Secondary 3 Honors
2-2 Notes Factoring and Long Division

Warm-up
Factor the following:
1. $m^2 + 10m + 21$

$(m+7)(m+3)$

2. $v^2 + 11v + 24$

$(m+8)(m+3)$

3. $7b - 63$

$7(b-9)$

⭐ _**ALWAYS LOOK FOR GREATEST COMMON FACTORS FIRST!!**_ ⭐

Special Patterns to know

S — same
O — opposite
A — always
P — positive

Difference of Cubes
$(a^3 - b^3) = (a - b)(a^2 + ab + b^2)$
Sum of Cubes
$(a^3 + b^3) = (a + b)(a^2 - ab + b^2)$

Factor the following:
1. $x^3 - 27$

$(x - 3)(x^2 + 3x + 9)$

2. $x^3 + 8$

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

3. $64 - a^3$

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

4. $27 + 8m^3$

$(3 + 2m)(9 - 6m + 4m^2)$

Factoring polynomials with 3 terms:

Guess and Check

1) List all factors of the constant
2) place the factors in parenthesis
  ⭐ may need to change signs
    after checking your work!

Multiply first and last terms "AC Method"

1) Multiply the first # and the last # (A·C)
2) Factor
3) Put leading coefficient back in
4) simplify then divide

Factor the following:

5. $4m^2 + 20m + 16$

$4(m^2 + 5m + 4)$

$\boxed{4(m+1)(m+4)}$

6. $7x^2 - 39x - 70$

$x^2 - 39x - 490$

$(x-49)(x+10)$

$(7x-49)(7x+10)$

$\boxed{(x-7)(7x+10)}$

7. $5x^2 - 34x - 48$

$x^2 - 34x - 240$

$(x-40)(x+6)$

$(5x-40)(5x+6)$

$\boxed{(x-8)(5x+6)}$

Factoring Polynomials with 4 terms:

Grouping

1) Group the first two terms and second two terms together.
2) SIMPLIFY BY USING G.C.F.
3) simplify   4) write the new binomial times the binomial created.

Factor the following:

8. $x^3 + 10x^2 + 21x + 210$

$x^2(x+10) + 21(x+10)$

$\boxed{(x+10)(x^2+21)}$

9. $4r^3 - 3r^2 + 28r - 21$

$r^2(4r-3) + 7(4r-3)$

$\boxed{(4r-3)(r^2+7)}$

10. $6a^3 - 5a^2 + 36a - 30$

$a^2(6a-5) + 6(6a-5)$

$\boxed{(6a-5)(a^2+6)}$

11. $15a^3 - 5a^2 + 21a - 7$

$5a^2(3a-1) + 7(3a-1)$

$\boxed{(3a-1)(5a^2+7)}$

LONG DIVISION
Divide the two functions using Long Division and write a summary statement in fraction form.

12. $(4v^3 + 2v^2 + 4v) \div 8v$ $\dfrac{4v^3 + 2v^2 + 4v}{8v}$

$$\begin{array}{r} \frac{1}{2}v^2 + \frac{1}{4}v + \frac{1}{2} \\ 8v \overline{)\,4v^3 + 2v^2 + 4v + 0} \\ -4v^3 \\ \hline 2v^2 \\ -2v^2 \\ \hline 4v \\ -4v \\ \hline 0 \end{array}$$

0 Remainder

$\boxed{\dfrac{1}{2}v^2 + \dfrac{1}{4}v + \dfrac{1}{2}}$

13. $(x^3 + 12x^2 + 33x - 21) \div (x + 7)$

$$\begin{array}{r} x^2 + 5x - 2 \\ x+7 \overline{)\,x^3 + 12x^2 + 33x - 21} \\ -(x^3 + 7x^2) \\ \hline 5x^2 + 33x \\ -(5x^2 + 35x) \\ \hline -2x - 21 \\ -(-2x - 14) \\ \hline -7 \end{array}$$

-7 remainder

$\boxed{x^2 + 5x - 2 + \dfrac{-7}{x+7}}$

14. $(4b^3 + 39b^2 + 54b - 13) \div (b + 8)$

$$\begin{array}{r} 4b^2 + 7b - 2 \\ b+8 \overline{)\,4b^3 + 39b^2 + 54b - 13} \\ -(4b^3 + 32b^2) \\ \hline 7b^2 + 54b \\ -(7b^2 + 56b) \\ \hline -2b - 13 \\ -(-2b - 16) \\ \hline 3 \end{array}$$

$\boxed{4b^2 + 7b - 2 + \dfrac{3}{b+8}}$

15. $(b^4 - 49b^2 + 4b + 29) \div (b + 7)$

$$\begin{array}{r} b^3 - 7b^2 + 4 \\ b+7 \overline{)\,b^4 + 0b^3 - 49b^2 + 4b + 29} \\ -(b^4 + 7b^3) \\ \hline -7b^3 - 49b^2 \\ -(-7b^3 - 49b^2) \\ \hline 0 \quad 0 \quad 4b + 29 \\ -(4b + 28) \\ \hline 1 \end{array}$$

$\boxed{b^3 - 7b^2 + 4 + \dfrac{1}{b+7}}$