Warm-Up

Divide using Long Division

$$(3p^3 - 4p^2 + 5p - 6) \div (p - 1)$$

Divide using Synthetic Division

$$(x^4 + 4x^3 - 4x^2 - 22x + 20) \div (x - 2)$$

- Unit 4 Test

Objectives

Today we will...

- Use the Remainder Theorem to evaluate a function
- Apply the Factor Theorem to determine if something is a factor of a polynomial
- Apply the Factor theorem and our factoring techniques to find Zeros of polynomials

Remainder Theorem

If a polynomial is divided by $(x-k)$, then the remainder is $f(k)=r$

$p-1=0$

$p=1$

$3p^3-4p^2+5p-6 \div p-1$

$R=-2$

Ex. 1 $(v^3 + v^2 - 9v - 24) \div (v + 2)$

-2 | 1 1 -9 -24

-2 2 14

1 -1 -7 -10

R

$(-2)^3 + (-2)^2 - 9(-2) - 24$

$-8 + 4 + 18 - 24$

-10

$f(-2) = -10$

Ex.2 Evaluate $f(x) = 3x^3+8x^2+5x-7$ for $f(-2)$.

$$\begin{array}{r|cccc} -2 & 3 & 8 & 5 & -7 \\ & & & & \\ \hline & & & & -9 \end{array}$$

$(x+2)$

$$3(-2)^3 + 8(-2)^2 + 5(-2) - 7$$

$$-9$$

$$f(-2) = -9$$

Factor Theorem

A polynomial has a factor $(x-k)$ if and only if $f(k)=0$

(or using the remainder theorem... the remainder is zero)

Is (x+2) a factor of $f(x)=2x^3+7x^2+7x+2$?

$$\begin{array}{r|cccc} -2 & 2 & 7 & 7 & 2 \\ & & -4 & -6 & -2 \\ \hline & 2 & 3 & 1 & \boxed{0} \end{array}$$

yes, $(x+2)$ is a factor

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

$$-16+28-14+2$$

$$\boxed{0}$$

$$(x^3 + 3x^2 - 15x + 18) \div (x + 6)$$

Is (x+6) a factor?

$$\begin{array}{r|rrrr} -6 & 1 & 3 & -15 & 18 \\ & & -6 & 18 & -18 \\ \hline & 1 & -3 & 3 & \boxed{0} \end{array}$$

Yes!

Review: Find the factors and zeros of

$$x^3 + 2x^2 - 3x - 6 = 0$$

Factors

$x^2(x+2) - 3(x+2) = 0$

$(x^2 - 3)(x+2) = 0$

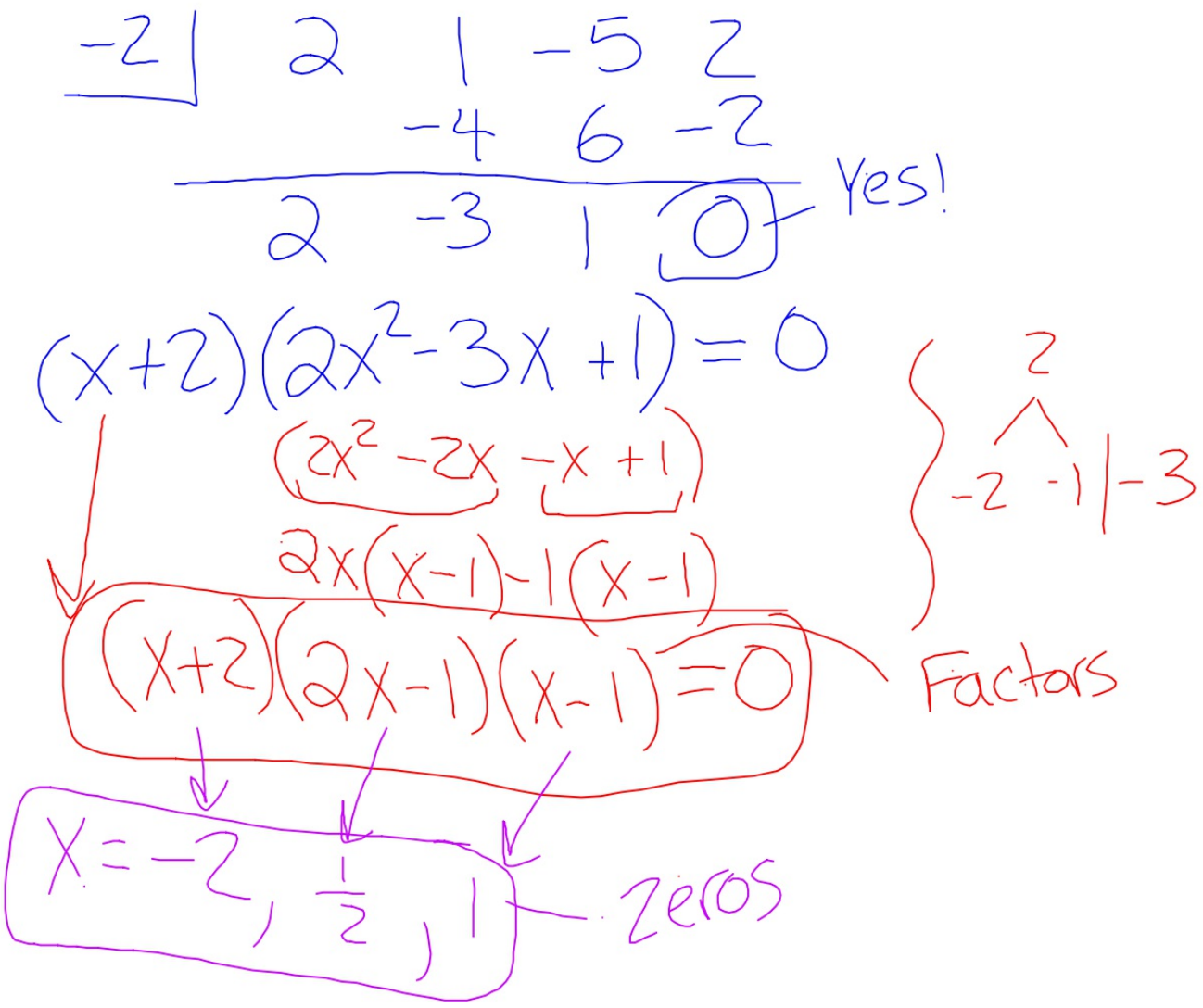
Zeros

$x^2 - 3 = 0$ $\quad x+2=0$

$x = \pm\sqrt{3}$ $\quad x = -2$

If $(x+2)$ is a factor of $f(x)=2x^3+x^2-5x+2$

Find all linear factors and zeros



Verify that $x=-3$ ($x+3$) is a root (factor) of $f(x)=x^3-19x-30$, then find all linear factors and zeros

$f(x)=x^3-8x^2+4x+48$

A) Is (x-4) a factor?

B) What are all the linear factors

C) What are the roots?

(x-1) x^3+5x^2+2x-8