SECTION 5.2

FACTOR BY GROUPING

Factor completely:

1. \( xy + by + ax + ab = \) \( \frac{(x+y)(y+a)}{\phantom{a}} \)
   - \( y \) is common to the 1st and 2nd terms, so factor it out. \( y(x+y) + a(x+y) \)
   - Now there are 2 terms with \( x+y \) common, factor it out. \( (x+y)(y+a) \)

2. \( x^2 + 5x + xy + 5y = \) \( \frac{\phantom{x(x+5)}+y(x+5)}{\phantom{(x+5)(x+y)}} \)
   - \( x \) is common, so factor it out. \( x(x+5) + y(x+5) \)
   - Now there are 2 terms with \( x+5 \) common, factor it out. \( (x+5)(x+y) \)

3. \( 3x - 3y + x - yz = \) \( \frac{\phantom{3(x-y)+y(x-y)}}{(x-y)(3+y)} \)
   - \( 3(x-y) + y(x-y) = (x-y)(3+y) \)

4. \( 7x - 21 + xy - 3y = \) \( \frac{\phantom{7(x-3)+y(x-3)}}{(x-3)(7+y)} \)
   - \( 7(x-3) + y(x-3) = (x-3)(7+y) \)

5. \( 2ab + b - 6a - 3 = \) \( \frac{\phantom{(2a+1)-3(2a+1)}}{(2a+1)(6-3)} \)
   - Since this is a negative, factor \(-1\) out first. \( -1 \cdot (2a+1) - 3(2a+1) \)
   - Now factor by grouping. \( (2a+1)(6-3) \)

6. \( 9a + 6 - 3ab - 2b = \) \( \frac{\phantom{3(3a+2)-4(3a+2)}}{(3a+2)(3-b)} \)
   - \( 3(3a+2) - 4(3a+2) = (3a+2)(3-b) \)

There may be a GCF, factor it out first:

7. \( 3x^3 - 15x^2 + 6x^2 - 30x = \) \( \frac{\phantom{3x(x^2-5x+10)}}{3x(x-5)(x+2)} \)
   - \( 3x \) is common, so factor it out. \( 3x(x^2-5x+10) \)
   - Now factor by grouping. \( 3x(x-5) + 2(x-5) \)
   - \( 3x(x-5)(x+2) \)

You may have to rearrange the terms:

8. \( 8mm - 3 + 4m - 6m = \) \( \frac{\phantom{(4m-3)(2m+1)}}{(4m-3)(2m+1)} \)
   - \( 8mm - 6m + 4m - 3 \)
   - \( 2m(4m-3) + 1(4m-3) = (4m-3)(2m+1) \)

It is good to keep the + sign in the middle, so try switching +3 and -6m.