Warm up

1. Simplify the following:

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

$-4-2i$

b. $(2+3i)(-4-\sqrt{-9})$

$1-18i$

c. $\dfrac{1-i}{3+2i}\cdot\dfrac{3-2i}{3-2i}$

$\dfrac{3-2i-3i+2i^2}{9-6i+6i+4i^2} = \dfrac{1-5i}{13} = \dfrac{1}{13}-\dfrac{5}{13}i$

d. $i^3 = i^2 \cdot i = -1 \cdot i = -i$

e. $i^4 = i^2 \cdot i^2 = -1 \cdot -1 = 1$

$i^5 = i^4 \cdot i = 1 \cdot i = i$

$i^6 = i^4 \cdot i^2 = 1 \cdot -1 = -1$

f. $i^7 = i^6 \cdot i = -1 \cdot i = -i$

$= i^4 \cdot i^3$

$i^{126} = -1$

2. A football is thrown at a point 6 feet above the ground at a velocity of 60 feet per second at an angle of 45° with respect to the ground. The path of the football is given by the function $f(x) = -0.0168x^2 + x + 6$ where f(x) is the height of the football (in feet) and x is the horizontal distance form the quarterback (in feet). What is the maximum height reached by the football?

20.88 feet

Sep 18-6:32 AM

GO COUGARS!

p 137 **Homework Questions**

In Exercises 1–4, find real numbers a and b such that the equation is true.

1. $a + bi = -9 + 4i$ ($a = -9$, $b = 4$)
2. $a + bi = 12 + 5i$
3. $(a-1) + (b+3)i = 5 + 8i$ ($a - 1 = 5$, $a = 6$; $b + 3 = 8$, $b = 5$)
4. $(a+6) + 2bi = 6 - 5i$

In Exercises 5–14, write the complex number in standard form.

5. $5 + \sqrt{-16}$
6. $2 - \sqrt{-9}$
7. -6
8. 8
9. $-5i + i^2$
10. $-3i^2 + i$
11. $(\sqrt{-75})^2$
12. $(\sqrt{-4})^2 - 7$
13. $\sqrt{-0.09}$
14. $\sqrt{-0.0004}$

In Exercises 15–24, perform the addition or subtraction and write the result in standard form.

15. $(4+i) - (7-2i)$
16. $(11-2i) - (-3+6i)$
17. $(-1+\sqrt{-8}) + (8-\sqrt{-50})$ $= -1 + 2\sqrt{2}i + 8 - 5\sqrt{2}i = 7 - 3\sqrt{2}i$
18. $(7+\sqrt{-18}) + (3+\sqrt{-32})$
19. $13i - (14-7i)$
20. $22 + (-5+8i) - 10i$

29. $(1+i)(3-2i)$
30. $(6-2i)(2-3i)$
31. $4i(8+5i)$
32. $-3i(6-i)$
33. $(\sqrt{14}+\sqrt{10}i)(\sqrt{14}-\sqrt{10}i)$ $14 - \sqrt{140}i + \sqrt{140}i + 10$ = 24
34. $(3+\sqrt{-5})(7-\sqrt{-10})$
35. $(4+5i)^2 - (4-5i)^2$
36. $(1-2i)^2 - (1+2i)^2$

In Exercises 37–44, write the complex conjugate of the complex number. Then multiply the number by its complex conjugate.

37. $4 + 3i$
38. $7 - 5i$
39. $-6 - \sqrt{5}i$ ($-6 + \sqrt{5}i$)
40. $-3 + \sqrt{2}i$

$(-6-\sqrt{5}i)(-6+\sqrt{5}i)$

$36 - 6\sqrt{5}i + 6\sqrt{5}i + 5$

41

In Exercises 45–52, write the quotient in standard form.

45. $\dfrac{6}{i} \cdot \dfrac{-i}{-i} = \dfrac{-6i}{1} = -6i$
46. $-\dfrac{5}{2i}$
47. $\dfrac{2}{4-5i}$
48. $\dfrac{3}{1-i}$
49. $\dfrac{2+i}{2-i} \cdot \dfrac{2+i}{2+i}$
50. $\dfrac{8-7i}{1-2i}$

$\dfrac{4+2i+2i+i^2}{4+2i-2i-i^2}$

$\dfrac{3}{5} + \dfrac{4i}{5}$

Feb 2-9:51 PM

2-2 Polynomial Functions of a Higher Degree

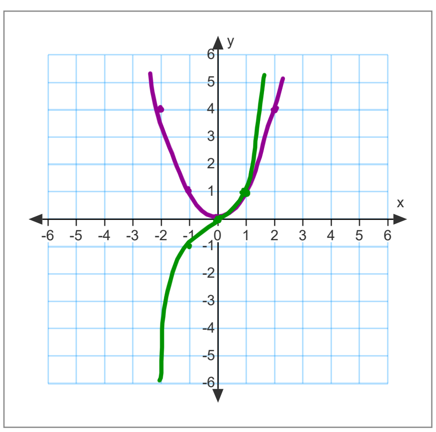
Leading Coefficient Test

End Behavior

Zeros of a polynomial

Sep 18-6:35 AM

Polynomial - a smooth continuous curve



* $y = x^2$

U

* $y = x^3$

S

Sep 26-8:09 AM

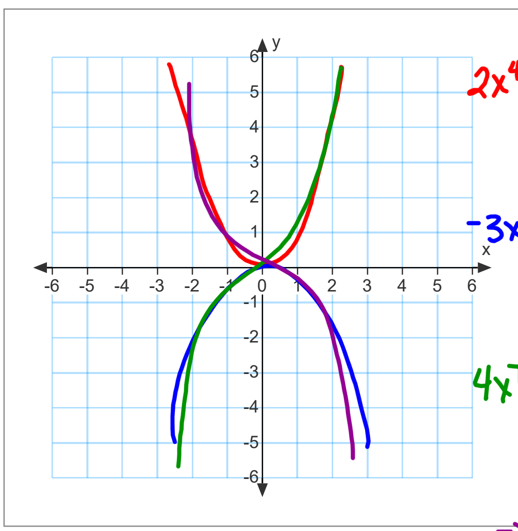
If $y = x^a$ and a is an odd number, the graph has on overall 'S' shape.

If $y = x^a$ and a is an even number, the graph has on overall 'U' shape.

To determine the 'left hand, right hand' or 'end' behavior use
The Leading Coefficient Test

1. Look at the largest power, called degree, of the polynomial which tells us 'S' or 'U'.
2. Look at the coefficient of the highest degreed term to decide direction.

Sep 26-8:10 AM



$2x^4$ If the leading coefficient is positive and the degree is even the end behavior is:
$\lim_{x\to\infty} f(x) = \infty$ $\lim_{x\to-\infty} f(x) = \infty$

$-3x^{10}$ If the leading coefficient is negative and the degree is even the end behavior is:
$\lim_{x\to\infty} f(x) = -\infty$ $\lim_{x\to-\infty} f(x) = -\infty$

$4x^7$ If the leading coefficient is positive and the degree is odd the end behavior is:
$\lim_{x\to\infty} f(x) = \infty$ $\lim_{x\to-\infty} f(x) = -\infty$

$-8x^5$ If the leading coefficient is negative and the degree is odd the end behavior is:
$\lim_{x\to\infty} f(x) = -\infty$ $\lim_{x\to-\infty} f(x) = \infty$

Sep 26-8:29 AM

What does the degree of a polynomial tell us?

shape

Zeros = roots = solutions = x-intercepts (sometimes)

Describe the end behavior using the notation discussed.

Polynomial	degree	shape	end behavior
$y = 3x^5 - 4x + 1$	5	S+	$\lim_{x\to\infty} f(x) = \infty$ $\lim_{x\to-\infty} f(x) = -\infty$
$y = 5 - 2x^{16}$	16	U-	
$y = -4x^3 + x$	3	S-	

Sep 26-8:32 AM

To find the zeros of a polynomial we factor, if possible.

$f(x) = x^3 + x^2 - 20x$

$0 = x(x^2 + x - 20)$

$x(x+5)(x-4)$

$x=0$ | $x=-5$ | $x=4$

$f(x) = -x^5 - x^3 + 20x$

$-x(x^4 + x^2 - 20)$

$-x(x^2+5)(x^2-4)$

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

$x=0$ | $x^2=-5$ | $x=2$ | $x=-2$

$x=\pm\sqrt{-5}$

$x=\pm\sqrt{5}i$

If a polynomial does not factor, use the quadratic formula!!

Sep 26-8:37 AM

Factoring Review

sum/difference of cubes

difference of squares

Sep 19-6:12 AM

Factoring the Sum or Difference of Cubes

Multiply $(x-3)(x^2+3x+9) = x^3 - 27 \neq (x-3)^3$

Factor

1. $x^3 - 8 = (x-2)(x^2+2x+4)$
   $x^3 - 2^3$

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

3. $a^3 + b^3$
   $(a+b)(a^2 - ab + b^2)$

4. $8x^3 - 27$
   $(2x - 3)(4x^2 + 6x + 9)$

5. $125z^3 + 1$

What's the pattern?

(cube root, cube root)(square, squish, square,)
binomral — trinomral

SOAP ⇒ same, opposite, always positive

[redacted]

Aug 22-8:33 AM

Difference of Squares

You should be familar with this:

$$4x^2-9=(2x-3)(2x+3)$$

But what if one of the terms is a binomial?

$$(x+2)^2-25$$

It is still the difference of two squared terms!

Sep 19-6:02 AM

HOMEWORK

p 112 9, 15-21odd, 33, 35, 41-47 odd

Workbook p 17 ~~odds~~ cubes column 1-7 odd

Aug 29-6:38 AM

GO COUGARS!

Homework Questions

In Exercises 23–32, find all the real zeros of the polynomial function. Determine the multiplicity of each zero. Use a graphing utility to verify your result.

23. $f(x) = x^2 - 25$
24. $f(x) = 49 - x^2$
25. $h(t) = t^2 - 6t + 9$
26. $f(x) = x^2 + 10x + 25$
27. $f(x) = x^2 + x - 2$
28. $f(x) = 2x^2 - 14x + 24$
29. $f(t) = t^3 - 4t^2 + 4t$
30. $f(x) = x^4 - x^3 - 20x^2$

In Exercises 65–68, sketch the graph of a polynomial function that satisfies the given conditions. If not possible, explain your reasoning. (There are many correct answers.)

65. Third-degree polynomial with two real zeros and a negative leading coefficient

66. Fourth-degree polynomial with three real zeros and a positive leading coefficient

67. Fifth-degree polynomial with three real zeros and a positive leading coefficient

68. Fourth-degree polynomial with two real zeros and a negative leading coefficient

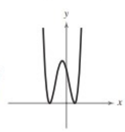
In Exercises 69–78, sketch the graph of the function by (a) applying the Leading Coefficient Test, (b) finding the zeros of the polynomial, (c) plotting sufficient solution points, and (d) drawing a continuous curve through the points.

69. $f(x) = x^3 - 9x$
70. $g(x) = x^4 - 4x^2$
71. $f(x) = x^3 - 3x^2$
72. $f(x) = 3x^3 - 24x^2$
73. $f(x) = -x^4 + 9x^2 - 20$
74. $f(x) = -x^6 + 7x^3 + 8$
75. $f(x) = x^3 + 3x^2 - 9x - 27$

In Exercises 83–90, use a graphing utility to graph the function. Identify any symmetry with respect to the *x*-axis, *y*-axis, or origin. Determine the number of *x*-intercepts of the graph.

83. $f(x) = x^2(x + 6)$
84. $h(x) = x^3(x - 4)^2$
85. $g(t) = -\frac{1}{2}(t - 4)^2(t + 4)^2$
86. $g(x) = \frac{1}{8}(x + 1)^2(x - 3)^3$
87. $f(x) = x^3 - 4x$
88. $f(x) = x^4 - 2x^2$
89. $g(x) = \frac{1}{5}(x + 1)^2(x - 3)(2x - 9)$

107. (a) $f(x) = (x - 1)^2(x + 2)^2$
(b) $f(x) = (x - 1)(x + 2)$
(c) $f(x) = (x + 1)^2(x - 2)^2$
(d) $f(x) = -(x - 1)^2(x + 2)^2$
(e) $f(x) = -(x + 1)^2(x - 2)^2$



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