

1.6 Other Equations

GOALS:

Find Solutions to Other Equations:

- I. Polynomial Equations, higher order
- II. Radical Equations
- III. Equations in Quadratic Form
- IV. Equations with Absolute Value

Study 1.6 CVC # 1-11; # 1,5,9,13,... 25;
23, 43, 47, 55, 59, 61-69, 73, 87, 99, 101

Class Notes: Prof. G. Battaly, Westchester Community College, NY

 College Algebra & Trig Home Page

 Homework

1.6 Other Equations

I. Polynomial Equations, order > 2

If possible, factor common factors
or factor by grouping,

Then, use similar techniques as for
quadratic solutions (except no formula).

eg: Solve for x: $5x^4 - 20x^2 = 0$

Class Notes: Prof. G. Battaly, Westchester Community College, NY

 College Algebra & Trig Home Page

 Homework

1.6 Other Equations

I. Polynomial Equations, order > 2

eg: Solve for x: $5x^4 - 20x^2 = 0$

Solve for x:

$$5x^4 - 20x^2 = 0$$

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

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

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

ch: $0 - 0^2 = 0 \checkmark$ $5(16) - 20(4) = 0$ \checkmark
 $80 - 80 = 0 \checkmark$

Class Notes: Prof. G. Battaly, Westchester Community College, NY

[College Algebra & Trig Home Page](#)
[Homework](#)

1.6 Other Equations

I. Polynomial Equations, order > 2

First simplify to form for Zero Product Principle
 ie: $expression = 0$

Solve for x: $x + 1 = 9x^3 + 9x^2$

Class Notes: Prof. G. Battaly, Westchester Community College, NY

[College Algebra & Trig Home Page](#)
[Homework](#)

1.6 Other Equations

I. Polynomial Equations, order > 2

Solve for x: $x + 1 = 9x^3 + 9x^2$

Solve for x:

$$x + 1 = 9x^3 + 9x^2$$

$$9x^3 + 9x^2 - x - 1 = 0$$

$$9x^2(x+1) - (x+1) = 0$$

$$(9x^2 - 1)(x+1) = 0$$

$9x^2 - 1 = 0$	$x + 1 = 0$
$(3x+1)(3x-1) = 0$	$x = -1$
$3x+1=0$	$3x-1=0$
$x = -\frac{1}{3}$	$x = \frac{1}{3}$

ch.
-1 + 1 = 0, -9 + 9 = 0 ✓

$$-\frac{1}{3} + 1 = \frac{2}{3} = \frac{9}{27} + \frac{9}{27} \checkmark \quad \frac{1}{3} + 1 = \frac{4}{3} = \frac{9}{27} + \frac{9}{27} \checkmark$$

Class Notes: Prof. G. Battaly, Westchester Community College, NY

College Algebra & Trig Home Page

Homework

1.6 Other Equations

II. Radical Equations

1. Simplify to the form $\sqrt{u} = v$
2. Then square both members of the equation to get $u = v^2$
3. **Must check** results for extraneous solution

Solve for x: $\sqrt{20 - 8x} = x$

Class Notes: Prof. G. Battaly, Westchester Community College, NY

College Algebra & Trig Home Page

Homework

1.6 Other Equations

II. Radical Equations

Solve for x: $\sqrt{20 - 8x} = x$

$$\begin{aligned} \text{Solve for } x: \quad & \sqrt{20 - 8x} = x \\ (\sqrt{20 - 8x})^2 &= (x)^2 \quad \text{check is} \\ 20 - 8x &= x^2 \quad \text{required!} \\ x^2 + 8x - 20 &= 0 \\ (x + 10)(x - 2) &= 0 \\ x + 10 = 0 & \quad | \quad x - 2 = 0 \\ x = -10 & \quad | \quad x = 2 \\ \text{ck: } \sqrt{20 + 80} &\neq -10 \quad | \quad \sqrt{20 - 16} = 2 \\ & \quad \quad \quad \sqrt{4} = 2 \checkmark \end{aligned}$$

Class Notes: Prof. G. Battaly, Westchester Community College, NY

College Algebra & Trig Home Page

Homework

1.6 Other Equations

II. Radical Equations

Solve for x: $x - \sqrt{x + 11} = 1$

II. Radical Equations

1. Simplify to the form $\sqrt{u} = v$
2. Then square both members of the equation to get $u = v^2$
3. **Must check** results for extraneous solution

Class Notes: Prof. G. Battaly, Westchester Community College, NY

College Algebra & Trig Home Page

Homework

1.6 Other Equations

II. Radical Equations

Solve for x: $x - \sqrt{x+11} = 1$

$$\begin{aligned} \text{Solve for } x: \quad x - \sqrt{x+11} &= 1 \\ -\sqrt{x+11} &= 1-x \\ \sqrt{x+11} &= x-1 \quad \text{check} \\ (\sqrt{x+11})^2 &= (x-1)^2 \quad \text{required!} \\ x+11 &= x^2-2x+1 \\ x^2-3x-10 &= 0 \\ (x-5)(x+2) &= 0 \\ \begin{array}{l|l} x-5=0 & x+2=0 \\ \hline \textcircled{x=5} & x=-2 \end{array} \\ \text{Ch: } 5 - \sqrt{16} &? 1 & -2 - \sqrt{9} &? 1 \\ 5 - 4 &= 1 \checkmark & -2 - 3 &\neq 1 \end{aligned}$$

Class Notes: Prof. G. Battaly, Westchester Community College, NY

College Algebra & Trig Home Page

Homework

1.6 Other Equations

II. Radical Equations

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

1. Simplify to the form $\sqrt{u} = v$ but more complex
 - Start by separating the radicals.
 - Will need to repeat the squaring process.

Class Notes: Prof. G. Battaly, Westchester Community College, NY

College Algebra & Trig Home Page

Homework

1.6 Other Equations

II. Radical Equations

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

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

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

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

requires check

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

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

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

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

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

$$x^2 - 8x + 12 = 0$$

$$(x-2)(x-6) = 0$$

$x-2=0$	$x-6=0$
$x=2$	$x=6$

Check $\sqrt{4-3} - \sqrt{0} = 1$ $\sqrt{9} - \sqrt{4} = 1$

$\sqrt{1} = 1$ ✓

Class Notes: Prof. G. Battaly, Westchester Community College, NY

College Algebra & Trig Home Page

Homework

1.6 Other Equations

III. Equations in Quadratic Form

1. Use substitution to get quadratic form: $u = f(x)$
2. Solve for substituted variable: u
3. Solve for the variable: x

Solve: $4x^4 = 13x^2 - 9$

Class Notes: Prof. G. Battaly, Westchester Community College, NY

College Algebra & Trig Home Page

Homework

1.6 Other Equations

III. Equations in Quadratic Form

Solve: $4x^4 = 13x^2 - 9$

Solve for x: $4x^4 = 13x^2 - 9$

Substitution: $4x^4 - 13x^2 + 9 = 0$ Let $u = x^2$
 then $u^2 = x^4$

Solve for u: $4u^2 - 13u + 9 = 0$ $(-4)(-9) = +36$
 $4u(u-1) - 9(u-1) = 0$ $(-4) + (-9) = -13$
 $(4u-9)(u-1) = 0$

$4u - 9 = 0$	$u - 1 = 0$
$4u = 9$	$u = 1$
$u = \frac{9}{4}$	$x^2 = 1$
$x^2 = \frac{9}{4}$	$x = \pm 1$
$x = \pm \frac{3}{2}$	

Solve for x:

Class Notes: Prof. G. Battaly, Westchester Community College, NY

College Algebra & Trig Home Page

Homework

1.6 Other Equations

III. Equations in Quadratic Form

Solve: $x^{-2} - x^{-1} - 6 = 0$

Class Notes: Prof. G. Battaly, Westchester Community College, NY

College Algebra & Trig Home Page

Homework

1.6 Other Equations

III. Equations in Quadratic Form

Solve: $x^{-2} - x^{-1} - 6 = 0$

Substitution:

Solve for u:

Solve for x:

$$\begin{array}{l} \text{Solve for } x: \quad x^{-2} - x^{-1} - 6 = 0 \\ \quad \quad \quad (x^{-1})^2 - (x^{-1}) - 6 = 0 \\ \text{Let } u = x^{-1}: \quad u^2 - u - 6 = 0 \\ \quad \quad \quad (u-3)(u+2) = 0 \\ \quad \quad \quad \begin{array}{l|l} u-3=0 & u+2=0 \\ \hline u=3 & u=-2 \\ x^{-1}=3 & x^{-1}=-2 \\ \frac{1}{x} = \frac{3}{1} & \frac{1}{x} = \frac{-2}{1} \\ \hline \boxed{x = \frac{1}{3}} & \boxed{x = -\frac{1}{2}} \\ 9 - 3 - 6 \stackrel{?}{=} 0 \checkmark & 4 + 2 - 6 \stackrel{?}{=} 0 \checkmark \end{array} \end{array}$$

Class Notes: Prof. G. Battaly, Westchester Community College, NY

College Algebra & Trig Home Page

Homework

1.6 Other Equations

If a is a real number

IV. Equations with Absolute Value

$$|a| = \begin{cases} a, & \text{if } a \geq 0 \\ -a, & \text{if } a < 0 \end{cases}$$

If $|u| = c$ is true
then $u = c$ or $u = -c$

Solve for x: $|x - 2| = 9$

Class Notes: Prof. G. Battaly, Westchester Community College, NY

College Algebra & Trig Home Page

Homework

1.6 Other Equations

IV. Equations with Absolute Value

Solve for x: $|x + 2| = 9$

Class Notes: Prof. G. Battaly, Westchester Community College, NY

[College Algebra & Trig Home Page](#)[Homework](#)

1.6 Other Equations

IV. Equations with Absolute Value

Solve for x: $|x + 2| = 9$

$$\begin{array}{l} \text{Solve for } x: |x + 2| = 9 \\ x + 2 = 9 \quad | \quad x + 2 = -9 \\ \underline{x = 7} \quad \quad \quad \underline{x = -11} \\ \text{ch: } |7 + 2| = 9 \checkmark \quad \quad \quad | -11 + 2 | = 9 \\ \quad \quad \quad \quad \quad \quad \quad \quad \quad | -9 | = 9 \checkmark \end{array}$$

Class Notes: Prof. G. Battaly, Westchester Community College, NY

[College Algebra & Trig Home Page](#)[Homework](#)

1.6 Other Equations

IV. Equations with Absolute Value

Solve for x: $4|2x - 1| = 36$

To solve, need: $|u| = c$

Class Notes: Prof. G. Battaly, Westchester Community College, NY

[College Algebra & Trig Home Page](#)
[Homework](#)

1.6 Other Equations

IV. Equations with Absolute Value

Solve for x: $4|2x - 1| = 36$

Solve for x: $4 2x - 1 = 36$	
$ 2x - 1 = 9$	
$2x - 1 = 9$	$2x - 1 = -9$
$2x = 10$	$2x = -8$
$x = 5$	$x = -4$
Ch. $4 10 - 1 = 36$	$4 -8 - 1 = 36$
$4 9 = 36 \checkmark$	$4 -9 = 36 \checkmark$

Class Notes: Prof. G. Battaly, Westchester Community College, NY

[College Algebra & Trig Home Page](#)
[Homework](#)

1.6 Other Equations

IV. Equations with Absolute Value

Solve for x: $-4 | 2x - 1 | = 36$

Class Notes: Prof. G. Battaly, Westchester Community College, NY

 College Algebra & Trig Home Page

 Homework

1.6 Other Equations

IV. Equations with Absolute Value

Solve for x: $-4 | 2x - 1 | = 36$

$$| 2x - 1 | = \frac{36}{-4} = -9$$

NOT POSSIBLE:

+ ≠ -

∴ ∅

Class Notes: Prof. G. Battaly, Westchester Community College, NY

 College Algebra & Trig Home Page

 Homework

1.6 Other Equations

To solve, need: $|u| = c$

IV. Equations with Absolute Value

Solve for x: $5|4x| - 9 = 16$

Class Notes: Prof. G. Battaly, Westchester Community College, NY

[College Algebra & Trig Home Page](#)
[Homework](#)

1.6 Other Equations

IV. Equations with Absolute Value

Solve for x: $5|4x| - 9 = 16$

Solve for x: $5|4x| - 9 = 16$
 $5|4x| = 25$
 $|4x| = 5$
 $4x = 5$ $4x = -5$
 $x = \frac{5}{4}$ $x = \frac{-5}{4}$

Class Notes: Prof. G. Battaly, Westchester Community College, NY

[College Algebra & Trig Home Page](#)
[Homework](#)