4.3: Rational Equations

What restrictions are on the variable?

20. Solve (a) $\frac{2}{3x}+\frac{1}{4}=\frac{11}{6x}-\frac{1}{3}$ restrictions: $x \neq 0$

Step 1: M! both sides by LCD = $12x$

$$12x\left(\frac{2}{3x}+\frac{1}{4}\right)=\left(\frac{11}{6x}-\frac{1}{3}\right)12x$$

$$4\,12x\cdot\frac{2}{3x}+12x\cdot\frac{1}{4}=12x\cdot\frac{11}{6x}-12x\cdot\frac{1}{3}$$

$$8+3x=22-4x$$

$$7x=14$$

$$x=2$$

(b) $\frac{36}{p^2-9}=\frac{2p}{p+3}-1$ restrictions: $p \neq 3, -3$

Step 1: FACTOR denominators and find LCD

$$(p-3)(p+3)\left(\frac{36}{(p-3)(p+3)}\right)=\left(\frac{2p}{p+3}-1\right)(p-3)(p+3)$$

Step 2: M! both sides by LCD.

$$36=2p(p-3)-(p-3)(p+3)$$

$$36=2p^2-6p-(p^2-9)$$

$$36=2p^2-6p-p^2+9$$

$$0=p^2-6p-27$$

$$0=(p-9)(p+3)$$

$p=9, \cancel{-3}$ makes denom = 0!

$p=9$

(c) $\frac{-8}{t^2-6t}+\frac{t}{t-6}=\frac{1}{t}$

Step 1: Factor denominators
Step 2: M! both sides by LCD

$$t(t-6)\left(\frac{-8}{t(t-6)}+\frac{t}{t-6}\right)=\left(\frac{1}{t}\right)t(t-6)$$

$$-8+t^2=t-6$$

Step 2: Multiply both sides by LCD:

$$t^2-t-2=0$$

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

$t=2, -1$

Practice: PT4, ALEKS PR7

More practice – Text Exercises: 4.3 #13, 15, 19, 23, 27, 29, 35, 39

1.2: Solving for a Variable

$m =$ (no m's!)

21. Solve for *m*: $\frac{3}{k} + \frac{1}{m} = x$

Step 1: Multiply by LCD: $km\left(\frac{3}{k} + \frac{1}{m}\right) = (x)\,km$

$3m + k = xkm$

$-xkm \quad -k \quad -xkm \quad -k$

Step 2: Isolate *m* terms $3m - xkm = -k$

Step 3: Factor out *m* and finish $m(3 - xk) = -k$

$$m = \frac{-k}{3 - xk}$$

4.6: Radical Equations

22. ***T or F?*** F To solve $\sqrt{x-1} - \sqrt{3x+1} = -2$, we can square each term to get $(x-1) - (3x-1) = 4$

Solve $\sqrt{x-1} - \sqrt{3x+1} = -2$

ISOLATE: $\sqrt{x-1}^2 = \left(\sqrt{3x+1} - 2\right)^2$

SQ both sides:

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

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

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

ISOLATE: $4\sqrt{3x+1} = 2x + 6$

$\left(2\sqrt{3x+1}\right)^2 = (x+3)^2$

$4(3x+1) = x^2 + 6x + 9$

$12x + 4 = x^2 + 6x + 9$

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

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

$x = 5, 1$

Check:

$x = 5$: $\sqrt{4} - \sqrt{16} = -2$

$2 - 4 = -2$ ✓

$x = 1$: $\sqrt{0} - \sqrt{4} = -2$

$-2 = -2$ ✓

Practice: PT4, ALEKS PR8

More practice – Text Exercises: 1.2 #77, 79; **4.6** #19, 23, 49