**College Review Math** SOLVING POLYNOMIAL EQUATIONS BY FACTORING Section 2F nen a dou  $3x^3 + 5x^2 - 12x - 20 = 0$ 1)  $2x^5 - 22x^3 = 0$ 2)  $3x^3 - 12x + 5x^2 - 20 = 0$  $2x^{3}(x^{2}-11)=0$ or run program...  $3x(x^2-4) + 5(x^2-4) = 0$ factor by grouping x = 0,  $x^2 - 11 = 0$  $x = \pm 3.4$  $x^{2} = 11$  $(x^2 - 4)(3x + 5) = 0$  $x = \pm \sqrt{11}$ (x-2)(x+2)(3x+5) = 0x = 2, x = -2, x = -5/34)  $x^4 + 4x^2 - 3x^3 - 12x + 2x^2 + 8 = 0$ 3)  $3y^5 + 9y^3 + 24y^2 = -72$  $3y^5 + 9y^3 + 24y^2 + 72 = 0$  $x^{2}(x^{2}+4) - 3x(x^{2}+4) + 2(x^{2}+4) = 0$  $v^{5} + 3v^{3} + 8v^{2} + 24 = 0$  $(x^{2}-3x+2)(x^{2}+4)=0$  $y^{3}(y^{2}+3) + 8(y^{2}+3) = 0$  $(x-2)(x-1)(x^{2}+4) = 0$  $y = 1 \pm 1.7i$ ,  $(y^{3} + 8)(y^{2} + 3) = 0$  $v = \pm 1.7i$  or use  $(y + 2)(y^2 - 2y + 4)(y^2 + 3) = 0$  $x^2 = -4$ quadratic formula y = -2, run program twice x = ±2i by hand



(Quadratic Form)

Question: Why is the problem  $4x^2 - 10x - 15 = 0$  easy to do?

It's a quadratic equation which can be factored or solved using the quadratic formula.

With that in mind...

5) 
$$n^4 - 16n^2 + 63 = 0$$
  
 $x^2 - 16x + 63 = 0$   
 $(x - 9)(x - 7) = 0$   
 $x = 9, x = 7$   
 $n^2 = 9 \text{ and } n^2 = 7$   
 $n = \pm 3, n = \pm \sqrt{7}$   
7)  $x^6 + 7x^3 - 8 = 0$ 

$$z^{2} + 7z - 8 = 0$$

$$(z + 8)(z - 1) = 0$$

$$z = -8, \quad z = 1$$

$$x^{3} = -8 \text{ and } x^{3} = 1$$

$$x^{3} + 8 = 0, x^{3} - 1 = 0$$

$$(x+2)(x^{2}-2x+4) = 0, (x-1)(x^{2}+x+1) = 0$$

$$x = -2, x = 1 \pm 1.7i, \quad x = 1, x = -.5 \pm .9i$$

6)  $6y^{4} + 17y^{2} = 14$   $6x^{2} + 17x - 14 = 0$  (3x - 2)(2x + 7) = 0 x = 2/3, x = -7/2  $y^{2} = 2/3, y^{2} = -7/2$   $y = \pm .8, y = \pm 1.9i$ 

8) 
$$z^4 + 3z^2 - 54 = 0$$

 $x^{2} + 3x - 54 = 0$ (x + 9)(x - 6) = 0 x = -9, x = 6 z^{2} = -9 and z^{2} = 6 z = ±3i, z = ± $\sqrt{6}$ 

## \*\*with approximations

The final answers have been rounded. Should you choose to use the quad-program at any point, the solutions will not be 100% accurate.

\*\*likely to see on a quiz



Find all the zeros (roots, solutions, answers) to the following polynomial equations, but first answer the questions.

1)  $3x^3 + 13x^2 - 32x - 12 = 0$  Can you group it? <u>Does have 4-parts, but will not group</u>.

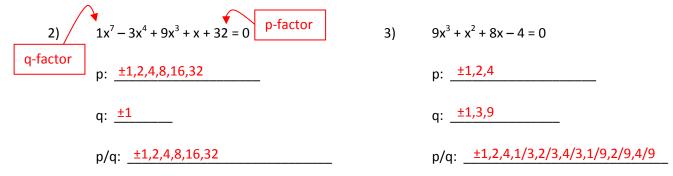
Can you use quadratic substitution? <u>No, too many parts</u>.

Then what do you do?

Construct a p & q-factor list, and choose a "potential" root from the list. Using trial and error and synthetic division, find a number that gives you a remainder of zero, then...

Listing the "potential roots" using the RATIONAL ROOT THEOREM

Examples (list the p, q, and p/q's only – you do not need to solve the equation)



Examples: Use the rational root theorem to

find all zeros (real and imaginary) for each polynomial equation

4) 
$$5x^3 - 3x^2 - 20x + 12 = 0$$
 5)  $x^4 - 12x^3 + 37x^2 - 12x + 36 = 0$ 

Work for problems 4-6 are on the next page.

6) 
$$3x^4 + 15x^3 + 10x^2 - 10x - 8 = 0$$

