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Ch 5-7

Chapter 5: Quadratics
Topic 7: Sum and Product of the Root

Sum & Product of the Roots – General

Recall: The ROOTS of an equation are what we get when the equation is set equal to zero and we solve. Also known as the x-intercepts, the zeros, or the solutions.

We will sometimes be asked to find the sum of the roots and/or the product of the roots.

- To find the sum of the roots, we could solve the equation and add together the two solutions.
- To find the product of the roots, we could solve the equation and multiply the two solutions.

OR… We can take a shortcut…

Given the standard form:

Sum of the Roots =

Product of the Roots =

Examples: Identify a, b, c. Write the formula. Plug in and reduce.

1. $3x^2 - 6x + 11 = 0$

2. $x^2 + 8x = -7$

Prove it to yourself! For question #2, factor, solve & find sum and product by hand. Are they the same?

Multiple Choice Practice:

3. What are the sum(s) and product (p) of the roots the equation $x^2 + 3x - 27 = 0$.

(1) $s = 3, p = 27$ (3) $s = -27, p = 2$

(2) $s = -3, p = -27$ (4) $s = -27, p = -3$

4. What is the product of the roots of the equation $-8x^2 + 3x + 2 = 0$?

(1) $-\frac{1}{4}$ (2) 2

(3) $\frac{3}{16}$ (4) -2

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Standard equation modified for Sum & Product:

$$x^2 - (sum)x + (product) = 0$$

Two very important things to notice:

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Write an Equation: Given the SUM & PRODUCT

Two options could happen…

If you're given integers, just plug in:

5. The sum of the roots of a quadratic equation is 12 and the product is -4. Write a quadratic equation.

If you're given fractions, get an LCD, plug in, and multiply to clear the denominators:

6. Write a quadratic equation, with integral coefficients whose roots have the following sum and products:

$$sum = \frac{-3}{4} \qquad product = \frac{-1}{2}$$

You try, in your notebook: Write a quadratic equation whose roots have the following sum and product. All equations must have integral coefficients

7. $sum = 4, product = -9$

8. $sum = \frac{4}{5}, product = \frac{2}{3}$

9. $sum = \frac{-1}{6}, product = \frac{1}{3}$

10. $sum = -3, product = \frac{4}{5}$

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Write an Equation: Given the ROOTS

Take the original sum & product equation:

$$x^2 - sum\ x + product = 0$$

Think about what sum (addition) and product (multiplication) mean.

If we call the two roots "r_1" and "r_2", then the sum is $r_1 + r_2$, and the product is $r_1 \cdot r_2$. We can rewrite the equation as:

Examples:

11. Write a quadratic formula whose roots are -3 and 7.

- Write the formula
- Calculate sum
- Calculate product
- Plug in & simplify

12. Write a quadratic equation with integral coefficients whose roots are $\frac{3}{4}$ and $\frac{1}{2}$.

- Write the formula
- Calculate sum
- Calculate product
- Rewrite with LCD
- Plug in & simplify

You try, in your notebook. Write the quadratic equation with integral coefficients which have the following roots:

13. Roots: $\frac{2}{5}$ and $\frac{4}{3}$

14. Roots: $\frac{2}{3}$ and $\frac{5}{6}$

15. Roots: $(3 + \sqrt{5})$ and $(3 - \sqrt{5})$

16. Roots: $(2 + 3\sqrt{2})$ and $(2 - 3\sqrt{2})$

17. Roots: $(3 + 4i)$ and $(3 - 4i)$

18. One root of $(5 + 6i)$

19. One root of $4 + \sqrt{7}$

Hint for 18 & 19:

Look at the previous examples… what is the relationship between the roots when they are irrational or imaginary?

_____ _____

Use that to determine the second root!

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Given an incomplete equation and one root... find the missing value and second root

Example:

20. If a root of the equation $x^2 - 6x + k = 0$ is 4, find the second root and the missing value.

Collect the pieces that we know:

$a =$ $b =$ $c =$

Plug in as much as we can...

SUM: PRODUCT:

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

Final answer: $\boldsymbol{k =}$ $\boldsymbol{r_2 =}$

21. Given the equation $x^2 + kx + 18 = 0$ with one root of 6, find the second root and the missing value.

Collect the pieces that we know:

$a =$ $b =$ $c =$

Plug in as much as we can...

SUM: PRODUCT:

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

Final answer: $\boldsymbol{k =}$ $\boldsymbol{r_2 =}$

You try, in your notebook. For these equations, one root is given. Find the second root and the missing value.

22. $x^2 - x + k = 0$ $r_1 = -4$

23. $2x^2 + bx - 15 = 0$ $r_1 = 3$

24. $3x^2 - x + k = 0$ $r_1 = \frac{-5}{3}$