Algebra 2 5.6

Evaluate functions using "synthetic substitution"
Determine whether a binomial is a factor of a given polynomial

remainder theorem

synthetic substitution

depressed polynomial

factor theorem

$f(a) = 4a^2 - 3a + 6$ by $a - 2$.

$f(2) = 4 \cdot 4 - 3 \cdot 2 + 6$

$16 - 6 + 6 = 16$

Method 1 Long Division

$$4a + 5 + \frac{16}{a-2}$$

$$a-2 \;\overline{)\; 4a^2 - 3a + 6}$$

$-4a^2 + 8a$

$5a + 6$

$-5a + 10$

16

Method 2 Synthetic Division

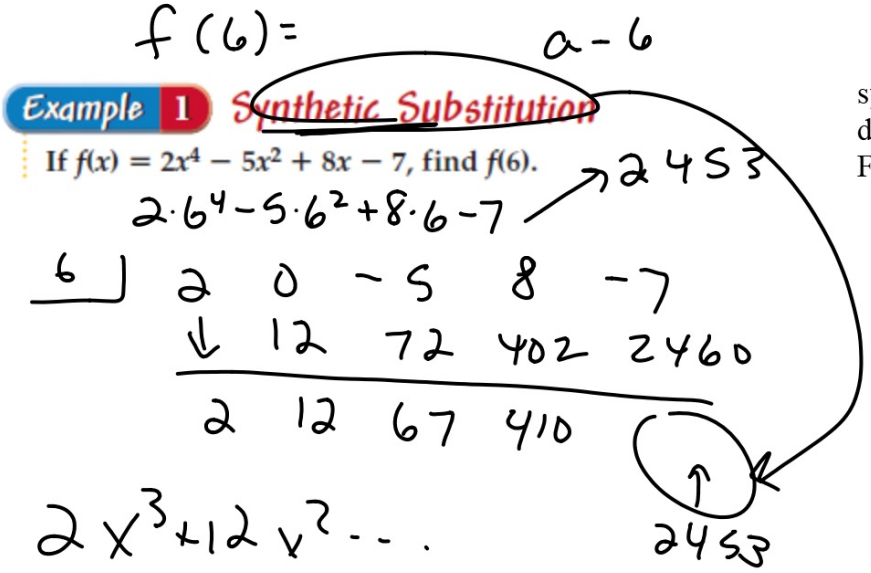
$$2 \;\big|\; 4 \quad -3 \quad 6$$

$\downarrow \quad 8 \quad 10$

$4 \quad 5 \quad 16$

$4a + 5 + \frac{16}{a-2}$

remainder= $f(2)$.



synthetic substitution (synth. division)
direct substitution (order of operations)
Follow directions

$f(3) = 7$

Use ~~synthetic~~ direct substitution to find $f(3)$ and $f(-4)$ for each function.

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

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

$$\begin{array}{r|cccc} 3 & 1 & -2 & -1 & 1 \\ & \downarrow & 3 & 3 & 6 \\ \hline & 1 & 1 & 2 & 7 \end{array}$$

$$\begin{array}{r|cccc} -4 & 1 & -2 & -1 & 1 \\ & \downarrow & -4 & 24 & -92 \\ \hline & 1 & -6 & 23 & -91 \end{array}$$

$f(-4) = -91$

How do I know whether something is a factor?
Ex: is 6 a factor of 522?

$$6\overline{)522} \quad 87 \text{ R. } 0$$

FACTORS OF POLYNOMIALS Divide $f(x) = x^4 + x^3 - 17x^2 - 20x + 32$ by $x - 4$.

4 ⌋

depressed polynomial
factor theorem (R=0)

Key Concept — *Factor Theorem*

The binomial $x - a$ is a factor of the polynomial $f(x)$ if and only if $f(a) = 0$.

Example 2 *Use the Factor Theorem*

Show that $x + 3$ is a factor of $x^3 + 6x^2 - x - 30$. Then find the remaining factors of the polynomial.

How many more should there be?

$$\begin{array}{r|cccc} -3 & 1 & 6 & -1 & -30 \\ & \downarrow & -3 & -9 & 30 \\ \hline & 1 & 3 & -10 & 0 \end{array}$$

11

$5 \times -2 = -10$, $5 + (-2) = 3$

$x^2 + 3x - 10$

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

Given a polynomial and one of its factors, find ~~the remaining~~ all factors of the ~~polynomial. Some~~ factors may not be binomials.

6. $x^3 - x^2 - 5x - 3$; $x + 1$

7. $x^3 - 3x + 2$; $x - 1$

$$\begin{array}{r|cccc} -1 & 1 & -1 & -5 & -3 \\ & \downarrow & -1 & 2 & 3 \\ \hline & 1 & -2 & -3 & 0 \end{array}$$

$-3 \times 1 = -3$, $-3 + 1 = -2$

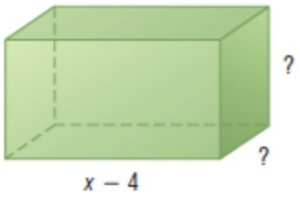
$x^2 - 2x - 3$

$(x+1)(x-3)(x+1)$

$V = (B)(h) = (\quad)(\quad)(\quad)$

Example 3 *Find All Factors of a Polynomial*

GEOMETRY The volume of the rectangular prism is given by $V(x) = x^3 + 3x^2 - 36x + 32$. Find the missing measures.



$$\begin{array}{r|rrrr} 4 & 1 & 3 & -36 & 32 \\ & \downarrow & 4 & 28 & -32 \\ \hline & 1 & 7 & -8 & 0 \end{array}$$

$x^2 + 7x - 8$

$(x+8)(x-1)$