

9.4B notes: the zero product property

recall the 2 forms of polynomials:

standard

$$x^2 + x + 1 = 0$$

factored

$$(x+3)(x-2) = 0$$

How can we solve for x in factored form?

a) $(x-3)(x+2) = 0$

$$\begin{array}{r} x-3=0 \\ +3 \quad +3 \\ \hline x=3 \end{array}$$

$$\begin{array}{r} x+2=0 \\ -2 \quad -2 \\ \hline x=-2 \end{array}$$

$$x=3, -2$$

b) $(x+1)(x+3) = 0$

$$\begin{array}{r} x+1=0 \\ -1 \quad -1 \\ \hline x=-1 \end{array}$$

$$\begin{array}{r} x+3=0 \\ -3 \quad -3 \\ \hline x=-3 \end{array}$$

$$x=-1, -3$$

• These x -values are called roots, x -intercepts

• This property is called the zero product property.
To use ZPP, the polynomial must be in factored form & the equation must = 0

• The ZPP: If $a \cdot b = 0$, then $a=0, b=0$
 $a=0, b=0$

Practice!

1) $(2x+3)(x-4) = 0$

$$\begin{array}{r} 2x+3=0 \\ -3 \quad -3 \\ \hline 2x = -3 \\ \frac{2x}{2} = \frac{-3}{2} \\ x = -\frac{3}{2} \end{array}$$

$$\begin{array}{r} x-4=0 \\ +4 \quad +4 \\ \hline x=4 \end{array}$$

$$x = -\frac{3}{2}$$

$$x = -\frac{3}{2}, 4$$

2) $6x(x-4) = 0$

$$\begin{array}{r} 6x=0 \\ \frac{6x}{6} = \frac{0}{6} \\ x=0 \end{array}$$

$$\begin{array}{r} x-4=0 \\ +4 \quad +4 \\ \hline x=4 \end{array}$$

$$x = 0, 4$$

3) $x(y-8)(2y-9) = 0$

$$x=0$$

$$\begin{array}{r} y-8=0 \\ +8 \quad +8 \\ \hline y=8 \end{array}$$

$$\begin{array}{r} 2y-9=0 \\ +9 \quad +9 \\ \hline 2y=9 \\ \frac{2y}{2} = \frac{9}{2} \\ y = \frac{9}{2} \end{array}$$

$$x=0, y=8, \frac{9}{2}$$

$$y = \frac{9}{2}$$

Put it all together! Factor out the GCF & solve using the ZPPI!

$$1) 2x^2 + 8x = 0$$

$$\begin{array}{l} 2x \\ \underline{2x} \\ 0 \end{array} \quad \begin{array}{l} x \\ \underline{x} \\ 0 \end{array} + 4 = 0$$

$$\begin{array}{l} 2x = 0 \\ \underline{2} \quad \underline{2} \\ x = 0 \end{array}$$

$$\begin{array}{l} x + 4 = 0 \\ \underline{-4} \quad \underline{-4} \\ x = -4 \end{array}$$

$$\boxed{x = 0, -4}$$

$$2) 6n^2 - 15n = 0$$

$$3n(2n - 5) = 0$$

$$\begin{array}{l} 3n = 0 \\ \underline{3} \quad \underline{3} \\ n = 0 \end{array} \quad \begin{array}{l} 2n - 5 = 0 \\ \underline{2n} \quad \underline{-5} \\ n = 5/2 \end{array}$$

$$n = 0 \quad n = 5/2$$

$$\boxed{n = 0, 5/2}$$

$$3) -3s^2 = 39s$$

$$\begin{array}{l} -3s^2 \\ \underline{+3s^2} \\ 0 \end{array} = \begin{array}{l} 39s \\ \underline{+3s^2} \\ 0 \end{array}$$

$$0 = 3s^2 + 39s$$

$$0 = 3s(s + 13)$$

$$\begin{array}{l} 0 = 3s \\ \underline{3} \quad \underline{3} \\ 0 = s \end{array} \quad \begin{array}{l} 0 = s + 13 \\ \underline{-13} \quad \underline{-13} \\ -13 = s \end{array}$$

$$0 = s \quad -13 = s$$

$$\boxed{s = 0, -13}$$

$$4) 4x^2 = 16x$$

$$\begin{array}{l} 4x^2 \\ \underline{-16x} \quad \underline{-16x} \\ 0 \end{array}$$

$$4x^2 - 16x = 0$$

$$4x(x - 4) = 0$$

$$\begin{array}{l} 4x = 0 \\ \underline{4} \quad \underline{4} \\ x = 0 \end{array} \quad \begin{array}{l} x - 4 = 0 \\ \underline{x} \quad \underline{-4} \\ x = 4 \end{array}$$

$$x = 0 \quad x = 4$$

$$\boxed{x = 0, 4}$$

$$5) 18c^2 + 6c = 0$$

$$\begin{array}{l} 18c^2 \\ \underline{6c} \quad \underline{6c} \\ 0 \end{array}$$

$$6c(3c + 1) = 0$$

$$6c = 0 \quad 3c + 1 = 0$$

$$c = 0 \quad c = -\frac{1}{3}$$

$$6) 28m^2 = -8m$$

$$\begin{array}{l} 28m^2 \\ \underline{+8m} \quad \underline{+8m} \\ 0 \end{array}$$

$$28m^2 + 8m = 0$$

$$4m(7m + 2) = 0$$

$$4m = 0 \quad 7m + 2 = 0$$

$$m = 0 \quad m = -\frac{2}{7}$$