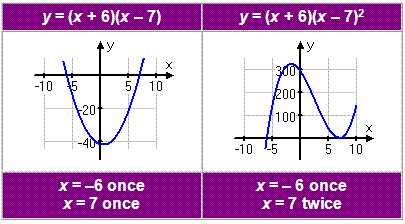
***Lesson 1: The Special Role of Zero in factoring***

* Multiplicity- the number of times that a root of an equation occurs; if there is a double-root (mult. of 2), the graph will hit the x-axis and bounce back



**1)** f(x)=(x2-9)(x2-16)

1. Find the zeros
2. State their multiplicities
3. State the degree of the polynomial

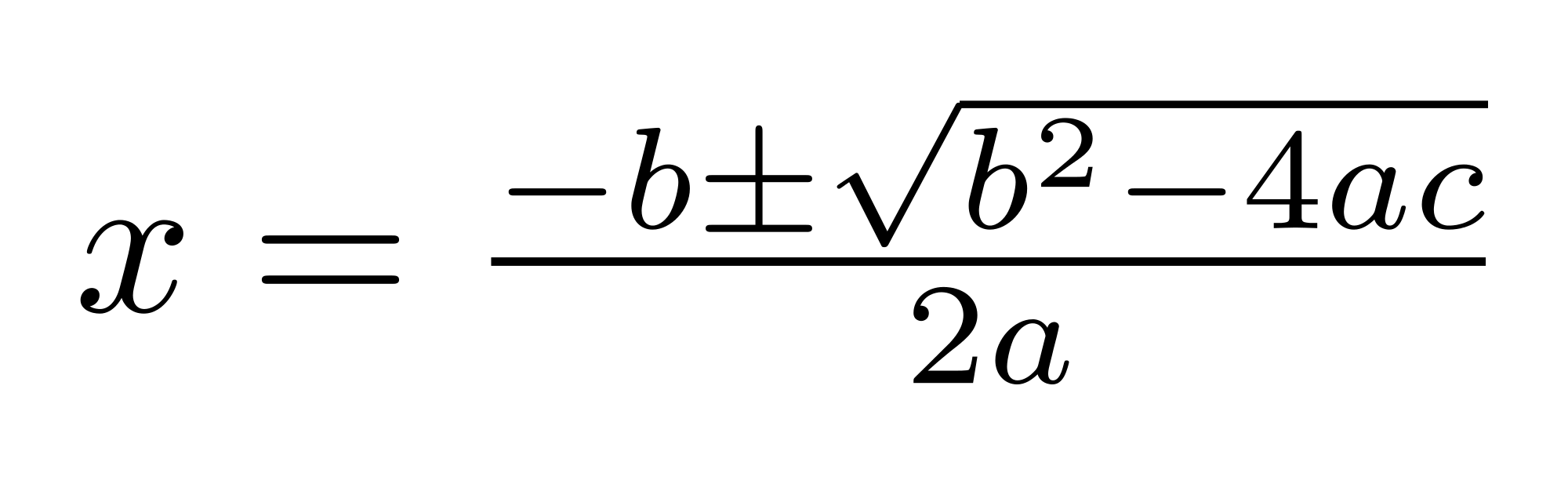
a) Find the factors: (x+3)(x-3)(x+4)(x-4) and set them equal to zero: x+3=0 x=-3, x—3=0 x=3, x+4=0 x=-4, x-4=0 x=4

b) multiplicity of 1

c) degree is 4 because x2\*x2=x4

**2)** Given the roots {4, -5, 0} create an **equation \*need equal sign\***

(x-4)(x+5)(x) -distribute/use tabular method x2+5x-4x-20(x)= x2+x-20(x)= **Answer: x3+x2-20x=0**

***Lesson 2: Using the Quadratic Formula***

**\*Equation must be in y=ax2+bx+c form**\*

1. Find the zeros in simplest radical form of x2 - 4x - 1=y

-(-4) ± √(-4)2-4(1)(-1)

x= 2(1)

4± √16+4

x= 2

4±√20

x= 2

4± 2√5

x= 2

**Answer: x= 2± 2√5**

***Lesson 3: Completing the Square***

Steps: \***always check for a GCF first\***

1. The a-value must equal 1.
2. Move the constant (c-value) to the right side.
3. Make the left side a perfect square trinomial (Take half of the b-value and square it) and add it to BOTH sides.
4. Factor the perfect square trinomial and simplify the right side.
5. Take the square root of both sides and solve! (Remember **POSITIVE AND NEGATIVE** results!!!!!)

Find the roots in simplest radical form for x2+8x-4=0.

+4 +4

\*Bring c-term over- x2+8x=4

b=8 (8/2)2= (4)2=16

x2+8x+[16]=4+[16]

Factor: (x+4)2=20

Take square root of each side: √(x+4)2=√20

x+4=±2√5

-4 -4 **Answer: x=-4±2√5**

***Lesson 4: End Behavior of Polynomial Functions***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Function** | **Even/Odd Degree** | **Positive/Negative Leading Coefficient** | **Rise/Fall to the left** | **Rise/Fall to the right** |
| f(x)=2x2-3x+3 | Even | Positive | Rise | Rise |
| f(x)=-x4+x3-x2+3 | Even | Negative | Fall | Fall |
| f(x)=x5+x3-x+6 | Odd | Positive | Fall | Rise |
| f(x)=-x3-x-4 | Odd | Negative | Rise | Fall |

**End behavior:**

* + **even degree- left and right end behavior is the same**
  + **odd degree- left and right end behavior is different**

1. Find the end behavior of f(x)=x4-4x3+3x+25

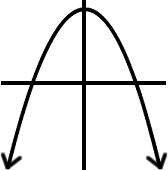
Degree: 4 (even) Leading coefficient: +1 (+) End behavior: Rise, Rise

1. Find the end behavior of f(x)=-4x4+5x5+x2

\*put into standard form first: -5x5-4x4+x2

Degree: 5 (odd) Leading coefficient: -5 (--) End behavior: Rise, Fall

***Lesson 5: Even/Odd Functions***

* We use the term **Even function** (“***E***qual”) when a function *f* satisfies the equation f(-x)=f(x) for every number *x* in its domain. (When you plug –x in, you will get back to the original equation.)

1. Consider the graph of f(x)=-3x2+7

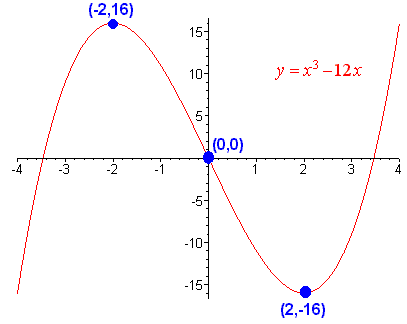
1. Evaluate f(-x)

f(-x)=-3(-x)2+7= -3x2+7

b. Is *f* an even function? Explain how you know.

Yes because f(-x)=f(x)

* We use the term ***Odd function*** (“**O**pposite”) when a function *f* satisfies the equation f(-x)=**-**f(x) for every number *x* in its domain.



1. Consider the graph of f(x)= x3-12x
2. Evaluate f(-x)

f(-x)=(-x)3-12(-x)=**-**x3+12x

1. Is *f* an even function? Explain how you know.

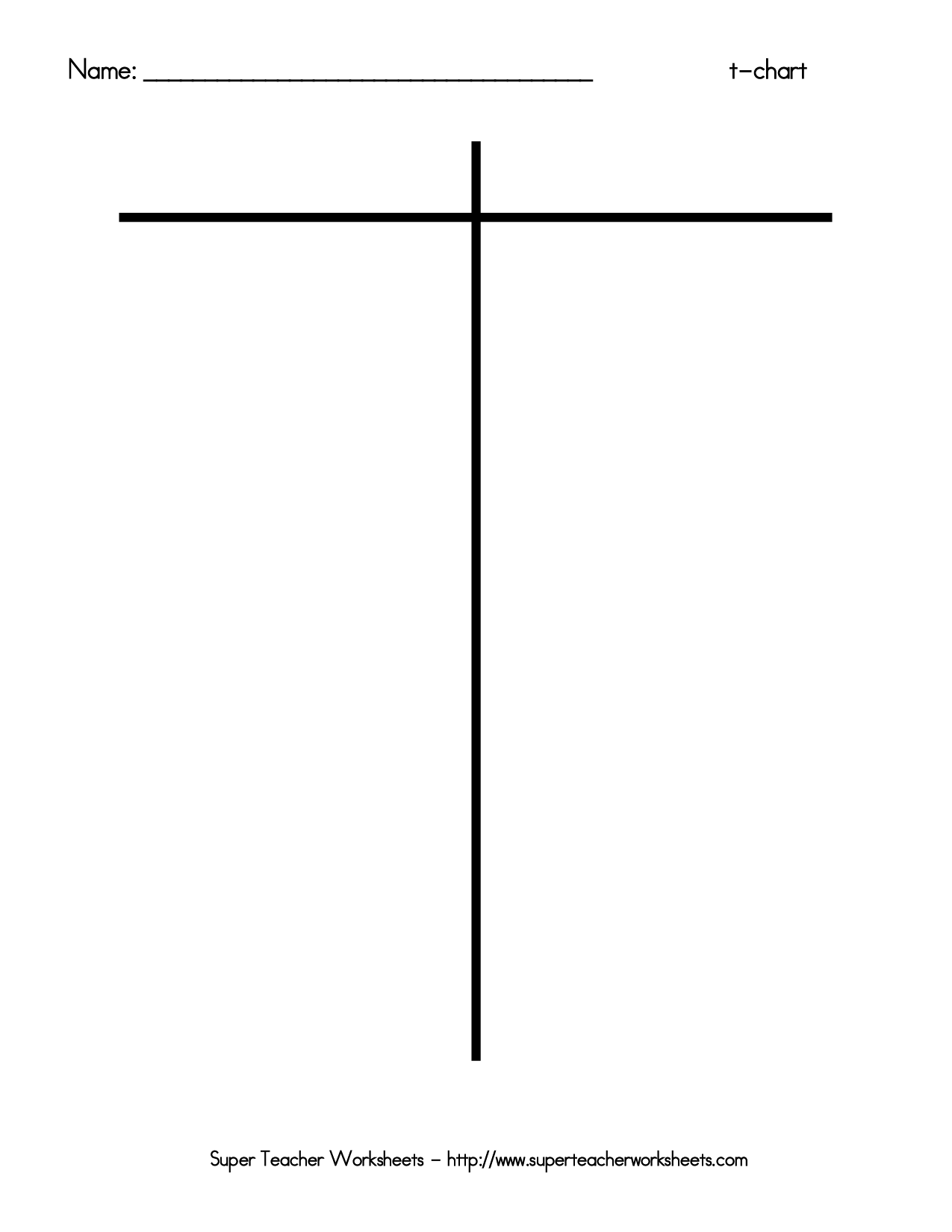
No because f(-x)=**-**f(x).

* In general, an **EVEN** function has the following properties:
  + Its graph is symmetric about the y-axis.
  + The exponents of all terms in the equation are even and there can be constants.
* In general, an **ODD** function has the following properties:
  + Its graph is symmetric about the origin.
  + The y-intercept is zero.
  + The exponents of all terms in its equation are odd and there can be no constant.

***Lesson 6: The Relationship Between Multiplicity and the Graph of a Function***

* The multiplicity of a root determines whether each graph crosses the x-axis at that zero or if it “bounces” off the root in the direction from which it came.
* When the multiplicity is EVEN, the graph will bounce at the root.
* When the multiplicity is ODD, the graph will go through at the root.

1. Given the function, f(x)=**-**2x(x+5)2(x-3)(x-6)(x-3), **WITHOUT A CALCULATOR**
2. State the degree of the function. **6**
3. State the roots of the function and their multiplicity.

 Root Mult.

0 1

-5 2

3 2

6 1

1. State the y-intercept of the function. **0**
2. Describe the end behavior of the function. **Fall, Fall**

***Lesson 7: Modeling with Polynomials***

* Roller coasters are fun! How cool is this real life application!?

***Lesson 8: Long Division with Remainders***

Remainder

Divisor

* Answer= Quotient +

1. Find the quotient of

2x+2

x+2)2x2+6x+5

-(2x2+4x)

**1**

**x+2**

2x+5 **Answer: 2x+2+**

-(2x+4)

1

1. Is 2x-5 a factor of 4x3+5x-8?

2x2+5x+15

2x-5) 4x3+0x2+5x-8 \*Don’t forget the missing term\*

-(4x3-10x2)

-10x2+5x **Answer: No b/c there is a remainder of 67**

-(-10x2-25x)

30x-8

-(30x-75)

67

* ***If the remainder is zero, the divisor is a factor of the dividend.***
* ***If there is a remainder, the divisor is not a factor of the dividend.***

***Lesson 9: The Remainder Theorem***

* The remainder found after dividing P by x-a will be the same value as P(a)
* If *P(a)= 0,* then *(x-a)* is a factor of *P*

1. Use the remainder theorem to find the remainder of the following

(x2+3x+1)

(x+2) x=-2

f(-2)=(-2)2+3(-2)+1 = 4-6+1

**Answer: f(-2)=-1 (x+2) is not a factor because the remainder is -1**

1. When x3+kx2-4x+2 is divided by x+2, the reminder is 26. Find k.

26= (-2)3+k(-2)2-4(-2)+2

26= -8+4k+8+2

26=4k+2

-2 -2

24=4k **Answer: k=6**

4 4