Write your questions and thoughts here!

7.5 –Polynomial Division

Recall Long Division: a. $\frac{851}{23}$

Polynomial Long Division:

b. Divide $f(x) = 3x^4 - 5x^3 + 4x - 6$ by $(x^2 - 3x + 5)$

c. Divide $f(x) = 6m^4 - 12m^3 + m - 2$ by $(m - 2)$

You Try!: d. Divide $n^4 + 3n^3 - 7n^2 - 21n$ by $(n + 3)$

Synthetic Division

Synthetic Division is a method for dividing polynomials that is quicker and more efficient:

Examples:

e. Divide $f(x) = x^3 + 5x^2 - 7x + 2$ by $x - 2$

f. Determine if $(x + 3)$ is a factor of $(x) = 2x^3 + x^2 - 8x + 21$ by using synthetic division. If so, find the other factors.

Remainder Theorem:

If a polynomial f(x) is divided by ***x – k***, then the remainder is ***r = f(k).***

Factor Theorem:

A polynomial f(x) has a factor of ***x – k*** if and only if ***f(k) = 0.***

Finding zeros/roots/factors:

Suppose you know that (x + 9) is a factor of the function $f(x) = x^3 + 2x^2 – 51x + 108$. Factor f(x) completely.

Suppose you know that x = -2 is a zero of the function $f(x) = x^3 + 2x^2 – 9x – 18$. Find the other zeros.

So one day you are playing around with the function $f(x) = 4x^3 + 15x^2 – 63x – 54$ and you notice that f(-6) = 0. Find the all of the zeros.

Application!

Suppose the profit P (in millions of dollars) for a new Algebros T-shirt manufacturer can be modeled by $P = -x^3 + 4x^2 + x$ where x is the number of Bro-Shirts made (in millions). Currently the company produces 4 million shirts and makes a profit of $4,000,000. Can the company make a lesser number of bro-shirts and still make the same profit?

Now summarize what you have learned!

Practice 7.5

Divide using polynomial long division.

1) $(x^3 + 14x^2 + 55x + 48) \div (x + 6)$

2) $(x^4 - 61x^2 - 26x + 16) \div (x - 8)$

3) $(10a^4 + 60a^3 + 10a + 60) \div (a + 6)$

4) $(n^3 + 10n^2 + 30n + 72) \div (n + 7)$

Divide using synthetic division.

5) $(n^4 + 3n^3 - 9n - 38) \div (n + 3)$

6) $(a^4 - 4a^3 + 5a^2 + 8a - 14) \div (a - 2)$

7) $(4a^3 - 36a^2 + 60a + 72) \div (a - 6)$

8) $(x^4 + 16x^3 + 75x^2 + 91x + 49) \div (x + 7)$

Use the Factor Theorem to determine whether the given binomial is a factor of the given polynomial.

9) $(n^3 + 16n^2 + 71n + 56) \div (n + 8)$

10) $(n^4 + 7n^3 - 25n^2 + 22n - 25) \div (n - 2)$

11) $(m^4 - 17m^3 + 78m^2 - 47m - 63) \div (m - 7)$

12) $(v^4 - 6v^3 - 35v^2 + 26v + 20) \div (v + 4)$

Given a polynomial f(x) and a factor of f(x), factor f(x) completely.

13) $f(x) = 25x^3 - 40x^2 + 17x - 2;\ 5x - 2$

14) $f(x) = 5x^3 - 18x^2 - 33x - 10;\ x - 5$

15) $f(x) = 15x^3 - 28x^2 + 15x - 2;\ 3x - 2$

16) $f(x) = 9x^3 + 3x^2 - 5x + 1;\ 3x - 1$

Application 7.5

1. If $f(x) = 6x^3 + 7x^2 - 18x + 5$ and one factor of $f(x)$ is $(x - 1)$, completely factor $f(x)$.

2. Is $m = 7$ a zero of $f(m) = m^4 - 8m^3 + 7m^2$?

Synthetic division clearly simplifies the long division process for dividing by a linear expression $(x - a)$, but is there a way to use synthetic division when dividing by a linear expression of the form $(ax - b)$ where $a > 1$?

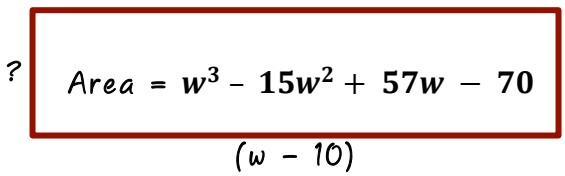
3. Use long division to divide $6x^3 - 11x^2 - 5x + 12$ by $(2x - 3)$.

4. Use synthetic division to divide $6x^3 - 11x^2 - 5x + 12$ by $\left(x - \frac{3}{2}\right)$

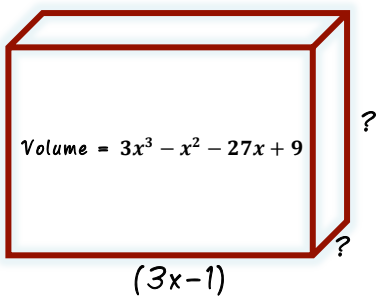
5. Compare the quotients you calculated in #3 and #4 and the factors $(2x - 3)$ and $\left(x - \frac{3}{2}\right)$ that you divided by. Now, explain how to use synthetic division to divide by a linear expression of the form $(ax - b)$ where $a > 1$.

Find the missing dimensions:

5.



6.



7.5 –Polynomial Division

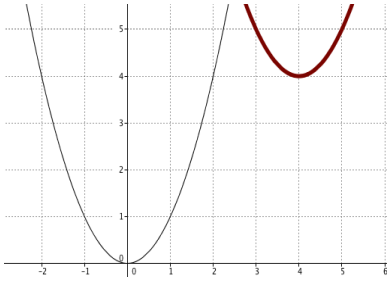
Algebra Skillz

GRAPH

Below, the graph of $f(x) = (x-4)^2 + 4$ is sketched in bold. Its parent function $f(x) = x^2$ is represented by the thin curve.

1. Describe the translation of the parent graph.

2. How does the translation relate to the equation?



SIMPLIFY

3. $\sqrt{45} + \sqrt{80} + \sqrt{500}$

4. $\sqrt{3}(10 - 2\sqrt{5})$

SOLVE

5. Solve:
$4(x-1)(2x-3) = 0$

6. Factor and solve.
$2x^2 + 5x - 3 = 0$

SAT Review

MUTIPLE CHOICE

Determine the number of zeros that are positive integers for the function:

$$f(x) = 6x^3 - x^2 - 12x - 5$$

(A) 0
(B) 1
(C) 2
(D) 3
(E) Cannot be determined

Free Response

What is the remainder when $x^6 - 4x^4 + 4x^2 - 10$ is divided by (x – 3)?