The Function $f(x)=x^3+2x^2-5x-6$ has x-intercepts at -3, -1, 2

What is the y-value at the x-intercept?
y=0 at the x-intercept

What is the value of the function at the x-intercept?
Y= $f(x)=0$

This is why x-intercepts are called zeros

The function is perfectly divisible by its factors
$f(x)= x^3+2x^2-5x-6$
$=(x+3)(x+1)(x-2)$
[Note: last term in each bracket multiply to get last term in function 3 x 1 x (-2) = -6]

Ex1:

Factor $x^3-x^2-14x+24$

1. Factors of 24 ± 1 ± 2 ± 3 ± 4 ± 6 ± 8 ± 12 ± 24
2. Use *Remainder Theorem* to find first zero
   $f(1)=10$

   $f(-1)= 36$

   $f(2)= 0$ *Perfectly divisible into $x^3-x^2-14x+24$, therefore (x-2) is a factor

3. Use synthetic division to divide($x^3-x^2-14x+24$) $\div (x-2)$
   You get x^2+x-12 R0
4. Factor the quadratic $x^2+x-12 = (x+4)(x-3)$

Therefore the factors of $x^3-x^2-14x+24$ are $(x+4)(x-3)(x-2)$

EX2:

Factor $g(x)=x^3+9x^2+5x-18$

1. Factors of -18 are $\pm 1 \ \pm 2 \ \pm 3 \ \pm 6 \ \pm 9 \ \pm 18$

2. Use *Remainder Theorem* to find first zero
   $f(1)\neq 0$
   $f(-1)\neq 0$
   $f(2)\neq 0$
   $f(-2)=0$ *Perfectly divisible First zero is (x+2)

3. Use synthetic division to divide
   You get x^2+7x-9

Since the quadratic can't be factored the factors of $\boldsymbol{g(x)=x^3+9x^2+5x-18=(x+2)(x^2+7x-9)}$

The Factor Theorem

(x-p) is a factor of *f*(x) if and only if *f*(p)=0

Steps to Factoring Polynomials

1. Test factors of the constant term for $f(p)=0$
2. Divide the factor found in (1.)
3. Factor the Polynomial found in (2.)

EX3:

Factor fully: $3x^3+2x^2-7x+2$

Now we factor (factor of 2/factor of 3)

$\frac{\pm 1}{\pm 1}\ \frac{\pm 2}{\pm 1}\ \frac{\pm 1}{\pm 3}\ \frac{\pm 2}{\pm 3}$

$f(1)=0$

Use synthetic division to divide $3x^3+2x^2-7x+2$ / (x-1)

And you get: $3x^2+5x-2$

Which can factor to (x+2)(3x-1)

$f(x) = (x+2)(3x-1)(x-1)$