

$(x \pm \#)$
3-8 Synthetic Division and the Remainder & Factor Theorems

$x^2 + 4x - 7$
 Can NOT do Synthetic

Oct 15-5:37 PM

Synthetic Division

- Synthetic division can be used to divide any polynomial by a divisor of the form $x - k$
- Write the ZERO of the divisor outside the box
- Write the coefficients of the dividend inside the box.
- Bring down the first term.
- Multiply the outside by the zero to get the number to put inside the box.
- Add the numbers on the inside of the box in columns.
- Write the outside numbers as your quotient with a remainder.

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Divide $f(x) = 2x^3 + x^2 - 8x + 5$ by $x + 3$ using synthetic division.

Zero: -3

$$\begin{array}{r|rrrr}
 -3 & 2 & 1 & -8 & 5 \\
 & & -6 & 15 & -21 \\
 \hline
 & 2 & -5 & 7 & -16
 \end{array}$$

$2x^2 - 5x + 7 + \frac{-16}{x+3}$

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① 107 1-ball
 $7+8$

② Binomial
 8 done

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#5

$x^2 + 3x - 18 \div x + 6$

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

$x + 6 \overline{) x^2 + 3x - 18}$

$x(x+6)$
 $-3(x+6)$

$-3x - 18$
 $+3x + 18$
 $\hline 0$

$x+6$ is a factor
 $x-3$ is a factor

$-3 \overline{) 1 \ 4 \ -1 \ -1}$

$\downarrow -3 \ -3 \ 12$

$1 \ 1 \ 4 \ 11$

$x^2 + x + -4 \overline{) 11}$

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Login your clickers & yes calculators.

Get a piece of paper & the 3.8 w.s. (1/2 sheet) from the brown table.

Pick 4 long division problems & complete them.

Factor a polynomial

Factor $f(x) = 3x^3 - 4x^2 - 28x - 16$ completely given that $x + 2$ is a factor.

SOLUTION Give all the factors

Because $x + 2$ is a factor of $f(x)$, you know that $f(-2) = 0$. Use synthetic division to find the other factors.

$\textcircled{-2}$ Synthetic Division

3	-4	-28	-16
	-6	20	16
3	-10	-8	0

New polynomial $3x^2 - 10x - 8$ Factored form including the give factor

Factors to $(3x + 2)(x - 4)$ $(x + 2)(3x + 2)(x - 4)$

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Factor the polynomial completely given that $x - 4$ is a factor.

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

$$\begin{array}{r|rrrr} 4 & 1 & -6 & 5 & 12 \\ & & 4 & -8 & -12 \\ \hline & 1 & -2 & -3 & 0 \end{array}$$

$$\begin{array}{r} 1 \\ \times \\ -3 \\ \hline -2 \end{array}$$

$$(x+1)(x-3)(x-4)$$

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

6. $f(x) = x^3 - x^2 - 22x + 40$

$$\begin{array}{r|rrrr} 4 & 1 & -1 & -22 & 40 \\ & & 4 & 12 & -40 \\ \hline & 1 & 3 & -10 & 0 \end{array}$$

$$\begin{array}{r} 5 \\ \times \\ -2 \\ \hline -10 \end{array}$$

$$x^2 + 3x - 10$$

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

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Find the other zeros of f given that $f(-2) = 0$.

7. $f(x) = x^3 + 2x^2 - 9x - 18$

$$\begin{array}{r|rrrr} -2 & 1 & 2 & -9 & -18 \\ & & -2 & 0 & 18 \\ \hline & 1 & 0 & -9 & 0 \end{array}$$

$$\begin{array}{r} 3 \\ \times \\ 3 \\ \hline 9 \end{array}$$

$$(x-3)(x+3)(x+2)$$

$$x = 3, x = -3, x = -2$$

8. $f(x) = x^3 + 8x^2 + 5x - 14$

$$\begin{array}{r|rrrr} -2 & 1 & 8 & 5 & -14 \\ & & -2 & -12 & 14 \\ \hline & 1 & 6 & -7 & 0 \end{array}$$

$$\begin{array}{r} 7 \\ \times \\ -1 \\ \hline -7 \end{array}$$

$$(x+7)(x-1)(x+2)$$

$$x = -7, x = 1, x = -2$$

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1 Answer?
One zero of $f(x) = x^3 - 2x^2 - 23x + 60$ is $x = 3$. What is another zero of f ?

(A) -5 (B) -4 (C) 2 (D) 5

$$\begin{array}{r} 5 \\ \times \\ -4 \\ \hline -20 \end{array}$$

$$\begin{array}{r} 1 \\ \times \\ -4 \\ \hline -4 \end{array}$$

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

$$x = -5, x = 4$$

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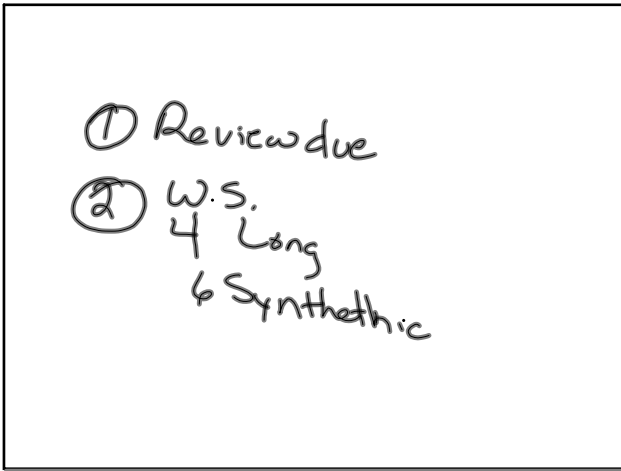
a)

$$\begin{array}{r|rrrr} 2 & 3 & 14 & -1 & 20 \\ & & 6 & 40 & 78 \\ \hline & 3 & 20 & 39 & 98 \end{array}$$

$$\begin{array}{r|rrrr} 2 & 1 & -3 & 2 \\ & & 2 & 6 & 6 \\ \hline & 1 & 3 & 3 & 0 \end{array}$$

$$\begin{array}{r|rrrr} -2 & 1 & -1 & -8 & 12 \\ & & 2 & 2 & -2 \\ \hline & 1 & 1 & -6 & 10 \end{array}$$

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