

Name: _____

Teacher: _____

M202: Rational Exponents and Complex Numbers Pre-Badge Task

New Badge Alert!

This task will provide a preview of what we will be learning during the M202 - Rational Exponents and Complex Numbers. You already know so much math, so use this task to share any understanding that you have before we start our learning. You will have a chance to do the same task at the end of the badge to see how your thinking has evolved.

The Task

QUESTION 1 Consider the following powers of 4:

$$4^{-1} = \frac{1}{4} \quad 4^0 = 1 \quad 4^1 = 4 \quad 4^2 = 16$$

What do you think $4^{\frac{1}{2}}$ would be? Explain your reasoning.



QUESTION 2 Abigail and Ben are comparing their methods to solving for the roots of $f(x) = x^2 + 4x + 13$.

Abigail's work:

$$x = \frac{-4 \pm \sqrt{4^2 - 4(1)(13)}}{2(1)}$$

Ben's work:

$$x = \frac{-4 \pm \sqrt{4^2 - 4(1)(13)}}{2(1)}$$

$$x = \frac{-4 \pm \sqrt{16-52}}{2}$$

$$x = \frac{-4 \pm \sqrt{-36}}{2}$$

$$x = \frac{-4 \pm 6i}{2}$$

$$x = -2 \pm 3i$$

$$x = \frac{-4 \pm \sqrt{16-52}}{2}$$

$$x = \frac{-4 \pm \sqrt{36}}{2}$$

$$x = \frac{-4 \pm 6}{2}$$

$$x = 1 \text{ and } x = -5$$

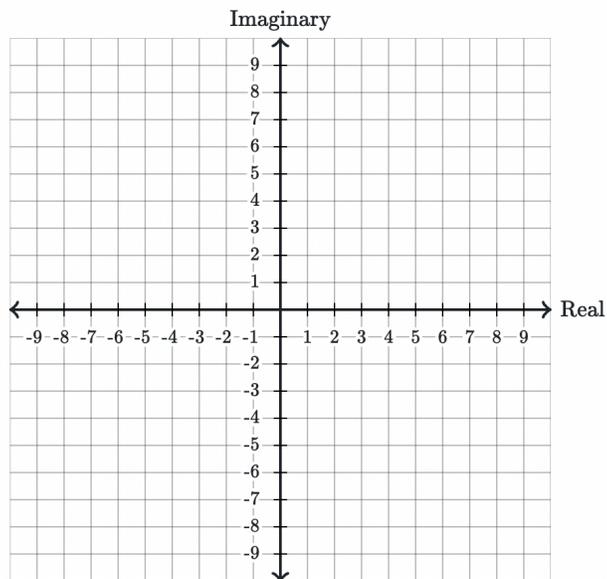
After reviewing Abigail and Ben's work, answer the following questions:

- Who is correct? Explain.
- Graph the two correct solutions on a complex plane.



Who is correct and why:

Graph:



QUESTION 3 A researcher is studying bacterial growth and finds that the number of bacteria in a sample follows the function: $P(t) = 100(2^{\frac{t}{3}})$ where t represents time in hours.

- Solve for $P(900)$. Interpret this solution in the context of bacteria growth.
- Suppose another researcher uses a different model: $Q(t) = 100(4^{\frac{t}{6}})$. Compare the growth rates of P and Q . Which model predicts faster growth? Why?



QUESTION 4 Consider the function $h(x) = x^{\frac{2}{3}} - 4$.

- Graph $h(x)$ by hand or using technology.
- Identify any intercepts and describe the overall shape of the graph.
- How does the graph of this function differ from the graphs of $f(x) = x^2$ or $f(x) = x^3$? What patterns do you notice?



QUESTION 5 Consider $A = 4 - i$ and $B = 3 + 2i$. Compute the following:

- $A + B$
- $B - A$
- A^2
- $(A - 4)^2$

How do your solutions for A^2 and $(A - 4)^2$ compare? What do you notice?

