1-11 HW Answer Key

1. 64, {3, 1/3}
2. 29, $\left\{\frac{3\pm\sqrt{29}}{2}\right\}$
3. 153, $\left\{\frac{-7\pm3\sqrt{17}}{4}\right\}$ $\sqrt{153}$ simplifies!
4. 97, $\left\{\frac{-7\pm\sqrt{97}}{-6}\right\}$ or $\left\{\frac{7\pm\sqrt{97}}{6}\right\}$
5. 1.4 seconds
6. $(y-8)(y^2+8y+64)$
7. {-1, 5}
8. {0, 1/2}
9. {-2, 1/2}
10. $2a^2b^2-3b^3c-b^4-2a^3+3abc+ab^2$

Find the zeros/roots of the functions/equations using the quadratic formula. Leave all solutions in simplest radical form. Find the discriminant first.

1. $f(x) = 3x^2 - 10x + 3$

$3x^2 - 10x + 3 = 0$

Disc $= (-10)^2 - 4(3)(3)$

$= 100 - 36$

$= 64$

$x = \frac{-(-10) \pm \sqrt{64}}{2(3)}$

$x = \frac{10 \pm 8}{6}$ $\quad x = \frac{10+8}{6} = 3$ $\quad x = \frac{10-8}{6} = \frac{1}{3}$

$\{3, 1/3\}$

2. $h(x) = x(x - 3) - 5 = 0$

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

Disc $= (-3)^2 - 4(1)(-5) = 9 + 20$

$D = 29$

$x = \frac{-(-3) \pm \sqrt{29}}{2(1)} = \frac{3 \pm \sqrt{29}}{2}$

$\left\{\frac{3 \pm \sqrt{29}}{2}\right\}$

3. $2x^2 + 7x - 13 = 0$

Disc $= (7)^2 - 4(2)(-13)$

$= 49 + 104$

$= 153$

$x = \frac{-7 \pm \sqrt{153}}{2(2)} = \frac{-7 \pm \sqrt{9}\sqrt{17}}{4}$

$x = \frac{-7 \pm 3\sqrt{17}}{4}$ $\quad \left\{\frac{-7 \pm 3\sqrt{17}}{4}\right\}$

4. $-3x^2 + 7x = -4$

$-3x^2 + 7x + 4 = 0$

Disc $= (7)^2 - 4(-3)(4)$

$= 49 + 48 = 97$

$x = \frac{-7 \pm \sqrt{97}}{2(-3)} = \frac{-7 \pm \sqrt{97}}{-6}$

$\left\{\frac{-7 \pm \sqrt{97}}{-6}\right\}$ or $\left\{\frac{7 \pm \sqrt{97}}{6}\right\}$

5. In a shot put event, Jamie tosses her last shot from a position of about 5' above the ground with an initial vertical and horizontal velocity of 18 ft/sec. The height of the shot is modeled by the function $h(t) = -16t^2 + 18t + 5$, where t is the time in seconds after the toss. Algebraically determine how long it takes the shot to reach the ground. Round to the nearest tenth.

① $h(t) = 0$

② $-16t^2 + 18t + 5 = 0$

$16t^2 - 18t - 5 = 0$

Disc $= (-18)^2 - 4(16)(-5)$

$= 324 + 320$

$= 644$

$x = \frac{18 \pm \sqrt{644}}{2(16)}$

$x = \frac{18 \pm \sqrt{644}}{32}$

$x = \frac{18 + \sqrt{644}}{32}$ $\quad x = \frac{18 - \sqrt{644}}{32}$

$x = 1.355$ $\quad x = -.2305$ reject

1.4 seconds

6. Factor $y^3 - 512$. $= (y-8)(y^2+8y+64)$

$a=y$
$b=8$

Solve the following by factoring.

7. $x^2 - 4x = 5$

$x^2-4x-5=0$ $P=-5$ $S=-4$ $1, -5$

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

$x=-1 \mid x=5$

$\{-1, 5\}$

8. $6x^2 - 3x = 0$

$3x(2x-1)=0$

$3x=0 \mid 2x-1=0$

$x=0 \mid x=1/2$

$\{0, 1/2\}$

9. $2x^2 + 3x - 2 = 0$ $P=-4, S=3$ $-1, 4$

$2x^2+4x-1x-2=0$

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

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

$x=-2 \mid 2x-1=0$

$x=1/2$

$\{-2, 1/2\}$

10. Simplify $(2a^2 - 3bc - b^2)(b^2 - a)$.

$=b^2(2a^2-3bc-b^2)-a(2a^2-3bc-b^2)$

$=2a^2b^2-3b^3c-b^4-2a^3+3abc+ab^2$

1-12: Solve Quadratic Equations Using the Square Root Property and Completing the Square

Many quadratic equations contain expressions that cannot be easily factored. For these equations, you can use square roots to find roots.

Know it! Note — **Square-Root Property**

WORDS	NUMBERS	ALGEBRA
To solve a quadratic equation, you can take the square root of both sides. Be sure to consider the positive and negative square roots.	$x^2 = 15$ $\lvert x \rvert = \sqrt{15}$ $x = \pm\sqrt{15}$	If $x^2 = a$ and a is a nonnegative real number, then $x = \pm\sqrt{a}$.

Example: Find the roots of the equations.

Not Normal!

1. $4x^2 - 2 = 5$

$$\frac{4x^2}{4} = \frac{7}{4}$$
$$\sqrt{x^2} = \sqrt{\frac{7}{4}} = \frac{\sqrt{7}}{\sqrt{4}}$$
$$x = \frac{\pm\sqrt{7}}{2} \qquad \left\{\pm\frac{\sqrt{7}}{2}\right\}$$

2. $x^2 - 10x + 25 = 27$

$$(x-5)(x-5) = 27$$
$$\sqrt{(x-5)^2} = \sqrt{27}$$
$$x - 5 = \pm\sqrt{9}\sqrt{3} = \pm 3\sqrt{3}$$
$$x = 5 \pm 3\sqrt{3}$$

The method used in the previous examples can only be used for expressions that factor to perfect squares.

If a quadratic expression in the form $x^2 + bx$ does not factor as a perfect square, we can add a term to both sides of an equation to form a perfect square trinomial. This is called completing the square.

Example: Solve each equation by completing the square. $x^2 = 12x - 20$

a

Steps:

1. Coefficient of x^2 must be 1 $a=1$

(÷ by "a" if necessary, there can be no "a" coefficient!)

2. Get equation into the form: $x^2 + bx = constant$

$x^2 - 12x = -20$

3. Divide linear term (b) by 2 and then square it.

$x^2 - 12x + \boxed{36} = -20 + \boxed{36}$

4. Add that number from step 3 to both sides: $\left(\frac{b}{2}\right)^2 = \left(\frac{-12}{2}\right)^2 = 36$

5. Factor left side (Looks like: $\left(x + \frac{b}{2}\right)^2 = \_\_\_\_$)

$(x-6)(x-6) = 16$

$\sqrt{(x-6)^2} = \sqrt{16}$

6. Take square root of both sides (Don't forget ±)

$x - 6 = \pm 4$

7. Solve for "x" (2 cases)

$x = 6 \pm 4$

$6+4=10$

$6-4=2$

$\{2, 10\}$

1. $\frac{3x^2-24x}{3}=\frac{27}{3}$

$\left(\frac{-8}{2}\right)^2$

$x^2-8x=9$

$x^2-8x+\boxed{16}=9+\boxed{16}$

$\sqrt{(x-4)^2}=\sqrt{25}$

$x-4=\pm 5$

$x=4\pm 5$

$\{9,-1\}$

2. $\frac{18x+3x^2}{3}=\frac{45}{3}$

$\left(\frac{6}{2}\right)^2$

$6x+x^2=15$

$x^2+6x+\boxed{9}=15+\boxed{9}$

$\sqrt{(x+3)^2}=\sqrt{24}$

$x+3=\pm\sqrt{4}\sqrt{6}$

$x=-3\pm 2\sqrt{6}$

3. $x^2-2=9x$ not a good of comp. the square because b is odd!

$x^2-9x=2$

$\left(\frac{-9}{2}\right)^2=\frac{81}{4}$

Leave fractions!

$x^2-9x+\boxed{81/4}=2+\boxed{81/4}$

$\sqrt{\left(x-\frac{9}{2}\right)^2}=\sqrt{\frac{89}{4}}$

$x-\frac{9}{2}=\frac{\pm\sqrt{89}}{\sqrt{4}\,2}$

$x=\frac{9}{2}\pm\frac{\sqrt{89}}{2}$ or $\frac{9\pm\sqrt{89}}{2}$

Choosing which method to use to solve quadratics takes as much skill as being able to use these methods. This chart may help.

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Summary of Solving Quadratic Equations		
Method	**When to Use**	**Examples**
Factoring	$c = 0$ or the expression is easily factorable.	$x^2 + 4x + 3 = 0$ $(x + 3)(x + 1) = 0$ $x = -3$ or $x = -1$
Square roots	The variable side of the equation is a perfect square.	$(x - 5)^2 = 24$ $\sqrt{(x-5)^2} = \pm\sqrt{24}$ $x - 5 = \pm 2\sqrt{6}$ $x = 5 \pm 2\sqrt{6}$
Completing the square	$a = 1$ and b is an even number.	$x^2 + 6x = 10$ $x^2 + 6x + \square = 10 + \square$ $x^2 + 6x + \left(\frac{6}{2}\right)^2 = 10 + \left(\frac{6}{2}\right)^2$ $(x + 3)^2 = 19$ $x = -3 \pm \sqrt{19}$
Quadratic Formula	Numbers are large or complicated, and the expression does not factor easily.	$5x^2 - 7x - 8 = 0$ $x = \frac{-(-7) \pm \sqrt{(-7)^2 - 4(5)(-8)}}{2(5)}$ $x = \frac{7 \pm \sqrt{209}}{10}$

Which method do you like the best? Why?