C11- 6.0 - Q1 Rational Solutions

a) $\frac{12x^3}{3x}$

$= 4x^2$

b) $\frac{2x+6}{x+3}$

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

$= 2$

c) $\frac{x^2+5x+6}{x+2}$

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

$= x+3$

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

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

$= x-2$

e) $\frac{x+7}{x+7}$

$= 1$

f) $\frac{x-2}{x^2+2x-8}$

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

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

g) $\frac{2(x+5)}{5+x}$ $\quad 5+x = x+5$

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

$= 2$

h) $\frac{x^2-6x+8}{x+3}$

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

Can't Simplify

C11- 6.0 - Q1 Rational Solutions

i) $\dfrac{2x^2+5x+3}{x+1}$ $(2x^2+2x+3x+3)$ $\frac{2}{}\times\frac{3}{}=6$

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

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

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

$=2x+3$

j) $\dfrac{x-5}{5-x}$ $5-x$

$-x+5$

$-(x-5)$

$\dfrac{(x-5)}{-(x-5)}$

$=-1$

C11- 6.0 - Q1 Rational Solutions

k) $\frac{2x-2}{1-x}$

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

$=-2$

$1-x$

$-x+1$

$-(x-1)$

o) $\frac{3-x}{x+3}$

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

$3-x$

$-x+3$

$-(x-3)$

c) $\frac{x^2-4}{4-x^2}$

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

$=-1$

$4-x^2$

$-x^2+4$

$-(x^2-4)$

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

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

$=1$

$1-x$

$-x+1$

$-(x-1)$

$-x-1$

$-(x+1)$

C11- 6.0 - Q2 Rational Solutions

2a) $\frac{2}{x}$ $x \neq 0$

b) $\frac{3}{x-1}$ $x-1 \neq 0$ $x \neq 1$

c) $\frac{x+1}{2}$

No restrictions

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

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

$x-2 \neq 0$

$x \neq 2$

e) $\frac{3x+2}{x^2+9x-10}$

$(x+10)(x-1)$

$x+10 \neq 0$ $x-1 \neq 0$

$x \neq -10$ $x \neq 1$

f) $\frac{6}{x^2+4}$ DNE

$x^2+4 \neq 0$

$\sqrt{x^2} \neq \sqrt{-4}$

g) $\frac{1}{x^2-1}$

$x^2-1 \neq 0$

$\sqrt{x^2} \neq \sqrt{1}$

$x \neq \pm 1$

$(x+1)(x-1)$

$x+1 \neq 0$ $x-1 \neq 0$

$x \neq -1$ $x \neq 1$

3a) $\frac{3x^3}{2} \cdot \frac{4|2}{x^2}$

$3x \cdot 2$

$= 6x$

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

$= x+2$

c) $\frac{1}{x^2+5x+6} \cdot \frac{x+3}{2}$

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

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

d) $\frac{4}{x^2-x-6} \cdot \frac{x^2+5x+6}{3}$

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

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

e) $\frac{2x^2-x-6}{x+3} \cdot \frac{x^2-9}{x^2-4}$

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

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

$2x^2-x-6$

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

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

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

f) $\frac{5}{5-x} \cdot (x-5)$

$\frac{5}{5-x} \cdot -(5-x)$

$= -5$

g) $\frac{x}{2} \div \frac{2x^2-4x}{x+3}$

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

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

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

h) $\dfrac{2x^2-x-6}{x+2} \div \dfrac{x^2-4}{x^2+5x+6}$

$\dfrac{(2x+3)(x-2)}{x+2} \cdot \dfrac{(x+3)(x+2)}{(x+2)(x-2)}$

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

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

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

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

4a) $\dfrac{\frac{x}{3}}{\frac{5}{2}}$

$\frac{x}{3} \div \frac{5}{2}$

$\frac{x}{3} \cdot \frac{2}{5}$

$= \frac{2x}{15}$

b) $\dfrac{x}{\frac{2}{3}}$

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

$\frac{x}{1} \cdot \frac{3}{2}$

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

c) $\dfrac{\frac{x}{3}}{3}$

$\frac{x}{3} \div \frac{3}{1}$

$\frac{x}{3} \cdot \frac{1}{3}$

$\boxed{\frac{x}{9}}$

5a) $\frac{3\times 1}{3\times 2} + \frac{1\times 2}{3\times 2}$

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

$= \frac{5}{6}$

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

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

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

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

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

c) $\frac{c\cdot 1}{c\cdot ab} + \frac{1}{ac}\cdot\frac{b}{b}$

$\frac{c}{abc} + \frac{b}{abc}$

$= \frac{c+b}{abc}$

d) $\frac{b\cdot 1}{b\cdot a^2} + \frac{1}{ab}\cdot\frac{a}{a}$

$\frac{b}{a^2b} + \frac{a}{a^2b}$

$= \frac{b+a}{a^2b}$

e) $\frac{(a+2)\cdot 1}{(a+2)\cdot a} + \frac{1}{a+2}\cdot\frac{a}{a}$

$= \frac{(a+2)+a}{a(a+2)}$

$= \frac{2a+2}{a(a+2)}$

$= \frac{2(a+1)}{a(a+2)}$

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

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

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

g) $\frac{1}{x-2} - \frac{1}{2-x}$

$2-x$
$-x+2$
$-(x-2)$

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

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

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

h) $\frac{x+3}{x^2-x-6} + \frac{3x+9}{x^2-4}$

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

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

$= \frac{x^2+x-6+3x^2-27}{(x-3)(x+2)(x-2)}$

$= \frac{4x^2+x-33}{(x-3)(x+2)(x-2)}$

$= \frac{(4x-11)(x+3)}{(x-3)(x+2)(x-2)}$

$4x^2+x-33$
$(4x^2+12x)(-11x-33)$
$4x(x+3)-11(x+3)$
$(4x-11)(x+3)$

6a) $\dfrac{\left(2-\frac{4}{x}\right)\cdot x^2}{\left(3-\frac{1}{x^2}\right)\cdot x^2}$

$\dfrac{2x^2-4x}{3x^2-1}$

b) $\dfrac{\left(\frac{1}{x+3}-1\right)\cdot(x+3)}{\left(\frac{x}{1}\right)\cdot(x+3)}$

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

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

C) $\dfrac{\left(\frac{1}{2}+\frac{3}{x+1}\right)\cdot 2(x+1)}{\left(\frac{5}{1}-\frac{1}{x+1}\right)\cdot 2(x+1)}$

$\dfrac{x+1+6}{10(x+1)-2}$

$\dfrac{x+7}{10x+8}$

$\dfrac{x+7}{2(5x+4)}$

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

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

$\dfrac{2x+2}{-3x^2-5x+2}$

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

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

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

$-(3x^2+6x)(-1x-2)$

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

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

C11- 6.0 - Q7 Rational Solutions

7a) $\left(\frac{1}{3}+\frac{1}{x}=\frac{1}{2}\right)\cdot 6x$ $x\neq 0$

$2x+6=3x$

$6=x$

b) $\left(\frac{x}{x+3}-2=-\frac{3}{x+3}\right)\cdot(x+3)$ $x+3\neq 0$, $x\neq -3$

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

$x-2x-6=-3$

$-x=3$

$x=-3$ reject

c) $\left(\frac{1}{x}+\frac{1}{(x+1)}=\frac{5}{6}\right)\cdot(6x(x+1))$

$x \neq 0$
$x \neq -1$

$6(x+1)+6x=5x(x+1)$

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

$12x+6=5x^2+5x$

$5x^2-7x-6=0$

$(5x^2-10x)+(3x-6)=0$

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

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

$x=2$

$5x+3=0$

$5x=-3$

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

7d) $\left(\frac{3x+4}{x+2} + \frac{1}{2} = \frac{5}{2x+4}\right) \cdot 2(x+2)$

$2(x+2)$

$x \neq -2$

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

$6x + 8 + x + 2 = 5$

$7x + 10 = 5$

$7x = -5$

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

e) $\left(\frac{3x}{x^2-4} - \frac{12}{x+2} = -1\right) \cdot (x+2)(x-2)$

$(x+2)(x-2)$

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

$3x - 12x + 24 = -x^2 + 4$

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

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

$x \neq 2$

$x \neq -2$

$x = 4$ $x = 5$

7f) $\left(\frac{x}{x+4} = \frac{2-x}{x^2+3x-4} + \frac{1}{x-1}\right) \cdot (x+4)(x-1)$

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

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

$x^2 - x = 6$

$x^2 - x - 6 = 0$

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

$x = 3 \quad x = -2$

$x \neq -4$

$x \neq 1$

8) $\boxed{A = x^2 - 4}$ $L = ?$

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

$\omega = \dfrac{(x-1)(x-2)}{(x-1)}$

$\omega = (x-2)$

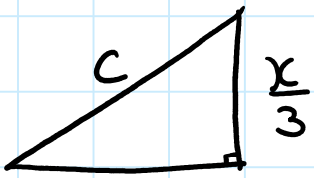
$A = L\omega$

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

$\dfrac{(x+2)(x-2)}{(x-2)} = \dfrac{L(x-2)}{(x-2)}$

$L = x + 2$

9) Find c



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

$\left(\frac{x}{3}\right)^2 + \left(\frac{x-1}{2}\right)^2 = c^2$ $\quad (x-1)^2$ $x^2 - 2x - 1$

4. $\left(\frac{x^2}{9}\right) + \left(\frac{x^2-2x+1}{4}\right)\cdot 9 = c^2$

4. $\left(\frac{x^2}{9}\right) + \left(\frac{x^2-2x+1}{4}\right)\cdot 9 = c^2$

$\dfrac{4x^2}{36} + \dfrac{9x^2 - 18x + 9}{36} = c^2$

$\dfrac{13x^2 - 18x + 9}{36} = c^2$

$c = \sqrt{\dfrac{13x^2 - 18x + 9}{36}}$

10)

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

$\frac{x^2-6x+5}{x-1}$

$A = \frac{bh}{2}$

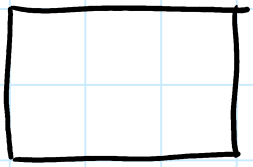
$A = \frac{\left(\frac{x^2-6x+5}{(x-1)}\right)\left(\frac{2}{x-5}\right)}{2}$

$A = \frac{\left(\frac{(x-5)(x-1)}{(x-1)}\right)\left(\frac{2}{x-5}\right)}{2}$

$A = \left(\frac{2}{2}\right)$

$A = 1$

11)



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

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

$A = lw$

$A = \left(\frac{2-x}{x}\right)\left(\frac{3}{x^2}\right)$

$A = \frac{6-3x}{x^3}$

12) $\frac{L}{w} = \frac{L+w}{L}$ $L=?$ $w = 10\text{cm}$

$\frac{L}{10} = \frac{L+10}{L}$

$L^2 = 10L + 100$

$L^2 - 10L - 100 = 0$

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

$\frac{-(-10) \pm \sqrt{(-10)^2 - 4(1)(-100)}}{2(1)}$

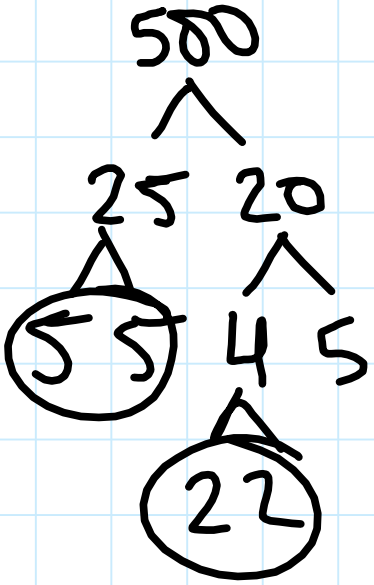
$\frac{10 \pm \sqrt{100+400}}{2}$

$L = \frac{10 \pm \sqrt{500}}{2}$

$L = \frac{10 \pm 10\sqrt{5}}{2}$

$L = 5 \pm 5\sqrt{5}$

$L = 16.18$



13a) $$R_{T\,11} = \frac{1}{\frac{1}{R_1} + \frac{1}{R_2}}$$

$$R_T = \frac{1}{2 \cdot \frac{1}{1} + \frac{1}{2}}$$

$$R_T = \frac{1}{\frac{3}{2}}$$

$$R_T = 1 \div \frac{3}{2}$$

$$R_T = 1 \cdot \frac{2}{3}$$

$$\boxed{R_T = \frac{2}{3}}$$

b) $$R_T = \frac{1}{\frac{1}{R_1} + \frac{1}{R_2}}$$

$R_1 = x$

$R_2 = x+1$

$$R_T = \frac{\left(\frac{1}{1}\right) \cdot x(x+1)}{\left(\frac{1}{x} + \frac{1}{(x+1)}\right) \cdot x(x+1)}$$

$$R_T = \frac{x(x+1)}{(x+1)+(x)}$$

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

14)

	Amount	Time	Rate
Hose A	1 pool	3	1/3
Hose B	1 pool	x	1/x
Together	1 pool	2	1/2

let x = hose B time (hr)

$$\left(\frac{1}{2} = \frac{1}{3} + \frac{1}{x}\right) 6x$$

$3x = 2x + 6$

$x = 6$ It will take 6 hours

$$\frac{1}{2} = \frac{1}{3} + \frac{1}{6} \checkmark$$

15) let x = 1st # let y = 2nd #

$x \neq 0$
$y \neq 0$

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

$$\frac{1}{(x)} + \frac{1}{y} = \frac{3}{8}$$

$$\left(\frac{1}{(12-y)} + \frac{1}{y} = \frac{3}{8}\right) 8y(12-y)$$

$$8y + 8(12-y) = 3y(12-y)$$
$$8y + 96 - 8y = 36y - 3y^2$$
$$\frac{3y^2 - 36y + 96}{3} = \frac{0}{3}$$

$$y^2 - 12y + 32 = 0$$
$$(y-8)(y-4) = 0$$

$y = 8 \quad y = 4$

$x + y = 12$

$x + (8) = 12$ $\quad$ $x + (4) = 12$

$x = 4$ $\quad$ $x = 8$

$4 + 8 = 12$ ✓

The two numbers are 4 and 8

$$\frac{1}{4} + \frac{1}{8} = \frac{3}{8}$$ ✓

16) let $x = \#$

$$x - 2\left(\frac{1}{x}\right) = -1 \qquad x \neq 0$$

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

$$x^2 - 2 = -x$$

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

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

$x = -2$ $x = 1$

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

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

the numbers are -2 and 1

17) let 1st # = x let 2nd # = $x+2$

$x \neq -2$

$$\frac{x+3}{((x+2)-5)} = \frac{11}{5}$$

$$\frac{x+3}{x-3} = \frac{11}{5}$$

$$5(x+3) = 11(x-3)$$

$$5x + 15 = 11x - 33$$

$$48 = 6x$$

$$x = 8$$

the first number is 8

the second number is 10

$$\frac{8+3}{10-5} = \frac{11}{5}$$ ✓

18a) let x be 1st # let $(x+2)$ be 2nd #

$$\left(\frac{1}{x}+\frac{1}{(x+2)}=\frac{8}{15}\right)15x(x+2)$$

$x \neq 0$
$x \neq -2$

$$15(x+2)+15x=8x(x+2)$$
$$15x+30+15x=8x^2+16x$$
$$30x+30=8x^2+16x$$
$$\frac{8x^2}{2}-\frac{14x}{2}-\frac{30}{2}=\frac{0}{2}$$
$$4x^2-7x-15=0$$
$$(4x+5)(x-3)$$

$4x+5=0$ $\quad x=3$

$4x=-5$

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

1st # = 3
2nd # = 5

not an integer

$4x^2-7x-15$
$(4x^2-12x)(+5x-15)$
$4x(x-3)+5(x-3)$
$(4x+5)(x-3)$

$\frac{1}{3}+\frac{1}{5}=\frac{8}{15}$ ✓

18b) let 1st # = x let 2nd # = $x+1$

$x \neq -1$
$x \neq 0$

$$\left(\frac{1}{x} + \frac{1}{(x+1)} = \frac{13}{42}\right)42x(x+1)$$

$$42(x+1) + 42x = 13x(x+1)$$

$$42x + 42 + 42x = 13x^2 + 13x$$

$$84x + 42 = 13x^2 + 13x$$

$$13x^2 - 71x - 42 = 0$$

$$(13x + 7)(x - 6) = 0$$

$-78 \times 7 = -546$
$-78 + 7 = -71$

$13x^2 - 71x - 42$
$13x^2 - 78x + 7x - 42$
$13x(x-6) + 7(x-6)$
$(13x+7)(x-6)$

$13x + 7 = 0$
$13x = -7$
$x = -\frac{7}{13}$

$x - 6 = 0$
$x = 6$

1st # = 6 2nd # = 7

not an integer

$\frac{1}{6} + \frac{1}{7} = \frac{13}{42}$ ✓

19) let V = speed of boat in still water

	Speed	Distance	Time
Down river	$V+6$	40	t
Up river	$V-6$	16	t

$V = \frac{d}{t}$

$V+6 = \frac{40}{t}$

$V = \left(\frac{40}{t} - 6\right)$

$V = \frac{40}{2} - 6$

$V = 14 \frac{km}{h}$

$V = \frac{d}{t}$

$(V) - 6 = \frac{16}{t}$

$\left(\frac{40}{t} - 6\right) - 6 = \frac{16}{t}$

$\left(\frac{40}{t} - 12 = \frac{16}{t}\right) t$

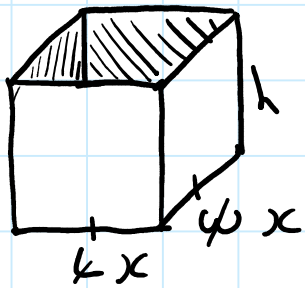
$40 - 12t = 16$

$-12t = -24$

$t = 2$

the velocity of the boat in still water is 14 km/hr.

20)



$V = 60m^3$

$V = LWh$

$V = x^2h$

$60 = x^2h$

$x^2 = \left(\frac{60}{h}\right)$

$x = \sqrt{\frac{60}{h}}$

$SA = x^2 + 4hx$

$SA = \frac{60}{h} + 4h\sqrt{\frac{60}{h}}$