

keep scrolling to
get a sneak peek!

Help your Algebra students practice **finding roots of polynomials using the Fundamental Theorem of Algebra**. Students will be eager to get the self-checking benefits from this circuit activity!

THE FUNDAMENTAL THEOREM OF ALGEBRA

Differentiated Circuit worksheet

THE FUNDAMENTAL THEOREM OF ALGEBRA
A circuit is a route that starts and ends at the same place. Start in the first box, solve the problem. Search through the remaining boxes for the answer you got. Complete that question. Continue until you have completed the questions and return to the original question. Record your path below.

1 → _____ → _____ → _____ → _____ → _____

Previous Answer: $x = -3, -1/2, 5$ # _____

2. Find all the zeros of $f(x) = x^3 + 7x^2 + 16x + 12$

Previous Answer: $x = -1, 1, i$ # _____

2. Find all the zeros of $f(x) = 2x^3 - 3x^2$

Previous Answer: $x = -1, \pm 2i$ # **2**

1. Find all the zeros of $f(x) = x^3 + 4x^2 + x - 6$

Handwritten work for problem 1:
Synthetic division: $\begin{array}{r|rrrr} 1 & 1 & 4 & 1 & -6 \\ & & 4 & 5 & 6 \\ \hline & 1 & 5 & 6 & 0 \end{array}$
 $x^2 + 5x + 6 = (x+2)(x+3)$
Zeros: $x = 1, -2, -3$

Previous Answer: $x = -1, \pm 2i$ # _____

2. Find all the zeros of $f(x) = x^3 - 4x^2 + 4x - 4$

Handwritten work for problem 2:
Synthetic division: $\begin{array}{r|rrrr} -1 & 1 & -4 & 4 & -4 \\ & & -1 & 5 & -4 \\ \hline & 1 & -5 & 9 & -8 \end{array}$
 $x^2 + 4 = 0$
 $x = \pm 2i$



2 versions + answer key included

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Why do you need this?

The Fundamental Theorem of Algebra Circuit



It's self-checking! Your students will know if they are correct or not.



2 differentiated versions for all students practice this essential math skill.

Name: _____ Date: _____

THE FUNDAMENTAL THEOREM OF ALGEBRA CIRCUIT

Directions: A circuit is a route that starts and ends at the same place. Start in the first box labeled 1 and solve the problem. Search through the remaining boxes for the answer you got for question 1. Now complete that question. Continue until you have completed the questions and you are back to the original question. Record your path below.

1 → _____ → _____ → _____ → _____

Previous Answer: $x = -3, -1/2, 5$	# _____	Previous
1. Find all the zeros of $f(x) = x^3 + 7x^2 + 16x + 12$		2. Find
Previous Answer: $x = -3, -2$	# _____	Previous
3. Find all the zeros of $f(x) = 4x^3 - 2x^2 - 24x - 18$		4. Find d
Previous Answer: $x = 4, \pm i$	# _____	Previous
5. Find all the zeros of $f(x) = x^3 - 8x^2 + x + 42$		6. Find all the zeros of $f(x) = x^4 + 2x^3 - 13x^2 + 10x$
Previous Answer: $x = -2, 3, 7$	# _____	Previous
7. Find all the zeros of $f(x) = x^4 - x^3 + 2x^2 - 4x - 8$		8. Find all the zeros of $f(x) = x^4 - 8x^3 + 17x^2$

Helpful Hints: Use these hints to help you solve the problems.

Steps for finding zeros:
the Rational Roots Theorem
Step 3: If necessary, use synthetic division to divide the polynomial.
Step 4: Set each factor equal to zero and solve for x.

The Fundamental Theorem of Algebra Circuit *includes:*

Helpful Hints: Use these hints to help you solve the problems.	
Steps for finding zeros:	
Step 1: Use the Rational Roots Theorem to find all possible zeros.	Step 3: If necessary, factor the remaining polynomial.
Step 2: Use synthetic division to test possible zeros to find the real zeros.	Step 4: Set each factor the equal to zero.
How are you feeling about this topic? Circle one: 😊 😐 😱 😞	
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- ✓ 8 self-checking problems
- ✓ a detailed answer key
- ✓ a standard version with an extension question
- ✓ a basic version with helpful hints section
- ✓ student self assessment

The Fundamental Theorem of Algebra Circuit

standards covered:

CCSS: HSA-APR.B.3

TEKs: A2.7.D, A2.7.E

VA SOLs: EO.A1.1.c

THE FUNDAMENTAL THEOREM OF ALGEBRA CIRCUIT

Previous Answer: $x = -4, -2, 6$ # **8**

5. Find all the zeros of
 $f(x) = 3x^3 - 25x^2 + 58x - 40$

$$\begin{array}{r} 2 \\ 3 \\ \downarrow \\ 5 \\ 3 \\ \downarrow \\ 3 \\ 3x - 4 = 0 \\ x = 4/3 \end{array}$$

$x = 4/3, 2, 5$

Previous Answer: $x = -1/3, 1, \pm 2\sqrt{3}$ # **7**

6. Find all the zeros of
 $f(x) = x^5 - 3x^4 + 5x^3 - x^2 - 6x + 4$

$$\begin{array}{r} 1 \\ \downarrow \\ -1 \\ \downarrow \\ 1 \\ \downarrow \\ 1 \\ x^2 - 2x + 4 = 0 \end{array}$$

$x = \frac{2 \pm \sqrt{4 - 4(1)(4)}}{2}$
 $x = \frac{2 \pm \sqrt{-12}}{2}$
 $x = \frac{2 \pm 2i\sqrt{3}}{2}$
 $x = 1 \pm i\sqrt{3}, \pm 1$

Previous Answer: $x = 4/3, 2, 5$ # **5**

7. Find all the zeros of
 $f(x) = 3x^4 - 2x^3 - 37x^2 + 24x + 12$

$$\begin{array}{r} 1 \\ 3 \\ \downarrow \\ 3 \\ 3 \\ 3x^3 + x^2 - 36x - 12 \\ x^2(3x+1) - 12(3x+1) \\ (x^2-12)(3x+1) \\ x^2-12=0 \quad 3x+1=0 \end{array}$$

$x = -1/3, 1, \pm 2\sqrt{3}$
 $x = \pm 2\sqrt{3} \quad x = -1/3$

Previous Answer: $x = 1, 6, 7$ # **4**

8. Find all the zeros of
 $f(x) = x^3 - 28x - 48$

$$\begin{array}{r} -2 \\ 1 \\ \downarrow \\ 1 \\ x^2 - 2x - 24 \\ (x-6)(x+4) \end{array}$$

$x = -2, -4, 6$

Challenge: Explain why a polynomial of even degree could...

Expl...

how this circuit resource works

Then search for their answer on the worksheet. Once the answer is found, students complete the problem below it.

Students can track their path at the top.

Name: _____ Date: _____

THE FUNDAMENTAL THEOREM OF ALGEBRA CIRCUIT

Directions: A circuit is a route that starts and ends at the same place. Start in the first box labeled 1 and solve the problem. Search through the remaining boxes for the answer you got for question 1. Now complete that question. Continue until you have completed the questions and you are back to the original question. Record your path below.

1 → _____ → _____ → _____ → _____ → _____ → _____ → _____ → 1

Previous Answer: $x = -3, -1/2, 5$ # _____	Previous Answer: $x = -1, 1, 1 \pm i\sqrt{3}$ # _____
1. Find all the zeros of $f(x) = x^3 + 7x^2 + 16x + 12$	2. Find all the zeros of $f(x) = 2x^3 - 3x^2 - 32x - 15$
Previous Answer: $x = -3, -2$ # _____	Previous Answer: $x = 3/2, -1, 3$ # _____
3. Find all the zeros of $f(x) = 4x^3 - 2x^2 - 24x - 18$	4. Find all the zeros of $f(x) = x^3 - 14x^2 + 55x - 42$

Students start with the first question.

The last question they answer should lead back to problem #1 to "close" the circuit.

how to use this resource

This is a great activity to use when reviewing how to use the fundamental theorem of algebra to find roots of polynomials.

It can be used right after teaching the concept or as homework.

This is also a **substitute-friendly** assignment!

Name: **Answer Key** Date: _____

THE FUNDAMENTAL THEOREM OF ALGEBRA CIRCUIT

Directions: A circuit is a route that starts and ends at the same place. Start in the first box labeled 1 and solve the problem. Search through the remaining boxes for the answer you got for question 1. Now complete that question. Continue until you have completed the questions and you are back to the original question. Record your path below.

1 → **3** → **4** → **8** → **5** → **7** → **6** → **2** → 1

Previous Answer: $x = -3, -1/2, 5$ # 2	Previous Answer: $x = -1, 1, 1 \pm i\sqrt{3}$ # 6
---	--

1. Find all the zeros of
 $f(x) = x^3 + 7x^2 + 16x + 12$

$$\begin{array}{r|rrrr} -2 & 1 & 7 & 16 & 12 \\ & \downarrow & -2 & -10 & -12 \\ \hline & 1 & 5 & 6 & 0 \end{array}$$

$x^2 + 5x + 6$
 $(x+2)(x+3)$

$x = -2, -3$

THE FUNDAMENTAL THEOREM OF ALGEBRA CIRCUIT

Previous Answer: $x = 4, \pm i$ # 8	Previous Answer: $x = -1, 2, \pm 2i$ # 7
--	---

5. Find all the zeros of
 $f(x) = x^3 - 8x^2 + x + 42$

$$\begin{array}{r|rrrr} -2 & 1 & -8 & 1 & 42 \\ & \downarrow & -2 & 20 & -42 \\ \hline & 1 & -10 & 21 & 0 \end{array}$$

$x^2 - 10x + 21$
 $(x-7)(x-3)$

$x = -2, 3, 7$

6. Find all the zeros of
 $f(x) = x^4 + 2x^3 - 13x^2 + 10x$

$$\begin{array}{r|rrrr} 1 & 1 & 2 & -13 & 10 \\ & \downarrow & 1 & 3 & -10 \\ \hline & 1 & 3 & -10 & 0 \end{array}$$

$x^2 + 3x - 10$
 $(x+5)(x-2)$

$x = -5, 2, 1$

3. Find all the zeros of
 $f(x) = 4x^3 - 2x^2 - 24x + 18$

$$\begin{array}{r|rrrr} -1 & 4 & -2 & -24 & 18 \\ & \downarrow & -4 & 6 & 18 \\ \hline 3 & 4 & -6 & -18 & 0 \\ & \downarrow & 12 & 18 & \\ \hline & 4 & 6 & 0 & \end{array}$$

$4x + 6 = 0$
 $x = -3/2$

Previous Answer: $x = -2, 3, 7$ # 5	Previous Answer: $x = -2, 2, \pm\sqrt{2}$ # 4
--	--

7. Find all the zeros of
 $f(x) = x^4 - x^3 + 2x^2 - 4x - 8$

$$\begin{array}{r|rrrr} -1 & 1 & -1 & 2 & -4 & -8 \\ & \downarrow & -1 & 2 & -4 & 8 \\ \hline & 1 & -2 & 4 & -8 & 0 \end{array}$$

$x^3 - 2x^2 + 4x - 8$
 $x^2(x-2) + 4(x-2)$

8. Find all the zeros of
 $f(x) = x^4 - 8x^3 + 17x^2 - 8x + 16$

$$\begin{array}{r|rrrr} 4 & 1 & -8 & 17 & -8 & 16 \\ & \downarrow & 4 & -16 & 4 & -16 \\ \hline & 1 & -4 & 1 & -4 & 0 \end{array}$$

$x^3 - 4x^2 + x - 4$
 $x^2(x-4) + 1(x-4)$

You may also enjoy ...

SYNTHETIC DIVISION OF POLYNOMIALS

Printable Maze

Self-checking

Synthetic Division of Polynomials Maze

Directions: Find the quotient of each problem. The answer will lead you to the next question. Don't forget to show your work!

START HERE!

Synthetic Division of Polynomials

Directions: Find the quotient of each problem. The answer will lead you to the next question. Don't forget to show your work!

Math with Ms. Rivera

Answer key included

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THE FUNDAMENTAL THEOREM OF ALGEBRA

Algebra 2 Guided Notes

THE FUNDAMENTAL THEOREM OF ALGEBRA

If $f(x)$ is a polynomial of degree n where $n > 0$, then $f(x) = 0$ has at least n solutions in the complex number system.

Descartes's Rule of Signs

The number of positive real zeros of a polynomial function is equal to the number of sign changes in the polynomial or less than that by an even number.

Complex Conjugates

Complex Conjugates: If $a + bi$ is a root of the polynomial, then its complex conjugate $a - bi$ is also a root.

Steps for writing polynomial questions with complex roots:
 Step 1: Identify the all real roots.
 Step 2: Write the polynomial function.
 Step 3: Multiply the factors.

Directions: Determine the possible numbers of positive real zeros, negative real zeros, and imaginary zeros.

$f(x) = x^6 - 2x^5 + 3x^4 - 10x^3 - 6x^2 - 8x - 8$

Math with Ms. Rivera

Answer key included

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POLYNOMIAL FUNCTIONS

Algebra 2 Guided Notes

CLASSIFYING POLYNOMIAL FUNCTIONS

Polynomial Function	Type of Polynomial
A monomial or the sum of monomials	Monomial
A polynomial written in the form $ax^n + bx^{n-1} + \dots + k$	Polynomial
The degree of the polynomial is n	Polynomial
The leading coefficient is a	Polynomial

COMPLEX CONJUGATES

Complex Conjugates: If $a + bi$ is a root of the polynomial, then its complex conjugate $a - bi$ is also a root.

Steps for writing polynomial questions with complex roots:
 Step 1: Identify the all real roots.
 Step 2: Write the polynomial function.
 Step 3: Multiply the factors.

Directions: Write a polynomial function $f(x)$ of leading coefficient of 1, and zeros: 2 and $3 + i$.

Descartes's Rule of Signs

The number of positive real zeros of a polynomial function is equal to the number of sign changes in the polynomial or less than that by an even number.

Graphical Function Characteristics

Points on the graph that help to determine which function is which. They are also called **Intervals**.

Directions: Decide whether each function is a polynomial function. Write the degree of the polynomial in standard form and state the degree.

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

Math with Ms. Rivera

Answer key included

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check it out!

Answer Key
Name: _____ Date: _____
ADDING & SUBTRACTING RATIONAL EXPRESSIONS
Directions: Simplify each rational expression. Show your work.

Solving Systems of Equations
Date: _____
Solve each system of equations using substitution or elimination. Check your solution.
 $2x - 6y = -18$
 $x = 3y - 9$
 $4x + 6y = -1$
 $y = -2x + 3$
 $y = 2 + 5$
 $y = 7$
 $2(3y - 9) - 4y = -18$
 $6y - 18 - 4y = -18$
 $-18 = -18$
infinitely many solutions

Multiplying & Dividing Rational Expressions
Date: _____
Directions: Multiply or divide the rational expressions. Show your work.

Rational Expression Operations - Addition & Subtraction
Directions: Answer each question and type the question number with the matching answer in the answer column to the right.

#	Question	Answer	Type the matching question numbers here
1	$\frac{5}{x} + \frac{3}{x+1}$	$\frac{2x+1}{x+2}$	
2	$\frac{2}{x+4} - \frac{x^2}{x^2-16}$	$-\frac{1}{x^2-1}$	
3	$\frac{x+2}{x^2+4x+4} + \frac{2x}{x+2}$	$\frac{2x^2+2x+5}{x^2+x-2}$	
4	$\frac{x}{x-2} + \frac{3}{x-1}$	$-\frac{x^2+2x-8}{x^2-16}$	
5	$\frac{x}{4x+8} - \frac{1}{x^2+2x}$	$\frac{8x+5}{x^2+1}$	
6	$\frac{x+2}{x-1} + \frac{x-1}{x+2}$	$\frac{x^2-3x+7}{x^2-4}$	
7	$\frac{2x+1}{x^2-4} + \frac{x-3}{x+2}$	$\frac{x^2+2x-6}{x^2-3x+2}$	
8	$\frac{x^2+2x}{x^2-1} - \frac{x+1}{x-1}$	$\frac{x-2}{4x}$	

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hey there!

My name is Malia and I'm passionate about making learning and practicing math fun. I love creating engaging math resources for my students and I hope your students enjoy this activity too!

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