+3}{30} \times \frac{5(x-4)}{(a-3)(a+3)}$

$= \frac{5}{30}$

$= \frac{1}{6}$

(d) $\frac{3x+12}{3x^2-5x-12} \times \frac{x-3}{x+4} \div \frac{15}{3x+4}$

$\frac{3(x+4)}{(3x+4)(x-3)} \times \frac{x-3}{x+4} \times \frac{(3x+4)}{15}$

$= \frac{3}{15} \quad x \neq -4/3, 3, -4$

$= \frac{1}{5}$

(e). $\frac{2x^2-x-6}{2x^2+3x-2} \div \frac{x^2-9}{x^2-x-6} \times \frac{4x^2-4x+1}{2x^2-5x+2}$

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

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

$= \frac{2x+3}{x+3} \quad x \neq 1/2, -2, 3, -3, 2$

2. (a). $\frac{4x-3}{6} - \frac{x-2}{4}$

$\frac{2(4x-3)}{12} - \frac{3(x-2)}{12}$

$\frac{2(4x-3) - 3(x-2)}{12}$

$\frac{8x-6-3x+6}{12}$

$\frac{5x}{12}$

(b). $\frac{2y-1}{3y} + \frac{y-2}{2y} - \frac{y-8}{6y}$

$\frac{2(2y-1)}{6y} + \frac{3(y-2)}{6y} - \frac{y-8}{6y}$

$\frac{2(2y-1) + 3(y-2) - (y-8)}{6y}$

$\frac{4y-2+3y-6-y+8}{6y}$

$\frac{6y}{6y} = 1 \qquad y \neq 0$

(c). $\frac{9}{x-3} + \frac{7}{x^2-9}$

$\frac{9}{x-3} + \frac{7}{(x-3)(x+3)}$

$\frac{9(x+3)}{(x-3)(x+3)} + \frac{7}{(x-3)(x+3)}$

$\frac{9(x+3)+7}{(x-3)(x+3)}$

$\frac{9x+27+7}{(x-3)(x+3)}$

$\frac{9x+34}{(x-3)(x+3)} \qquad x \neq 3, -3$

(d) $\frac{a}{a+3} - \frac{a^2-3a}{a^2+a-6}$

$\frac{a}{a+3} - \frac{a(a-3)}{(a+3)(a-2)}$

$\frac{a(a-2)}{(a+3)(a-2)} - \frac{a(a-3)}{(a+3)(a-2)}$

$\frac{a(a-2)-a(a-3)}{(a+3)(a-2)}$

$\frac{a^2-2a-a^2+3a}{(a+3)(a-2)}$

$\frac{a}{(a+3)(a-2)} \qquad a \neq -3, 2$

(e) $\frac{a}{a-b} - \frac{2ab}{a^2-b^2} + \frac{b}{a+b}$

$\frac{a}{a-b} - \frac{2ab}{(a-b)(a+b)} + \frac{b}{a+b}$

$\frac{a(a+b)}{(a-b)(a+b)} - \frac{2ab}{(a-b)(a+b)} + \frac{b(a-b)}{(a-b)(a+b)}$

$\frac{a(a+b) - 2ab + b(a-b)}{(a-b)(a+b)}$

$\frac{a^2+ab-2ab+ab-b^2}{(a-b)(a+b)}$

$\frac{a^2-b^2}{(a-b)(a+b)}$ $a \neq b$ $a \neq -b$

$\frac{(a-b)(a+b)}{(a-b)(a+b)}$

$=1$

(f) $\frac{2x}{4x^2-9} + \frac{x}{2x^2+5x+3} - \frac{1}{2x-3}$

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

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

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

$\frac{2x^2+2x+2x^2-3x-(2x^2+5x+3)}{(2x-3)(2x+3)(x+1)}$

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

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

3. (a) $\frac{s-3}{s+3} = 2 \quad ; \quad s \neq -3$

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

$s-3 = 2s+6$

$-9 = s$

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

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

$x^2+x-2 = 3x^2+11x+6$

$0 = 2x^2+10x+8$

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

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

$x = -4, -1$

(c) $\frac{z-2}{z} + \frac{1}{5} = \frac{-4}{5z} \qquad z \neq 0$ (multiply by $5z$)

$5(z-2) + z = -4$

$5z-10+z = -4$

$6z = 6$

$z = 1$

(d) $\frac{3m}{m-3} + 2 = \frac{3m-1}{m+3}$ (multiply by $(m-3)(m+3)$)

$3m(m+3) + 2(m-3)(m+3) = (3m-1)(m-3)$

$3m^2+9m+2(m^2-9) = 3m^2-10m+3$

$3m^2+9m+2m^2-18 = 3m^2-10m+3$

$5m^2+9m-18 = 3m^2-10m+3$

$2m^2+19m-21 = 0$

$(2m+21)(m-1) = 0$

$m = -21/2, +1 \qquad m \neq 3, -3$

(e). $\frac{x}{x-3} = \frac{3}{x-3} - 3$ $x \neq 3$

$x = 3 - 3(x-3)$

$x = 3 - 3x + 9$

$4x = 12$

$x = 3$

Inadmissible

$x \neq 3$

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

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

$2x^2 - 4x = 2x^2 + x + 2x^2 - 5x - 3$

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

$0 = 2x^2 - 3$

$x = \frac{\pm\sqrt{6}}{2}$ or 1.22 -1.22

$x \neq 0, -\frac{1}{2}$

$\frac{0 \pm \sqrt{0^2 - 4(2)(-3)}}{2(2)}$

$\frac{\pm\sqrt{24}}{4}$ $\frac{\pm 2\sqrt{6}}{4}$

$\frac{\pm\sqrt{4(6)}}{4}$ $\frac{\pm\sqrt{6}}{2}$

$2x^2 = 3$

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

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

$(\sqrt{2}x - \sqrt{3})(\sqrt{2}x + \sqrt{3})$

(g). $\frac{3}{x+2} + \frac{5}{x-3} = \frac{3x}{x^2-x-6} - 1$ $x \neq -2, 3$

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

$3(x-3) + 5(x+2) = 3x - 1(x-3)(x+2)$

$3x - 9 + 5x + 10 = 3x - 1(x^2 - x - 6)$

$8x + 1 = 3x - x^2 + x + 6$

$8x + 1 = -x^2 + 4x + 6$

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

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

$x = -5, 1$

(h) $\frac{12}{x} - 10 = \frac{14}{2-x}$ $x(2-x)$ $x(2-x)$ $x(2-x)$ $x \neq 2, 0$

$12(2-x) - 10x(2-x) = 14x$

$24 - 12x - 20x + 10x^2 = 14x$

$10x^2 - 32x + 24 = 14x$

$10x^2 - 46x + 24 = 0$

$2(5x^2 - 23x + 12) = 0$

$2(5x - 3)(x - 4) = 0$

$x = 3/5, 4$

(i) $\frac{16}{x-3} - \frac{9}{2x-1} = 7$ $x \neq 3, \frac{1}{2}$

$16(2x-1) - 9(x-3) = 7(x-3)(2x-1)$

$32x - 16 - 9x + 27 = 7(2x^2 - 7x + 3)$

~~$23x + 11 = 7($~~

$23x + 11 = 14x^2 - 49x + 21$

$0 = 14x^2 - 72x + 10$

$0 = 2(7x^2 - 36x + 5)$

$0 = 2(7x - 1)(x - 5)$

$x = \frac{1}{7}, 5$

4. x

$12 - x$

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

$8(12-x) + 8x = 3x(12-x)$

$96 - 8x + 8x = 36x - 3x^2$

$96 = -3x^2 + 36x$

$3x^2 - 36x + 96 = 0$

$3(x^2 - 12x + 32) = 0$

$3(x-8)(x-4) = 0$

$x = 8, 4$

#15

x	8
$12-x$	4

6. $2\times\frac{3}{x+2}+2\times\frac{2}{x-3}=5$

$\frac{6(x+2)(x-3)}{x+2}+\frac{4(x+2)(x-3)}{x-3}=5(x+2)(x-3)$

$6(x-3)+4(x+2)=5(x+2)(x-3)$

$6x-18+4x+8=5(x^2-x-6)$

$10x-10=5x^2-5x-30$

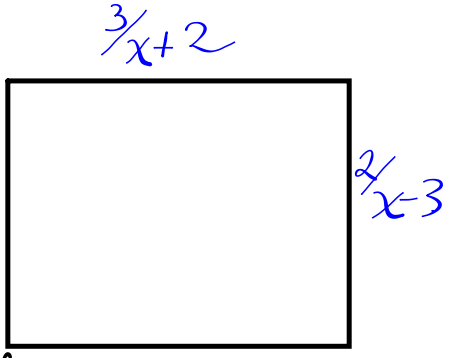
$0=5x^2-15x-20$

$0=5(x^2-3x-4)$

$0=5(x-4)(x+1)$

$x=4,-1$ inadmissible

$x=4$



length cannot be negative

7.

	D	S	T
Ed-Van	1200	$x-5$	$1200/x-5$
Van-Ed	1200	x	$1200/x$
			31

$x(x-5)$ $x(x-5)$

$\frac{1200}{x-5}+\frac{1200}{x}=31\,x(x-5)$

$1200x+1200(x-5)=31x(x-5)$

$1200x+1200x-6000=31x^2-155x$

$0=31x^2-2555x+6000$

$\frac{2555\pm\sqrt{5784025}}{62}$

$\frac{2555\pm2405}{62}$ → 80 km/h, 2.42 km/h inadmissible

$x=80$

going 75 km/h

return 80 km/h

8 x, $x-12$

$16x(x-12)$

$\frac{1}{x} + \frac{1}{x-12} = \frac{5}{16} \quad 16x(x-12)$

$16(x-12) + 16x = 5x(x-12)$

$16x - 192 + 16x = 5x^2 - 60x$

$0 = 5x^2 - 92x + 192$

$\frac{+92 \pm \sqrt{4624}}{10}$

$\frac{92 \pm 68}{10}$ → 16, 2.4

#5

x	16
$x-12$	4

9. $A = 10x^2 + 3x - 1 \quad L = 5x - 1$

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

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

$w = 2x + 1$

(b) if $x = 5m$

width $= 2(5) + 1$

$= 11$

Absolute Value

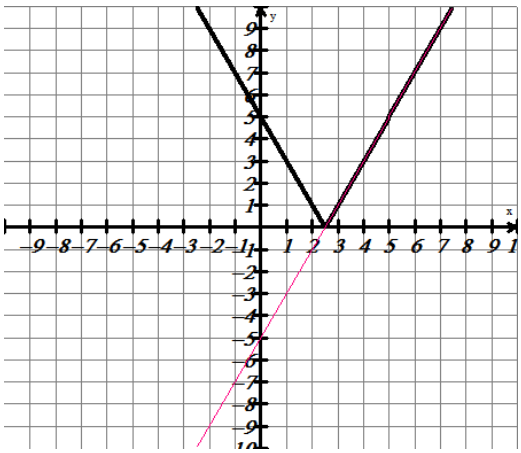
1. a) 5
   b) 41

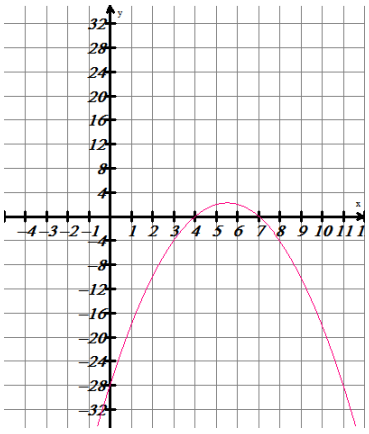
2. a) 11
   b) -5
   c) 1

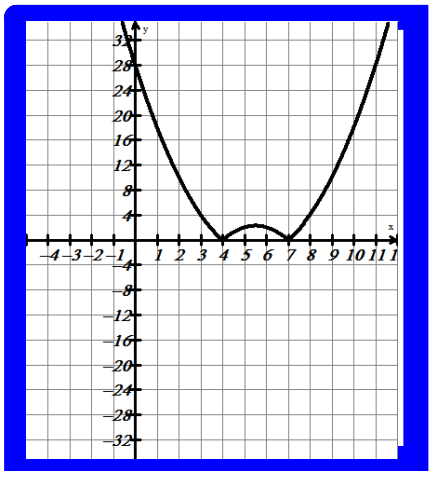
3. (a) $f(x) = \begin{cases} -2x-18 ; & x \le -9 \\ -(-2x-18) ; & x > -9 \end{cases}$

b) $f(x) = \begin{cases} x^2+6x-16 ; & x \le -8 \\ -(x^2+6x-16) ; & -8 < x < 2 \\ x^2+6x-16 ; & x \ge 2 \end{cases}$

4.







$y = -x^2+11x-28$

$-(x^2-11x)-28$

$-(x^2-11x+30.25-30.25)-28$

$-(x^2-11x+30.25)+30.25-28$

$-(x-5.5)^2+2.25$

vertex (5.5, 2.25)

$y = -x^2+11x-28$

$-(x^2-11x)-28$

$-(x^2-11x+30.25-30.25)-28$

$-(x^2-11x+30.25)+30.25-28$

$-(x-5.5)^2+2.25$

vertex (5.5, 2.25)

$y = -x^2+11x-28$

x-int: $-(x^2-11x+28)$

$-(x-7)(x-4)$

7 & 4

y-int

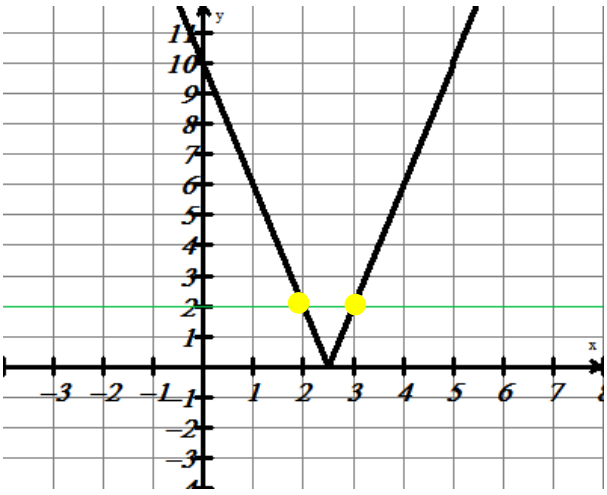
$= -28$

6 $|18-4x|+10=4$

$|18-4x| = -6$

↗ abs. value cannot = a negative

7.



Graph of $y=|4x-10|$

8.

(a) $|2x-5|=11$

$2x-5=11$ $2x-5=-11$

$2x=16$ $2x=-6$

$x=8$ $x=-3$

(b) $3x+1=4x-15$ $3x+1=-(4x-15)$

$-x=-16$ $3x+1=-4x+15$

$x=16$ $7x=14$

$x=2$

inadmissible

c) $x^2-7x-15=6x+15$ $x^2-7x-15=-(6x+15)$

$x^2-13x-30=0$ $x^2-7x-15=-6x-15$

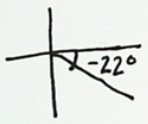
$(x-15)(x+2)=0$ $x^2-x=0$

$x=15,-2$ $x(x-1)=0$

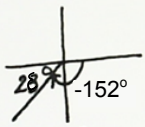
$x=0,1$

Trig

(1)

1. 

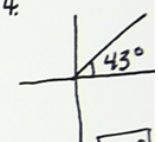
22°

2. 

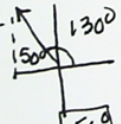
28°

3. 

37°

4. 

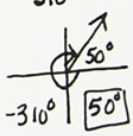
43°

6. 

50°

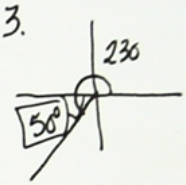
7. 305°


55°

8. -310°


50°

2. 25°,
155°
205°
335°

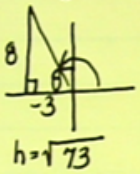
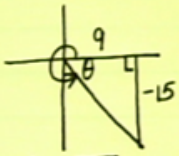
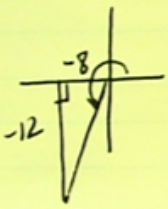
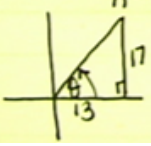

3. 

ref. of 50°
130°, 230°, 31

4. 

$\tan\theta = \frac{-4}{6}$
34°
326°
$r^2 = 6^2 + (-4)^2$
$r^2 = 52$
$r = \sqrt{52}$
$r = \sqrt{4(13)}$
$2\sqrt{13}$

5.

Ordered Pair	Diagram	Quadrant	Reference Angle	Rotation Angle	State
$(-3,8)$	 $h=\sqrt{73}$	2	69.4°	110.6°	$\sin\theta=\frac{8}{\sqrt{73}}$
$(9,-15)$	 $h=\sqrt{306}$	4	59°	301°	$\cos\theta=\frac{9}{\sqrt{306}}$
$(-8,-12)$	 $h=\sqrt{208}$ $h=4\sqrt{13}$	3	56.3°	236.3°	$\tan\theta=\frac{-12}{-8}$ $=12/8$
$(13,17)$	$h=\sqrt{458}$ 	1	52.6°	52.6°	$\sin\theta=\frac{17}{\sqrt{458}}$

6.

(a)

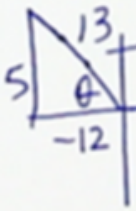
$h^2 = 5^2 + (-3)^2$

$h^2 = 34$

$h = \sqrt{34}$

$\sin\theta = \frac{-3}{\sqrt{34}}$ $\cos\theta = \frac{5}{\sqrt{34}}$ $\tan\theta = \frac{-3}{5}$

(b)



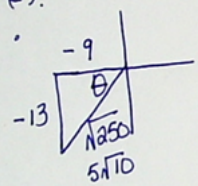
$h^2 = (5)^2 + (-12)^2$

$h = 13$

$\sin\theta = \frac{5}{13}$ $\cos\theta = \frac{-12}{13}$

$\tan\theta = \frac{-5}{12}$

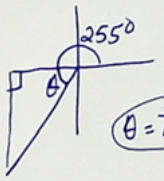
(c).



$\sin\theta = \frac{-13}{5\sqrt{10}}$

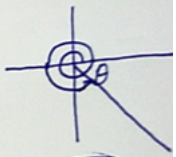
$\tan\theta = \frac{-13}{-9} = \frac{13}{9}$

(d) ref for 255°



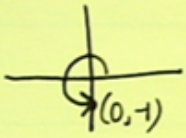
$\theta = 75°$

(e) ref. for 659



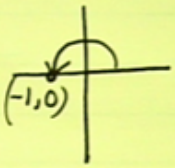
$\theta = 61°$

7. (a) $\sin 270°$



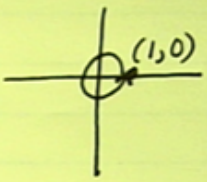
$= -1$

(b) $\tan 180°$



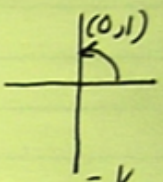
$= 0/1 = 0$

(c) $\cos 360°$



$= 1$

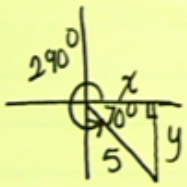
(d) $\tan 90°$



$= 1/0$

undefined

8.



$\sin 70° = \frac{y}{5}$ $\cos 70° = \frac{x}{5}$

$5 \sin 70° = y$ $5 \cos 70° = x$

$y = 4.7$ $x = 1.7$

$(1.7, 4.7)$

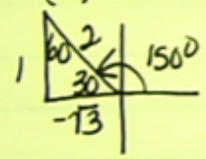
9. (a) positive

(b) positive

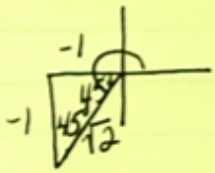
(c) negative

(d) negative

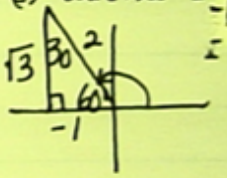
10. (a) $\sin 150^\circ = \frac{1}{2}$



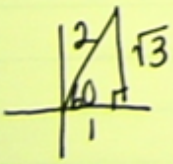
(b) $\cos 225^\circ = \frac{-1}{\sqrt{2}}$



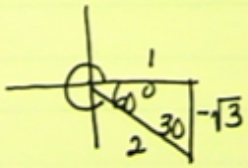
(c) $\tan 120^\circ = \frac{\sqrt{3}}{-1} = -\sqrt{3}$



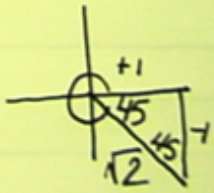
(d) $\sin 60^\circ = \frac{\sqrt{3}}{2}$



(e) $\cos 300^\circ = \frac{1}{2}$



(f) $\tan 315^\circ = \frac{-1}{1} = -1$



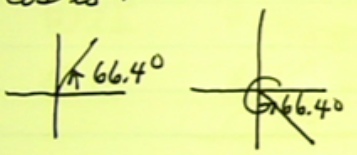
11. $\cos\theta = \frac{2}{5}$

$\theta = \cos^{-1}\frac{2}{5}$

$\theta = 66.4^\circ$

ref

cos is +



12. (a) $\cos\theta = -0.8320$
ref $\theta = 33.7°$
cos is (−)
$\therefore$ 146.3°, 213.7°

(b) $\sin\theta = 0.2105$
ref $\theta = 12.2°$
sin is (+)
$\therefore$ 12.2°, 167.8°

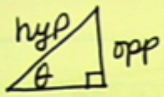
(c) $\tan\theta = 0.2945$
ref $\theta = 16.4°$
tan is +
$\therefore$ 16.4°, 196.4°

(d) $\sin\theta = -0.7362$
ref $\theta = 47.4°$
sin is (−)
$\therefore$ 227.4°, 312.6°

(e) $\cos\theta = 0.4310$
ref $\theta = 64.5°$
cos is (+)
64.5°, 295.5°

(f) $\tan\theta = -22.654$
ref $\theta = 87.5°$
tan is (−)
92.5°, 272.5°

13. A.



$\sin\theta = \frac{opp}{hyp}$; $\cos\theta = \frac{adj}{hyp}$

the opp and adj sides of a right triangle are always smaller than the hypothenuse. Thus, the denominator will always be larger than the numerator so the fraction ($\frac{O}{H}$ or $\frac{A}{H}$) will always be less than 1.

B. $\tan\theta = \frac{opp}{adj}$ if opp > adj tan is greater than 1
if opp < adj tan is less than 1
the opp side can be larger or smaller than the adjacent side

14. a) 60°, 120°
b) 30°, 333°
c) 45°, 225°
d) omit 135°, 225°
e) 120°, 300°
f) omit 225°, 315°
g) 270°, 630°
h) 180°, 360°
(i) 90°, 270°

* did not do in 2015

15. (a) 2nd quad

(b) 3rd quad

(c) 4th quad

(d) 2nd quad

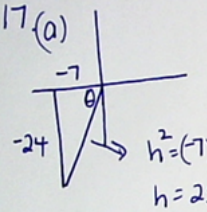
2	1
3	4

16. (a) 493°

(b) -141°

(c) -610°

17. (a)



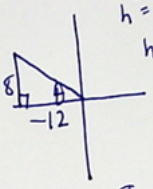
$h^2 = (-7)^2 + (-24)^2$

$h = 25$

$\tan\theta = \frac{-24}{-7} = \frac{24}{7}$

$\cos\theta = \frac{-7}{25}$

(b)



$h^2 = 8^2 + (-12)^2$

$h = \sqrt{208}$

$h = \sqrt{16}\sqrt{13}$

$h = 4\sqrt{13}$

$\sin\theta = \frac{8}{4\sqrt{13}} = \frac{2}{\sqrt{13}}$

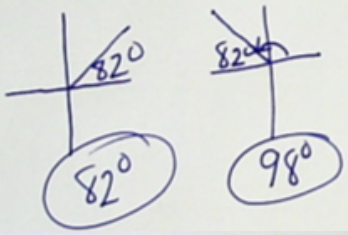
$\cos\theta = \frac{-12}{4\sqrt{13}} = \frac{-3}{\sqrt{13}}$

18. (a) $\sin\theta = 0.9903$

$\theta = \sin^{-1} 0.9903$

$\theta = 82^\circ$

S | A
T | C



19 a) $\sin 315^\circ = \frac{-1}{\sqrt{2}}$ b) $\cos(240^\circ) = \frac{-1}{2}$ (c) $\frac{-1}{\sqrt{3}}$

20. (a) 53.5° (d) $x = 2.8$

(b) 43.6° (e) $x = 12.5$

(c) $x = 41.8$ (f) $x = 1.8$