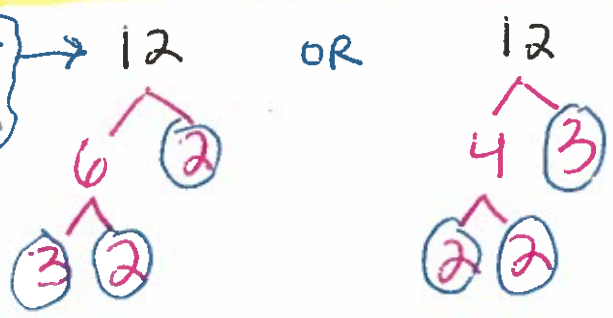


# 6.2 Polynomials & Linear Factors

Just as you can write a whole # as a product of its prime factors, you can write a polynomial as a product of its linear factors.

Prime #'s: 2, 3, 5, 7, 11, 13, 17, 19, ...

Break 12 Down.



$x^2 + 4x - 12$  (Degree 2)  
 $(x-2)(x+6)$  } so it has 2 linear factors

$12 = 2 \cdot 2 \cdot 3$  Prime Factors  
 $12 = 2^2 \cdot 3$  Prime Factorization

1. Write each expression as a polynomial in standard form.  
 (means multiply, distribute, simplify)

like #1+3 on hw

(ex)  $(x+1)(x+1)(x+2)$

$x^2 + 1x + 1x + 1$

$(x^2 + 2x + 1)(x+2)$

$x^3 + 2x^2 + 1x$   
 $+ 2x^2 + 4x + 2$

$x^3 + 4x^2 + 5x + 2$

(ex)  $(x+5)(x-4)$

$x^2 - 4x + 5x - 20$

$x^2 + x - 20$

**2.** Find the zeros of each function.

Then graph the function.

like 16, 18+  
on 19  
on ttw

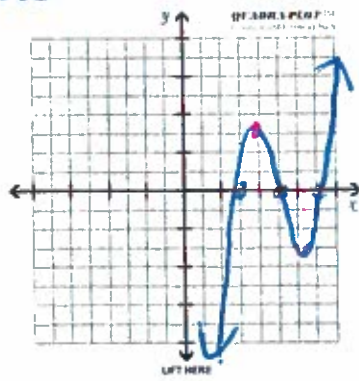
ex a.  $y = (x-7)(x-5)(x-3)$

zeros:  $x-7=0 \rightarrow x=7$ ,  $x-5=0 \rightarrow x=5$ ,  $x-3=0 \rightarrow x=3$

set each factor = to zero and solve

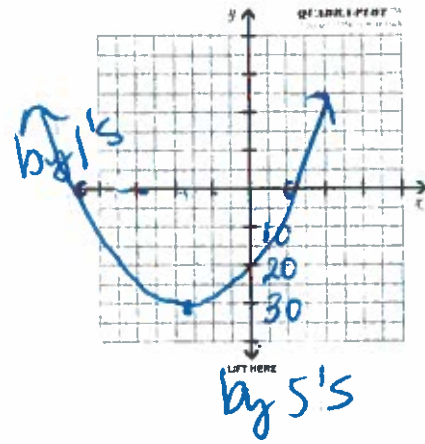
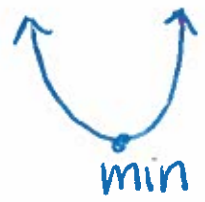
relative max: (3.8, 3.1)  
relative min: (6.15, -3.1)

Plot the zeros, the max + min, then draw the curve



ex b.  $y = (x-2)(x+9)$

zeros:  $x=2$ ,  $x=-9$   
relative max: none  
relative min: (-3.5, -30.25)



\* like 48 + 50 on ttw

Use calculator,  $y = 2x^3 - 23x^2 + 78x - 72$

ex c. Find zeros: 1.5, 4, 6  
relative max: (2.53, 10.51)  
relative min: (5.14, -7.14)

**3.** Write a polynomial in standard form with the given zeros.

like 25-28 on ttw

ex a. -4, -2, and 1

$f(x) = (x+4)(x+2)(x-1)$

opposite signs of the zeros

write the linear factors for each zero then simplify

ex b. -4, -2 and 0

$f(x) = (x+4)(x+2)x$

Simplified  $(x^2 + 2x + 4x + 8)x$   
 $(x^2 + 6x + 8)x$

$f(x) = x^3 + 6x^2 + 8x$

like 35 on tw

4. Find the zeros. state the multiplicity of multiple zeros.

(ex)  $y = (5x-2)^3(x+3)^2$  (ex)  $y = (x-2)(2x-3)(x+1)^2$

$5x-2=0$   
 $+2 \quad +2$   
 $\frac{5x}{5} = \frac{2}{5}$   
 $x = \frac{2}{5}$  mult. of 3

$x+3=0$   
 $-3 \quad -3$   
 $x = -3$  mult. of 2

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

$2x-3=0$   
 $+3 \quad +3$   
 $2x = 3$   
 $x = 1.5$

$x+1=0$   
 $-1 \quad -1$   
 $x = -1$  mult. of 2

DAY 62

5. Write each function in factored form.

A (ex)  $y = x^3 - 4x^2 + 4x$

$x(x^2 - 4x + 4)$   
 $x(x-2)(x-2)$   
 OR  
 $x(x-2)^2$   
 $x=0$   $x=2$  mult. 2

Find zeros

B (ex)  $y = 6x^3 - 15x^2 - 36x$

$3x(2x^2 - 5x - 12)$   
 $2x^2 - 8x + 3x - 12$   
 $2x(x-4) + 3(x-4)$   
 $3x(2x+3)(x-4)$

$3x=0$   
 $\frac{3}{3} \quad \frac{0}{3}$   
 $x=0$

$2x+3=0$   
 $-3 \quad -3$   
 $x = -1.5$

$x-4=0$   
 $x=4$

$2(-12) = -24$   

1	-21
2	-12
3	-6
4	-3

C (ex)  $y = \frac{1}{2}x^3 - \frac{1}{8}x$

$y = \frac{1}{2}x^2 - \frac{1}{4}x$   
 $y = \frac{1}{2}x(x^2 - \frac{1}{4})$   
 $y = \frac{1}{2}x(x + \frac{1}{2})(x - \frac{1}{2})$

# Key Concepts p. 316 Summary Box

- ①  $-4$  is a **SOLUTION** of  $x^2 + 3x - 4 = 0$
- ②  $-4$  is an **x-intercept** of the graph  
 $y = x^2 + 3x - 4$
- ③  $-4$  is a **ZERO** of  $y = x^2 + 3x - 4$
- ④  $x + 4$  is a **FACTOR** of  $x^2 + 3x - 4$
- ⑤  $-4$  is a **ROOT**

## Solve by FACTORING

$$x^2 + 3x - 4 = 0$$

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

$$x+4=0 \quad x-1=0$$

$$-4 \quad -4 \quad +1 \quad +1$$

$$x = -4$$

$$x = 1$$

Degree 2:

at most can  
cross twice

$-4$  and  $1$  are the solutions, the roots,  
the x-intercepts and the zeros.

$x+4$  and  $x-1$  are the FACTORS.

### Practice 6-2

### Polynomials and Linear Factors

For each function, determine the zeros. State the multiplicity of any multiple zeros.

1.  $y = (x-5)^3$   
 $x-5=0$   
 $+5+5$   
 $x=5$   
 **$x=5$**   
**mult. 3**

2.  $y = x(x-8)^2$

3.  $y = (x-2)(x+7)^3$   
 $x-2=0$   
 $x+7=0$   
 **$x=2$**   
 **$x=-7$  mult 3**

4.  $f(x) = x^4 - 8x^3 + 16x^2$

5.  $f(x) = 9x^3 - 81x$

6.  $y = (2x+5)(x-3)^2$

Factor  
1st  
4+5

Write each function in standard form.

distribute

7.  $y = (x-5)(x+5)(2x-1)$

8.  $y = (2x+1)(x-3)(5-x)$

$x^2 + 5x - 5x - 25$   
 $(x^2 - 25)(2x - 1)$

$(2x+1)(5-x)$

**$2x^3 - 1x^2 - 50x + 25$**

9. A rectangular box is 24 in. long, 12 in. wide, and 18 in. high. If each dimension is increased by  $x$  in., write a polynomial function in standard form modeling the volume  $V$  of the box.

Write the **FACTORS 1st**  
 then - **MUST simplify!**

Write a polynomial function in standard form with the given zeros.

10. ~~1, 2, 4~~

11. 1, 1, 2

12. -3, 0, 0, 5

13. -2 multiplicity 3

0, -1, 3  
 $x(x+1)(x-3)$   
 $(x^2+1x)(x-3)$

$(x-1)(x-1)(x-2)$   
 $(x^2-2x+1)(x-2)$

$x^3 - 3x^2 + 1x - 3x = x^3 - 3x^2 + 1x - 3x$

Write each expression as a polynomial in standard form.

14.  $x(x-1)^2$

15.  $(x+3)^2(x+1)$

16.  $(x+4)(2x-5)(x+5)^2$

then  
simplify

$x(x-1)(x-1)$

17-19 & 25-27 are like warm-ups

Write each function in factored form. Check by multiplication.

17.  $y = 2x^3 + 10x^2 + 12x$

18.  $y = x^4 - x^3 - 6x^2$

19.  $y = -3x^3 + 18x^2 - 27x$

Find the zeros of each function. ~~Then graph the function.~~ **DO NOT GRAPH**  
 Set each factor = to zero and solve for x.

20.  $y = (x+1)(x-1)(x-3)$

21.  $y = (x+2)(x-3)$

22.  $y = x(x-2)(x+5)$

Handwritten work for problem 20:

$$\begin{array}{l} \downarrow \\ x+1=0 \\ -1 \quad -1 \\ \boxed{x=-1} \end{array}$$

$$\begin{array}{l} x-1=0 \\ +1 \quad +1 \\ \boxed{x=1} \end{array}$$

$$\begin{array}{l} x-3=0 \\ +3 \quad +3 \\ \boxed{x=3} \end{array}$$

Find the relative maximum, relative minimum, and zeros of each function.

23.  $f(x) = x^3 - 7x^2 + 10x$

24.  $f(x) = x^3 - x^2 - 9x + 9$

Factor 1st

use calculator to get rel. min.

rel max.      zeros!

Write each polynomial in factored form. Check by multiplication.

25.  $x^3 - 6x^2 - 16x$

26.  $x^3 + 7x^2 + 12x$

27.  $x^3 - 8x^2 + 15x$

—28.— A rectangular box has a square base. The combined length of a side of the square base, and the height is 20 in. Let  $x$  be the length of a side of the base of the box.

a. Write a polynomial function in factored form modeling the volume  $V$  of the box.

b. What is the maximum possible volume of the box?

\* FACTOR. All Have a GCF except 1.  
Then Factor Further.

### Day 62 Warm-ups:

①  $x^3 - x$

②  $x^3 + 2x^2 + x$

③  $x^3 - 36x$

④  $x^3 + 7x^2 + 10x$

⑤  $x^4 - 16$

⑥  $x^4 + 8x^3 - 9x^2$

1. The first part of the paper is a general introduction to the subject of the paper. It is written in a clear and concise style, and it is easy to read. The author has done a good job of explaining the background of the problem and the objectives of the study. The paper is well organized and the arguments are clearly presented. The author has done a good job of explaining the background of the problem and the objectives of the study. The paper is well organized and the arguments are clearly presented.

2. The second part of the paper is a detailed description of the method used in the study. The author has done a good job of explaining the method and the results of the study. The paper is well organized and the arguments are clearly presented. The author has done a good job of explaining the background of the problem and the objectives of the study. The paper is well organized and the arguments are clearly presented.

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4. The fourth part of the paper is a conclusion. The author has done a good job of explaining the conclusion and the implications of the study. The paper is well organized and the arguments are clearly presented. The author has done a good job of explaining the background of the problem and the objectives of the study. The paper is well organized and the arguments are clearly presented.

5. The fifth part of the paper is a list of references. The author has done a good job of explaining the references and the sources of the study. The paper is well organized and the arguments are clearly presented. The author has done a good job of explaining the background of the problem and the objectives of the study. The paper is well organized and the arguments are clearly presented.

6. The sixth part of the paper is a list of appendices. The author has done a good job of explaining the appendices and the sources of the study. The paper is well organized and the arguments are clearly presented. The author has done a good job of explaining the background of the problem and the objectives of the study. The paper is well organized and the arguments are clearly presented.

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10. The tenth part of the paper is a list of references. The author has done a good job of explaining the references and the sources of the study. The paper is well organized and the arguments are clearly presented. The author has done a good job of explaining the background of the problem and the objectives of the study. The paper is well organized and the arguments are clearly presented.