Hi Class!

Today we're going to learn all about the Sum and Product of the roots of a quadratic! Does that wind your clock?

1. Grab a clicker
2. Work the below problem

Dr. T.

The roots of a quadratic, according to the quadratic formula, can be represented by the two expressions below:

$$\frac{-b+\sqrt{b^2-4ac}}{2a} \qquad \frac{-b-\sqrt{b^2-4ac}}{2a}$$

a. Add and simplify the two roots

b. Multiply and simplify the two roots

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$$\frac{-b+\sqrt{b^2-4ac}}{2a} + \frac{-b-\sqrt{b^2-4ac}}{2a}$$

S: $\Rightarrow \frac{-b+\sqrt{b^2-4ac}-b-\sqrt{b^2-4ac}}{2a} = \frac{-2b}{2a} = \boxed{\frac{-b}{a}}$

P: $\left(\frac{-b+\sqrt{b^2-4ac}}{2a}\right)\left(\frac{-b-\sqrt{b^2-4ac}}{2a}\right)$

$\frac{b^2+b\sqrt{b^2-4ac}-b\sqrt{b^2-4ac}-(b^2-4ac)}{4a^2}$

$+\frac{4ac}{4a^2} = \boxed{\frac{c}{a}}$

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A2.A.20 I can state the sum and product of the roots of a quadratic equation by examining its equations.

$* r_1 + r_2 = \frac{-b}{a} \quad r_1 \cdot r_2 = \frac{c}{a} *$

Exercise #2: For each of the following quadratic equations, state the sum and product of their roots.

(a) $2x^2 + 8x - 3 = 0$ $\quad a \; b \; c$

$S = r_1 + r_2 = \frac{-8}{2} = -4$

$P = r_1 \cdot r_2 = \frac{-3}{2}$

(b) $5x^2 + 2x - 20 = 0$

$S: \frac{-2}{5}$

$P: \frac{-20}{5} = -4$

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A2.A.21 I can write a quadratic equation if I am given the sum and product of its roots.

Exercise #3: A quadratic equation has roots that sum to 5 and have a product of −3. Which of the following could be the equation of the quadratic?

(1) $x^2+5x-3=0$ (3) $x^2-3x+5=0$

(2) $x^2-5x-3=0$ (4) $x^2+3x-5=0$

$\frac{5}{1}=\frac{-b}{a}$ $\frac{-3}{1}=\frac{c}{a}$

x^2-5x-3

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Exercise #4: Which of the following quadratic equations has roots of $x=5\pm\sqrt{7}$?

(1) $x^2-10x+18=0$ (3) $x^2-5x+7=0$

(2) $x^2+7x-5=0$ (4) $x^2+10x-3=0$

$5+\sqrt{7}+5-\sqrt{7}$

$S=10$

$P=18$

$a=1$

$b=-10$

$c=18$

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A2.A.21 I can write a quadratic equation if I am given the sum and product of its roots.

Exercise #6: Find the equation of a quadratic function if its leading coefficient is 3 and it has irrational x-intercepts of $x=4\pm\sqrt{3}$.

$a=3$

$r_1=(4+\sqrt{3})$

$r_2=(4-\sqrt{3})$

$\frac{-b}{a}=\frac{8}{1}$ $\frac{c}{a}=\frac{13}{1}$

$3(1x^2-8x+13)=0$

$3x^2-24x+39$

Exercise #7: Find the equation of a quadratic function if it has roots of $x=3\pm\sqrt{10}$ and a y-intercept of −2.

$S: \frac{6}{1}$

$P=\frac{-1}{1}$

$a=1$ $b=-6$ $c=-1$

$(x^2-6x-1)=0$

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

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A2.A.21 I can write a quadratic equation if I am given the sum and product of its roots.
PRACTICE

Determine an equation for a quadratic function that has x-intercepts given by $x = 8 \pm \sqrt{2}$ if its leading coefficient is equal to 2.

Determine the equation for a quadratic function in standard form if it has x-intercepts given by $x = -5 \pm \sqrt{11}$ and a y-intercept of -42.

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A2.A.21 I can write a quadratic equation if I am given the sum and product of its roots.
PRACTICE

Determine an equation for a quadratic function that has x-intercepts given by $x = 8 \pm \sqrt{2}$ if its leading coefficient is equal to 2.

$\text{Sum} = 8+\sqrt{2}+8-\sqrt{2} = 16$
$\text{Product} = (8+\sqrt{2})(8-\sqrt{2})$
$= 64-2 = 62$

$\Rightarrow$

$\frac{-b}{2} = 16 \Rightarrow -b = 32 \Rightarrow b = -32$
$\frac{c}{2} = 62 \Rightarrow c = 124$

$\Rightarrow$

$y = 2x^2 - 32x + 124$

Determine the equation for a quadratic function in standard form if it has x-intercepts given by $x = -5 \pm \sqrt{11}$ and a y-intercept of -42.

$\text{Sum} = -5+\sqrt{11}-5-\sqrt{11} = -10$
$\text{Product} = (-5+\sqrt{11})(-5-\sqrt{11})$
$= 25-11 = 14$

$\Rightarrow$

$\frac{-b}{a} = -10 \Rightarrow -b = -10a \Rightarrow b = 10a$
$\frac{c}{a} = 14 \Rightarrow c = 14a$
$c = 14a = -42 \Rightarrow a = -3$

$\Rightarrow$

$y = ax^2 + 10ax + 14a$
$y = -3x^2 - 30x - 42$

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A2.A.21 I can write a quadratic equation if I am given the sum and product of its roots.
TICKET TO LEAVE

For which equation does the sum of the roots equal $\frac{3}{4}$ and the product of the roots equal -2?

1) $4x^2 - 8x + 3 = 0$
2) $4x^2 + 8x + 3 = 0$
3) $4x^2 - 3x - 8 = 0$
4) $4x^2 + 3x - 2 = 0$

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