Name	Date	Class

Challenge 5-6 *Relating Roots and Coefficients of a Quadratic Equation*

The general solution of the quadratic equation $ax^2 + bx + c = 0$ can be written in terms of the coefficients *a*, *b*, and *c*, and this solution is known as the Quadratic Formula. You can explore some other relationships between the roots and the coefficients.

1. Complete the table below.

	Equation	Roots	Sum of the Roots	Product of the Roots
a.	$x^2-6x+8=0$			
b.	$x^2 - 7x + 12 = 0$			
c.	$x^2 + 2x - 35 = 0$			
d.	$4x^2-8x+3=0$			
e.	$9x^2+3x-2=0$			

- **2.** Refer to the table above. Let the roots of the quadratic equation $ax^2 + bx + c = 0$ be represented by r_1 and r_2 .
 - **a.** Express the sum of the roots in terms of the coefficients of the equation.

 $r_1 + r_2 =$

b. Express the product of the roots in terms of the coefficients of the equation.

 $r_1 r_2 =$

Use the relationships between roots and coefficients that you wrote in Exercise 2. Verify your answer by solving the equation.

- 3. Write a quadratic equation whose roots are $2 + \sqrt{5}$ and $2 \sqrt{5}$.
- **4.** The sum of the roots of $5x^2 kx 3 = 0$ is equal to the product of the roots. Determine the value of *k*.
- 5. Without solving, decide which numbers are the roots of $9x^2 6x 1$.

A.
$$1 \pm \sqrt{2}$$
 B. $1 \pm \sqrt{3}$ **C.** $\frac{1 \pm \sqrt{2}}{3}$ **D.** $\frac{1 \pm \sqrt{3}}{2}$

6. Which of these equations has $\frac{-5 \pm \sqrt{17}}{2}$ as its solutions?

- **A.** $x^2 + 5x + 2 = 0$ **B.** $x^2 + 5x 2 = 0$
- **C.** $x^2 5x 2 = 0$ **D.** $x^2 5x + 2 = 0$

LESSON	Reteach				LESSON	Challenge			
5-6	The Quadratic	Formula (continue	ed)				s and Coe	efficients of a Q	uadratic Equation
The dis	scriminant of $ax^2 + bx$	$c + c = 0 \ (a \neq 0) \text{ is } b^2 - b^2$	4 <i>ac</i> .					ion $ax^2 + bx + c = 0$	
		ine the number of roots o		on. A quadratic				c, and this solution is some other relationship	
		ions, 1 real solution, or 2	complex solutions.		betwee	n the roots and the co	efficients.		
Find the	e type and number of s	olutions.			1. Co	mplete the table below	ι.		
	$2x^2-5x=3$	$x^2 + 10x = -25$	3x ²	-4x = -2		Equation	Roots	Sum of the Roots	Product of the Roots
	the equation in	Write the equation in		equation in	a.	$x^2-6x+8=0$	4, 2	6	8
	ard form: 5x - 3 = 0	standard form: $x^{2} + 10x + 25 = 0$	standard f $3x^2 - 4x$		b.	$x^2 - 7x + 12 = 0$	4, 3	7	12
	b = -5, c = -3	x + 10x + 25 = 0 a = 1, b = 10, c = 25		+2 = 0 = -4, c = 2	с.	$x^2 + 2x - 35 = 0$	5, -7	-2	-35
	, $D = -5$, $C = -3$ ate the discriminant:	a = 1, b = 10, c = 25 Evaluate the discrimina		= -4, c = 2 he discriminant:			1 3		3
$b^2 - 4$		$b^2 - 4ac$	$b^2 - 4ac$	ne discriminant.	d.	$4x^2-8x+3=0$	$\frac{1}{2}, \frac{3}{2}$	2	4
-	$^{2} - 4(2)(-3)$	$(10)^2 - 4(1)(25)$	$(-4)^2 - 4ac$	4(3)(2)	e.	$9x^2 + 3x - 2 = 0$	1_2	_1	_2
25 + 2		100 - 100	16 - 24	(U)(L)	с.	37 1 37 2 - 0	3' 3	3	9
49		0	-8			fer to the table above.			
When	$b^{2}-4ac>0,$	When $b^2 - 4ac = 0$, the term of ter	he When b ²	- 4 <i>ac</i> < 0, the		-		e represented by r_1 and	id r ₂ .
	quation has 2 real	equation has 1 real so	ution. equation h	nas 2 complex		Express the sum of the the coefficients of the		ns of r ⊥ r	$-r_1 + r_2 = -\frac{k_1}{2}$
solutio	ons.		solutions.			Express the product of	•		$r_1 + r_2 = -\frac{r_1}{a}$
						the coefficients of the		r ₁ r ₂	$r_1 r_2 = \frac{c}{a}$
		solutions for each equat							
		4. $x^2 - 4x = -7$	5. $x^2 - 7x$			e relationships betwe cise 2. Verify your an		coefficients that you ing the equation.	wrote
x ² -	-12x + 36 = 0	$x^2 - 4x + 7 =$	$= 0 x^2 -$	-7x + 3 = 0		ite a quadratic equatio	-	•	2
		a = 1, b = -4,				$2 + \sqrt{5}$ and $2 - \sqrt{5}$.			$x^2 - 4x - 1 =$
a =	<u>,</u> $b = -12$, $c = -3$	a = 1, b = -4,	a = 1, 1	-1, c = 3		e sum of the roots of 5			k = -3
b² -	- 4 <i>ac</i> =	$b^2 - 4ac =$	b ² - 4a	ac =		product of the roots.			
	0					-		are the roots of $9x^2$ –	
	0			37	A.	$1 \pm \sqrt{2}$ B. $1 \pm \sqrt{2}$	3 C . <u>1</u> ±	$\frac{\sqrt{2}}{3}$ D. $\frac{1 \pm \sqrt{3}}{2}$	C
Clas	ssify solutions:	Classify solutions:	Classify	solutions:				-	
	1 real solution	2 complex solut	ions 2 r	eal solutions	6. Wh	nich of these equations	has $\frac{-5 \pm \sqrt{2}}{2}$	as its solutions?	
		2 comprex coru			A.	$x^2+5x+2=0$	B. x ²	+5x-2=0	
					c	$x^2 - 5x - 2 = 0$	D x ²	-5x + 2 = 0	А
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rights reserv	/ Holt, Rinehart and Winston. ved.	47		HUIL AIYEDI'A Z	All rights rese	erved.		40	Tion Aigo
	Durch Laure Carl								
ESSON	Problem Solv	/ing Formula				Reading St			
	The Quadratic I	<i>∽OFMUIA</i> ses her last shot from a	nonition of		50	Graphic Orga	11201		
		with an initial vertical a			The Qu	adratic Formula can b	e used to solv	e any quadratic equati	on.
		The height of the shot i			Defin	nition		Facts	
		0t + 6, where t is the tin distance traveled after t			Wher	n the equation is in the	form	In a quadratic equa	
	d by $d(t) = 20t$.								tion, the expression
oueleu						$ax^2 + bx + c = 0$	0	under the square ro	
I. Jenn	na wants to know the ex	act distance the shot trav	els at a velocity		The	$ax^2 + bx + c = 0$ guadratic formula is	0	under the square ro known as the discr	ot sign, <i>b²</i> – 4 <i>ac</i> , is iminant. It tells you
I. Jenn of 20	na wants to know the ex 0 feet per second.		els at a velocity		The o	quadratic formula is		under the square ro known as the discr about the roots of th	tot sign, $b^2 - 4ac$, is iminant. It tells you ne equation.
I. Jenn of 20 a. U	na wants to know the ex 0 feet per second. Jse the Quadratic Form	ula $t = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$.25, 1.5	The c			under the square rooknown as the discr about the roots of the $b^2 - 4ac > 0$: two	ot sign, $b^2 - 4ac$, is iminant. It tells you ne equation. real roots
of 20 a. U	na wants to know the ex 0 feet per second. Jse the Quadratic Form o solve the height functi	ula $t = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ on for t .	els at a velocity $t = -0.$	25, 1.5	The c	quadratic formula is		under the square rocknown as the discr about the roots of the $b^2 - 4ac > 0$: two $b^2 - 4ac < 0$: two	ot sign, $b^2 - 4ac$, is iminant. It tells you ne equation. real roots complex roots
I. Jenn of 20 a. U to b. U	na wants to know the ex 0 feet per second. Jse the Quadratic Form	ula $t = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ on for t.				quadratic formula is $x = \frac{-b \pm \sqrt{b^2 - a}}{2a}$		under the square rocknown as the discr about the roots of the b ² - 4ac > 0 : two b ² - 4ac < 0 : two b ² - 4ac = 0 : one	ot sign, $b^2 - 4ac$, is iminant . It tells you ne equation. real roots complex roots real root
I. Jenn of 20 a. U to b. U fir	na wants to know the ex 0 feet per second. Use the Quadratic Form o solve the height functi Use the value for t and the nd the distance her sho	ula $t = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ on for <i>t</i> . the distance function to the travels.	<u>t = -0</u>	ft	The o	quadratic formula is $x = \frac{-b \pm \sqrt{b^2 - a}}{2a}$ nple	<u>4ac</u>	under the square ro known as the discr about the roots of th $b^2 - 4ac > 0$: two $b^2 - 4ac < 0$: two $b^2 - 4ac = 0$: one Find the number o	ot sign, $b^2 - 4ac$, is iminant . It tells you ne equation. real roots complex roots real root
I. Jenn of 20 a. U to b. U fir 2. Jenn	a wants to know the ex 0 feet per second. Jse the Quadratic Form o solve the height functi Jse the value for <i>t</i> and the distance her sho na is working to improve	ula $t = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ on for t.	$\frac{t = -0}{30}$ akes a table to show	ft		quadratic formula is $x = \frac{-b \pm \sqrt{b^2 - 4}}{2a}$ nple $x^2 - x - 6 = 0$	<u>4ac</u>	under the square ro known as the discr about the roots of th $b^2 - 4ac > 0$: two $b^2 - 4ac < 0$: two $b^2 - 4ac = 0$: one Find the number o $b^2 - 4ac$	ot sign, $b^2 - 4ac$, is iminant. It tells you he equation. real roots complex roots real root f roots.
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I. Jenn of 20 a. U to b. U fir 2. Jenn how	ha wants to know the ex 0 feet per second. Jse the Quadratic Form o solve the height functi Jse the value for <i>t</i> and th nd the distance her sho ha is working to improve the horizontal distance Velocity (tt/s) 22	ula $t = -b \pm \sqrt{b^2 - 4ac}$ on for t . 2a he distance function to it travels. the performance. She may varies with velocity. Comp Formula	$\frac{t = -0}{30}$ akes a table to show blete the table. Time (s)	ft Distance (ft) 1 35.4 ft	Exan x =	quadratic formula is $x = \frac{-b \pm \sqrt{b^2 - a}}{2a}$ nple $x^2 - x - 6 = 0$ $a = 1, b = -1, c = \frac{-(-1) \pm \sqrt{(-1)^2 - a}}{2(1)}$ $x = 3, x = -2$ e equation $2x^2 - 6x$	$\frac{4ac}{4ac}$ $\frac{1}{2} - 6$ $\frac{1}{4(1)(-6)}$ $\frac{1}{2} - 9 = 0 \text{ to an and } c.$	under the square ro known as the discri about the roots of th $b^2 - 4ac > 0$: two $b^2 - 4ac < 0$: two $b^2 - 4ac = 0$: one Find the number o $b^2 - 4ac$ $(-1)^2 - 4(1)(-6)$ 1 + 24 = 25 25 > 0 There are two real in	tot sign, $b^2 - 4ac$, is iminant. It tells you he equation. real roots complex roots real root f roots.
I. Jenn of 20 a. U to b. U fir 2. Jenn how	ha wants to know the exponent of the exponent	ula $t = -b \pm \sqrt{b^2 - 4ac}$ on for t . 2a he distance function to it travels. the performance. She may varies with velocity. Comp Formula	$\frac{t = -0}{30}$ akes a table to show blete the table. Time (s) t = -0.23, 1.67	ft Distance (ft) 1 35.4 ft	Exan x = Use the 1. Wr	quadratic formula is $x = \frac{-b \pm \sqrt{b^2 - a}}{2a}$ mple $x^2 - x - 6 = 0$ $a = 1, b = -1, c = -(-1) \pm \sqrt{(-1)^2 - a}$ $\frac{-(-1) \pm \sqrt{(-1)^2 - a}}{2(1)}$ x = 3, x = -2 e equation $2x^2 - 6x$. it the values of <i>a</i> , <i>b</i> , <i>a</i>	$\frac{4ac}{-6}$ 6 $\frac{4(1)(-6)}{-9}$ - 9 = 0 to an and <i>c</i> . a = 2,	under the square ro known as the discri about the roots of th $b^2 - 4ac > 0$: two $b^2 - 4ac < 0$: two $b^2 - 4ac < 0$: two $b^2 - 4ac = 0$: one Find the number of $b^2 - 4ac$ $(-1)^2 - 4(1)(-6)$ 1 + 24 = 25 25 > 0 There are two real in swer the following que	tot sign, $b^2 - 4ac$, is iminant. It tells you he equation. real roots complex roots real root f roots.
I. Jenn of 20 a. U to b. U fir 2. Jenn how	ha wants to know the evolution of the e	ula $t = -b \pm \sqrt{b^2 - 4ac}$ on for t . 2a he distance function to it travels. the performance. She may varies with velocity. Comp Formula	$\frac{t = -0}{30}$ akes a table to show blete the table. Time (s) t = -0.23, 1.67	ft Distance (ft) 1 35.4 ft 7 44.3 ft	Exan x = Use the 1. Wr	quadratic formula is $x = \frac{-b \pm \sqrt{b^2 - a}}{2a}$ nple $x^2 - x - 6 = 0$ $a = 1, b = -1, c = \frac{-(-1) \pm \sqrt{(-1)^2 - a}}{2(1)}$ $x = 3, x = -2$ e equation $2x^2 - 6x$	$\frac{4ac}{4ac}$ $\frac{4ac}{4(1)(-6)}$ -9 = 0 to an and c. a = 2, riminant.	under the square ro known as the discri about the roots of th $b^2 - 4ac > 0$: two $b^2 - 4ac < 0$: two $b^2 - 4ac < 0$: two $b^2 - 4ac = 0$: one Find the number of $b^2 - 4ac$ $(-1)^2 - 4(1)(-6)$ 1 + 24 = 25 25 > 0 There are two real the swer the following que b = -6, $c = -9$	ot sign, b ² – 4ac, is iminant. It tells you he equation. real roots complex roots real root f roots.
 Jenni of 20 a. U b. U fir Jenni how a. b. 	ha wants to know the exponent of the exponent	ula $t = -b \pm \sqrt{b^2 - 4ac}$ on for t . 2a he distance function to it travels. the performance. She may varies with velocity. Comp Formula	$\frac{t = -0}{30}$ akes a table to show blete the table. Time (s) t = -0.23, 1.67 $t = -0.21, 1.77$	ft Distance (ft) 1 35.4 ft 7 44.3 ft	Exan x = Use the 1. Wr	quadratic formula is $x = \frac{-b \pm \sqrt{b^2 - a}}{2a}$ nple $x^2 - x - 6 = 0$ $a = 1, b = -1, c = -(-1) \pm \sqrt{(-1)^2 - a}$ $\frac{-(-1) \pm \sqrt{(-1)^2 - a}}{2(1)}$ $x = 3, x = -2$ e equation 2x ² - 6x. it the values of a, b, a d the value of the disc	4ac 4ac -6 4(1)(-6) -9 = 0 to an and c. a = 2, riminant. $(-6)^2 - 6$	under the square ro known as the discri about the roots of th $b^2 - 4ac > 0$: two $b^2 - 4ac < 0$: two $b^2 - 4ac = 0$: one Find the number o $b^2 - 4ac$ $(-1)^2 - 4(1)(-6)$ 1 + 24 = 25 25 > 0 There are two real the swer the following quarks b = -6, c = -9 -4(2)(-9) = 100	ot sign, b ² – 4ac, is iminant. It tells you he equation. real roots complex roots real root f roots.
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