More synthetic Division

- Remember if you are missing a term, you need to put in a zero for the coefficient

$$\left(z^5 - 3z^2 - 88\right) \div (z+2)$$

$$\begin{array}{r|rrrrrr} -2 & 1 & 0 & 0 & -3 & 0 & -88 \\ & \downarrow & -2 & 4 & -8 & 22 & -44 \\ \hline & 1 & -2 & 4 & -11 & 22 & \boxed{-132} \end{array}$$

$$x^4 - 2x^3 + 4x^2 - 11x + 22 + \frac{-132}{x+2}$$

More synthetic Division

$$\left(4x^4 - 17x^2 + 14x - 3\right) \div \left(2x - 3\right)$$

$2x - 3 = 0$

$\cancel{2}x = \frac{3}{2}$

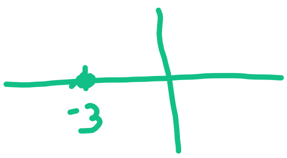
$$\begin{array}{c|ccccc}
\frac{3}{2} & 4 & 0 & -17 & 14 & -3 \\
 & \downarrow & 6 & 9 & -12 & 3 \\
\hline
 & 4 & 6 & -8 & 2 & 10 \\
 & \div 2 & \div 2 & \div 2 & \div 2 &
\end{array}$$

Divide by the denominator

$2x^3 + 3x^2 - 4x + 1$

① $x^2 + 10x + 21$ X+3 is a factor $x = -3$ Root $(-3, 0)$

$(-3)^2 + 10(-3) + 21 = 0$



③ $a^2 - 8a - 16$ $a = -4$

32

④ $y^2 - 10y - 25$ $y = 5$

-50

The Remainder Theorem

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

If $P(a) = 0$

$x - a$ is a factor

<u>And</u>

a is a root/zero

The Factor Theorem

Let $f(x)$ be a polynomial.

a. If $f(c) = 0$, then $x - c$ is a factor of $f(x)$.

b. If $x - c$ is a factor of $f(x)$, then $f(c) = 0$.

Is $x - 2$ a factor of $x^5 - 32$?

If it is, write $P(x)$ as a product of two factors.

$x - 2 = 0$
$x = 2$

$(2)^5 - 32$

$32 - 32 = 0$

$$\begin{array}{r|rrrrrr} 2 & 1 & 0 & 0 & 0 & 0 & -32 \\ & \downarrow & 2 & 4 & 8 & 16 & 32 \\ \hline & 1 & 2 & 4 & 8 & 16 & \underline{0} \end{array}$$

$(x^4 + 2x^3 + 4x^2 + 8x + 16)(x - 2)$