Warmup:

Divide using synthetic division:

1. $(x^3 - x^2 - 10x - 8) \div (x-4)$

$x^2 + 3x + 2$

$\boxed{x^2 + 3x + 2}$

4 | 1 -1 -10 -8
↓ 4 12 8
1 3 2 0

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

2 | 1 -2 1 -1 2
↓ 2 0 2 2
1 0 1 1 4

$1x^3 + 1x + 1 + \frac{4}{x-2}$

3. $(x^4 - 5x^3 - 11x^2 - 17x - 36) \div (x-7)$

7 | 1 -5 -11 -17
1 2 3 4

4. $(2x^3 - 17x^2 - 26x - 45) \div (x-10)$

10 | 2 -17 -26 -45
↓ 20 30 40
2 3 4 (-5)

$2x^2 + 3x + 4 - \frac{5}{x-10}$

Remainder Theorem

Evaluate the following:

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

$f(2) = 2^4 - 2(2)^3 + 2^2 - 2 + 2 = 4$

$f(x) = x^4 - 5x^3 - 11x^2 - 17x - 36$ when x = 7

$f(7) = -8$

$f(x) = 2x^3 - 17x^2 - 26x - 45$ when x = 10

$f(10) =$

1. Consider the polynomial function $f(x) = 3x^2 + 8x - 4$.

a. Divide f by $x - 2$.

b. Find $f(2)$.

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

$\div (x-2)$

$$\begin{array}{r|rrr} 2 & 3 & 8 & -4 \\ & & 6 & 28 \\ \hline & 3 & 14 & \boxed{24} \end{array}$$

$f(2)$

$3(2)^2 + 8(2) - 4$

$3 \cdot 4 + 16 - 4$

$12 + 16 - 4$

$28 - 4 = 24$

2. Consider the polynomial function $g(x) = x^3 - 3x^2 + 6x + 8$.

a. Divide g by $x + 1$.

b. Find $g(-1)$.

$x^3 - 3x^2 + 6x + 8$

$\div \; x+1$

$$\begin{array}{r|rrrr} -1 & 1 & -3 & 6 & 8 \\ & & -1 & 4 & -10 \\ \hline & 1 & -4 & 10 & -2 \end{array}$$

$g(-1)$

$(-1)^3 - 3(-1)^2 + 6(-1) + 8$

$-1 - 3(1) - 6 + 8$

$-1 - 3 - 6 + 8$

$-10 + 8 = -2$

3. Consider the polynomial function $h(x) = x^3 + 2x - 3$.

a. Divide h by $x - 3$.

b. Find $h(3)$.

Remainder Theorem

P(a) is the remainder when the function *P* is divided by x - a.

Evaluate a function at a given value, a, that value is <u>equal to</u> the remainder, when you divide by it's linear factor, x-a.

$$f(x) = 5x^4 + 10x^2 - 6x + 7$$

$$f(-4) = 5(-4)^4 + 10(-4)^2 - 6(-4) + 7 = 1471$$

$$\begin{array}{r|rrrrr}
-4 & 5 & 0 & 10 & -6 & 7 \\
 & \downarrow & -20 & 80 & -360 & 1464 \\
\hline
 & 5 & -20 & 90 & -366 & 1471
\end{array}$$

Use the Remainder Theorem to evaluate $f(x) = 6x^3 - 5x^2 + 4x - 17$ at $x = 3$.

$$
\begin{array}{r|rrrr}
3 & 6 & -5 & 4 & -17 \\
  & \downarrow & 18 & 39 & 129 \\
\hline
  & 6 & 13 & 43 & 112
\end{array}
$$

$f(3) = 112$

$(3, 112)$

Using the Remainder Theorem, find the value of $f(-5)$, for $f(x) = 3x^4 + 2x^3 + 4x$.

$x = -5$

$\div (x+5)$

-5	3	2	0	4	0
	↓	-15	65	-325	1605
	3	-13	65	-321	1605

$$\boxed{f(-5) = 1{,}605}$$

In Class Practice

HW #3:
Remainder Theorem