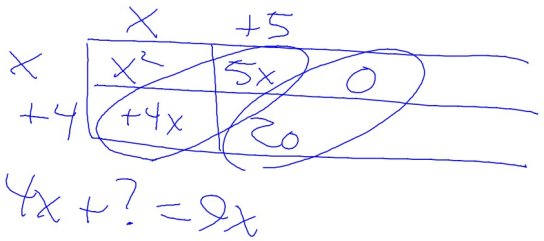
Using the "Box" for Polynomial Division

$$\frac{x^2 + 9x + 20}{x + 4} = x + 5$$

$x + 4 \overline{)\ x^2 + 9x + 20}$

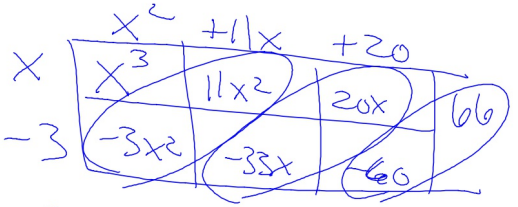


$4x + ? = 9x$

Using the "Box" for Polynomial Division

$$\frac{x^3 + 8x^2 - 13x + 6}{x - 3} = x^2 + 11x + 20 \quad r = 66$$

$x - 3 \overline{)\ x^3 + 8x^2 - 13x + 6}$ $\quad x^2 + 11x + 20$, $r = 66$

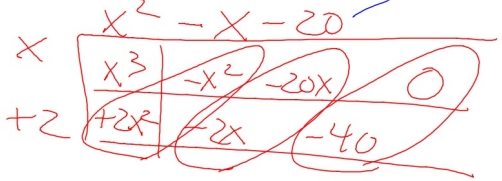


$-3x^2 + ? = 8x^2$ $\quad -33x + ? = -13x$

$-60 + ? = 60$, $+60$ $+60$

If $x + 2$ is a factor, use polynomial division to factor $x^3 + x^2 - 22x - 40$ completely.

Factor this further. $x^2 - x - 20$



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

Therefore:

$x^3 + x^2 - 22x - 40 = (x + 2)(x - 5)(x + 4)$

$$\frac{x^3 - 5x^2 + 8x - 11}{x + 3} = x^2 - 8x + 32 - \frac{107}{x+3}$$

What is the remainder? $r = -107$

What is the zero of the divisor? -3

Evaluate the dividend using the zero of the divisor.

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

-11

$= -107$

Do you notice anything?

The remainder is the same value as if you evaluated the dividend using 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 $P(a)$.

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

You could actually perform the division or use the Remainder Theorem.

The zero of the divisor is 2
Evaluate the dividend using the zero of the divisor: $2(2)^3 + (2)^2 - 7(2) - 10 = -4$

The remainder would be -4 if you performed the division.

What is the remainder of this quotient?

$$\frac{6x^2 + 5x - 2}{x - 4}$$

Use the zero of the divisor (4) and plug it into the dividend:

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

114 would be the remainder

No, x - 4 isn't a factor because the remainder isn't zero.

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

$f(x)$

Only if the remainder is zero!

Yes $\quad f(3) = 0$

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

zero $= -2$

call the dividend $f(x)$

Evalute the dividend using the zero of the divisor.

$f(-2) = -7$

x + 2 isn't a factor because the remainder isn't zero.