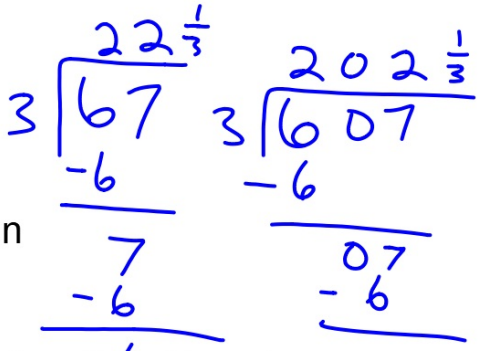
Algebra 2 5.2

Divide polynomials using long division

Divide polynomials using synthetic division



simplify (a fraction)

long division algorithm (old school--works for all problems)

synthetic division (shortcut--works for many problems--but not ALL)

depressed polynomial

whiteboards?

$$
\begin{array}{r|l}
3x+1 & 6x^5+5x^4+x^3-3x^2+x+0 \\
 & \quad 2x^4+x^3-1x+\frac{2}{3}-\frac{\frac{2}{3}}{3x+1} \\
\hline
 & -6x^5+2x^4 \\
 & \quad 3x^4+x^3 \\
 & \quad -3x^4+-x^3 \\
\hline
 & \qquad -3x^2+x \\
 & \qquad +3x^2+x \\
\hline
 & \qquad\quad 2x+0 \\
 & \qquad\quad -2x+-\frac{2}{3} \\
\hline
 & \qquad\quad -\frac{2}{3}
\end{array}
$$

$-\frac{2}{3}$

$\frac{-2}{9x+3}$

$-\frac{2}{3}\cdot\frac{1}{3x+1}$

$3x\cdot ? = 6x^5$

$\frac{3x}{3x}\cdot ? = \frac{2x}{3x}$

$\frac{3x}{3x}\cdot ? = \frac{3x^4}{3x}$

$\frac{2}{3}(3x+1)$

$3x\cdot ? = -\frac{3x^2}{3x}$

$2x+\frac{2}{3}$

$$x+2 \overline{)\, x^5+3x^2+5x-6}$$

$$x^4-2x^3$$

$$x+2 \overline{)\, x^5 \qquad\qquad 3x^2+5x-6}$$

$$\frac{x\cdot ?}{x} = \frac{x^5}{x} \qquad -x^5+2x^4$$

$$-2x^4+6$$

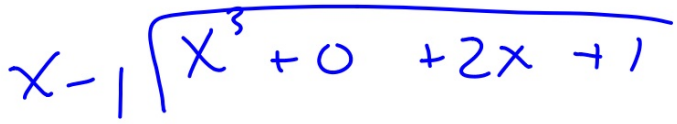
$$\frac{x\cdot ?}{x} = \frac{-2x^4}{x} \qquad -2x^4+4x^3$$

$$4x^3+3x^2$$

whiteboards

$$(x^2 - 13x + 12) \div (x - 1)$$

Is 54 the same as 504?



What if there is a missing term in the expression?

$x^3 + 2x + 1 \div (x - 1)$

What if there is a coefficient?

Look for similarities

$x - 1 = 0$ $\quad\quad$ $- -1 = 1$

$x = 1$

Long division vs Synthetic division (shortcut)

$(x^2 - 13x + 12) \div (x - 1)$

$$
\begin{array}{r|l}
x - 12 & \\
\hline
x - 1 & x^2 - 13x + 12 \\
 & -x^2 + x \\
\hline
 & -12x + 12 \\
 & +12x + 12 \\
\hline
 & 0
\end{array}
$$

$$
\begin{array}{r|rr}
 & 1 & -13 \quad 12 \\
 & \downarrow & 1 \quad -12 \\
\hline
 & 1 & -12 \quad 0
\end{array}
$$

$x - 12$

$(x^2 + 3x - 40) \div (x - 5)$.

$$x - 5 \overline{)\, x^2 + 3x - 40}$$

$x + 8$

$-x^2 + 5x$

$8x - 40$

$-8x + 40$

0

$- -5 \quad 5$

5	1	3	-40
	↓	5	40
	1	8	0

$x + 8$

KeyConcept Synthetic Division

Step 1 Write the coefficients of the dividend so that the degrees of the terms are in descending order. Write the constant r of the divisor $x - r$ in the box. Bring the first coefficient down.

Step 2 Multiply the first coefficient by r, and write the product under the second coefficient.

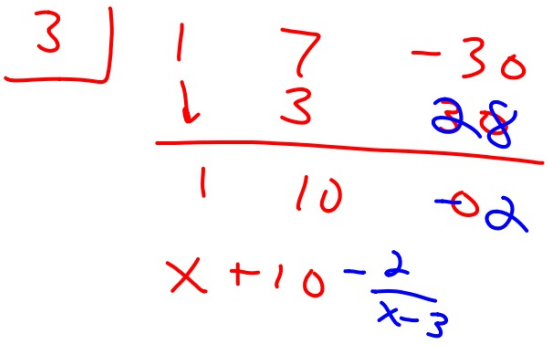
Step 3 Add the product and the second coefficient.

Step 4 Repeat Steps 2 and 3 until you reach a sum in the last column. The numbers along the bottom row are the coefficients of the quotient. The power of the first term is one less than the degree of the dividend. The final number is the remainder.

depressed polynomial

GuidedPractice

2A. $(x^2 + 7x - 30) \div (x - 3)$



Example 4 Synthetic Division

Use synthetic division to find $(2x^3 - 13x^2 + 26x - 24) \div (x - 4)$.

$$\begin{array}{r|rrrr} 4 & 2 & -13 & 26 & -24 \\ & \downarrow & 8 & -20 & 24 \\ \hline & 2 & -5 & 6 & 0 \end{array}$$

$2x^2 - 5x + 6$

multiply...add(?)...bring down...
What does that remind you of?

Use synthetic division to find each quotient.

4A. $(2x^3 + 3x^2 - 4x + 15) \div (x + 3)$

$-3 \;|\; 2 \quad 3 \quad -4 \quad 15$

$\quad\quad\downarrow \quad -6 \quad 9 \quad -15$

$\quad\quad 2 \quad -3 \quad 5 \quad 0$

$2x^2 - 3x + 5$

$x^2 + 6x + 12 \div :$

$-1 \;|\; 1 \quad 6 \quad 12$

$\quad\quad\downarrow \quad -1 \quad -5$

$\quad\quad 1 \quad 5 \quad 7$

4B. $(3x^3 - 8x^2 + 11x - 14) \div (x - 2)$

4C. $(4a^4 + 2a^2 - 4a + 12) \div (a + 2)$

$$\begin{array}{r|ccccc} -2 & 4 & 0 & 2 & -4 & 12 \\ & \downarrow & -8 & 16 & -36 & 80 \\ \hline & 4 & -8 & 18 & -40 & 92 \end{array}$$

$$4a^3 - 8a^2 + 18a - 40 + \frac{92}{a+2}$$

Example 5 Divisor with First Coefficient Other than 1

Use synthetic division to find $(3x^4 - 5x^3 + x^2 + 7x) \div (3x + 1)$.

There is a way... not sure if it is worth the trouble
Just use (old school) long division...

$3x+1\overline{\qquad\qquad\qquad\qquad}$

WB 5.2 prac

odds + 26