

# MeTEOR Performance Task

## Algebra II

Mathematics

Factoring a Wood Sculpture

## **Performance Task Item: Factoring a Wood Sculpture**

Grade Level: Algebra 2

**Focus Area:** Factoring and Finding Zeros

**Essential Question:** For a polynomial, how are factors, zeros and x-intercepts related?

**Core Ideas:**

- Understands zeros of polynomial functions.
- Understands factors of polynomials.
- Understands how multiple zeros affect a graph.

**Learning Targets:**

- Students will write polynomials in factored form.
- Students will find zeros of functions.
- Students will write polynomial functions in standard form.
- Students will write a polynomial given its factors or zeros.
- Students will explain their reasoning.

### **STANDARDS**

**Domain: Algebra:** Seeing Structure in Expressions

**Content Standards:**

- Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.
  - a) Factor a quadratic expression to reveal the zeros of the function it defines.
  - b) Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.
  - c) Use the properties of exponents to transform expressions for exponential functions. *For example the expression  $1.15^t$  can be rewritten as  $(1.15^{1/12})^{12t} \approx 1.012^{12t}$  to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.*
- Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. *For example, calculate mortgage payments.*

**Supporting Standard:**

- Know precise definitions of quadratic terminology.

**Math Practice Standards:**

MP 1: Make sense of problems and persevere in solving them.

MP 2: Reason abstractly and quantitatively.

MP 3: Construct viable arguments and critique the reasoning of others.

MP 4: Model with mathematics.

MP 6: Attend to precision.

MP 7: Look for and make use of structure.

**Materials:**

- Performance Task
- Pencil
- Paper
- Calculator

**Task/Question 1:**

**DOK Level 1:** Recall & Reproduction

**Math Practice Standards:**

- MP 6: Attend to precision.

- A.** The zeros of a polynomial function identify the following:
- B.** What is the difference between a quartic polynomial and a quadratic polynomial?
- C.** Write the factored form of each given polynomial:

$$x^3 + 7x^2 + 10x$$

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$$x^3 + 9x^2 + 20x$$

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$$9x^3 + 6x^2 - 3x$$

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- D.** Find the zeros for each:

$$y = (x + 4)(x + 5)$$

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$$y = x(x - 3)(x + 7)$$

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$$y = (x + 1)(x - 2)(x + 3)$$

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- E.** Several geologists were viewing the graph of an earthquake's waves. On the graph, the x-intercepts were (-3, 0), (0,0) and (2,0). What was the polynomial function?

**Task/Question 2:**

**DOK Level 2:** Basic Application of Skills and Concepts

**Math Practice Standards:**

- MP 1: Make sense of problems and persevere in solving them.
- MP 6: Attend to precision.

**A.** What do the zeros of a polynomial function tell you about the function's graph?

**B.** Write each of the polynomial functions in standard form with the given zeros:

$x = 2, 4, 6$

$x = -3, 5, -2$

$x = -5, -5, 3$

$x = 4, 0, -1$

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**C.** Factor each polynomial and write the zeros:

$x^2 + 5x + 6$

$5x^3 + 35x + 60x$

$x^2 - 4x + 3$

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**D.** Your friend, Susan, missed school the last two days. Your teacher, Ms. Rouse, went over how to solve a function by factoring and how to solve to find zeros. Explain to Susan how to solve the two functions below by factoring so you can find the zeros.

$$f(x) = 2x^2 - 5x - 7$$

$$f(x) = 2x^2 - 32$$

**Task/Question 3:**

**DOK Level 2:** Basic Application of Skills and Concepts

**Math Practice Standards:**

- MP 1: Make sense of problems and persevere in solving them.
- MP 4: Model with mathematics.
- MP 6: Attend to precision.

- A.** What is the polynomial function, in factored form, whose zeros are -2, 4, and 6, and whose leading coefficient is -2?
- B.** You are given the polynomial function  $y = 2x^2 - x + 1 = 0$ . You have a hard time factoring it to find the zeros. Name another method you could use.
- C.** The volume of a rectangular box, expressed as a polynomial, is  $12x^3 - 27x$  cubic units. What are the three side lengths of this box?

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- D.** Explain how you found the side lengths in Part C.

- E.** The volume of the box in Part C was changed to  $2x^3 + 10x^2 + 12x$  cubic units. What are the three side lengths for the box?

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**Task/Question 4:**

**DOK Level 3:** Strategic Thinking and Complex Reasoning.

**Math Practice Standards:**

- MP 1: Make sense of problems and persevere in solving them.
- MP 2: Reason abstractly and quantitatively.
- MP 3: Construct viable arguments and critique the reasoning of others.
- MP 4: Model with mathematics.
- MP 7: Look for and make use of structure.

Danielle, a local artist, has a block of wood that she wants to use to make a wood sculpture. The block is currently  $6x$  units in length,  $3x$  units wide and,  $9x$  units high.

- A. What is the volume of the wooden block?
  
- B. Danielle feels she needs to make each side 2 units smaller before she begins making the sculpture. What will the volume of the new piece of wood Danielle will work with become?
  
- C. Danielle believes removing two units from each side is too much and decides to remove only one unit from each side. Calculate the new volume. Explain any pattern you see.
  
- D. If you remove the volume calculated in Part C, how much will Danielle remove from the original block?
  
- E. Explain how determined the answer to Part D. Justify and defend how your approach to solving this is the **most efficient**.



<p>factors, set them equal to zero and solve getting <math>x = -1</math> and <math>7/2</math>. For the second one, we can divide both terms by 2. This leaves us the difference between two squares. We set them equal to zero and solve getting <math>-4</math> and <math>4</math>.”</p>				
<p><b>Task 3:</b>            A. <math>-2x^3 + 16x^2 - 8x - 96</math>            B. Quadratic Formula            C. <math>3x(2x + 3)(2x - 3)</math>            D. Answers may vary. Possible Explanation: “I factored out the GCF of <math>3x</math>. This left the difference of two squares. I then factored it.”            E. <math>2x(x + 2)(x + 3)</math></p>	<b>2</b>	<b>1</b> <b>1</b> <b>1</b> <b>2</b> <b>1</b>	<b>6</b>	
<p><b>Task 4:</b>            A. <math>162x^3</math> cubic units            B. <math>162x^3 - 198x^2 + 72x - 8</math> cubic units            C. <math>162x^3 - 99x^2 + 18x - 1</math> cubic units.            Explanation: “I found the first term to remain the same because nothing changed with that measure. However, I see a pattern dealing with multiples of two. The second term is half the size, the third term is one fourth the size and the fourth term is one eighth the size of the original volume.”            D. <math>99x^2 - 18x + 1</math> cubic units            E. Answers may vary. Possible Explanation: “I subtracted the volume to be removed from the original sculpture’s volume that was found in Part C. However, when you add or subtract polynomials, you must follow the integer rules.”</p>	<b>3</b>	<b>1</b> <b>1</b> <b>2</b>  <b>1</b>  <b>2</b>	<b>7</b>	
<b>TOTAL POINTS:</b>				



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