

Simplify.

$$1) (6 - 2i) + (4 - 7i)$$

$$10 - 9i$$

$$3) (2 + 4i) - (6 - 3i)$$

$$-4 + 7i$$

$$5) (-2i)(4i)(1 - 6i)$$

$$8 - 48i$$

$$7) (-7 - 6i)^2$$

$$13 + 84i$$

$$9) (8 + 2i) - (-3 + 5i)$$

$$11 - 3i$$

$$11) (5 + 2i) + (3i) - (8i)$$

$$5 - 3i$$

$$13) \frac{10 - 4i}{4i}$$

$$\frac{-5i - 2}{2}$$

$$15) \frac{3}{7i}$$

$$\frac{-3i}{7}$$

$$17) \frac{4i}{-2 + i}$$

$$\frac{-8i + 4}{5}$$

$$19) \frac{1 - i}{7i}$$

$$\frac{-i - 1}{7}$$

$$21) \frac{9}{4i}$$

$$\frac{-9i}{4}$$

$$23) i^{56} (i^2)^{28} = 1$$

$$25) i^{209} (i^2)^{104} i = i$$

$$27) 3\sqrt{-24}$$

$$6i\sqrt{6}$$

$$2) (6 - 4i) + (5 + 4i)$$

$$11$$

$$4) (1 + 8i) - (4 + i)$$

$$-3 + 7i$$

$$6) (-1 - i)(-5 - 7i)$$

$$-2 + 12i$$

$$8) (6 - 3i)(7 + 8i)$$

$$66 + 27i$$

$$10) (-1 - 8i)^2$$

$$-63 + 16i$$

$$12) (3 + i) + (-2 + 8i)$$

$$1 + 9i$$

$$14) \frac{6 + 2i}{9i}$$

$$\frac{-6i + 2}{9}$$

$$16) \frac{-9 - 10i}{7i}$$

$$\frac{9i - 10}{7}$$

$$18) \frac{5 - 2i}{1 - 6i}$$

$$\frac{17 + 28i}{37}$$

$$20) \frac{10 - 4i}{-i}$$

$$10i + 4$$

$$22) \frac{9 + 7i}{2i}$$

$$\frac{-9i + 7}{2}$$

$$24) i^{87} (i^2)^{43} i = -i$$

$$26) \sqrt{-4} = 2i$$

$$28) 5\sqrt{-32}(6\sqrt{-18})$$

$$20i\sqrt{2}(18i\sqrt{2}) \rightarrow 360i^2\sqrt{4} = -720$$

HOMEWORK

Simplify:

$$\begin{aligned} 1. (3+4i)-(3-5i) \\ 3+4i-3+5i \\ 9i \end{aligned}$$

$$\begin{aligned} 2. -3(-i)+(8i)(4-5i) \\ 3i+32i-40i^2 \\ \quad \quad \quad -40(-1) \\ 40+35i \end{aligned}$$

$$\begin{aligned} 3. (-2+7i)(8+7i) \\ -16-14i+56i+49i^2 \\ -65+42i \end{aligned}$$

$$\begin{aligned} 4. (-1-3i)-7+2 \\ -1-3i-7+2 \\ -6-3i \end{aligned}$$

$$\begin{aligned} 5. \left(\frac{10+2i}{-4i} \right) \cdot \frac{10i+2i^2}{-4i^2} \\ \frac{-2+10i}{4} = \frac{-1+5i}{2} \end{aligned}$$

$$\begin{aligned} 6. \frac{-2+8i}{-7i} \cdot \frac{-2i+8i^2}{-7i^2} \\ = \frac{-8-2i}{7} \end{aligned}$$

$$7. \sqrt{-72} = 6i\sqrt{2}$$

$$8. 5\sqrt{-8} = 10i\sqrt{2}$$

$$\begin{aligned} 9. 6i\sqrt{-125} \\ 30i^2\sqrt{3} \\ -30\sqrt{3} \end{aligned}$$

$$\begin{aligned} 10. -8i\sqrt{-196} \\ -8i(14i) \\ -112i^2 \\ = 112 \end{aligned}$$

Factor each completely.

1) $a^2 - a - 12$

$$(a-4)(a+3)$$

3) $n^2 - 11n + 28$

$$(n-7)(n-4)$$

5) $p^2 + 15p + 50$

$$(p+5)(p+10)$$

7) $15p^2 - 55p + 50$

$$5(3p-5)(p-2)$$

9) $10b^2 + 45b + 50$

$$5(2b+5)(b+2)$$

11) $6x^4 - 12x^2 - 288$

$$6(x^2-8)(x^2+6)$$

13) $x^4 + 11x^2 + 30$

$$(x^2+5)(x^2+6)$$

15) $x^4 - x^2 - 90$

$$(x^2+9)(x^2-10)$$

2) $x^3 + 15x^2 + 54x$

$$x(x+6)(x+9)$$

4) $n^3 - 3n^2 - 40n$

$$n(n+5)(n-8)$$

6) $9x^3 + 33x^2 + 24x$

$$3x(3x+8)(x+1)$$

8) $5x^2 + 2x$

$$x(5x+2)$$

10) $12a^4 + 40a^3$

$$4a^3(3a+10)$$

12) $x^4 + 8x^2 + 16$

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

14) $x^4 - 13x^2 + 42$

$$(x^2-7)(x^2-6)$$

16) $16x^2 - 25$

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

$$17) 9x^2 - 25$$

$$(3x+5)(3x-5)$$

$$19) 9x^2 - 6x + 1$$

$$(3x-1)^2$$

$$21) 25x^2 - 1$$

$$(5x+1)(5x-1)$$

$$23) 4x^2 - 1$$

$$(2x+1)(2x-1)$$

$$25) 125 + a^3$$

$$(5+a)(25-5a+a^2)$$

$$27) 8x^3 + 27$$

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

$$29) 54x^3 - 2$$

$$2(3x-1)(9x^2+3x+1)$$

$$31) 27x^3 - 8$$

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

$$18) 25n^2 - 9$$

$$(5n+3)(5n-3)$$

$$20) 16n^2 - 9$$

$$(4n+3)(4n-3)$$

$$22) b^2 + 4b + 4$$

$$(b+2)^2$$

$$24) 80x^2 - 40x + 5$$

$$5(4x-1)^2$$

$$26) 2x^3 + 250$$

$$2(x+5)(x^2-5x+25)$$

$$28) a^3 + 27$$

$$(a+3)(a^2-3a+9)$$

$$30) 125u^3 - 1$$

$$(5u-1)(25u^2+5u+1)$$

$$32) 256u^3 - 500$$

$$4(4u-5)(16u^2+20u+25)$$

Homework

Factor each. Just think of all the ways we can factor. ☺

<p>1. $c^2 - 11c + 18$ $(c-9)(c-2)$</p>	<p>2. $9x^2 - 49$ $(3x+7)(3x-7)$</p>	<p>3. $9x^2 - 12x + 4$ $(3x-2)^2$</p>
<p>4. $2x^2 - x - 10$ $(2x-5)(x+2)$</p>	<p>5. $5a^2 + 10a + 5$ $5(a^2 + 2a + 1)$ $5(a+1)(a+1)$</p>	<p>6. $3p^2 + 22p - 16$ $(p+8)(3p-2)$</p>
<p>7. $16x^5 - 44x^4 + 30x^2$ $2x^2(8x^3 - 22x^2 + 15)$</p>	<p>8. $18a^2 - 50$ $2(9a^2 - 25)$ $2(3a+5)(3a-5)$</p>	<p>9. $3x^2 + 11x + 6$ $(x+3)(3x+2)$</p>
<p>10. $27x^3 + 64$ $(3x)^3 + 4^3$ $(3x+4)(9x^2 - 12x + 16)$</p>	<p>11. $8x^3 - 1$ $(2x)^3 - 1^3$ $(2x-1)(4x^2 + 2x + 1)$</p>	<p>12. $125x^3 + 343$ $(5x)^3 + 7^3$ $(5x+7)(25x^2 - 35x + 49)$</p>

Solve: exact answers simplest form

1) $m^2 - 30 = -m$

$$= -6, 5$$

3) $n^2 + 4n = 32$

$$= 4, -8$$

5) $p^2 = 64$

$$= \pm 8$$

7) $7m^2 = -4 + 16m$

$$= 2/7, 2$$

9) $x^2 - 20x - 26 = -5$

$$= 21, -1$$

11) $a^2 + 14a - 80 = -8$

$$= 4, -18$$

13) $9n^2 - 1 = 431$

$$= \pm 4\sqrt{3}$$

15) $4r^2 - 3 = -26$

$$= \pm \frac{i\sqrt{23}}{2}$$

17) $9x^2 + 7 = 107$

$$= \pm 10/3$$

19) $2b^2 + 4 = 4b$

$$= 1+i, 1-i$$

21) $8x^2 + 8x = -8$

$$= \frac{-1+i\sqrt{3}}{2}, \frac{-1-i\sqrt{3}}{2}$$

2) $n^2 = n + 12$

$$= 4, -3$$

4) $x^2 = -7x$

$$= -7, 0$$

6) $k^2 - 13k = -40$

$$= 8, 5$$

8) $5p^2 - 34p = -24$

$$= 4/5, 6$$

10) $x^2 - 14x - 88 = 7$

$$= 19, -5$$

12) $v^2 + 2v - 45 = 6$

$$= -1 + 2\sqrt{13}, -1 - 2\sqrt{13}$$

14) $6p^2 + 4 = -22$

$$= \pm \frac{i\sqrt{39}}{3}$$

16) $5b^2 - 8 = -61$

$$= \pm \frac{i\sqrt{266}}{5}$$

18) $3n^2 - 10n = 77$

$$= 7, -11/3$$

20) $x^2 - 81 = 0$

$$= \pm 9$$

22) $n^2 = -9$

$$= \pm 3i$$

Homework Solving Quadratics

<p>Solve by graphing.</p> $x^2 - 9x + 14 = 0$ $x = 2$ $x = 7$	<p>Solve by factoring.</p> $3x^2 - 10x + 3 = 0$ $x = 3$ $x = \frac{1}{3}$	<p>Solve by square roots.</p> $(2x - 3)^2 = 45$ $x = \frac{3 \pm 3\sqrt{5}}{2}$
<p>Solve by quadratic formula.</p> $7x^2 + 6x = 2$ $7x^2 + 6x - 2 = 0$ $x = \frac{-6 \pm \sqrt{36 - 4(7)(-2)}}{14}$ $= \frac{-6 \pm 2\sqrt{23}}{14}$ $= \frac{-3 \pm \sqrt{23}}{7}$	<p>Solve by completing the square.</p> $x^2 - 10x - 8 = 0$ $x^2 - 10x + \underline{\quad} = 8 + \underline{\quad}$ $(x - 5)^2 = 33$ $x = 5 \pm \sqrt{33}$	<p>Solve with any method. State which method you picked.</p> $n^2 - 14n + 49 = 3$ $n^2 - 14n + \frac{49}{4} = -46 + \frac{49}{4}$ $(n - 7)^2 = 3$ $n = 7 \pm \sqrt{3}$
<p>Solve with any method.</p> $49x^2 - 16 = 0$ $(7x + 4)(7x - 4) = 0$ $x = -4/7 \quad x = 4/7$ <p style="text-align: center;">or</p> $49x^2 = 16$ $x^2 = \frac{16}{49} = \pm \frac{4}{7}$	<p>Solve with any method.</p> $x^2 + 2x = 2$ $x^2 + 2x + 1 = 2 + 1$ $(x + 1)^2 = 3$ $x = -1 \pm \sqrt{3}$	<p>Solve with any method.</p> $x^2 - 10x + 28 = 0$ $x^2 - 10x + \frac{25}{4} = -28 + \frac{25}{4}$ $(x - 5)^2 = -3$ $x = 5 \pm i\sqrt{3}$

Homework

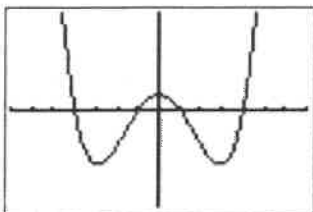
Polynomial	Degree	Leading Coefficient	End Behavior
$y = -2x^3 + 3$	3	-	$x \rightarrow -\infty, f(x) \rightarrow \infty$ $x \rightarrow \infty, f(x) \rightarrow -\infty$
$y = x^4 - 3x^2 + 1$	4	+	$x \rightarrow -\infty, f(x) \rightarrow \infty$ $x \rightarrow \infty, f(x) \rightarrow \infty$
$y = 2x^3 - 7x^2$	3	+	$x \rightarrow -\infty, f(x) \rightarrow -\infty$ $x \rightarrow \infty, f(x) \rightarrow \infty$
$y = -x^6 - 4x^3$	6	-	$x \rightarrow -\infty, f(x) \rightarrow -\infty$ $x \rightarrow \infty, f(x) \rightarrow -\infty$

Find the (a) relative maximum, (b) relative minimum, (c) and all the zeros for each function, (d) state the end behavior.

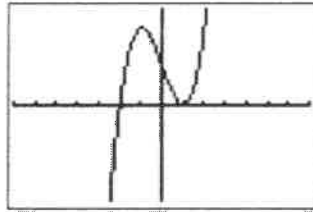
2. $f(x) = x^4 - 3x^3 + 5x = x(x^3 - 3x^2 + 5)$ 3. $f(x) = -0.3x^3 + 4x + 2$
- (a) = (1, 3) (a) = (2.11, 7.62)
- (b) = (-0.66, -2.25) (1.91, 1.95) (b) = (-2.11, -3.62)
- (c) = (-1.1, 0) (0, 0) *real ; 2 imag* (c) = (-3.37, 0) (-0.51, 0) (3.88, 0)
- (d) = $x \rightarrow \infty, f(x) \rightarrow \infty$ $x \rightarrow -\infty, f(x) \rightarrow \infty$ (d) = $x \rightarrow -\infty, f(x) \rightarrow \infty$ $x \rightarrow \infty, f(x) \rightarrow -\infty$

4.

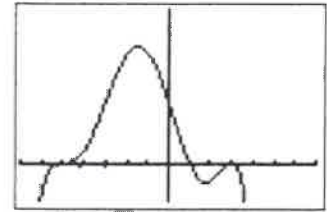
Write a factored form polynomial function $f(x)$ of least degree that has a leading coefficient of 1 with the real zeros shown in the graph.



$$f(x) = (x+4)(x+1)(x-1)(x-4)$$



$$f(x) = (x+2)(x-1)^2$$



$$f(x) = (x+5)^3(x-1)(x-2)^2$$

State the following for each polynomial below:

a. Zeros and multiplicity

b. Degree

c. Leading coefficient

d. End behavior

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

4

+1

$x \rightarrow -\infty$
 $f(x) \rightarrow \infty$

$x \rightarrow \infty$
 $f(x) \rightarrow \infty$

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

6

+2

$x \rightarrow -\infty$
 $f(x) \rightarrow \infty$

$x \rightarrow \infty$
 $f(x) \rightarrow \infty$

3. $h(x) = -3(x-7)(x+2)^3$

4th

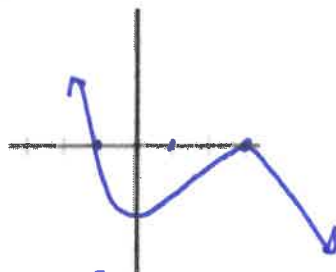
-3

$x \rightarrow -\infty$
 $f(x) \rightarrow -\infty$

$x \rightarrow \infty$
 $f(x) \rightarrow -\infty$

6. **WITHOUT a calculator, sketch the graph of each polynomial functions using the info provided.**

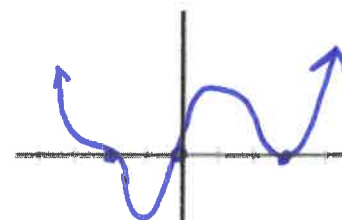
26. A polynomial with a negative leading coefficient and zeros of $x = -3$ (mult. 2) and $x = 1$.



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

3rd

27. A polynomial with a positive leading coefficient and zeros of $x = -2$ (mult. 3), $x = 0$, and $x = 3$ (mult. 2)



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

6th

Homework

Divide by using LONG Division.

<p>1) $(20x^2 - 13x + 2) \div (4x - 1)$</p> $= 5x - 2$	<p>2) $(x^2 - 2x + 3) \div (x + 5)$</p> $= x - 7 + \frac{38}{x+5}$
<p>3) $(x^3 + 2x^2 - x - 2) \div (x + 2)$</p> $= x^2 - 1$	<p>4) $(6x^2 - 7x - 5) \div (3x - 5)$</p> $= 2x + 1$
<p>5) $\frac{5x^3 - 7x - 1}{x - 1}$</p> $= 5x^2 + 5x - 2 - \frac{3}{x-1}$	<p>6) $(12x^3 + 16x^2 - 8x) \div 2x$</p> $= 6x^2 + 8x - 4$

7) There is an error in the student work below: The student divided $(x^3 - 8)$ by $(x - 2)$. What is the error (or errors!) and explain how to solve the problem correctly!

$$\begin{array}{r}
 x^2 \\
 x - 2 \overline{) x^3 - 8} \\
 \underline{x^3 - 2x^2} \\
 -6 + 2x^2
 \end{array}$$

The answer is x^2 remainder $-6 + 2x^2$.

Homework

Divide using synthetic division.

<p>1. $(-2x^5 + 2x^4 + 2x^3 - 3x^2 - 4x - 1) \div (x - 3)$</p> $= 2x^4 - 4x^3 + 10x^2 - 33x - 103 - \frac{310}{x-3}$	<p>2. $(x^4 - 6x^3 - 40x + 33) \div (x - 7)$</p> $= x^3 + x^2 + 7x + 9 + \frac{96}{x-7}$
<p>3. $(2x^6 + 5x^5 - x^4 - x^3 - 5x^2 - 2) \div (x + 4)$</p> $2x^5 - 3x^4 + 11x^3 - 45x^2 + 175x - 700 + \frac{2798}{x+4}$	<p>4. $(x^4 - x^2 + 2x - 3) \div (x + 2)$</p> $= x^3 - 2x^2 + 3x - 4 + \frac{5}{x+2}$

State if the given binomial is a factor of the polynomial.

7) $(k^3 - k^2 - k - 2) \div (k - 2)$

yes remainder 0

8) $(b^4 - 8b^3 - b^2 + 62b - 34) \div (b - 7)$

no

9) $(n^4 + 9n^3 + 14n^2 + 50n + 9) \div (n + 8)$

no

10) $(p^4 + 6p^3 + 11p^2 + 29p - 13) \div (p + 5)$

no

Homework ~ Unit Review

Find the remainder when $f(x) = x^5 - 2x^3 + 3x + 4$ is divided by $x + 3$.

$$= -194$$

Find all zeros of the polynomial function. Give exact values. List multiple zeros as necessary.

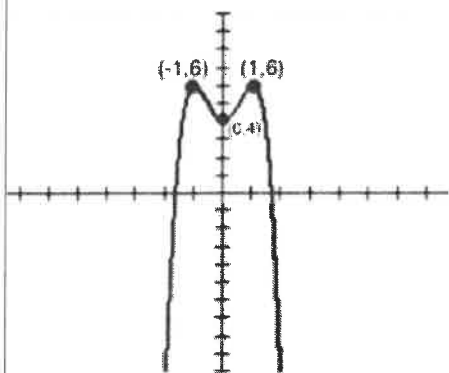
$$f(x) = x^3 + 13x^2 + 51x + 63$$

$$x = -7$$

$$x = -3 \text{ M2}$$

$$\text{Factor } x^2 + 7x + 10 = (x+5)(x+2)$$

Find the domain and range of the polynomial function graphed below.



$$D (-\infty, \infty)$$

$$R (-\infty, 6]$$

State the end behavior of the polynomial.

$$x \rightarrow -\infty \\ f(x) \rightarrow -\infty$$

$$x \rightarrow \infty \\ f(x) \rightarrow -\infty$$

Relative Max:
 $(-1, 6)$ $(1, 6)$

Relative Min:
 $(0, -4)$

$$\text{Factor } 4x^2 - 36 = 4(x^2 - 9) = 4(x+3)(x-3)$$

Is $(x - 7)$ a factor of: $x^3 - 9x^2 - 9x - 35$? Explain why or why not.

no remainder not zero

$$r = -196$$

Simplify and write in standard form. Then classify by degree and number of terms.

$$(2x - 4x^2 + 12) - (x^2 - 10 + 5)$$

$$-5x^2 + 2x + 17$$

deg: 2nd Quad

term: 3 trinomial

$$\text{Factor completely } 3x^3 + 81 = 3(x^3 + 27) = 3(x+3)(x^2 - 3x + 9)$$