

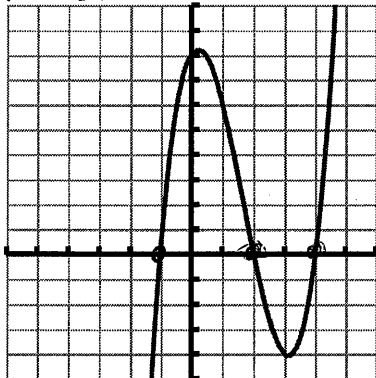
Math 3
Finding Zeros from graphs and Equations

Name _____

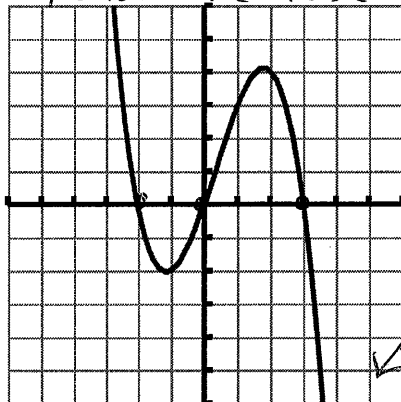
It is conventional
to write
monomial
factors on
the left

Identify the zeros from the following graphs.

1. zeros: $x = -1, x = 2, x = 4$
factors: $(x+1)(x-2)(x-4)$

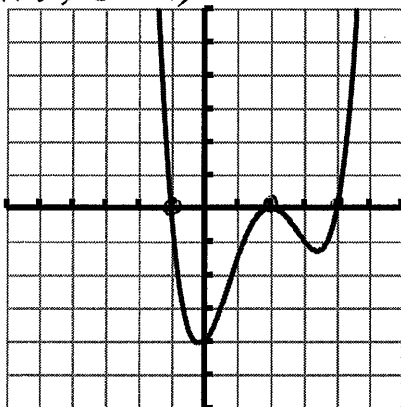


2. zeros: $x = -2, x = 0, x = 3$
factors: $x(x+2)(x-3)$

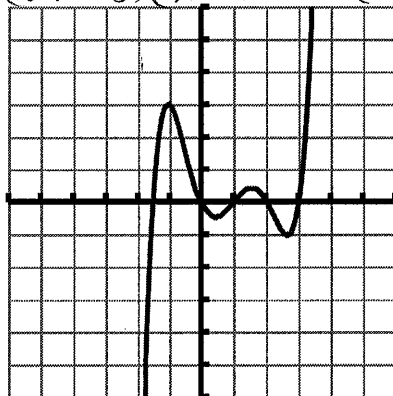


decreasing
on right
means
negative
lead
coeff

3. zeros: $x = -1, x = 2$ (mult. 2), $x = 4$
factors: $(x+1)(x-2)^2(x-4)$



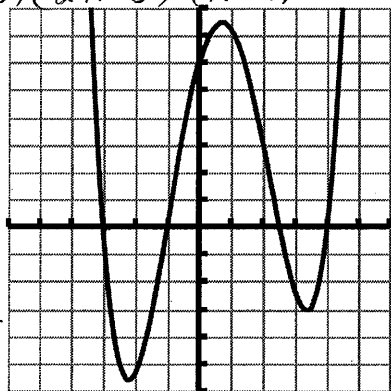
4. zeros: $x = -1.5, x = 0, x = 1, x = 2, x = 3$
factors: $x(2x+3)(x-1)(x-2)(x-3)$



If $x = -1.5$
same as
 $x = -\frac{15}{10}$
or $x = -\frac{3}{2}$

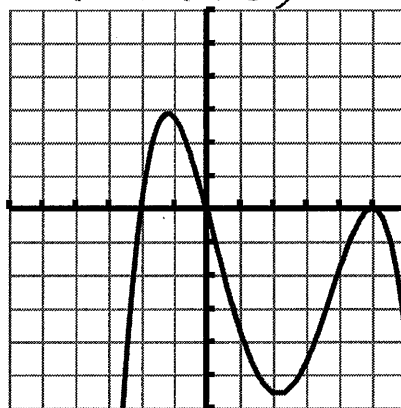
$2x = -3$

5. zeros: $x = -3, x = 2.5, x = 4$
factors: $(x+3)(2x-5)(x-4)$



$x = 2.5$
same as
 $x = \frac{25}{10}$
or $x = \frac{5}{2}$
 $2x = 5$
 $(2x-5) = 0$

6. zeros: $x = -2, x = 0, x = 5$ (mult. 2)
factors: $-x(x+2)(x-5)^2$



Graph
upside
down
means
negative
lead
coeff.

decreasing on
right side

the degree = # solutions

Ex $y = x^2 - 25 \rightarrow 2$ solutions

Ex $y = 4x^3 - 6x^2 + 9x - 11 \rightarrow 3$ solutions

THE FUNDAMENTAL THEOREM OF ALGEBRA: The degree of the function tells the total number of solutions including rational, irrational and complex solutions.

THE ZERO PRODUCT PROPERTY: If a polynomial is completely factored and there is a zero on one side of the equation, then each factor can be solved as a linear equation

USE WHEN FACTORING

APPLY THE ZERO PRODUCT PROPERTY

NOTES- SOLVE BY FACTORING

Steps:

1. Set the polynomial equal to zero.
2. Factor
3. Set the factors equal to zero and solve.

$15(22x-7) = 0$
 $330x - 105 = 0$
 ↑ one solution

Factored Form equal to zero $(3x-8)(x+5) = 0$ Factored? Is it set to 0? $3x-8=0 \rightarrow 3x=8 \rightarrow x=\frac{8}{3}$ $x+5=0 \rightarrow x=-5$	You try: $(5x+7)(3x-16) = 0$ $5x+7=0 \rightarrow 5x=-7 \rightarrow x=-\frac{7}{5}$ $3x-16=0 \rightarrow 3x=16 \rightarrow x=\frac{16}{3}$ ZPP
$6x(5x-9) = 0$ $6x=0 \rightarrow x=0$ $5x-9=0 \rightarrow 5x=9 \rightarrow x=\frac{9}{5}$	$15(22x-7) = 0$ There is no variable disregard 15 $22x-7=0 \rightarrow 22x=7 \rightarrow x=\frac{7}{22}$
Factored Form not equal to zero: $x(x+8) = -15$ distribute first $x^2 + 8x = -15$ $x^2 + 8x + 15 = 0$ $(x+5)(x+3) = 0$ ZPP $x = -5, x = -3$	$x^2 - 10x - 20 = 4$ $x^2 - 10x - 24 = 0$ $(x-12)(x+2) = 0$ $x-12=0 \rightarrow x=12$ $x+2=0 \rightarrow x=-2$
Solve by factoring Polynomial equal to zero: $x^2 - 10x = 0$ GCF $x(x-10) = 0$ $x=0$ or $x-10=0 \rightarrow x=10$	$8x^2 - 24x = 0$ GCF $8x(x-3) = 0$ $8x=0 \rightarrow x=0$ $x-3=0 \rightarrow x=3$
$2x^2 - 11x + 5 = 0$ BICAX $(x-5)(2x-1) = 0$ ZPP $x-5=0 \rightarrow x=5$ $2x-1=0 \rightarrow 2x=1 \rightarrow x=\frac{1}{2}$	$-2x^2 - 9x + 4 = 0$ Change the sign to positive by changing every sign to the opposite $2x^2 + 9x + 4 = 0$ $(x+4)(2x+1) = 0$ $x+4=0 \rightarrow x=-4$ $2x+1=0 \rightarrow 2x=-1 \rightarrow x=-\frac{1}{2}$

NO! you must have a zero!

$x+5=0 \rightarrow x=-5$
 and
 $x+3=0 \rightarrow x=-3$

ZPP

$\frac{8}{2} \times \frac{1}{2}$
 $\frac{4}{9}$

ZPP: $8 \neq 0$

$x+3=0$ $x-3=0$
 $x=-3$ $x=3$

$8x^2 - 72 = 0$
 $8(x^2 - 9) = 0$
 $8(x+3)(x-3) = 0$

$-5x^2 + 125 = 0$
 $5x^2 - 125 = 0$

$5(x^2 - 25) = 0$
 $5(x+5)(x-5) = 0$
 $x = -5, x = 5$

Solve by factoring Polynomial not equal to zero
 $8x^2 = 4x$
 $8x^2 - 4x = 0$
 $4x(2x - 1) = 0$

$30x^2 = -15x$
 $30x^2 + 15x = 0$
 $15x(2x + 1) = 0$
 $15x = 0$
 $2x + 1 = 0$

$x=0$
will be a solution

$12x^2 = 11x - 2$
 $12x^2 - 11x + 2 = 0$
 $(3x - 2)(4x - 1) = 0$

$-3x^2 = x - 10$
 $3x^2 + x - 10 = 0$

$3x - 2 = 0$ $4x - 1 = 0$
 $3x = 2$ $4x = 1$
 $x = \frac{2}{3}$ $x = \frac{1}{4}$

$(x+2)(3x-5) = 0$
 $x+2=0$
 $x = -2$

$3x - 5 = 0$
 $3x = 5$
 $x = \frac{5}{3}$

$$16. -2x^2 - 17x = -30$$

$$2x^2 + 17x = 30$$

$$2x^2 + 17x - 30 = 0$$

$$(x+10)(2x-3) = 0$$

$$\begin{array}{r} 60 \\ 20 \quad -3 \\ \hline 2 \quad 17 \quad 2 \end{array}$$

Name _____

Solve: $x = -10$, $2x = 3$
 $x = \frac{3}{2}$ Solve by Factoring Practice

1. $(9x-2)(7x-3) = 0$

2. $(2x-5)(2x+3) = 0$

13. $12x^2 - 9x = 0$

$$3x(4x-3) = 0$$

$$3x = 0 \quad 4x - 3 = 0$$

$$\boxed{x = 0} \quad 4x = 3$$

$$\boxed{x = \frac{3}{4}}$$

3. $7x(x+3)(4x-5) = 0$

4. $8(7x-15) = 0$

5. $x(x+17) = -60$

6. $x^2 - 3(x+2) = 4$

7. $x^2 - 5x - 36 = 0$

8. $-8x^2 - 10x = 0$

14. $-x^2 = -6x - 27$

$$x^2 = 6x + 27$$

$$x^2 - 6x - 27 = 0$$

$$(x-9)(x+3) = 0$$

$$x-9=0, x+3=0$$

$$\boxed{x=9, x=-3}$$

9. $3x^2 + 19x + 6 = 0$

10. $-15x^2 + 2x + 8 = 0$

11. $8x^2 - 50 = 0$

12. $-64x^2 = -9$

13. $12x^2 - 9x = 0$

14. $-x^2 = -6x - 27$

15. $3x^2 - 17x = -20$

16. $-2x^2 - 17x = -30$

15. $3x^2 - 17x = -20$

$$3x^2 - 17x + 20 = 0$$

$$(x-4)(3x-5) = 0$$

$$\boxed{x=4} \quad 3x=5$$

$$\boxed{x = \frac{5}{3}}$$

$$\begin{array}{r} 60 \\ -12 \quad -5 \\ \hline 3 \quad 17 \quad 3 \end{array}$$

1. $(9x-2)(7x-3) = 0$

$$9x-2=0 \quad 7x-3=0$$

$$9x=2 \quad 7x=3$$

$$\boxed{x = \frac{2}{9} \quad x = \frac{3}{7}}$$

2. $(2x-5)(2x+3) = 0$

$$2x-5=0 \quad 2x+3=0$$

$$2x=5$$

$$\boxed{x = \frac{5}{2}}$$

$$2x = -3$$

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

3. $7x(x+3)(4x-5) = 0$

$$7x=0 \quad x+3=0 \quad 4x-5=0$$

$$\boxed{x=0} \quad \boxed{x=-3} \quad 4x=5$$

$$\boxed{x = \frac{5}{4}}$$

4. $\frac{8}{8}(7x-15) = \frac{0}{8}$

$$(7x-15) = 0$$

$$\frac{7x}{7} = \frac{15}{7}$$

$$\boxed{x = \frac{15}{7}}$$

5. $x(x+17) = -60$
 $x^2 + 17x + 60 = 0$

$\begin{array}{r} 60 \\ \times \\ 12 \quad 35 \\ \hline 17 \end{array}$

$(x+12)(x+5) = 0$
 ZPP $x+12=0$ $x+5=0$
 $x = -12, x = -5$

6. $x^2 - 3(x+2) = 4$
 $x^2 - 3x - 6 - 4 = 0$
 $x^2 - 3x - 10 = 0$

$\begin{array}{r} -10 \\ \times \\ -5 \quad 2 \\ \hline -3 \end{array}$

$(x-5)(x+2) = 0$
 $x = 5, x = -2$

7. $x^2 - 5x - 36 = 0$

$\begin{array}{r} -36 \\ \times \\ -9 \quad 4 \\ \hline -5 \end{array}$

$(x-9)(x+4) = 0$
 $x = 9, x = -4$

8. $-8x^2 - 10x = 0$
 $-4x(2x+5) = 0$
 $-4x = 0$ $2x+5 = 0$

$x = 0$ $2x = -5$
 $x = -\frac{5}{2}$

9. $3x^2 + 19x + 6 = 0$

$\begin{array}{r} 18 \\ \times \\ 3 \quad 19 \quad 1 \\ \hline 6 \end{array}$

$(x+6)(3x+1) = 0$
 $x+6=0$ $3x+1=0$
 $x = -6$ $3x = -1$
 $x = -\frac{1}{3}$

10. $-15x^2 + 2x + 8 = 0$
 $15x^2 - 2x - 8 = 0$

$\begin{array}{r} -120 \\ \times \\ -12 \quad 10 \\ \hline -2 \end{array}$

$(5x-4)(3x+2) = 0$
 $5x-4=0$ $3x+2=0$
 $5x = 4$ $3x = -2$
 $x = \frac{4}{5}$ $x = -\frac{2}{3}$

11. $8x^2 - 50 = 0$
 $2(4x^2 - 25) = 0$
 $2(2x-5)(2x+5) = 0$

$2 \neq 0$ $2x-5=0$ $2x+5=0$
 $2x = 5$ $2x = -5$
 $x = \frac{5}{2}$ $x = -\frac{5}{2}$

12. $-64x^2 = -9$
 $64x^2 = 9$
 $64x^2 - 9 = 0$
 $(8x-3)(8x+3) = 0$
 $8x-3=0$ $8x+3=0$
 $8x = 3$ $8x = -3$
 $x = \frac{3}{8}$ $x = -\frac{3}{8}$