

2.4 Complex Numbers.notebook

Warm up

Divide

1. $(x^4 - 1) \div (x - 1)$

2. $(6x^4 - x^3 - x^2 + 9x - 3) \div (x^2 + x - 1)$

$x^3 + x^2 + x + 1$




$6x^2 - 7x + 12 + \frac{-10x + 9}{x^2 + x - 1}$

$x^3 + x^2 + x + 1$



Sep 23-7:36 AM

GO COUGARS! 

p 159 **Homework Questions**

In Exercises 5-18, use long division to divide.

5. $(x^2 + 10x + 12) \div (x + 3)$
 7. $(4x^3 - 7x^2 - 11x + 5) \div (4x + 5)$
 13. $(6x^3 + 10x^2 + x + 8) \div (2x^2 + 1)$
 15. $(x^4 + 3x^2 + 1) \div (x^2 - 2x + 3)$

In Exercises 19-36, use synthetic division to divide.

21. $(4x^3 - 9x + 8x^2 - 10) \div (x + 2)$
 25. $(5x^3 - 6x^2 + 8) \div (x - 4)$
 29. $\frac{x^3 + 512}{x + 8}$

In Exercises 45-48, use synthetic division to find each function value. Verify your answers using another method.

45. $f(x) = 4x^3 - 13x + 10$
 (a) $f(1)$ (b) $f(-2)$ (c) $f(\frac{1}{2})$ (d) $f(8)$

In Exercises 49-56, use synthetic division to show that x is a solution of the third-degree polynomial equation, and use the result to factor the polynomial completely. List all real solutions of the equation.

Polynomial Equation Value of x
 49. $x^3 - 2x + 6 = 0$ $x = 2$
 51. $2x^3 - 15x^2 + 27x - 10 = 0$ $x = \frac{1}{2}$
 55. $x^3 - 3x^2 + 2 = 0$ $x = 1 + \sqrt{3}$

In Exercises 57-64, (a) verify the given factors of the function f . (b) find the remaining factors of f . (c) use your results to write the complete factorization of f . (d) list all real zeros of f , and (e) confirm your results by using a graphing utility to graph the function.

57. $f(x) = 2x^3 + x^2 - 5x + 2$ Factors: $(x + 2), (x - 1)$
 61. $f(x) = 6x^3 + 41x^2 - 9x - 14$ $(2x + 1), (3x - 2)$

In Exercises 69-72, simplify the rational expression by using long division or synthetic division.

69. $\frac{x^3 - 8x^2 + x + 7}{x^2 - 3}$
 71. $\frac{x^4 + 6x^3 + 11x^2 + 6x}{x^2 + 3x + 2}$

In Exercises 93-96, find a polynomial function that has the given zeros. (There are many correct answers.)

95. $-3, \sqrt{2}, -\sqrt{2}$

$(x + 3)(x - (1 + \sqrt{2}))(x - (1 - \sqrt{2}))$
 $(x + 3)(x - 1 - \sqrt{2})(x - 1 + \sqrt{2})$

$x \begin{matrix} x^2 - x + 10 \\ -x^2 + 3x - 2 \\ \hline 4x - 12 \end{matrix}$ $x^2 - 2x - 1$
 $-1 \begin{matrix} x^2 - 2x - 1 \\ -x^2 + 3x - 2 \\ \hline 4x - 12 \end{matrix}$ $x \begin{matrix} x^2 - 2x - 1 \\ -x^2 + 3x - 2 \\ \hline 4x - 12 \end{matrix}$

Feb 2-9:51 PM

2.4 Complex Numbers

define

operations with complex numbers

Sep 15-5:37 AM

What is a complex number?

Sep 15-5:38 AM

2.4 Complex Numbers.notebook

1. Solve $x^2 + 1 = 0$

$$\begin{aligned}x^2 &= -1 \\x &= \pm\sqrt{-1} \\x &= \pm i\end{aligned}$$

Sep 15-5:39 AM

Standard form of a complex number

$$\begin{array}{ccc} & a + bi & \\ & \downarrow \quad \downarrow & \\ & \text{real} \quad \text{imaginary} & \\ & \text{part} \quad \text{part} & \\ a + 0i & & 0 + bi \\ \text{pure real} & & \text{pure imaginary} \end{array}$$

Sep 15-5:42 AM

2.4 Complex Numbers.notebook

$$a + bi = c + di \quad \text{if and only if}$$

$$a = c \quad \text{and} \quad b = d$$

2. $3 + 6i = (a + 4) + (b - 2)i$ find a and b

$$\begin{array}{ll} 3 = a + 4 & 6 = b - 2 \\ -1 = a & 8 = b \end{array}$$

Sep 15-5:45 AM

Add and Subtract complex numbers

3. $(7 + 3i) + (5 - 4i) = 12 - i$

4. $(3 + 4i) - (5 + 2i) = -2 + 6i$

5. $4i - (-3 + 5i) + (2 - 6i) = 5 - 7i$

6. $(2 - \sqrt{-9}) + (4 + \sqrt{-25})$
 $(2 - 3i) + (4 + 5i) = 6 + 2i$

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Multiply complex numbers

7. $(\sqrt{-8})(\sqrt{-50})$

$$\sqrt{-8 \cdot -50} \left\{ \begin{array}{l} i\sqrt{8} \cdot i\sqrt{50} \\ i^2 \sqrt{400} \\ i^2 \cdot 20 \\ -20 \end{array} \right.$$

8. $(\sqrt{-5})^2$

$$i\sqrt{5} \cdot i\sqrt{5} \\ i^2(5) \\ -5$$

9. $8i(4-3i)$

$$24 + 32i$$

$$\times i^2 = -1$$

10. $(3-i)(5+4i) = 15 + 12i - 5i + 4i^2$

$$19 + 24i - 16 - 17i$$

$$19 + 7i$$

11. $(5-3i)^2$

$$16 - 30i + 25 - 30i + 9i^2$$

Sep 15-5:50 AM

Each complex number has a

complex conjugate

$$2 + 3i$$

$$2 - 3i$$

$$-5 - i$$

$$-5 + i$$

$$13i$$

$$-13i$$

$$4$$

$$4$$

Multiplying complex conjugates = a constant

$$(2 + 3i)(2 - 3i)$$

$$4 + 6i - 6i + 9i^2$$

$$13$$

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Writing a Quotient in Standard Form

$$12. \frac{6}{2+3i} \cdot \frac{2-3i}{2-3i}$$

$$\frac{12 - 18i}{13}$$

$$\frac{12}{13} - \frac{18}{13}i$$

$$13. \frac{4-5i}{1-i} \cdot \frac{1+i}{1+i} = \frac{2}{2}$$

$$\frac{9-i}{2}$$

$$\frac{9}{2} - \frac{1}{2}i$$

Sep 15-5:57 AM

Powers of i

$$i^0 = 1$$

$$i^1 = i$$

$$i^2 = -1$$

$$i^3 = i^2 \cdot i = -i$$

$$i^4 = i^3 \cdot i = 1$$

$$i^5 = i^4 \cdot i = i$$

i^n , divide n by 4

if the remainder is 0, the number simplifies to 1

if the remainder is 1, the number simplifies to i

if the remainder is 2, the number simplifies to -1

if the remainder is 3, the number simplifies to -i

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Complex solutions of a quadratic

$$x^2 + 4 = 0$$

$$x^2 = -4$$

$$x = \pm\sqrt{-4}$$

$$x = \pm 2i$$

$$6x^2 - 2x + 5 = 0$$

$$6x^2 - 2x = -5$$

$$6\left(x^2 - \frac{1}{3}x + \frac{1}{6}\right) = -5 + 6\left(\frac{1}{6}\right)$$

$$\frac{6\left(x - \frac{1}{6}\right)^2 = -29}{6}$$

$$\left(x - \frac{1}{6}\right)^2 = \frac{-29}{36}$$

$$x - \frac{1}{6} = \pm\sqrt{\frac{-29}{36}}$$

$$x = \frac{1}{6} \pm \frac{\sqrt{29}}{6}i$$

$$x = \frac{2 \pm \sqrt{4 - 4(6)(5)}}{2(6)}$$

$$\frac{2 \pm \sqrt{16}}$$

$$\frac{2 \pm \sqrt{-29}}{12}$$

$$\frac{1 \pm \sqrt{-29}}{6}$$

$$\frac{1}{6} \pm \frac{\sqrt{29}}{6}i$$

Sep 8-11:09 AM

HOMEWORK



p 167 3, 7, 13, 17-23 odd, 27, 35, 49, 53,
58, 65-69 odd, 86, 89

Aug 29-6:38 AM