

Always Look for a Common Factor FIRST!!!

GCF

$x^2 + 4x$

$x(x+4)$

$5y + 10$

$5(y+2)$

Remember the special cases from Algebra 1

➤ Sum of Two Cubes (SOAP):

$a^3 + b^3 = (a + b)(a^2 - ab + b^2)$

➤ Difference of Two Cubes (SOAP):

$a^3 - b^3 = (a - b)(a^2 + ab + b^2)$

➤ Difference of Squares:

$a^2 - b^2 = (a + b)(a - b)$

➤ Factoring by Grouping:

$ra + rb + sa + sb = r(a + b) + s(a + b) = (r + s)(a + b)$

Check List:

- 1) Always try to GCF!
- 2) Depends on # of terms:

- Binomial: Sum or Difference of Cubes or Difference of Squares
- Trinomial: normal factoring or unFOILING
- Polynomial: Factoring by Grouping

a) $x^3 - 64$ SOAP $a = x$ $b = 4$ $a^3 = x^3$ $b^3 = -64$

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

d) $2x^{13} + 10x^9 + 8x^5$

$2x^5(x^8 + 5x^4 + 4)$

$2x^5(x^4 + 1)(x^4 + 4)$

b) $-16x^5 - 250x^2$ SOAP $a = 2x$ $b = 5$

$-2x^2(8x^3 + 125)$

$-2x^2(2x+5)(4x^2 - 10x + 25)$

e) $x^3 - 4x^2 - 5x$

$x(x^2 - 4x - 5)$

$x(x-5)(x+1)$

c) $x^3 - 2x^2 - 9x + 18$

$x^2(x-2) - 9(x-2)$

$(x-2)(x-3)(x-2)$

f) $3y^5 - 48y^3$

$3y^3(y^2 - 16)$

$3y^3(y+4)(y-4)$

The Factor Theorem

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

- 1) Determining if a linear binomial is a factor
- 2) Use the factor to divide to find new factors
- 3) Factor once you have a quadratic instead of dividing

Show that $(x + 3)$ is a factor of $f(x) = x^4 + 3x^3 - x - 3$. Then factor completely.

$$\begin{aligned} & \hookrightarrow x = -3 & f(-3) &= (-3)^4 + 3(-3)^3 - (-3) - 3 = 0 \quad \checkmark & \text{yes} \\ & (x^4 + 3x^3)(x - 3) & & & \end{aligned}$$

$$x^3(x+3)(x+3)(-1)$$

$$(x+3)(x^3-1) \Rightarrow \text{SOAP } a=x \quad b=1 \quad \boxed{(x+3)(x-1)(x^2+x+1)}$$

Show that $(x - 2)$ is a factor of $f(x) = x^4 - 2x^3 + x - 2$. Then factor completely.

$$\begin{aligned} & \hookrightarrow x = 2 & f(2) &= (2)^4 - 2(2)^3 + (2) - 2 = 0 \quad \checkmark & \text{yes} \\ & (x^4 - 2x^3)(x - 2) & & & \end{aligned}$$

$$x^3(x-2)(x-2)$$

$$x^3(x-2) + 1(x-2) = (x^3+1)(x-2) \Rightarrow \text{SOAP } a=x \quad b=1 \quad \boxed{(x-2)(x+1)(x^2-x+1)}$$

Notes to yourself about what you struggled with so you don't make the same mistake again!!

- Always GCF 1st
- Check list!
- look to keep going unless the exponent is a 1.

Still need help with: