Pre-Calculus 20

6.1 Rational Expressions

Rational expression – an algebraic expression with a numerator and a denominator that are polynomials.

Example: $\frac{1}{x}$, $\frac{m}{m+1}$, $\frac{y^2-1}{y^2+2y+1}$ x^2-4 ← note: has a denominator of 1

Non-permissible values – a value for a variable that makes the expression undefined. In rationals, the denominator ≠ 0. (NPV)

Example: What are the non-permissible values for x in the following?

To determine NPV set the factored denominator equal to zero

1. $\frac{6-x}{2x}$

NPV

$\frac{2x}{2}=\frac{0}{2}$

$x\neq 0$

2. $\frac{3}{x-7}$

NPV

$x-7\,^{+7}=0\,^{+7}$

$x\neq 7$

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

Step 1 Factor the denominator

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

Step 2 Set both factors equal to zero and solve for "x"

$x+3\,^{-3}=0\,^{-3}$ $x+1\,^{-1}=0\,^{-1}$

$x\neq -3$ $x\neq -1$

4. $\frac{5t}{4sr^2}$

Step 1 Set both factors equal to zero and solve for variables

NPV

$\frac{4s}{4}=\frac{0}{4}$ $\sqrt{r^2}=\sqrt{0}$

$s\neq 0$ $r\neq 0$

Simplifying Rational Expressions

- divide out common factors in the numerator and denominator.

Example: Simplify and state non-permissible values.

1. $\frac{9\div 3}{12\div 3}$

$=\frac{1}{4}$

No variables therefore no Non-permissable values

2. $\frac{12m^2t^5}{3mt}$

$=4mt^4$

Divide to simplify

NPV

$m\neq 0$ $t\neq 0$

Note: To find non permissable values always use factored original denominator before simplifying

3. $\frac{3x-6}{x-2}$ ① Factor numerator and denominator

$= \frac{3\cancel{(x-2)}}{\cancel{x-2}}$ ② Find npv

③ Divide common Factors

NPV

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

$x \neq 2$

$= 3, x \neq 2$

↑ simplified answer ↑ Non-permissable values

4. $\frac{x^2+2x-15}{x-3}$

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

$= x+5, x \neq 3$

NPV

$x-3^{+3}=0^{+3}$

$x=3$

5. $\frac{2y^2+y-10}{y^2+3y-10}$ → Note: Do factoring work off to the side

$= \frac{(2y+5)\cancel{(y-2)}}{(y+5)\cancel{(y-2)}}$

NPV

$x+5^{-5}=0^{-5}$ $y-2^{+2}=0^{+2}$

$x \neq -5$ $y \neq 2$

$= \frac{2y+5}{y+5}, y \neq 2$

$x \neq -5$

6. $\frac{x^2-10x+24}{x^2-6x}$

$= \frac{\cancel{(x-6)}(x-4)}{x\,\cancel{(x-6)}}$

NPV

$x \neq 0$ $x-6^{+6} \neq 0^{+6}$

$x \neq 6$

$= \frac{(x-4)}{x}, x \neq 0, x \neq 6$

☆ 7. $\frac{1-t}{t^2-1}$

$= \frac{(1^{\div -1}-t^{\div -1})}{(t-1)(t+1)}$

Notice: the numerator is the opposite of one of the factors in the denominator

$= \frac{-1\cancel{(t-1)}}{\cancel{(t-1)}(t+1)}$

Factor a -1 out of the numerator

$= \frac{-1}{t+1}, t \neq 1, -1$

NPV

$t-1^{+1}=0^{+1}$ $t+1^{-1}=0^{-1}$

$t \neq 1$ $t \neq -1$

☆ 8. $\frac{25-x^2}{x^2-3x-10}$

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

Factors are opposite Take out a -1

NPV

$x-5^{+5} \neq 0^{+5}$ $x+2^{-2}=0^{-2}$

$x \neq 5$ $x \neq -2$

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

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

NOTE:

Assignment: Page 317 #3 ace, 4 acef, 6, ~~8(a-e)~~ 8, 11, 13

6.2 Multiplying and Dividing Rational Expressions

- Factor numerators and denominators
- Divide out common terms

Examples: Multiply. State non-permissible values.

1. $\frac{5}{8_{\div 2}} \cdot \frac{2^{\div 2}}{12}$

$$= \frac{5 \cdot 1}{4 \cdot 12}$$

$$= \frac{5}{48}$$

2. $\left(\frac{\overset{1}{\cancel{4}}x^{\cancel{2}}}{3\cancel{x}\cancel{y}}\right)\left(\frac{y^{\overset{4}{\cancel{5}}}}{\cancel{8}\,2}\right)$

NPV
$x \neq 0 \quad y \neq 0$

$$= \boxed{\frac{xy^4}{6}, xy \neq 0}$$

3. $\left(\frac{a^2-a-12}{a^2-9}\right)\left(\frac{a^2-4a+3}{a^2-4a}\right)$

Step 1
Factor numerators & denominators

Step 2
Find NPV's of all factors in the denominator

Step 3
Cancel same factors that are in numerator & denominator

$$= \left(\frac{\cancel{(a-4)}\cancel{(a+3)}}{\cancel{(a-3)}\cancel{(a+3)}}\right)\left(\frac{(a-1)\cancel{(a-3)}}{(a)\cancel{(a-4)}}\right) \leftarrow \text{NPV's}$$

$$\boxed{= \frac{(a-1)}{a}, a \neq 3, -3, 0, 4}$$

NPV's

$a-3 \overset{+3}{\neq} \overset{+3}{0} \qquad a+3 \overset{-3}{\neq} \overset{-3}{0} \qquad a \neq 0$

$a \neq 3 \qquad a \neq -3 \qquad a-4 \overset{+4}{\neq} \overset{+4}{0}$

$a \neq 4$

4. $\frac{x^2-25}{x^2-49} \cdot \frac{x^2-6x-7}{x^2+6x+5}$

$$= \frac{(x-5)\cancel{(x+5)}}{\cancel{(x-7)}(x+7)} \cdot \frac{\cancel{(x-7)}\cancel{(x+1)}}{\cancel{(x+5)}\cancel{(x+1)}}$$

$$\boxed{= \frac{(x-5)}{(x+7)}; x \neq 7, -7, -5, -1}$$

NPV's

$x-7 \overset{+7}{\neq} \overset{+7}{0} \qquad x+7 \overset{-7}{\neq} \overset{-7}{0} \qquad x+5 \overset{-5}{\neq} \overset{-5}{0} \qquad x+1 \overset{-1}{\neq} \overset{-1}{0}$

$x \neq 7 \qquad x \neq -7 \qquad x \neq -5 \qquad x \neq -1$

Dividing Rationals

- Multiply by the reciprocal of the rational following the division sign
- Divide out common terms only when multiplying
- Restrictions(Non – Permissible Values) apply to anything in the denominator at any time

Reciprocals- Interchange the numerator and denominator

- Examples: $\frac{1}{2} \rightarrow \frac{2}{1}$, $\frac{x^2}{y} \rightarrow \frac{y}{x^2}$, $\frac{a+5}{a} \rightarrow \frac{a}{a+5}$

Examples: Divide and simplify. State non-permissible values.

1. $\frac{6}{5} \div \frac{3}{2}$

$= \frac{\cancel{6}^{2}}{5} \times \frac{2}{\cancel{3}^{1}}$

$= \frac{4}{5}$

2. $\frac{3x^2}{y^2} \div \frac{x}{y}$

$= \frac{3x^{\cancel{2}}}{y^{\cancel{2}}} \times \frac{\cancel{y}}{\cancel{x}}$ ★ Multiply by the reciprocal

NPV's
$y \neq 0$
$x \neq 0$

$\boxed{= \frac{3x}{y}; y \neq 0, x \neq 0}$

3. $\frac{x^2-4}{x^2-4x} \div \frac{x^2+x-6}{x^2+x-20}$

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

$= \frac{\cancel{(x-2)}(x+2)}{x\cancel{(x-4)}} \times \frac{(x+5)\cancel{(x-4)}}{(x+3)\cancel{(x-2)}}$ ★ multiply by the reciprocal

NPV's
$x \neq -5$
$x \neq 4$
$x \neq 0$
$x \neq -3$
$x \neq 2$

$\boxed{= \frac{(x+2)(x+5)}{x(x+3)}; x \neq -5, 4, 0, -3, 2}$

4. $\frac{3x+12}{3x^2-5x-12} \div \frac{12}{3x+4} \times \frac{2x-6}{x+4}$

$\begin{array}{cc|c} 3x & 4 & 4x \\ x & -3 & -9x \\ \hline & & -5x \end{array}$

$= \frac{3(x+4)}{(3x+4)(x-3)} \div \frac{12}{3x+4} \times \frac{2(x-3)}{x+4}$

$= \frac{\cancel{3}^{1}\cancel{(x+4)}}{\cancel{(3x+4)}\cancel{(x-3)}} \cdot \frac{\cancel{3x+4}}{\cancel{12}^{\cancel{6}\,2}} \times \frac{\cancel{2}\cancel{(x-3)}}{\cancel{x+4}}$

NPV's
$x \neq \frac{-4}{3}$
$x \neq 3$
$x \neq -4$

$\boxed{= \frac{1}{2}; x \neq -\frac{4}{3}, 3, -4}$

6.2 Assignment: Page 327 #1,2 3, 8, 14,15,18,19

6.3 Adding/Subtracting Rational Expressions

Review Adding and Subtracting Fractions

a. $\frac{5}{7}-\frac{3}{7}$

$=\frac{2}{7}$

b. $\frac{3\cdot 2}{5\cdot 2}+\frac{1}{10}$

$=\frac{6}{10}+\frac{1}{10}=\frac{7}{10}$

Steps for Add/Subt. Rational Expressions

- Must have a common denominator (add numerators, leave denominators)
- Answer in simplest form (Reduce)
- State any non – permissible values (NPV)

Examples: Simplify the following rational expressions, leave answers in simplest form and state non-permissible values

1. $\frac{2a}{b}-\frac{a-1}{b}$

$=\frac{2a-(a-1)}{b}$

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

$=\frac{a+1}{b}\ ;\ b\neq 0$

Note: When subtracting make sure it applies to all terms.

2. $\frac{x^2}{x-2}+\frac{3x}{x-2}-\frac{10}{x-2}$

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

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

$=x+5\ ;\ x\neq 2$

NPV's

$x\neq 2$

3. $\frac{x\cdot 2x}{x\cdot xy}+\frac{4\cdot y}{x^2\cdot y}$

★ create a common denominator by multiply to create the LCD ★

$=\frac{2x^2}{x^2y}+\frac{4y}{x^2y}$

$=\frac{2x^2+4y}{x^2y}$

$=\frac{2(x^2+2y)}{x^2y}\ ;\ x\neq 0, y\neq 0$

4. $\frac{y^2-20}{y^2-4}+\frac{y-2}{y+2}$

$=\frac{y^2-20}{(y-2)(y+2)}+\frac{y-2}{y+2}\cdot\frac{(y-2)}{(y-2)}$

$=\frac{y^2-20+[(y-2)(y-2)]}{(y-2)(y+2)}$

$=\frac{y^2-20+[y^2-4y+4]}{(y-2)(y+2)}$

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

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

$=\frac{2(y-4)\cancel{(y+2)}}{(y-2)\cancel{(y+2)}}$

$=\frac{2(y-4)}{(y-2)}\ ;\ y\neq \pm 2$

$\boxed{\text{Step 1}}$ Factor numerators & denominators

$\boxed{\text{Step 2}}$ Create a common denominator

$\boxed{\text{Step 3}}$ Add numerators, denominators stay the same

$\boxed{\text{Step 4}}$ Factor & simplify

$\boxed{\text{Step 5}}$ State all NPV's

5. $\frac{x-1}{x^2+x-6}-\frac{x-2}{x^2+4x+3}$

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

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

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

$$= \frac{4x-5}{(x+3)(x-2)(x+1)} \; ; x \neq -3, 2, -1$$

6. $\frac{1+\frac{1}{x}}{x-\frac{1}{x}}$

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

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

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

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

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

$$= \frac{1}{x-1} \; ; x \neq 0, \pm 1$$

7. $\cancel{\frac{x^2-49}{x^2-8x+7}+\frac{2-2x}{x^2-1}}$

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

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

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

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

$$= \frac{x^2+8x+7+2-2x}{(x-1)(x+1)}$$

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

8. $\frac{x+1}{x+6}-\frac{x^2-4}{x^2+2x}\div\frac{2x^2+7x+3}{2x^2+x}$ ☆ Don't forget order of operations ☆

$$= \frac{x+1}{x+6} - \left[\frac{(x-2)\cancel{(x+2)}}{x\cancel{(x+2)}}\right] \div \frac{\cancel{(2x+1)}(x+3)}{x\cancel{(2x+1)}}$$

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

$$= \frac{(x+3) \cdot x+1}{(x+3) \cdot x+6} - \left[\frac{(x-2)\cancel{x} \cdot (x+6)}{\cancel{x}(x+3) \cdot (x+6)}\right]$$

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

$$= \frac{x^2+4x+3 - (x^2+4x-12)}{(x+3)(x+6)}$$

$$= \boxed{\frac{15}{(x+3)(x+6)}}$$

$x \neq 0, -2, -6, -\frac{1}{2}, -3$

6.3 Assignment: Page 336 #1e, 5bf, 6ade, 7ad, 8, 9, 10cd, 12, 15ac

6.4 Rational Equations

- An equation containing at least one rational (fractional) expression
- TO solve , find the LCD and multiply each term by the LCD to eliminate the fractions.
- Check. There may be extraneous roots

Review LCD = 6

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

$3x - 4 \overset{+4}{=} 3^{+4}$

$\frac{3x}{3} = \frac{7}{3}$ $x = \frac{7}{3}$

Example #1 Solve the following rational equations. Check for extraneous roots.

a) $\frac{x}{4} - \frac{7}{x} = 3$ LCD = 4x

$(\cancel{4}x)\frac{x}{\cancel{4}} - \frac{7(4\cancel{x})}{\cancel{x}} = 3(4x)$

$x^2 - 28 = 12x$ $\quad -12x \quad -12x$

$x^2 - 12x - 28 = 0$

$(x-14)(x+2) = 0$

$x - 14 = 0$ (+14, +14) $x + 2 = 0$ (−2, −2)

$x = 14$ $x = -2$

$\boxed{\text{The solution are } x = 14, -2}$

check x = 14

$\frac{14\cdot 14}{4\cdot 14} - \frac{7\cdot 4}{14\cdot 4} = 3$

$\frac{196}{56} - \frac{28}{56} = 3$

$\frac{168}{56} = 3$

$3 = 3$ ✓

Check x = −2

$\frac{-2\cdot -2}{4\cdot -2} - \frac{7\cdot 4}{-2\cdot 4} = 3$

$\frac{4}{-8} - \frac{28}{-8} = 3$

$-\frac{4}{8} + \frac{28}{8} = 3$

$\frac{24}{8} = 3$

$3 = 3$ ✓

b) $\cancel{(x-4)}\frac{2x}{\cancel{x-4}} = \frac{10}{\cancel{x-4}}\cancel{(x-4)}$

$\frac{2x}{2} = \frac{10}{2}$

$x = 5$

check x = 5

$\frac{2(5)}{5-4} = \frac{10}{5-4}$

$10 = 10$ ✓

$\boxed{\text{The solution is } x = 5}$

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

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

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

$x^2 + 2x + 2x - 4 = x^2 - 4$ $\quad (-x^2, +4 \quad -x^2, +4)$

$\frac{4x}{4} = \frac{0}{4}$

$x = 0$

Check x = 0

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

$0 + \frac{2}{2} = 1$

$1 = 1$ ✓

$\boxed{x = \{0\}}$

d) $\frac{9}{y-3} - \frac{4}{y-6} = \frac{18}{y^2 - 9y + 18}$

$\frac{9(y-6)(\cancel{y-3})}{\cancel{y-3}} - \frac{4(\cancel{y-6})(y-3)}{\cancel{y-6}} = \frac{18}{\cancel{(y-6)}\cancel{(y-3)}}\cancel{(y-6)}\cancel{(y-3)}$

$9(y-6) - 4(y-3) = 18$

$9y - 54 - 4y + 12 = 18$

$5y - 42 \overset{+42}{=} 18^{+42}$

$\frac{5y}{5} = \frac{60}{5}$

$y = 12$

Check y = 12

$\frac{9}{12-3} - \frac{4}{12-6} = \frac{18}{12^2 - 9(12) + 18}$

$\frac{9\cdot 6}{9\cdot 6} - \frac{4\cdot 9}{6\cdot 9} = \frac{18}{54}$

$\frac{54}{54} - \frac{36}{54} = \frac{18}{54}$

✓ $\frac{18}{54} = \frac{18}{54}$

$\boxed{Y = \{12\}}$

e) $\frac{3x}{x+2}-\frac{5}{x-3}=\frac{-25}{x^2-x-6}$

Check w npv

$x \neq 3$

$$(x-3)\cancel{(x+2)}\frac{3x}{\cancel{x+2}} - \frac{5}{\cancel{x-3}}\cancel{(x-3)}(x+2) = \frac{-25}{\cancel{(x-3)}\cancel{(x+2)}}\cancel{(x-3)}\cancel{(x+2)}$$

$3x(x-3) - 5(x+2) = -25$

$3x^2 - 9x - 5x - 10 = -25$

$3x^2 - 14x - 10 \overset{+25}{=} -25 \ {+25}$

$3x^2 - 14x + 15 = 0$

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

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

$3x$	-5
x	-3

AS $\boxed{x = \frac{5}{3}}$

Day 1 Assign Pg 348 #1, 2, 3, 6, 8, 11

$\boxed{\text{Day 2}}$

Example #2 Two friends share a paper route. Sheena can deliver the papers in 40min. Jeff can cover the same route in 50min. How long, to the nearest minute, does the paper route take if they work together?

Make a table to organize the information

	Time to Deliver Papers (min)	Fraction of work done in 1min	Fraction of work done in t mins
Sheena	40mins	$\frac{1}{40}$	$\frac{1}{40}(t)$ or $\frac{t}{40}$
Jeff	50mins	$\frac{1}{50}$	$\frac{t}{50}$
Together	t	$\frac{1}{t}$	$\frac{t}{t}$ or 1

The equation for Sheena & Jeff to complete the work together is:

$(200)\frac{t}{40} + (200)\frac{t}{50} = 1(200)$

$5t + 4t = 200$

$\frac{9t}{9} = \frac{200}{9}$

$t = \frac{200}{9}$ or approx. 22.2 min

Check solution because there are no non-permissible values.

$\frac{\left[\frac{200}{9}\right]}{40} + \frac{\left[\frac{200}{9}\right]}{50} = 1$

$\frac{\overset{5}{\cancel{200}}}{9}\left(\frac{1}{\cancel{40}}\right) + \frac{200}{9}\left(\frac{1}{50}\right) = 1$

$\frac{5}{9} + \frac{4}{9} = 1$

$\frac{9}{9} = 1$ ✓

6.4 Rational Equations Word Problems (Day 2)

Example #1 Two friends share a paper route. Sheena can deliver the papers in 40min. Jeff can cover the same route in 50min. How long, to the nearest minute, does the paper route take if they work together?

Make a table to organize the information

Sheena			
Jeff			
Together			

Example #2 A train has a scheduled run of 160km between two cities in Saskatchewan. If the average speed is decreased by 16km/h, the run will take ½ hour longer. What is the average speed of the train?

Note: Distance = Rate × time

Note: $t = \frac{D}{R}$

Average speed of train

	D(Km)	R(Km/h)	T(h)
Normal Run	160Km	x	$\frac{160}{x}$
Decreased Speed Run	160Km	x − 16	$\frac{160}{x} + \frac{1}{2}$

↑ Distances are equal

Normal Run Decreased Speed Run

$$R \times t = R \times t$$

$$\cancel{x}\left(\frac{160}{\cancel{x}}\right) = x-16\left(\frac{160}{x}\frac{(2)}{(2)} + \frac{1}{2}\frac{(x)}{(x)}\right)$$

$$160 = x-16\left(\frac{320}{2x} + \frac{x}{2x}\right)$$

$$(2x)\,160 = x-16\left(\frac{320+x}{\cancel{2x}}\right)\cancel{(2x)}$$

$$320x = (x-16)(320+x)$$

$$\overset{-320x}{320x} = \overset{-320x}{\cancel{320x}} + x^2 - 5120 - 16x$$

$$0 = x^2 - 16x - 5120$$

$$0 = (x^2 - 16x - 5120)$$

$$0 = (x-80)(x+64)$$

$x = 80$ $x = -64$ ← extraneous solution

The average speed was 80km/h

Example #3/ Jerry jogged 9 km in an hour. He covered the last 4 km at a speed that was 2 km/h slower than his speed over the first 5 km. What was his speed over the first 5 km?

$D = R \times t$

$t = \frac{D}{R}$

	Distance	Rate	Time
First 5Km	5Km	x	$\frac{5}{x}$
last 4Km	4Km	$x-2$	$\frac{4}{x-2}$

$$\frac{5}{\cancel{x}}(\cancel{x})(x-2) + \frac{4}{\cancel{x-2}}(x)(\cancel{x-2}) = 1\,(x)(x-2)$$

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

$$\overset{-5x}{5x} \overset{+10}{-10} + \overset{-4x}{4x} = x^2 - 2x \quad \overset{-5x}{\underset{-4x}{}} \quad \overset{+10}{}$$

$$0 = x^2 - 11x + 10$$

$$0 = (x-10)(x-1)$$

$$\boxed{x = 10} \quad x = 1 \leftarrow \text{Extraneous solution}$$

A speed of 1 Km/h would make his rate negative in the last 4Km

Jerry jogged at a speed of 10Km/h for the first 5Km.

6.4 Day 2 Assignment Pg 349#12,13,14, 15,16 and 17