Given the following function:

$f(x) = 5x^3 - 28x^2 + 25x + 41$

Find $f(4)$ $= 5(4)^3 - 28(4)^2 + 25(4) + 41 = 13$

$$\frac{5x^3 - 28x^2 + 25x + 41}{x - 4}$$

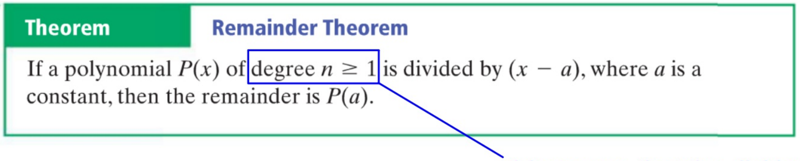
	$5x^2$	$-8x$	-7	
x	$5x^3$	$-8x^2$	$-7x$	13
-4	$-20x^2$	$32x$	28	

What is the remainder? 13

What is the zero of the divisor? 4

Evaluate the dividend using the zero of the divisor 13

Do you notice anything? the remainder is the same number that you get when you evaluate the dividend with the zero of the divisor.



Theorem **Remainder Theorem**

If a polynomial $P(x)$ of degree $n \geq 1$ is divided by $(x - a)$, where a is a constant, then the remainder is $P(a)$.

this means that the dividend must be at least a linear function.

The remainder of a quotient can be found by

evaluating the dividend using the zero of the divisor.

Find the remainder to this quotient: $\frac{2x^3 + x^2 - 7x - 10}{x - 2}$

Remainder Thm	Divide
	$2x^2+5x+3$
$2(2)^3+(2)^2-7(2)-10$	$x-2\,\overline{)\,2x^3+x^2-7x-10}$
	$2x^3-4x^2$
$= -4$	$5x^2-7x$
	$-\ 5x^2-10x$
	$3x-10$
	$-\ 3x-6$
	-4

Using either method, the remainder is -4

What is the remainder of this quotient? $\frac{6x^2 + 5x - 2}{x - 4}$

You could answer this questions by:

1. Actually doing the division

OR

2. Using the Remainder Theorem

zero of the divisor = 4

$6(4)^2 + 5(4) - 2 = 96 + 20 - 2 = 114$

The remainder = 114

Is $x - 3$ a factor of $2x^3 - 12x^2 + 21x - 9$?

Only if the remainder is zero!

$$2(3)^3 - 12(3)^2 + 21(3) - 9$$

$$54 - 108 + 63 - 9 = 0$$

Yes, x-3 is a factor because the remainder is zero.

Is $x + 2$ a factor of $x^3 + 7x^2 + 3x - 21$?

$$(-2)^3 + 7(-2)^2 + 3(-2) - 21$$

$$-8 + 28 - 6 - 21 \neq 0$$

No, x+2 is not a factor because the remainder isn't zero.

Now you can finish Hwk #31 Sec 6-3

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Problems 11,12, 23, 28, 29, 43, 44

Use polynomial long division or divide using the "Box"

Use just the Remainder Theorem

Synthetic Division

Uses the zero of the divisor.
By reversing the sign of the divisor you can ADD throughout the process instead of subtracting.

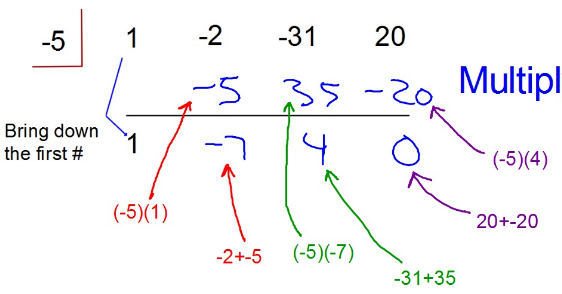
Synthetic Division can only be used if
the divisor is linear and
the leading coefficient is 1.

Meaning either ÷(x + a) or ÷(x - a)

$$\frac{x^3-2x^2-31x+20}{x+5} = x^2-7x+4 \quad R=0$$

Zero of the Divisor

Coefficients of the dividend in Standard Form



-5	1	-2	-31	20
		-5	35	-20
	1	-7	4	0

Multiply and ADD

Find each quotient using Synthetic Division

1. $\frac{4x^3-6x^2-7x-33}{x-3} = \boxed{4x^2+6x+11 \quad R=0}$

3	4	-6	-7	-33
		12	18	33
	4	6	11	0

---

2. $\frac{2x^4+18x^3+34x^2+43x+10}{x+7} = \boxed{2x^3+4x^2+6x+1 \quad R=3}$

-7	2	18	34	43	10
		-14	-28	-42	-7
	2	4	6	1	3