

## work: 1.6 - Miscellaneous Equations

&lt;&lt; &lt; 1 2 3 4 5 6 7 8 9 10 &gt; &gt;&gt;

Ex. Score: 0 of 1 pt

HW Score: 0% (0 of 19 pts)

Find all real and imaginary solutions to the equation.

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

The solution is {  }.(Type an exact answer, using radicals and  $i$  as needed. Use a comma to separate answers as needed.)

Factor by grouping

$$n^2(n-5) - 1(n-5) = 0$$

$$(n-5)(n^2-1) = 0$$

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

$$n \in \{-1, 1, 5\}$$

Find all real and imaginary solutions to the equation.

$$a^4 - 81 = 0$$

$$a = \square$$

(Use a comma to separate answers as needed.)

$$a^2 + 9 = 0$$

$$a^2 = -9$$

$$a = \pm \sqrt{-9} = \pm 3i$$

$$a^4 - 81 = (a^2)^2 - 81 =$$

$$u^2 - 81, \text{ where } u = a^2$$

$$(u-9)(u+9) \quad a^2 + 9$$

$$= (a^2 - 9)(a^2 + 9) = a^2 - (-9)$$

$$= (a-3)(a+3)(a-3i)(a+3i) = a^2 - (3i)^2$$

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Ex. Score: 0 of 1 pt      HW Score: 0% (0 of 1)

Find all real solutions.

$$\sqrt{x-6} = x-8$$

What is the solution set?  $\{\square\}$   
 (Type an exact answer, using radicals as needed. Use a comma to separate answers as needed.)

$(\sqrt{x-6})^2 = (x-8)^2$        $\mathcal{D}$ : Need  $x-6 \geq 0$   
 $x-6 = x^2 - 16x + 64$        $x \geq 6$   
 $x^2 - 17x + 72 = 0$

$x^2 - 17x + \left(\frac{17}{2}\right)^2 = -72 + \frac{289}{4}$        $\frac{17^2}{17}$   
 $\frac{17}{2} \rightarrow \left(\frac{17}{2}\right)^2 = \frac{289}{4} - 72$   
 $(x - \frac{17}{2})^2 = \frac{1}{4}$        $x = 8, 9$   
 $x - \frac{17}{2} = \pm \sqrt{\frac{1}{4}} = \pm \frac{1}{2}$   
 $x = \frac{17}{2} \pm \frac{1}{2} \rightarrow \frac{18}{2} = 9$   
 $\frac{16}{2} = 8$

$$x^2 - 17x + 72 = 0$$

$$(x-7)(x-10) = 0$$

$$x \in \{7, 10\}$$

Navigation: 1 2 3 4 5 6 7 8 9 10

Ex. Score: 0 of 1 pt HW Score: 0% (0 of 19 pts)

Solve.

$$\sqrt{x+2} + \sqrt{3x+10} = 2$$

$$x = \pm 2$$

$4 + \sqrt{22} = 2$ ? No  $x=2$  doesn't check!

Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

A. The solution set is  $\{\square\}$ .  
(Simplify your answer. Type an integer or a fraction. Use a comma to separate answers as needed.)

B. There is no solution.

$$\sqrt{3x+10} = 2 - \sqrt{x+2}$$

$$(\sqrt{3x+10})^2 = (2 - \sqrt{x+2})^2$$

$$3x+10 = x - 4\sqrt{x+2} + 6$$

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

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

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

$$x^2+4x+4 = 4x+8$$

$$x^2-4 = 0$$

$$x = \pm 2$$

$$(2-b)^2 = 2^2 - 2(2)b + b^2$$

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

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

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

<< < 1 2 3 4 5 6 7 8 9 10 > >>  
 Ex. Score: 0 of 1 pt HW Score: 0% (0 of 19 pts)

Find all real solutions.

$$x^{2/7} = 2$$

$$x = \square$$

(Simplify your answer. Use a comma to separate answers as needed. Type an exact answer, using radicals as needed.)

$$\begin{aligned}
 x^{2/7} &= 2 \\
 (x^{2/7})^7 &= 2^7 \\
 x^2 &= 2^7 \\
 x &= \sqrt[2]{2^7} = \sqrt{2^7} = \sqrt{2^6 \cdot 2} = 2^{3/2} \sqrt{2} = 2^3 \sqrt{2} \\
 &= \sqrt{\frac{2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2}{2 \cdot 2 \cdot 2 \cdot \sqrt{2}}}
 \end{aligned}$$

$$2^{7/2} = 2^{3 + 1/2} = 2^3 \cdot 2^{1/2} = 8\sqrt{2}$$

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Ex. Score: 0 of 1 pt HW Score: 0% (0 of 19 pts)

Find all real and imaginary solutions to the equation. Check your answer.

$$x^4 - 27x^2 + 176 = 0$$

The solution set is  $\{\square\}$ .

(Simplify your answer. Type an exact answer, using radicals as needed. Express complex numbers in terms

of  $i$ . Use a comma to separate answers as needed.)

$$u^2 - 27u + 176, \text{ if } u = x^2$$

$$a=1, b=-27, c=176$$

$$b^2 - 4ac = (-27)^2 - 4(1)(176) = 25 \text{ factors!}$$

$$u^2 - 16u - 11u + 176$$

$$u(u-16) - 11(u-16)$$

$$(u-16)(u-11)$$

$$(x^2-16)(x^2-11)$$

$$(x-\sqrt{16})(x+\sqrt{16})(x-\sqrt{11})(x+\sqrt{11})$$



~~$\sqrt{176} = 4\sqrt{11}$~~  No help.  
Factoring looks hard.

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Ex. Score: 0 of 1 pt HW Score: 0% (0 of 1)

Find all real and imaginary solutions to the equation.

$$(x^2 - 6x)^2 - 50(x^2 - 6x) - 275 = 0$$

Let  $u = x^2 - 6x$

The solution set is  $\{\ \ \ \ \}$ .

(Type an exact answer, using radicals as needed. Use a comma to separate answers as needed.)

$$\begin{aligned} u^2 - 50u - 275 &= 0 \\ u^2 - 55u + 5u - 275 &= 0 \\ u(u - 55) + 5(u - 55) &= 0 \\ (u - 55)(u + 5) &= 0 \end{aligned}$$

$$\begin{array}{r} 5 \overline{) 275} \\ \underline{5 \ 55} \\ 11 \end{array}$$

$$\begin{aligned} x^2 - 6x - 55 &= 0 \\ x^2 - 11x + 5x - 55 &= 0 \\ x(x - 11) + 5(x - 11) &= 0 \\ (x + 5)(x - 11) &= 0 \\ x &\in \{-5, 11\} \end{aligned}$$

$$\begin{aligned} x^2 - 6x + 5 &= 0 \\ (x - 5)(x - 1) &= 0 \\ x &\in \{1, 5\} \end{aligned}$$

or

$$x \in \{-5, 1, 5, 11\}$$

1 2 3 4 5 6 7 8 9 10

Ex. Score: 0 of 1 pt HW Score: 0% (0 of 19 pts)

Find all real and imaginary solutions to the equation. Check your answers.

$$q - 4q^{\frac{1}{2}} + 3 = 0$$

Let  $u = q^{\frac{1}{2}}$ .

The solution set is  $\{\square\}$ .  
(Simplify your answer. Type an exact answer, using radicals as needed. Express complex numbers in terms of  $i$ .)

$$u^2 - 4u + 3 = 0$$
$$(u-3)(u-1) = 0$$

$u = 1$	$u = 3$
$q^{\frac{1}{2}} = 1$	$q^{\frac{1}{2}} = 3$
$q = 1$	$q = 9$

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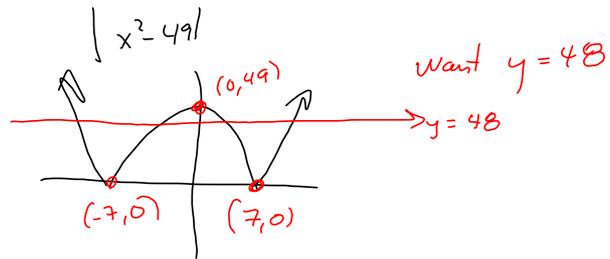
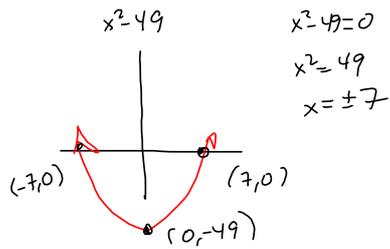
Ex. Score: 0 of 1 pt HW Score: 0% (0 of 1)

Solve the absolute value equation.

$$|x^2 - 49| = 48$$

x =

(Use a comma to separate answers as needed. Type an exact answer, using radicals as needed.)



$$|A| = B$$

$$A = B \quad \text{or} \quad A = -B$$

$$x^2 - 49 = 48 \quad \text{or} \quad x^2 - 49 = -48$$

$$x^2 = 97$$

$$x = \pm \sqrt{97}$$

$$x^2 = 1$$

$$x = \pm 1$$



<< < 1 2 3 4 5 6 7 8 9 10 > >>

Ex. Score: 0 of 1 pt HW Score: 0% (0 of 1)

Solve.  $x^2 - 3x = 5x$  or  $x^2 - 3x = -5x$   
 $|x^2 - 3x| = 5x \implies x^2 - 8x = 0$   $x^2 + 2x = 0$

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What is the solution set?  $x(x-8) = 0$   $x(x+2) = 0$

(Type an exact answer, using radicals as needed. Use a comma to separate answers as needed.)

$$x \in \{-2, 0, 8\}$$

11 12 13 14 15 16 17 18 19

Ex. Score: 0 of 1 pt HW Score: 0% (0 of 1)

Solve.

$$|x + 16| = |2x + 2|$$

What is the solution set?

(Type an exact answer, using radicals as needed. Use a comma to separate answers as needed.)

$$\begin{array}{l} x + 16 = 2x + 2 \quad \text{or} \quad x + 16 = -(2x + 2) = -2x - 2 \\ -x = -14 \qquad \qquad \qquad 3x = -18 \\ x = 14 \qquad \qquad \qquad x = -6 \end{array}$$

Ex. Score: 0 of 1 pt HW Score: 0% (0 of 15)

Solve the equation.

$v^6 - 64 = 0$

①  $v^6 = v^{2 \cdot 3} = (v^2)^3, 64 = 4^3$

②  $v^6 = v^{3 \cdot 2} = (v^3)^2, 64 = 8^2$

The real solutions are  $v = \square$ .

(Type an exact answer, using radicals as needed. Use a comma to separate answers as needed.)

① Let  $u = v^2$ . Then we have

$$(v^2)^3 - 4^3 = 0$$

$$u^3 - 4^3 = 0$$

$$(u-4)(u^2 + 4u + 4^2) = 0$$

$$v^2 - 4 = 0$$

$$v^2 = 4$$

$$v = \pm 2$$

$$(v^2)^2 - 4v^2 + 16 = 0$$

$$v^4 - 4v^2 + 16 = 0$$

$$u^2 - 4u + 16 = 0$$

Need to take square roots of non-real #s.  
Don't have the skill.

② Let  $u = v^3$ . Then we have

$$(v^3)^2 - 8^2$$

$$(v^3 - 8)(v^3 + 8) = (u^2 - 8)(u^2 + 8)$$

$$v^3 - 8 = 0$$

$$v^3 + 8 = 0$$

$$(v-2)(v^2 + 2v + 4) = 0$$

$$(v+2)(v^2 - 2v + 4) = 0$$

$$v = \pm 2$$

$$v^2 + 2v + 4 = 0$$

$$v^2 - 2v + 4 = 0$$

$$v^2 + 2v + 1^2 = -4 + 1$$

$$v^2 - 2v + 1^2 = -4 + 1$$

$$(v+1)^2 = -3$$

$$(v-1)^2 = -3$$

$$v+1 = \pm \sqrt{3} i$$

$$v-1 = \pm \sqrt{3} i$$

$$v = -1 \pm \sqrt{3} i$$

$$v = 1 \pm \sqrt{3} i$$



Ex. Score: 0 of 1 pt HW Score: 0% (0 of 1)

Solve the equation.

$$\sqrt[3]{5+x-5x^2} = x$$

What is the solution set?

(Type an exact answer, using radicals as needed. Use a comma to separate answers as needed.)

$$\sqrt[3]{-5x^2+x+5} = x$$

$$\left(\sqrt[3]{-5x^2+x+5}\right)^3 = x^3$$

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

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

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

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

$$x \in \{\pm 1, -5\}$$

<< < 11 12 13 14 15 16 17 18 19 > >>

Ex. Score: 0 of 1 pt

Solve the equation for all real and imaginary solutions.

$$\left(\frac{x-7}{2}\right)^2 - 2\left(\frac{x-7}{2}\right) + 17 = 0$$


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The solution set is  $\{\square \pm \square i\}$ .

Let  $u = \left(\frac{x-7}{2}\right)$ . Then

$$u^2 - 2u + 17 = 0$$

$$u^2 - 2u = -17$$

$$u^2 - 2u + 1^2 = -17 + 1$$

$$(u-1)^2 = -16$$

$$u-1 = \pm 4i$$

$$u = 1 \pm 4i$$

$$\frac{x-7}{2} = 1 \pm 4i$$

$$x-7 = 2 \pm 8i$$

$$x = 7 + 2 \pm 8i$$

$$x = 9 \pm 8i$$

<< < 11 12 13 14 15 16 17 18 19 > >>

Ex. Score: 0 of 1 pt HW Score: 0% (0 of 19 pts)

Solve the equation.

$$u^{\frac{2}{3}} = 5$$

$$(4x-1)^{2/3} = 5$$

x =

(Simplify your answer. Use a comma to separate answers as needed. Type an exact answer, using radicals as needed.)

$$\begin{aligned}
 \left(u^{\frac{2}{3}}\right)^3 &= 5^3 & u^{\frac{2}{3}} &= 5 \\
 u^2 &= 5^3 & \left(u^{\frac{2}{3}}\right)^{\frac{3}{2}} &= 5^{\frac{3}{2}} \\
 u &= \pm \sqrt{5^3} & &= \pm \sqrt{125} = \pm 5\sqrt{5} \\
 u &= \pm 5\sqrt{5} \\
 4x-1 &= \pm 5\sqrt{5} \\
 4x &= 1 \pm 5\sqrt{5} \\
 x &= \frac{1 \pm 5\sqrt{5}}{4}
 \end{aligned}$$



Ex. Score: 0 of 1 pt

Solve the equation.

$$|x^2 - 100| = x - 10$$

The solution set is  $\{\square\}$ .

Ex. Score: 0 of 1 pt HW Score: 0% (0 of 19 pts)

According to a certain organization's rules, the maximum sail area  $S$  for a boat with length  $L$  (in meters) and displacement  $D$  (in cubic meters) is determined by the equation given below.

$$L + 1.25S^{\frac{1}{2}} - 9.8D^{\frac{1}{3}} = 16.296$$

Find  $S$  for a boat with length 22.29 m and displacement  $19.25 \text{ m}^3$ .

The maximum sail area for a boat with length 22.29 m and displacement  $19.25 \text{ m}^3$  is  $S = \square \text{ m}^2$ .

(Round the final answer to two decimal places as needed. Round all intermediate values to five decimal places as needed.)

$$22.29 + 1.25S^{\frac{1}{2}} - 9.8(19.25)^{\frac{1}{3}} = 16.296 \quad \text{Solve for } S$$

$$a + 1.25S^{\frac{1}{2}} - b(c)^{\frac{1}{3}} = D$$

$$1.25S^{\frac{1}{2}} = D - a + b(c)^{\frac{1}{3}}$$

$$S^{\frac{1}{2}} = \frac{D - a + b \cdot c^{\frac{1}{3}}}{1.25}$$

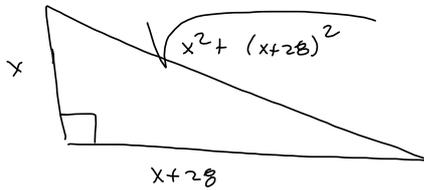
$$S = \left( \frac{D - a + b \cdot c^{\frac{1}{3}}}{1.25} \right)^2 = \left( \frac{16.296 - 22.29 + 9.8(19.25)^{\frac{1}{3}}}{1.25} \right)^2$$

$$\approx 262.9724388$$

Ex. Score: 0 of 1 pt HW Score: 0% (0 of 19 pts)

A sign in the shape of a right triangle has one leg that is 28 inch(es) longer than the other leg. What is the length of the shorter leg if the perimeter is 120 inches?

The length of the shorter leg is  inches.



Want x



$$x + x + 28 + \sqrt{x^2 + (x+28)^2} = 120$$

$$\sqrt{x^2 + (x+28)^2} = 120 - 28 - 2x$$

$$\frac{92}{4}$$

$$368$$

$$\sqrt{x^2 + x^2 + 56x + 784} = -2x + 92$$

$$2x^2 + 56x + 784 = 4x^2 - 368x + 8464$$

$$x^2 + 28x + 392 = 2x^2 - 184x + 4232$$

$$-x^2 - 28x - 392 = -x^2 - 28x - 392$$

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$$0 = x^2 - 212x + 3830$$

$$x^2 - 212x + 3830$$

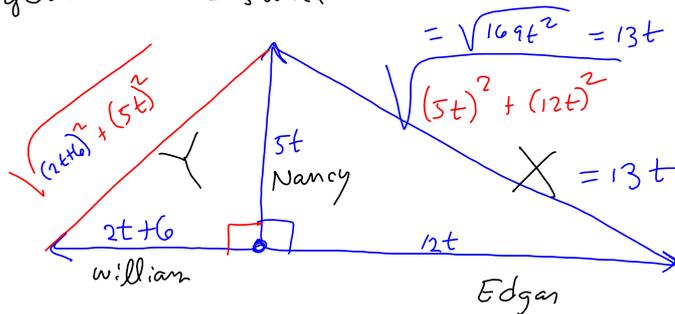
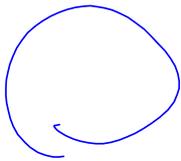
Ex. Score: 0.67 of 1 pt HW Score: 77.19% (14.67 of 19 pts) 17 of 19

William, Nancy, and Edgar met at the lodge at 8 A.M., and William began hiking west at 2 mph. At 11 A.M., Nancy began hiking north at 5 mph and Edgar went east on a three-wheeler at 12 mph. At what time was the distance between Nancy and Edgar 17 mi greater than the distance between Nancy and William?

The distance between Nancy and Edgar will be 17 mi greater than the distance between Nancy and William at : :  (Type whole numbers. Round to the nearest minute as needed.)

William hiking west @ 2 mph start @ 8am  
 Nancy hiking North @ 5 mph " " 11am  
 Edgar 4-wheeling East @ 12 mph

When is Distance from Nancy to Edgar 17 mi greater than Distance " " William?



$t =$  hours traveled by Nancy

William's hiking 3 extra hours.

$$D_w = 2t + (2)(3) = 2t + 6$$

$$D_N = 5t$$

$$D_E = 12t$$

Want to know  $t$  when  $X = Y + 17$

$$\sqrt{(2t+6)^2 + 25t^2} = 13t - 17$$

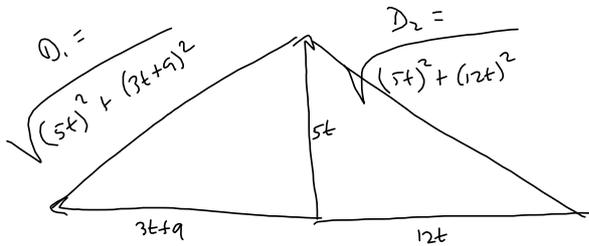
38.72763372

$$2.645460562 \text{ hrs} \approx 2 \text{ hrs} + (.645460562 \text{ hrs}) \left( \frac{60 \text{ min}}{1 \text{ hr}} \right)$$

$$\approx 2 \text{ hrs}, 39 \text{ min}$$

$$11 \text{ am} + 2 \text{ hrs}, 39 \text{ min}$$

$$1:39 \text{ pm}$$



$t =$  time Nancy & Edan are ~~walking~~ traveling

$D = 5t$  Nancy

$D = 12t$  Edgan

& William has 3-hr head start  
 $(3)(3) = 9$  mi head start.

So  $D = 3t + 9$  for William.

Want  $D_2 = D_1 + 14$

$(5t)^2 = 25t^2$

$(3t+9)^2 = 9t^2 + 54t + 81$

$D_1 = \sqrt{34t^2 + 54t + 81}$

$(12t)^2 = 144t^2$

$D_2 = \sqrt{144t^2 + 25t^2} = \sqrt{169t^2} = 13t$

Want  $D_2 - D_1 - 14 = 0$

$13t - \sqrt{34t^2 + 54t + 81} - 14 = 0$

4 min  $D_2 - 14 = D_1$   
 $13t - 14 = \sqrt{\text{mess}}$

$(D_2 - 14)^2 = D_1^2 \rightarrow 169t^2 - 364t + 196 = (\sqrt{\text{mess}})^2$

$169t^2 - 364t + 196 = 34t^2 + 54t + 81$

$135t^2 - 418t + 115 = 0$

2.7911

$2 \text{ hrs} + (.7911 \text{ hrs}) \left( \frac{60 \text{ min}}{1 \text{ hr}} \right)$

$\approx 2:47$

Add 2 hrs 47 min to ~~8:00~~ 11am:

10:47 am

$$\begin{array}{r} 169 \\ 13 \\ \hline 182 \\ 2(182) = 364 \\ \hline 196 \\ -81 \\ \hline 115 \end{array}$$

$$= \sqrt{34t^2 + 54t + 81}$$

$$= \sqrt{9t^2 + 54t + 81 + 25t^2}$$

$$= \sqrt{(3t+9)^2 + (5t)^2}$$

$$\sqrt{(5t)^2 + (12t)^2} = \sqrt{25t^2 + 144t^2} = \sqrt{169t^2}$$

$$= 13t| = 13t, \text{ since } t \geq 0,$$

$$w \& \text{ Nancy } D_1 = \sqrt{34t^2 + 54t + 81}$$

$$\text{Edgar \& Nancy } D_2 = 13t$$

$$\text{Want } D_2 - 14 = D_1$$

$$13t - 14 = \sqrt{34t^2 + 54t + 81}$$

$$\text{Want } 13t - 14 - \sqrt{34t^2 + 54t + 81} = 0$$

w & n got  
 3-hr head-start  
 @ 3mph