Warm-up

1. Divide. $\dfrac{x^4 + 10x + 2}{x + 2}$

2. Find the x and y intercepts algebraically
$y = 4x^2 - 5x - 6$.

3. List all possible rational zeros. $f(x) = 2x^4 - 3x^2 + 15$

4. Given that x - 4 is a factor, find all zeros for

$y = x^3 - x^2 - 10x - 8$

Homework Section 2.4

4. $f(x) = 2x^2 - 5x + \frac{7}{2} - \frac{9/2}{2x+1}$

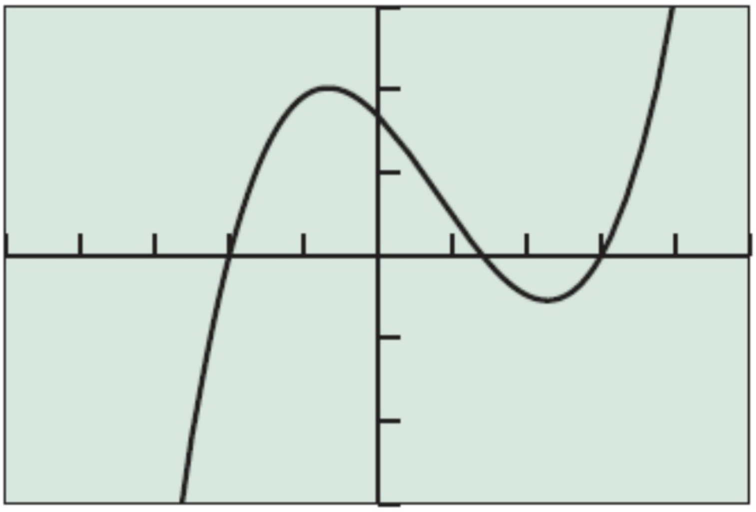
5. $x^2 - 4x + 12 + \frac{-32x+18}{x^2+2x-1}$

11. $\frac{5x^4 - 3x + 1}{4 - x}$ $-5x^3 - 20x^2 - 80x - 317 + \frac{-1269}{4-x}$

16. $f(x) = x^3 - 3x + 4;\ k = -2$ 2

18. $f(x) = x^5 - 2x^4 + 3x^2 - 20x + 3;\ k = -1$ 23

26. $f(x) = 5x^3 - 12x^2 - 23x + 42$ $f(x) = (x + 2)(x - 3)(5x - 7)$



[–5, 5] by [–75, 75]

30. Degree 4, with -3, -1, 0, and $\frac{5}{2}$ as zeros $2x^4 + 3x^3 - 14x^2 - 15x$

35. $\dfrac{\pm 1, \pm 3, \pm 9}{\pm 1, \pm 2}; \dfrac{3}{2}$

36. $\dfrac{\pm 1, \pm 2, \pm 3, \pm 4, \pm 6, \pm 12}{\pm 1, \pm 2, \pm 3, \pm 6}; -\dfrac{4}{3}$ and $\dfrac{3}{2}$

50. $f(x) = x^3 + 3x^2 - 3x - 9$ Rational zero: -3; irrational zeros: $\pm\sqrt{3}$

65. Multiple Choice Let f be a polynomial function with $f(3) = 0$. Which of the following statements is not true? A

(A) $x + 3$ is a factor of $f(x)$.

(B) $x - 3$ is a factor of $f(x)$.

(C) $x = 3$ is a zero of $f(x)$.

(D) 3 is an x-intercept of $f(x)$.

(E) The remainder when $f(x)$ is divided by $x - 3$ is zero.

2.5 Complex Zeros and the Fundamental Theorem of Algebra

Fundamental Theorem of Algebra states that:
A polynomial function of ___n degree___,

has __n complex roots___.

This means that:

imaginary roots pairs

x^3+2x-7

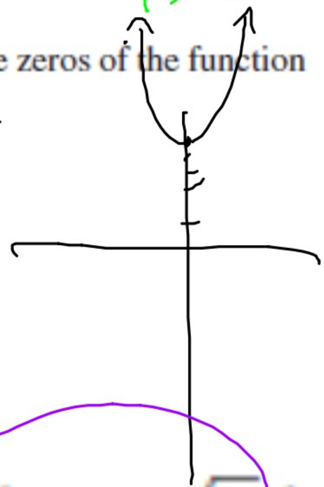
3 roots

3 complex
1 real
2i

Exploring Fundamental Polynomial Connections

Write the polynomial function in standard form, and identify the zeros of the function and the x-intercepts of its graph.

$i = \sqrt{-1}$



(a) $f(x) = (x - 2i)(x + 2i)$

$x^2 + 2ix - 2ix - 4i^2$

$x^2 - 4i^2$

$x^2 - 4(-1)$

$x^2 + 4$

(b) $f(x) = (x - 5)(x - \sqrt{2}i)(x + \sqrt{2}i)$

$(x - 5)(x^2 + 2)$ $\cdot 2i^2$

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

CONJUGATES....

THEOREM Complex Conjugate Zeros

Suppose that $f(x)$ is a polynomial function with *real coefficients*. If a and b are real numbers with $b \neq 0$ and $a + bi$ is a zero of $f(x)$, then its complex conjugate $a - bi$ is also a zero of $f(x)$.

Finding a Polynomial from Given Zeros

Write a polynomial function of minimum degree in standard form with real coefficients whose zeros include -3, 4, and $2 - i$.

Ex. write a polynomial function of minimum degree in standard form with real coefficients whose zeros and their multiplicities include those listed.

13. 1 (multiplicity 2), -2 (multiplicity 3)

In Exercises 21–26, state how many complex and real zeros the function has.

25. $f(x) = x^4 - 5x^3 + x^2 - 3x + 6$

Finding Complex Zeros

The complex number $z = 1 - 2i$ is a zero of $f(x) = 4x^4 + 17x^2 + 14x + 65$. Find the remaining zeros of $f(x)$, and write it in its linear factorization.

Hi 4 0 17 14 65. , unit Hista

1+z : y%f%i*I -

You try:

$$x^5 - 6x^4 + 11x^3 - x^2 - 14x + 5$$

Is $(2 - i)$ a solution?

Polynomial Function of Odd Degree

Every polynomial function of odd degree with real coefficients has at least one real zero.

Wrap-up

What is the polynomial of least degree that has the roots -2, 3*i* ?

In Exercises 33–36, using the given zero, find all of the zeros and write a linear factorization of $f(x)$.

33. $1 + i$ is a zero of $f(x) = x^4 - 2x^3 - x^2 + 6x - 6$.

34. $4i$ is a zero of $f(x) = x^4 + 13x^2 - 48$.

35. $3 - 2i$ is a zero of $f(x) = x^4 - 6x^3 + 11x^2 + 12x - 26$.

36. $1 + 3i$ is a zero of $f(x) = x^4 - 2x^3 + 5x^2 + 10x - 50$.

Relay Race

Rules...

Is the following binomial a factor?

1) $x^4 + 3x^3 + 3x^2 + 23x - 20$; $(x + 4)$

2) $8x^3 - 22x^2 - 9x + 9$; $(x - 3)$

3) $3x^3 - 75$; $(x - 3)$

4) $x^3 - 30x - 36$; $(x - 6)$

5) $7x^3 + 4x^2 + 3$; $(x - 1)$

6) $9x^3 + 63x^2 - 78x - 49$; $(x + 8)$

Use f(x) $= 2x^2 - x$ and g(x) $= 2x + 2$

1) (f - g) (-2)

2) (g + f) (1)

3) (f + f) (-3)

4) (g - f) (2)

5) (g + g) (4)

6) (f - g) (-1)

Use f(x) = 4x - 3 ; g(x) = 2x + 2 ; h(x) = x - 5

1) (f(g(x))

2) (h(f(x))

3) (f ∘ h)(x)

4) (g ∘ f)(x)

5) (h(g(x))

6) (f ∘ h(x))